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"It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science in different parts of *Asia*, will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish, if such communications shall be long intermitted; and it will die away, if they shall entirely cease." SIR WM. JONES.

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// JOURNAL

OF THE

ASIATIC SOCIETY.

PART II.—PHYSICAL SCIENCE.

No. I.—1870.

DESCRIPTIONS OF NEW SPECIES OF DIPLOMMATINÆ FROM THE KHASI HILLS,—*by Major* H. H. GODWIN-AUSTEN, F. R. G. S., *Deputy Superintendent Topographical Survey of India.*

[Received 18th January, 1868; read* 7th July, 1869.]

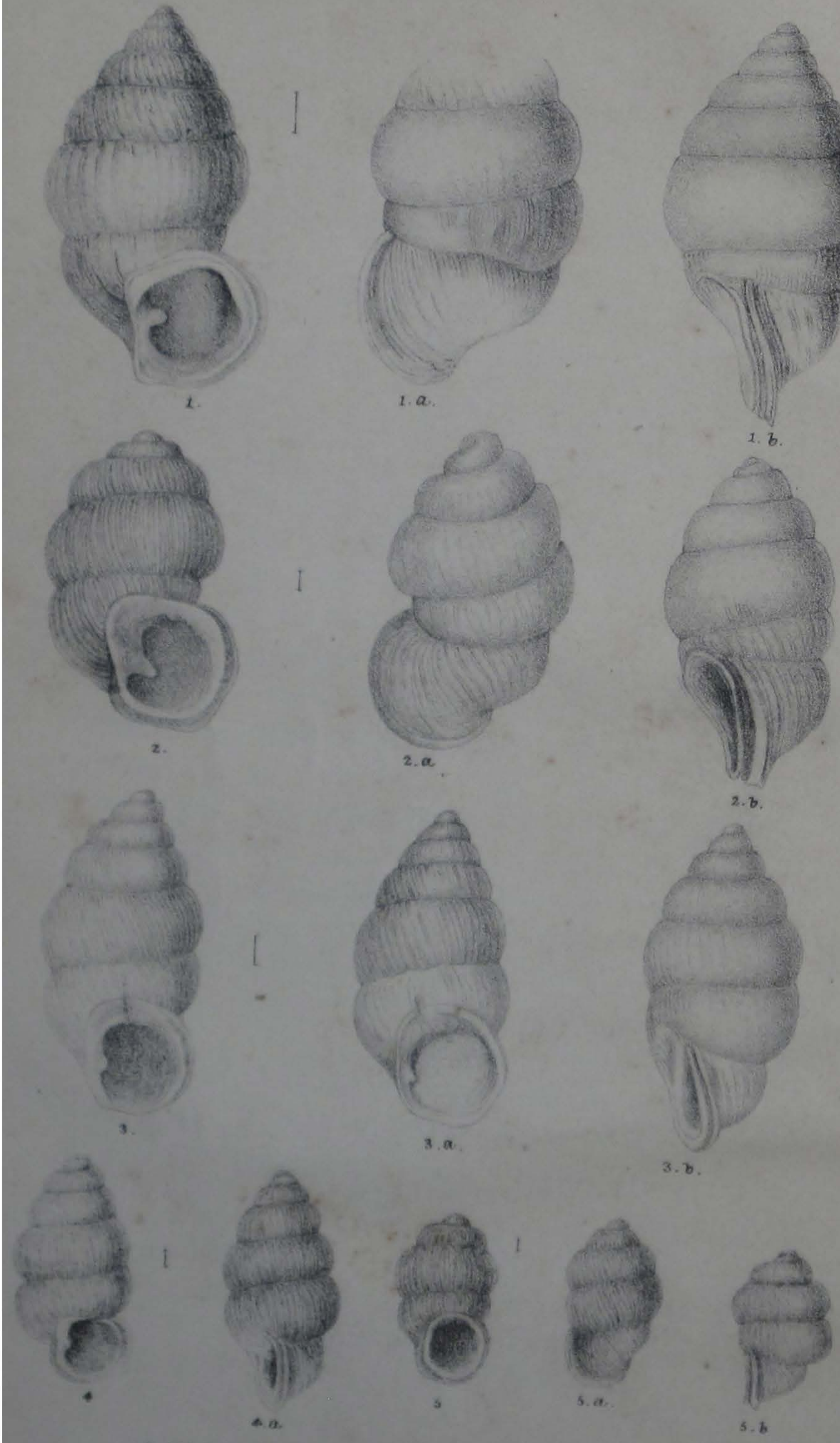
The following descriptions will form, as regards the genus *Diplommatina*, a continuation of those, in Part II, Vol. XXXVII of the Journal, Asiatic Society, Bengal, by W. T. Blanford, Esq., of the Geological Survey. It is trusted, with the help of the plates, they may be of some use to collectors, when identifying species of this interesting genus. All the species here described were collected by myself within the last few years.

1. **Diplommatina Jatingana,** n. sp. Pl. I., fig. 1.

Shell dextral, ovate fusiform, solid, pale corneous; specimens, when young, often of a bright sienna, diaphanous; rather finely and sharply costulated on the four whorls near the apex, becoming fainter below, and from the ante-penultimate to the body whorl almost smooth, or with only a faint trace of ribbing; spire conic, sides flattened, apex

* The reading of this paper was postponed by desire of the author.

1. *Diplom. insignis*; 2. *Diplom. tumida*.
3-5. *Dipl. pachycheilus*, vide, p. 7.
6. Lingual ribbon of same, vide p. 8.
7. ,, ,, of an *Alycæus* (like *Ingrami*,) p. 8.
8. ,, ,, ,, *Pup. imbricifera*, Bens., p. 8.



1. Dipl._ Jatingana. 3. Dipl. Sherfaiensis.
2. —— depressa. 4 —— polypleuris, var.
5. Dipl. parvula.

rather acute, suture slightly impressed below; whorls 7½, the ante-penultimate the largest; penultimate whorl slightly constricted at ¼ turn behind the peristome, last whorl ascending chiefly behind the constriction; aperture sub-vertical, broadly curiculate; peristome solid, double, columellar margin straight, right-angled at base; the usual tooth, large, coarse and blunt, sometimes descending; lips very slightly expanded, outer more so than the inner, this last continuous, forming a strong callus upon the penultimate whorl.

Animal, pale, almost colourless, tentacles brown, labial ribbon long and tapering.

Height, 4 mm.; diameter, 2¼ mm.; diameter of aperture, 1 mm.

Habitat.—Hill at the junction of the Kayeng and Jatinga rivers. N. Cachar Hills.

This is a very handsome and peculiar species, and one of the largest I have obtained in these hills; it was only found on the above isolated hill, where it was abundant. I have named it after the large river, the Jatinga, that flows below. The species is nearly allied to *D. Blanfordiana* and *D. semisculpta*: it is, however, somewhat more tumid, and has shallower sutures than either of these forms; and while it has not the distant retro-relict peristome and rimation of the former, it appears to be less sharply angulated at the base of the peristome than the latter. But the most distinctive character is the position of the slight constriction of the penultimate whorl which, instead of being in front of, or above, the aperture, as in *D. Blanfordiana*, *D. semisculpta* and *D. pachycheilus*, is at a considerable distance, about ¼ turn behind it, (vide fig. 1*a*, pl. I). Hence the suture of the last whorl rises rapidly behind the constriction, runs for a short distance in front of it parallel with the preceding suture, and finally again ascends to the margin of the peristome.

2. **Diplommatina depressa,** n. sp. Pl. I., fig. 2.

Shell dextral, not rimate, ovate, depressed; colour light amber, tinged rubescent at apex; costulation throughout close but sharply defined, more distant on body whorl; spire conoidal, apex blunt; suture deeply impressed; whorls 5, sides with considerable convexity, ante-penultimate much the largest and tumid; last whorl rises on the penultimate, almost to the suture, contracting the breadth of latter excessively; aperture vertical, broadly auriculate; peristome solid, double, the outer lip thick and strong, interrupted; the inner continuous, spreading in a broadly appressed parietal callus upwards on the sinistral side; columellar tooth large and thick; base prominent, descending.

Operculum and animal not observed.

Height, 1½ mm.; diameter, ¾ mm.; diameter of aperture, ⅛ mm.

Habitat.—Woods at Jawai, Jaintia Hills; also at Lailangkote, about 4000 feet, where the specimens were larger.

The small size, few whorls, impressed suture, obtuse apex &c. distinguish this form readily. As in the preceding species, the last whorl rises rapidly on the penultimate, and to a greater extent than in most species of this genus. In all these characters, it exhibits a nearer approach to *Opisthostoma* than any species of *Diplommatina* yet described.

3. **Diplommatina Sherfaiensis,** n. sp. Pl. I., fig. 3.

Shell dextral, ovate, fusiform, sub-rimate, thin, rubescent straw colour, diaphanous; sculpture very fine, close, filiform, shewing well on all the whorls; spire with sides slightly convex, apex sub-acuminate, conic; whorls 6, convex, penultimate and ante-penultimate of very nearly the same size, the former being slightly the largest and more tumid; last whorl constricted in front of peristome above the aperture, ascending; aperture sub-vertical, columellar margin much rounded, the tooth very small, and in some old specimens is hardly to be detected; peristome thin, double and close, the outer very slightly expanded, the inner distinctly so, continuous, forming a thin broad parietal callus. Animal not observed.

Height, 3 mm.; diameter, 1¾ mm.; diameter of aperture, ¾ mm.

Habitat.—On the highest ridges of the north Cachar hills, particularly the peaks "Sherfaisip" and "Marangksi," about 5,500 feet, in dense forest; I have named it after the former, a culminating point of the range.

In figure 3*b*, of this species, the constriction on the penultimate whorl has been shewn. When looking over a large number of

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shells of this genus, it is found to be a common feature in many species, but is not always visible, and more apparent and commoner in some species than in others. In form and size this species much resembles *D. Puppensis*, W. B l f., but is readily distinguished by its fine close costulation, and by the roundness of the aperture, (which is not angulated as in the above and many other species,) and by the thinness of the peristome.

4. Diplommatina polypleuris, *var.*, Pl. I., fig. 4.

D. polypleuris, Benson, Journ. Asiat. Soc. Bengal, Vol. XXXVII, Pt. II, 1868, p. 83, Pl. iii, fig. 1.

Shell dextral, ovate, cylindrical, not rimate, rather thick, pale amber colour, subtranslucent, regularly, deeply and rather closely costulated throughout; spire with sides elevately conoid, apex blunt; whorls 6½, convex, suture deeply impressed; the difference between the size of the penultimate and ante-penultimate is scarcely appreciable, and those towards apex decrease very regularly; last whorl scarcely ascending; aperture vertical, circular; peristome double, moderately thick; outer and inner lip equally developed, outer expanded angulate at the base of the columella; the inner straight, continuous over the penultimate whorl in a thin narrow callus; constriction in front of aperture. Animal not seen.

Height, 1½ mm., diam. ⅝ mm.; diam. of aperture, ⅛ mm.

Habitat.—North Cachar and north Jaintia hills, in damp woods.

This peculiar variety is distinguished from *D. depressa*, which is of about the same size, by its cylindrical form, its greater thickness and opacity, and by its comparative regularity of form, the last whorl scarcely ascending on the penultimate.

The specimen figured has the columellar tooth but slightly developed, in others it is seen much larger and pointed.

5. Diplommatina Jaintiaca, n. sp.

Diplomm. n. sp., Journ. Asiat. Soc., Bengal. Vol. XXXVII, Pt. II, Pl. iii, fig. 3.

Shell sinistral, elongately ovate, rather tumid, sub-rimate, rich amber colour, sharply very regularly and distantly costulated, rather solid; spire conical, slightly convex; whorls 5½, sides convex, suture deep, penultimate whorl largest, last whorl strongly constricted in front of the aperture, rising very slightly behind the peristome, chiefly between the inner and outer peristome; aperture slightly oblique, sub-circular; peristome double, inner slightly expanded, scarcely thickened, terminating in a sinuation at the base of the columella; outer greatly produced, expanded, continuous; parietal callus thin, moderately extended; columellar tooth blunt, moderately developed.

Height, 2¾ mm., diameter, 1½ mm., diameter of aperture with peristome, ¾ mm.

Habitat.—Locally plentiful in damp woods near Jawai, Jaintia hills, at about 4500 ft. elevation;—very rare in west Khasi Hills where only one specimen was found.

This species is very near *D. gibbosa*, from the same region, described by Mr. W. T. Blanford, and thus affording a second instance of a type intermediate between the dextral forms *D. pachycheilus*, *D. diplocheilus*, &c., and the sinistral forms of the Solomon Isles, &c. It is distinguished readily from *D. gibbosa* by its more regularly ovate form, its costulation, and the even, non-sinuated margin of the inner peristome.

Since the transmission of specimens of *Diplommatina*, published in the Journal for 1868, to Mr. W. T. Blanford, I have been fortunate enough to discover this species again. As the above quoted figure, on pl. iii, of the "Contributions to Indian Malacology, No. IX." was taken from a single shell, subsequently broken, the species remained unfortunately unnamed and undescribed. *D. gibbosa* I have found at Teria Ghat, but it is very rare in that locality, so rich in genera of other land shells.

6. **Diplommatina parvula**, n. sp. Pl. I, fig. 5.

Shell dextral, ovate, tumid, depressed, thin; colour bright corneous, pale in some specimens, translucent, finely yet sharply costulated throughout; spire oval, apex very flat, and blunt. Whorls 5, with sides very concave, enlarging rapidly from the apex, antepenultimate the largest, body whorl ascends slightly within a short distance of the peristome, suture deeply impressed; aperture circular with slight obliquity, columellar margin rounded, the usual tooth absent; peristome strong, well developed, double, both outer and inner lips expanded, the former to the greatest extent, the latter forming a thick parietal callus.

Height, 0.065 inch, (1½ mm.); thickness, 0.035, (1 mm.)

Habitat.—Moyong on north face of Khasi hills, not very plentiful.

This shell was found during the field Season 1866-67, and I am sorry that owing to some oversight it was not included among the *Diplommatinæ* sent to Mr. W. T. Blanford, whose description would have been so much more perfect. I have retained the name *parvula*, being the one selected by him, on inspection of a drawing of the shell.

7. **Diplommatina insignis,** n. sp. Pl. II, fig. 1.

Shell sinistral, acuminately oval, colour corneous or pink, costulation close and strong on the upper whorls, obsolete on the two last; spire rather pointed. Whorls 8, lower rounded, at apex flat-sided; penultimate the largest, the constriction of this last situated in front and covered by the parietal callus; suture impressed, aperture vertical, oval; peristome double, outer much thickened, inner continuous, callus strong; columellar margin rounded, the tooth-like process moderate.

Operculum, thin, spiral, no boss at the back. Animal pale colored, tentacles, black, rostrum pink; the body spotted with black which shews through the shell in fresh specimens.

Height 0.27 inch.; diam. 0.13 inch.; diam. of ap. with peristome 0.10 inch.

Habitat.—In the forests of Burrail range, at about 3000 feet, Asalu, particularly the forest near Garilo or Chota Asalu.

This fine sinistral form is up to the present time the largest known species from India. It is a well marked shell, and differs widely from the other sinistral species from these hills, three of which are now known, *D. gibbosa* W. Blanf., *D. Jaintiaca*, God.-Aust. and the above,

8. **Diplommatina tumida,** n. sp. Pl. II, fig. 2.

Shell dextral, ovately and tumidly fusiform, color pale corneous, or pale green; costulation fine and close throughout; spire attenuate, rather pointed. Whorls 8, lower tumid, sides rounded below, flat above, penultimate the largest; suture impressed,—a well marked constriction of penultimate whorl situated close behind the peristome, last whorl rises slightly on the penultimate; aperture vertical, circular, columellar, margin rather straight, tooth large, peristome double, moderately thickened and continuous, forming a callus on the penultimate.

Height 0.23; diam. 0.13; diam. of ap. with peristome, 0.07.

Habitat.—Burrail range near Nenglo, N. Cachar hills, in forest, and as usual among decaying leaves.

This species is a close ally of *D. pachycheilus*, B s., partaking also somewhat of the character of *D. Blanfordiana*, but tis a more tumid form, and particularly the position of the constriction separates it well from both those shells.

Fifteen species of *Diplommatina* are now known from these hills alone, and when the Garo hills have been explored, and the higher portions of the Burrail and Patkoi ranges, Munipúr, &c., we may expect more additions. Even now it establishes this region as quite a centre of the genus, though I think it very possible many species have escaped observation in other places, from the small size and difficulty in finding these shells.

Additional notes on *Diplommatinæ*, *Alycæus*, and *Pup. imbricifera*.

On almost all the species of *Diplommatina* that I have examined a constriction of the penultimate whorl is to be found, and in the larger species it is very well developed. This constriction of the whorl marks of course the position of the operculum when the animal is fully withdrawn into the shell, and the operculum of dead specimens is also to be found at this point. It would appear from an examination of these shells, that the constriction also marks the commencement of the formation of the columellar tooth. Behind the constriction the inside of the whorl appears thicker and is much more polished; with the constriction this contracts, leaves the outer surface of the shell and continues as a rim, like the sharp thread of a screw, running down and round the columella, terminating on the columellar margin of the peristome in the more or less blunt tooth-like process, characteristic of the genus. Situated also at the constriction on the roof of the whorl at this point may be seen a long tube-like ridge, very similar to the external tube of *Alycæus*, only that it diminishes from the back forwards. The position of the operculum as regards both this and the lower rim is at the back. It does not seem to me at all clear, for what purposes this internal formation has been created. Possibly the extremity of the foot carrying the operculum travels along the screw-like thread, and the ridge above may give the necessary guiding surface to the operculum when the animal issues from its shell. The operculum, situated as it is so far from the aperture, would require some fulcrum or guiding edges, to pass it evenly and smoothly out of the shell.

On plate ii, in figure 3, I have endeavoured to shew the position of the operculum and constriction from the front of *Dipl. pachycheilus ;* in fig. 4, the interior of the shell from the left hand side, where *t* represents the spiral rim ; *c*, the position of the constriction ; *r*, the upper ridge or tube.

Figs. 5 and 5*a*, are respectively a side view and plan of the relative positions of the operculum and the commencement of the spiral rim.

In fig. 1*a*, pl. I, I have shewn the position of the constriction in *D. Jatingana*, situated behind the aperture, a considerable distance, and as yet peculiar to this species alone.

Fig. 6 is the lingual ribbon of *D. pachycheilus*, B s.,—the outer laterals are very small and indistinct.

In order to compare the lingual ribbon of *Diplommatina* with those of other allied genera, I have added figures of the dentition of an *Alycæus* and of a *Pupina*. (vide fig. 7 and 8, pl. II).

Fig. 7, is taken from a large form closely allied, or identical with *A. Ingrami*, B e n s. ; fig. 8 represents the dentition of *P. imbricifera*, B e n s o n.

In *Alycæus* the form of arrangement is $\frac{3}{4\ 5\ 5}\ \frac{1}{5}\ \frac{3}{5\ 5\ 4}$, all the uncini being 5 cusped, with the exception of the outer on which I could only detect 4. It may be noticed that in the drawing the 5 cusps are not shewn in every instance, but it must be remembered that they can only thus be seen in certain positions, or from certain points of view the toothed edges being strongly curved, both longitudinaly and laterally. In figure 7*a*, 7*b* the uncini are drawn on a larger scale, shewing the tube-like form of the roof and its base. The uncini of this species are peculiarly spreading and fan-like, especially on the 1st and 2nd laterals.

The lingual ribbon of *Pupina* differs considerably in form from the last, $\frac{3}{444}\ \frac{1}{3}\ \frac{3}{444}$. The laterals are four-cusped, the medial tooth only being tri-cusped, and after a long search I could not detect more than as given above. The breadth of the ribbon was ·008 inch. *P. imbricifera* is the only species that I have met with in these hills. Specimens from the Burrail hills are smaller and more tumid than those from the Khasi hills, but differ in no other respect; the animal is quite black, of the usual *Cyclophoroid* form, tentacles moderately long and slender.

CONTRIBUTIONS TO INDIAN MALACOLOGY, No. XI.—DESCRIPTIONS OF NEW SPECIES OF *Paludomus*, *Cremnoconchus*, *Cyclostoma* and of *Helicidæ* from various parts of India, — *by* WILLIAM T. BLANFORD, A. R. S. M., F. G. S., &c.

[Received 25th June; read 17th July, 1869.]

The following species are from various collections. For specimens from the Khasi and Garo hills, and from Cachar, I am indebted to Major Godwin-Austen. Those from Western and Southern India have been found by Major Beddome, Major Evezard, Mr. Fairbank and myself.

1. **Paludomus reticulata,** *sp. nov.*, Pl. III, fig. 1.

Testa imperforata, globosa, solida, albida, epidermide fusca induta, liris reticulatis spiralibus et verticalibus decussato-sculpta, lirarum intersectionibus nodiferis. Spira brevis; apice eroso; sutura profunda. Anfr. superst. 2-3 *convexi, ultimus infra suturam tumidus. Apertura ovalis, postice vix subangulata, parum obliqua, intus cærulescens; peristoma tenue, acutum fere rectum, ad basin vix retrocurvatum, intus minute corrugatum, margine basali expansiusculo; columellâ mediocri. Operc.*

normale. Diam. maj. 17, *min.* 13½, *alt.* 19 *mm. Apertura* 13½ *mm. alta,* 10 *mm. lata.*

Hab *in Cachar.* (Godwin-Austen.)

This is an ally of *P. stephanus*, B s., so far as form is concerned, but it differs widely in sculpture, and although that is not a character of much importance in the genus *Paludomus* and its allies, still, as no intermediate forms between the two are known, it appears quite justifiable to separate them.

2. **Paludomus rotunda,** *sp. nov.*, Pl. III, fig. 2.

Testa non rimata, globosa, rotunda, solida, epidermide fusca induta, sub-lævigata, striis incrementi et liris sub-obsoletis confertis, minutis, spiralibus decussantibus signata. Spira brevissima; apice erosulo; sutura vix impressa. Anfr. 2½-3 *rapide crescentes, primi parum convexi, ultimus valde major, tumidus, antice non descendens, subtus convexus. Apertura sub-ovalis, postice angulata, obliqua, intus fasciis* 2-3 *intrantibus ornata; peristoma simplex, acutum, margine basali expansiusculo; columella albida, callosa, lata. Operc. normale. Alt.* 15, *diam. maj.* 14 *mm.*

Hab. *in regione Travancorica.* (Beddome.)

This is the most rounded form of restricted *Paludomus* with which I am acquainted. But for the operculum, it could scarcely be distinguished from some specimens of *Philopotamis globulosus.* It is, however, easily distinguished from all other Indian *Paludomi*; the nearest approach to its form is in the Burmese *P. ornatus*, B s.

I am not acquainted with the exact locality which is, however, in the South West of the Indian peninsula, and, I believe, in the Travancore hills.

3. **Cremnoconchus conicus,** *sp. nov.*, Pl. III, fig. 3.

Testa imperforata, ovato-conica, solida, albida, fasciâ spirali castaneâ supra peripheriam interdum ornata, epidermide olivaceâ, haud nitidâ, induta. Spira conica; apice acuto, plerumque eroso; sutura profunda. Anfr. 5 *convexi, (primi sæpissime carentes), ultimus ad peripheriam sub-angulatus, subtus convexus, non descendens. Apertura obliqua, ovata, postice subangulata, intus fulvescens vel alba, aliquando fasciâ castaneâ intranti instructa; peristoma tenue rectum, marginibus callo junctis, basali sub-effuso, columellari calloso. Operc. normale, corneum, pauci-spirale,* *nucleo sub-basali, haud procul a latere columellari sito. Long. exempli adolescentis spirâ perfectâ* 8, *diam.* 6, *ap. long.* 4½, *lat.* 3½ *mm.; exempli majoris, spirâ erosâ, long.* 9½, *diam.* 7, *ap. long.* 6, *lat.* 5 *mm.*

Hab. *ad Torna, haud procul a Poona versus occidentem.*

Var. **canaliculatus**; Pl. III, fig. 4; *sutura canaliculata, anfractibus juxta suturam acute carinatis. Long.* 8, *diam.* 6½.

Hab. *ad Torna.*

In consequence of the preoccupation of the name *Cremnobates* for a genus of fishes,* I have in the Ann. and Mag. Natural History, for May, 1869, proposed to substitute *Cremnoconchus*. The present is a third species of this peculiar form of the *Littorinidæ*, the others being *C. Syhadrensis*, the type of the genus, and *C. carinatus*, Layard, originally described as an *Anculotus*. All these shells have a similar habitat,—precipices or steep hill sides in places where water runs over the rocks during the monsoon. *C. Syhadrensis* is found on the hills opposite Bombay. I have met with it not only at Khandalla where the first specimens were obtained, but also on Matheran hill and at Egutpoora. *C. carinatus* has only been found at Mahableshwar. The present form was met with abundantly on the steep slopes of Torna one of the old Deccan hill forts about 35 miles west of Poona. The specimens were taken from rocks by the sides of the small torrents running down the hill side.

The canaliculate variety serves to connect the typical form with *carinatus*, as many specimens have the angle at the periphery more marked than in the typical *conicus*; but specimens of *carinatus* are of a somewhat different form, with considerably less swollen whorls. Perhaps all three forms should be considered as varieties of one species, for which, however, the name *carinatus*, which is not very appropriate even for full grown specimens of the Mahableshwar shell, can scarcely be retained with propriety.

Mr. Layard's original description of the latter shell was taken from a specimen in Mr. Hugh Cuming's cabinet, which, like other Bombay shells in the same collection, was probably originally derived from Mr. Fairbank, to whom also I am indebted for specimens, as I did not meet with the shell myself at Mahableshwar. I am inclined to believe that the type described by Mr. Layard

* Described by Dr. Günther in Proc. Zool. Soc. 1861, p. 374.

was not adult, though larger in its dimensions than the shells I possess; I therefore, add the description and figure of a small adult specimen.

4. **Cremnoconchus carinatus,** Layard, sp., Pl. III, fig. 5.

Syn. *Anculotus carinatus*, Layard, P. Z. S., 1854, p. 94.

Testa subperforata, ovato-conica, solida, olivacea, sub epidermide albescens, fascia lata rufescenti supra peripheriam notata. Spira conica; apice eroso; sutura profunda, sub-canaliculata. Anfr. circa 5, *plerumque* 2-3 *superstites convexiusculi, ultimus juxta suturam et ad peripheriam obtuse angulatus, subtus convexiusculus. Apertura obliqua, ovata, postice vix angulata, intus sordide albida, interdum castaneo-fasciata; peristoma tenue, rectum; margine columellari callose-expanso. Long.* 7½, *diam.* 5 *mm.*

Hab. *ad Mahableshwar.*

The animal is very similar to that of *C. Syhadrensis.* Foot short, rounded, containing a few indistinct coloured granules as amongst the *Melaniidæ;* muzzle short, its breadth exceeding the length, blackish at the end, the remainder of the animal being white. Tentacles rather short, subulate; eyes lateral, on slight projections at the base of the tentacles. The lingual ribbon is very long; in one specimen it measured 14 millimetres. I have no note of the exact form of the teeth. The animal is amphibious in its habits.

5. **Cyclostoma (Otopoma) Hinduorum,** Pl. III, fig. 6.

Syn. *Otopoma clausum*, Sow., apud Benson, Ann. and Mag. Nat. Hist., Ser. 3, Vol. IV, pp. 92, 95.

O. Hinduorum, W. Blanf., A. & M. N. H., Ser. 3, Vol. XIII, p. 464.

O. Hinduorum, Pfeiffer, Mon. Pneum. Supp. 2, p. 122.

Testa imperforata, clausa, umbilicata, globoso-turbinata, solidula, nitida, striata, juxta suturam et circa umbilicum lævis, extus versus peripheriam liris spiralibus sub-confertis nonnunquam obsoletis circumdata, carnea, vel albido-carnea; apice plerumque nigro; spira conoideo-convexa; sutura impressa. Anfr. 4½ *convexi, ultimus teres, antice descendens, varicem imperfectum interdum pone aperturam gerens. Apertura fere verticalis* *rotunda; peristoma obtusum, marginibus disjunctis, externo antice arcuato, basali expansiusculo, columellari sub-late expanso, umbilicum omnino callo complente. Operc. testaceum, intus membranaceum, paucispirale, margine interno anfractuum elevato, nucleo excentrico.*

Diam. maj. 12, *min.* 11, *axis* 9, *ap. diam.* 6 *mm.*

Hab. *in Kathiawar.* (W. Theobald.)

From *Cyclostoma* (*Otopoma*) *clausum*, Sow., to which Mr. Benson referred the present form, it is distinguished by being much smoother, with a less excavated umbilical region and a higher spire.

I have not previously published a complete description or figure of this shell. It is the most eastern form of the sub-genus known, other forms assigned to *Otopoma* found in the Indian and Burmese areas having been shewn to belong to the *Cyclophoridæ.*

6. **Nanina plicatula,** *sp. nov.*, Pl. III, fig. 7.

Testa vix perforata, depressa, tenuissima, cornea, confertim striatula, lineis minutis confertissimis spiralibus sub-lente undique decussata. Spira depresso sub-conica; apice obtuso; sutura parum impressa. Anfr. 6 *convexiusculi, sensim accrescentes, penultimus extus ad suturam plicatus, ultimus carina e plicis obliquis validis constante instructus, subtus tumidior, antice non descendens. Apertura fere verticalis, rotundato-lunaris, ad finem peripheriæ vix angulata; peristoma tenue, marginibus convergentibus, externo infra medium leviter sinuato, columellari sub-verticali, superne reflexo, perforationem fere tegente. Diam. maj.* 22, *min.* 19., *axis* 11 *mm. Apert.* 10 *mm. alta,* 12 *lata.*

Hab. *in montibus Khasi* (Godwin-Austen.)

This shell which I suppose to be a *Nanina,* is quite peculiar amongst Indian forms, and I do not know any to which it can be compared, nor am I quite clear as to its proper section. It may be easily distinguished by its strong plicate keel.

7. **Nanina Pollux,** Theobald, *var.*

Testa perforata, depressa, lenticularis, acute carinata, tenuis, cornea, nitida, striatula, lineis spiralibus minutissimis sub-lente, fere obsolete, decussata. Spira depresso-conica; apice obtuso; sutura linearis. Anfr. 5½, *intus convexiusculi, extus concaviusculi et colore saturatiori, ultimus juxta carinam compressus, subtus convexus, non descendens. Apertura obliqua* *angulato-lunaris; peristoma tenue, marginibus callo tenui junctis, basali leviter undulato, juxta perforationem vix reflexo. Diam. maj.* 30, *min.* 27, *axis* 11½ *mm.*

Hab. *Nongkulong et Habiang in montibus Khasi* (Godwin-Austen.)

This appears to me a variety of Mr. Theobald's species, differing only in the last whorl being a little narrower. Mr. Theobald's type of which I have a specimen is from Teria Ghat on the south side of the range. Major Godwin-Austen's specimens are from the North side.

8. **Nanina Cherraensis,** *sp. nov.*, Pl. III, fig. 8.

Testa perforata, depressa, acute carinata, lenticularis, tenuis, nitidula, castaneo-cornea, striis incrementi et lineis minutis spiralibus undique confertim decussata; spira depresso conica; apice obtuso; sutura linearis. Anfr. 6, *intus convexiusculi, extus planulati, ultimus juxta carinam compressus, subtus convexus, non-descendens. Apertura obliqua, angulato-lunaris; peristoma tenue, margine basali leviter undulato, columellari juxta perforationem vix reflexo. Diam. maj.* 32, *min.* 29, *axis* 13½ *mm.*

Hab. *ad Cherra Púnji in montibus Khasi.* (Godwin-Austen.)

I should not have distinguished this shell from *N. Pollux*, Theobald, had not Major Godwin-Austen assured me that the animal is totally different from that of the shell described above. It is distinguished by its higher spire, darker colour and by the more marked spiral striation. A few specimens only were met with in the deep valley below Cherra.

9. **Nanina rubellocincta,** *sp. nov.*, Pl. III, fig. 9.

Testa perforata, depressa, tenuis, cornea, lævis, nitidula, minute striatula, lineis minutissimis spiralibus sub-lente sub-obsolete decussata. Spira fere plana; apice vix prominulo; sutura parum impressa. Anfr. 6-6½, *primi vix convexi, intus cornei, extus rufi, ultimus ad peripheriam sub-angulatus et fasciâ latâ rufâ, utrinque gradatim pallidescente cinctus, subtus tumidior. Apertura subverticalis, late lunata; peristoma tenue, marginibus callo tenui junctis, basali leviter arcuato, columellari obliquo, superne ad umbilicum brevissime reflexo. Diam. maj.* 35, *min.* 31, *alt.* 14, *mm. Ap.* 19. *mm. lata,* 12 *alta. Exempli minoris diam. maj* 31, *min.* 28, *alt.* 12, *mm.*

Hab. *ad Habiang in montibus Garo.* (Godwin-Austen.)

This shell is somewhat allied to the Tenasserim *N. acerra* of Benson, but it is much less globose and easily distinguished by its rufous periphery.

10. **Nanina Austeni,** *sp. nov.*, Pl. III. fig. 10.

Testa imperforata, conoidea, depressa, tenuis, cornea, acute carinata, superne confertim arcuate costulata, costulis infra carinam evanescentibus, subtus lævis, polita, radiato-striatula. Spira breviter conoidea, lateribus concaviusculis; apice obtuso; sutura non impressa. Anfr. 6½ *planulati, lente accrescentes, cujusque margine externo leviter projiciente, ultimus parum latior, compresse carinatus, antice non descendens, subtus convexus. Apertura angulato lunaris, parum obliqua*; *peristoma obtusum album, infra carinam leviter sinuatum, marginibus callo tenui junctis, columellari obliquo, magis incrassato, superne haud reflexo. Diam. maj.* 15, *min.* 13½, *axis* 7 *mm.*

Hab. *ad Habiang in montibus Garo, extra fines meridionales provinciæ Assam in India orientali.* (Godwin-Austen.)

This very pretty little species, which I name after the discoverer, is intermediate in some respects between *N. serrula,* Bs. and *N. climacterica,* Bs., resembling the former above, and the latter beneath. It is distinguished from the first by being imperforate and from the latter by the higher spire, stronger sculpture and the projection of the external edge of each whorl just above the suture.

11. **Nanina falcata,** *sp. nov.*, Pl. III, fig. 11.

Testa aperte perforata, conoidea, depressa, cornea, oblique arcuatim costulato plicata, plicis infra peripheriam evanescentibus, subtus lævigata, polita, radiato striatula. Spira parum elevata, depresso conoidea; apice obtuso; sutura impressa. Anfr. 6 *convexi gradatim crescentes, ultimus paulo latior, subtus convexus, peripheria sub-angulata antice rotundata. Apertura lunaris, parum obliqua ; peristoma tenue, infra peripheriam late sed non profunde sinuatum, margine columellari juxta perforationem brevissimo, sub-verticali, reflexiusculo. Diam. maj.* 13, *min.* 12, *axis* 7 *mm.*

Hab. *ad Habiang in montibus Garo* (Godwin-Austen.)

This shell is somewhat allied to *N. ornatissima,* Bs., but is much smaller, less depressed, with the last whorl broader in proportion and one whorl less. It belongs to the same general group (*Hemiplecta ?*), as *Austeni, climacterica, ornatissima,* &c.

12. **Nanina Koondaensis,** *sp. nov.*, Pl. III, fig. 12.

Testa perforata, depressa, cornea, carinata, tenuis, superne oblique striata, lineis minutis confertis spiralibus sub-lente decussata, subtus lævior, nitidula radiato striatula, sculptura spirali infra carinam gradatim evanescente. Spira parum elevata, depresso-conoidea; apice obtuso; sutura vix impressa. Anfr. 5 *convexiusculi, ultimus latior, subtus tumidus, carinâ antice obtusiori. Apertura obliqua, angulato-lunaris; peristoma obtusum, rectum, intus tenuiter albido-labiatum, margine columellari obliquo, juxta perforationem reflexiusculo. Maj. diam.* 25, *min.* 22, *axis* 12, *mm. Apertura* 13 *mm. lata,* 12 *alta.*

Hab. *ad Sispara in montibus Koonda, ad latus occidentale montium Nilgiri Indiæ meridionalis.*

Found by both Major Beddome and myself at the locality mentioned. It is allied to *N. indica*, Pfr. and *Shiplayi*, Pfr., but distinguished from both by much finer sulpture and by being more swollen beneath.

A young specimen was obtained by Dr. Stoliczka in the botanic garden of Calcutta; it was probably imported with plants from South India.

13. **Nanina (Trochomorpha) apicata,** *sp. nov.*, Pl. III, fig. 13.

Testa sub-perforata, vel sub-oblecte perforata, trochiformis, tenuis, cornea, sub-lævigata, parum nitida, oblique striata. Spira conica, lateribus fere rectis; apice acuto; sutura non impressa. Anfr. 6 *planulati gradatim crescentes, ultimus ad peripheriam acute carinatus, infra carinam compressiusculus, antice tumidior, circa perforationem convexus, antice non descendens. Apertura obliqua, angulato-lunaris sub-rhombea; peristoma tenue, margine basali sinuato, columellari obliquo, reflexo. Diam. maj.* 14, *min.* 13, *axis* 10 *mm.*

Hab. *in summis montibus Nilgiri in India meridionali ad Coonoor, Neddiwuttom, &c.*

This is far from a rare shell on the Nilgiris, and I suspect that the reason why it has hitherto remained without a name is, that it has been confounded by others, as it long was by myself, with *N. cacuminifera*, Bs. That, however, is a larger shell, with a lower spire, very concave sides, and much stronger sculpture. So far as

I know it has only been found at Sispara on the Western edge of the Nilgiri plateau, whilst *N. apicata* is found on the Northern and Eastern portion of the hills.

The present shell may be destinguished from most of its allies, such as *N. hyphasma*, Pfr., by its want of marked sculpture, its straight sides and high spire.

14. **Nanina (Ariophanta) immerita,** *sp. nov.*

Testa sinistrorsa, anguste umbilicata, depressa, sublenticularis, fulvo-cornea, tenuis, oblique striata; spira parum elevata, conoideo-convexa; apice perobtuso; sutura vix impressa. Anfr. 4½ *convexiusculi, ultimus magnus, acute carinatus, carina antice obtusiori, subtus tumidiori, nitidula. Apertura obliqua sub-securiformis; peristoma tenue, rectum, margine columellari sub-verticali, reflexo. Diam. maj.* 25, *min.* 21, *axis* 14 *mm. Apertura* 13 *mill. longa,* 11 *lata.*

Hab. "*South Canara*" (Beddome).

This species approaches *N. interrupta*, Bs. (*N. Himalayana*, Lea), but has the sculpture finer and not decussated. I have only seen two specimens one of which is quite young, and it is possible that the one above described is also immature, but there appears no doubt that the form is undescribed. The specimen having been returned to Major Beddome, I am unable to figure it at present.

15. **Helix (Plectopylis) macromphalus,** *sp. nov.* Pl. III, fig. 14.

Testa sinistrorsa, late umbilicata, depressa, discoidea, tenuiuscula, pallido-cornea, superne plicis arcuatis obliquis incrementi et liris spiralibus decussata, ad peripheriam et subtus fere lævis, striatula: striis nonnullis spiralibus circa umbilicum aliquando distinguendis; spira plana; apice vix emergente; sutura leviter impressa. Anfr. 4½—5½ *planulati, arcte voluti; ultimus vix latior, supra peripheriam sub-angulatus, ad latus atque subtus convexus, antice leviter descendens. Apertura irregulariter lunaris, superne compressa, diagonalis; peristoma albido-labiatum, parum incrassatum, reflexiusculum, marginibus convergentibus, callo tenui junctis, externo supra peripheriam arcuato. Plicatio interna persimilis ei* Helicis Pinacis *et* H. plectostomatis: *e lamina unica parietali, verticali et plica tenui longiuscula basali, atque plicis* 5 *palatalibus: basali tenui sim-*

plici, ceteris duplicibus, constans. Diam. maj. 6½, *min.* 5½, *alt* 2¾ *mm.*

Hab. *ad Mairung in montibus Khasi, et varietas minor in valle Rungnu prope Darjiling in Sikkim.*

I procured specimens of this shell, 3½ to 4½ mm. in diameter, 12 years ago at Darjiling; they were considered by Mr. Benson a small variety of *Helix Pinacis,* (See Ann. and Mag. Nat. Hist. for April, 1860). Recently the same form has been found by Major Godwin-Austen in the Khasi hills. It differs so enormously in size from *H. Pinacis,* the respective diameter of the two shells being 6½ and 14 millimetres that, as no intermediate forms have been met with, it is evident that the two should be distinguished, and there are several differences of sculpture and form which appear to me to bear out the separation. Thus the mouth in *H. macromphalus* is compressed above the periphery, whereas in the larger form the mouth is regular. *H. Pinacis* too has spiral striation below, which is absent in the new form; and the former has 6, the latter only 5 internal palatal plicæ, which moreover differ from the 5 lower plicæ of *H. Pinacis* slightly in form. The last named shell also is much more angulate at the periphery.

16. **Bulimus vicarius,** *sp. nov.* Pl. III, fig. 15.

Testa profunde rimata, oblongo-turrita, tenuiuscula, opaca, fulvescente-castanea, oblique striatula, lineis minutis confertissimis flexuosis subobsolete decussata; spira turrita, lateribus convexis; apice obtuso; sutura impressa. Anfr. 8 *convexi, ultimus* ⅓ *longitudinis sub-æquans, basi subcompressus, antice sub-ascendens. Apertura fere verticalis, truncato-ovalis; peristoma undique expansum, album, marginibus convergentibus callo tenui junctis, columellari verticali. Long.* 15, *diam.* 5, *apert. cum perist.* 5 *longa,* 4 *lata.*

Hab. *ad Habiang in montibus Garo* (Godwin-Austen).

The nearest ally to this shell is *B. Nilagaricus,* Pfr., which, singularly enough, also occurs in the Khasi Hills, having been found by Major Godwin-Austen. The present form is distinguished by greater slenderness and smaller mouth.

17. **Bulimus Calcadensis,** Beddome, MS.

Testa sinistrorsa, sub-obtecte perforata, elevato trochiformis, solidula, striatula, albida, epidermide fulva? (vel flavescenti, forsan varie coloratâ) *obtecta ; spira conica ; apice obtuso ; sutura impressa. Anfr.* 5½ *convexi, regulariter crescentes, ultimus* 3/7 *longitudinis sub-æquans, carinatus, subtus convexus, antice tumidior. Apertura diagonalis, sub-rhomboidea ; peristoma non incrassatum, expansiusculum, marginibus distantibus, callo tenui junctis, columellari triangulatim reflexo, perforationem fere tegente. Long.* 23, *diam.* 17 *mm., ap. c. perist.* 11 *mill. longa, intus* 8 *lata.*

Hab. "*Calcad hills,*" *Travancore.*

Of this peculiar sinistral heliciform *Bulimus* a solitary specimen, much weathered but perfect, was found by Major Beddome. It is evidently a coloured shell but only traces of the epidermis remained. It is allied to *B. albizonatus*, Rv., and *B. intermedius*, Pfr., of Ceylon, but is sinistral and has a shorter more conical form.

As with *H. immerita*, I have returned the original specimen to Major Beddome, and cannot, therefore, add a figure.

18. **Glessula filosa,** *sp. nov.* Pl. III, fig. 16.

Testa sub-rimata, turrita, tenuis, cornea, verticaliter plicato-striata, parum nitida ; spira elevata ; apice obtuso, brevissime conico, sub-mucronato ; sutura impressa. Anfr. 8 *convexi, ultimus* ⅓ *longitudinis sub-æquans, basi rotundatus. Apertura verticalis, lunato sub-ovalis ; peristoma rectum, tenue ; columella arcuata, albida, lamelliformiter exstante, tenui, oblique truncata. Long.* 21, *diam.* 9 *mm. Apert.* 7 *mill. longa,* 5 *lata.*

Hab. *in Travancore* (Beddome).

A peculiar form easily distinguished by its strong sculpture, abrupt subconical apex, and by the columella standing out from the last whorl, so as to have a groove running along its side.

19. **Glessula Singhurensis,** *sp. nov.* Pl. III, fig. 17.

Testa pyramidali, turrita, tenuis, cornea, polita, nitida, levis, vix striatula ; spira elongato conica ; apice sub-acuto ; sutura impressa, minute corrugata. Anfr. 8 *convexi, ultimus* ⅓ *longitudinis vix æquans, subtus rotundatus. Apertura fere verticalis, ovato oblonga ; peristoma obtusum, albescens ; columella valde arcuata, antice oblique truncata. Long.* 12½, *diam.* 44, *ap. long.* 4, *lat.* 2½ *mm.*

Hab. *frequens ad Singhur, prope Poona.*

This is allied to the Nilgiri *G. Jerdoni*, Bens., but the sides of the spire are less convex, the shell being more regularly pyramidal with a less obtuse apex.

In some of the specimens of this species collected alive, but in which the animal had subsequently dried up, I found young shells. It would thus appear to be viviparous.

I have observed the same circumstance (the occurrence of young shells inside the old one) in *G. Cassiaca*, Bs. In other species of this genus I have found small round eggs with a calcareous shell, but these may be hatched, before they are deposited by the parent.

20. **Glessula rugata,** *sp. nov.* Pl. III, fig. 18.

Testa turrita, cornea, tenuis, parum nitida, verticaliter confertim plicato striata: striis sub-lente minute et regulariter granulatis, interstitiis lineis minutis confertis transversis (spiralibus) in anfractibus superis validioribus, decussatis; spira elongato conica; apice obtuso; sutura profunda. Anfr. 7½ *convexi, ultimus* ¼ *longitudinis sub-æquans. Apertura obliqua fere ovata; peristoma tenue, rectum; columella valde arcuata, antice oblique truncata. Long.* 6, *diam.* 2 *mm., ap.* 1½ *mill. longa,* 1 *lata.*

Hab. *ad Singhur, prope Poona.*

Var. major, long. 7 *mill.*

Hab. *ad Poorundhur,* (Evezard).

No described Indian species of *Glessula* possess sculpture at all resembling that of the present small form. Under an ordinary lens the shell appears to have a plicate striation, but beneath a stronger power the striæ are seen to be regularly nodose, and the decussating lines become distinctly visible. The markings are very elegant and regular, almost resembling those on some West Indian forms of *Cyclostomidæ*, as *Choanopoma.*

21. **Glessula lyrata,** *sp. nov.*

Testa ovato-turrita, solidula, cornea, parum nitida, verticaliter costulato-plicata, sub-lente lineis minutissimis confertis spiralibus, sæpe obsoletis, decussata; spira pyramidalis, lateribus vix convexis; apice obtusulo; sutura profunda. Anfr. 7½ *convexi, infra suturam obsolete sub-angulati, ultimus antice paulo ascendens. Apertura verticalis,* *truncata, semiovalis; peristoma obtusum; columella mediocriter arcuata, antice oblique truncata. Long.* 12, *diam.* 5½, *ap. long.* 4, *lat.* 2⅓ *mm.*

Hab. *ad Mahableshwar, infrequens.*

Var. **Matheranica,** Pl. III, fig. 19.

Minor, magis polita, lineis spiralibus carentibus, sculptura in anfractu ultimo obsolescenti. Long. 10 *lat.* 4½ *mill.*

Hab. *Matheran, haud procul a Bombay.*

This shell resembles in form *A. Oreas,* Bens., but is distinguished from that and all other allied species by its stronger sculpture. Possibly the two varieties should be ranked apart, as there is considerable difference between them. A third form, shorter and more tumid, occurs near Poona. As other intermediate varieties probably exist, I prefer for the present classing all in one species, but it may hereafter be desirable to distinguish them.

22. **Glessula pulla,** *sp. nov.* Pl. III, fig. 20.

Testa parva, turrita, tenuis, fusco cornea, parum nitens, levigata, striatula; spira elongato sub-conica, lateribus convexiusculis; apice obtuso; sutura impressa. Anfr. 7-8 *convexi, breves; ultimus* $\frac{2}{7}$ *longitudinis sub-æquans, subtus rotundatus. Apert. obliqua sub-ovata; peristoma tenue; columella arcuata, antice oblique truncata. Long.* 7, *diam.* 2¾, *ap. long.* 2, *diam.* 1½ *mm.*

Hab. *ad Torna,* (Evezard).

This is allied to *A. Fairbankii,* Bs., but distinguished by its more conical spire, smaller size and darker colour.

23. **Glessula hebes,** W. Blanf. *sp.,* Pl. III, fig. 21.

Testa sub-cylindrico turrita, tenuis, pallido cornea, translucens, polita, striatula; spira elevata, subtus sub-cylindrica, lateribus versus apicem obtusum convexis; sutura impressa. Anfr. 9—10½ *convexi, regulariter crescentes, ultimus brevis,* ¼—⅕ *longitudinis sabæquans. Apertura ovato oblonga, parum obliqua; peristoma tenue; columella valde arcuata, antice oblique truncata. Long.* 17—22, *diam.* 5 *mill. Ap.* 4-4½ *longa,* 2½-3 *lata.*

Hab. *Deo Ghat ad latus meridionale urbis Poona,* (Evezard).

Syn. *Achatina hebes,* W. Blanf., Pfr. Mon. Pneum., Vol. VI, p. 230.

The nearest ally to this species appears to be *G. Tamulica*, W. and H. Blanf., from near Trichinopoly, which is distinguished by greater diameter in proportion to the length, and a more regularly tapering spire. Intermediate forms may hereafter be found however.

A specimen from the Shevroy hills near Salem in Southern India, sent to me by Major Beddome, only differs from *G. hebes* in being longer and slightly more attenuate towards the apex. It has 13 whorls.

The present species has been already described by Dr. Pfeiffer (i. e.) from specimens sent to Mr. Hugh Cuming by Major Evezard, the discoverer. Dr. Pfeiffer justly remarks that it appears to be a different shell from *Spiraxis hebes*, W. and H. Blanf. The latter is a *Stenogyra* allied to *A. gracilis* (*Bulimus gracilis*, Hutt.).

24. **Glessula Tornensis,** *sp. nov.*, Pl. III, fig. 22.

Testa ovato oblonga, tenuiuscula, levigata, nitida, polita, sub-obsolete striatula, fulvo cornea ; spira elongato conoidea, lateribus convexis ; apice valde obtuso ; sutura impressa, superne sub-corrugata. Anfr. 7-7½ *convexi, ultimus* ⅜ *longitudinis superans, subtus rotundatus. Apertura sub-verticalis, oblongo semiovalis ; peristoma rectum, tenue, marginibus callo tenui junctis ; columella valde arcuata, albescens, antice fere verticaliter truncata. Long.* 25, *diam.* 14 *mill. ; apert. oblique* 12 *mm. longa,* 7 *lata.*

Hab. *in monte Torna dicto, haud procul versus occidentem ab urbe Poona in India.*

This rather fine species abounds on the hill mentioned, where it has been procured in large numbers by Major Evezard. I only found a few specimens myself. It is amongst the finest of the species of Western India. In form it is remarkably similar to *G. textilis*, W. Blanf., from the Anamullay hills, but it entirely wants the coloured markings of that species.

I have adopted the genus *Glessula* of E. von Martens (*Electra*, Albers), as there appear to me to be good generic distinctions, both of the animal and shell, from *Achatina*. The genus is most abundantly represented in the Western ghats, more so than in the Himalayas.

25. **Succinea rutilans,** *sp. nov.*, Pl. III, fig. 23.

Testa sub-ovata, tenuis, aurantiaca, striatula, nitidula; spira conoidea; apice sub-papillato; sutura impressa. Anfr. 2½, *penultimus convexus, ultimus tumidus* ¾ *longitudinis formans, basi rotundatus. Apertura obliqua, ovata; peristoma rectum; columella regulariter arcuata, subsimplex. Long.* 10½, *diam.* 6½, *alt.* 4¼, *ap. long.* 8, *lat. infra medium* 5 *mm.*

Hab. *ad Cherra Púnji,* (Godwin-Austen).

A more regularly ovate shell than *S. daucina,* Pfr., which it otherwise resembles.

26. **Succinea (Lithotis) tumida,** *sp. nov.*, Pl. III, fig. 24.

Testa ovata, oblique elliptica, tenuis, rubello-cornea, parum nitida, oblique striata; spira brevi; apice papillari; sutura profunda. Anfr. 2-2½ *tumidi, lira infra-suturali obtusa, antice in exemplis veteribus aliquando fere obsolescenti. Apertura obliqua, magna, ovalis, postice non angulata; peristoma tenue, rectum, continuum, margine columellari tenuiter calloso, appresso.*

Long. 6½, *diam.* 5, *alt.* 3, *ap. long.* 5½, *diam. vix* 4 *millim.*

Hab. *ad Singhur.*

Var. **subcostulata,** *costulato-striata, lira infra-suturali validiori.*

Hab. *ad Poorundhur.*

This is a second species of the remarkable sub-genus *Lithotis*, much more tumid than the type *Succinea (Lithotis) rupicola,* and with a proportionally more developed spire; it serves to connect that form with the typical rock inhabiting *Succineæ* of Western India, such as *S. Girnarica,* Theobald, and a new species from Mahableshwar, the animal of which is very similar to that of *Lithotis.*

The specimens figured are not the largest that have been found. Major Evezard possesses shells from Poorundhur measuring 9 millimetres in length, 6 in diameter, and 4 in height (when laid with the aperture downwards). In these the sculpture is much less regular and weaker, than in the accompanying figure which represents a young specimen. The largest Singhur specimen in the same collection measures 8, 6, and 3½ millimetres in its 3 dimensions, the aperture being 6 mill. by 4.

27. **Helix Ochthoplax,** Bens.

This fine species was described by Mr. Benson from a specimen in the collection of the Asiatic Society of Bengal, said to be from Pegu. Specimens exactly similar to the type have lately been discovered by Major Godwin-Austen at Moyang in the Khasi hills, and near Asaloo in North Cachar. The animal is a true *Helix*. The locality Pegu is in all probability erroneous, the shell having never been met with by either Mr. Theobald, Mr. Fedden, or myself in that province.

I have already in the "Contributions" and in the Annals and Magazine of Natural History mentioned several of the shells discovered or re-discovered by Major Godwin-Austen. There are, however, still several novelties which want description. Amongst the species not previously found on the Khasi hills, but known from other localities is, as already mentioned, *Bulimus Nilagaricus*, which Mr. Theobald has also identified amongst the shells collected by Mr. Fedden in the Shan States, east of Ava. This occurred at Nongbri and in the North Khasi hills. *Ennea stenopylis*, Bens., first met with at Darjiling, was found at Maotherichan. The Pegu *Alycæus sculptilis*, Bens., and a small variety of *A. nitidus*, W. Blanf., have also been sent by Major Godwin-Austen from the Khasi hills. *Nanina rimicola*, Bens., *Nanina subjecta*, Bens., and a small shell which appears to me identical with *N.? planiuscula*, Hutton, form part of the same extensive collection.

Explanation of Plate III.

1. *Paludomus reticulata*, sp. nov., natural size; p. 9.
2. *P. rotunda*, sp. nov. ditto; p. 10.
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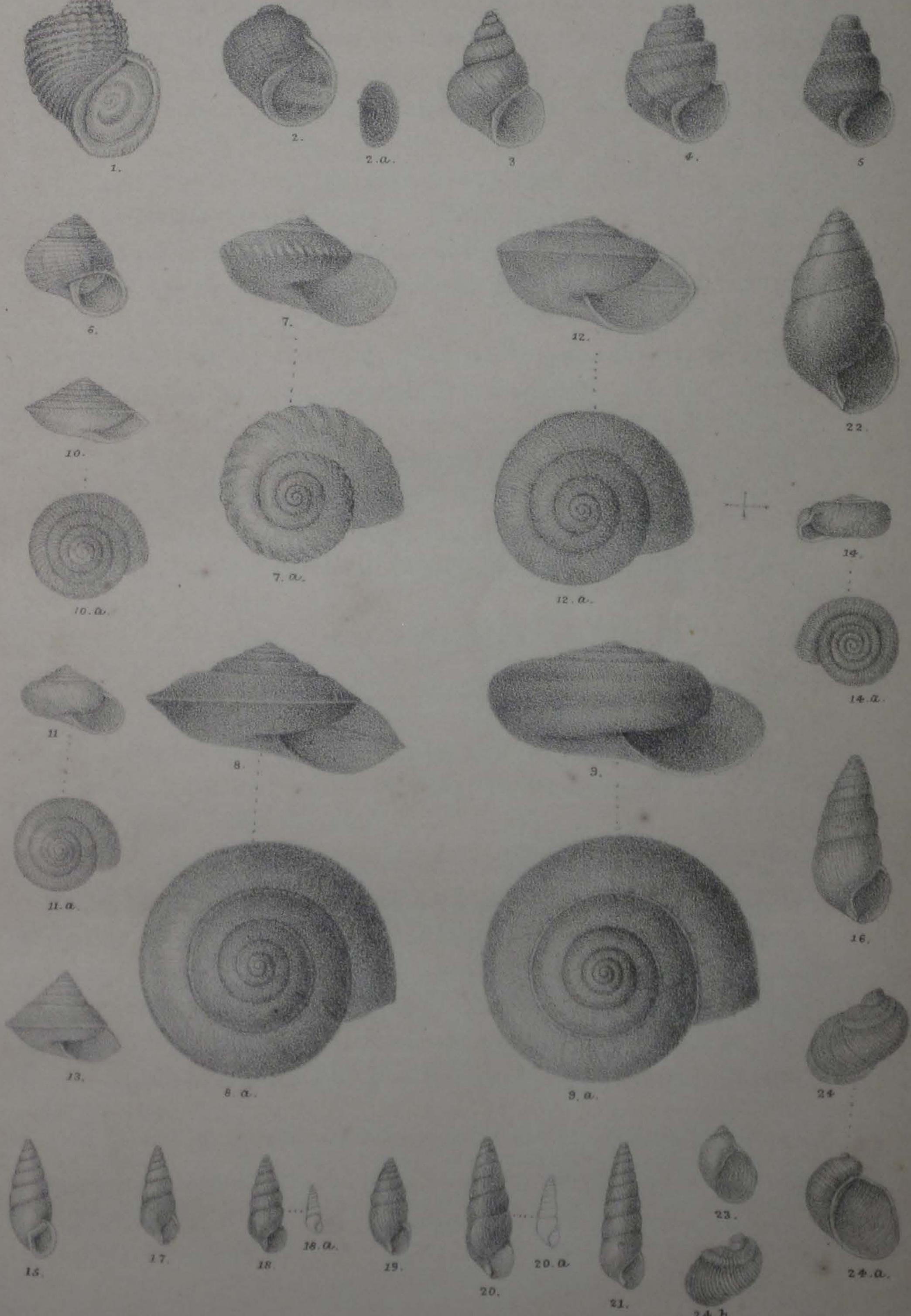

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Brief notes on the Geology and on the fauna in the neighbourhood of Nancowry harbour, Nicobar islands,—*by* V. Ball, B. A., *Geol. Survey of India.*

[Read 9th Oct. 1869, received 20th Oct. 1869.]

The following observations* have been made on a short trip of eight days to the new settlement at the Nancowry harbour, situated between parts of the southern coast of Camorta, and the northern coasts of the island Nancowry. To the north of the entrance of the harbour lies Trinkut, to which also a short visit has been paid. All three islands belong to the northern, or rather middle,

* An abstract of the Journal has been published in the October Proceedings of the Society for 1869, (p. 250), but as the Government of India has since resolved to publish all the available literature regarding the history and physical condition of the islands in their "Selections," the present account has been restricted to those observations which may prove of immediate interest to the scientific reader.

group of the Nicobars which, on account of the trade with cocoanuts and trepang are much better known to the Malayan traders than the southern larger islands. The history of the various attempts made by the Danes, Austrians and by French Missionaries for a settlement on these islands are well known from the records of the voyages of the Danish Corvette* "Galathea," (1847), from Dr. Rink's† "sketch of the Physical geography and geology" of these islands, and from the manifold reports relating to the Nicobars by different members of the Austrian expedition with the Frigatte "Novara," (1858).‡ In these works much has also been published relating to the fauna of these islands, but the accounts are not always the results of personal observations, and as such, the few notes which I have to place upon record will, I trust, prove of some interest.

For the notes on the fishes collected by me, I am indebted to Dr. F. Day, and for those on the Mollusca to Mr. G. Nevill.

Geology.

The geology of these islands as forming a portion of the Nicobar group has already been described by Dr. Rink, geologist attached to the Corvette "Galathea," and by Dr. Hochstetter, of the "Novara."

My field observations, I find on comparison, are simply confirmatory of the views as to the structure of these islands held by the last mentioned distinguished geologist, and which have recently been published in the Records of the Geological Survey of India.§ I do not, therefore, give them in detail here, but I shall briefly allude to the general results.

Dr. Rink separates the sedimentary rocks into two formations, calling the clay stones and their associated conglomerates of Camorta, Nancowry, Trinkut, &c. "*Older Alluvium*"; and the sandstones and slates of the southern islands "*brown coal formation*." Dr. Hochstetter does not agree in this opinion, believing

* Steen Billes account of the voyage of the Corvette "Galathea" round the world, Copenhagen, Leipzig, 1852.

† Copenhagen, 1847.

‡ Voyage of the Novara by Dr. Karl Scherzer, and Results of the scientific discoveries of the Novara expedition &c.

§ Vol. II, Part 3, 1869.

that they are only "petrographically different products of one and the same period of deposition."

The sandstones and slates of the southern islands are apparently identical with those of the Andamans which I examined at Port Blair. They both contain fragments of drift wood changed into coal, and impressions of plants resembling *Fucoids*. As the two sets of rocks have not been seen, and so far as is known, do not occur in contact, it is impossible to assert anything positively with regard to their mutual relations.

If they are to be regarded at all belonging to one formation, then local circumstances must have determined the great difference in lithological character which exists between the rocks of the northern and southern islands, while at the same time the processes at work during the deposition of the formation produced uniform results at places not only so distant as Port Blair and the great Nicobar, but as Arracan and Java. Mr. Blanford has stated it as his opinion* that the Andaman sandstones, from specimens brought by Mr. S. Kurz, are identical with those of Arracan. Dr. Hochstetter, (l. cit.) discusses the probability of the Nicobar rocks being the same age as some occurring in Java and Sumatra.

The terms "older alluvium" and "marl" which have been used by Dr. Rink, and Dr. Hochstetter respectively, neither accord very closely with the character of the Camorta and Nancowry rock, according to the generally accepted English system of rock nomenclature.

The term alluvium can scarcely be applied to rocks of the age of the claystones of Camorta, rocks whose strata are much disturbed, occasionally even being nearly vertical. A marl should contain some percentage of lime, the amount of which is disputed. The Camorta rocks, however, rarely contain even a trace of lime.

The rocks of these islands which determine the character of the soil are—

1st.—Coral rocks all round the coast.

2nd.—Magnesian claystones with interbedded conglomerates, of which an admirable section shewing a roll in the beds is well seen

* Report on the vegetation of the Andaman Islands, by Mr. S. Kurz, p. 2.

in Nancowry haven, on the Camorta and Nancowry shores. At the western entrance, there are great beds of conglomerate, some almost vertical, striking N. W.—S. E.

3rd.—Gabbro and Serpentinous rocks, well seen on the highlands east and west of the village of Alta Koang on Nancowry.

The coral rocks together with the sea drift form the soil in which the cocoa-nuts and vegetables cultivated by the natives grow and thrive.

The magnesian claystones, on disentegration, form a soil incapable of supporting more than a crop of grass. In the valleys where this formation occurs, the accumulating of vegetable matter &c. brought down by the streams, has proved sufficient in many cases to support a jungle of large trees. But in the hot house climate of the Nicobars, the poverty of the soil is so great, that the tops of some of the hills are perfectly bare, or are only able to support a fern, *Gleichenia dichotoma.* The presence of a conglomerate bed has the effect, by the decomposition of its contained pebbles of igneous rocks, of locally improving the character of the soil.

The igneous rocks, Gabbro and Diorites, produce a much better soil which is capable of supporting a dense jungle.

To the variability in the fertility of the soil which is thus explained is due the peculiarity of the scenery at Nancowry.

In the southern Nicobars, according to all accounts, and certainly in the Andamans, the greater uniformity is due to less variability in the character of the soils, derived from the rocks forming those islands.

As to the economic resources of the rocks, they cannot be estimated at a high rate. The coal of the southern islands is evidently similar to that of the Andamans, being simply derived from fragments of drift wood and forming little strings and nests in the sandstones in which it is imbedded. Dr. Rink discusses the possibility of gold being found in the igneous rocks. No trace of it has, however, been found. It is extremely improbable that the Nicobarians know its value.

Both Dr. Rink and Dr. Hochstetter obtained small traces of copper in the igneous rocks. This fact could not, however, be used as a proof of its occurrence in large quantities, though it might justify a closer and more extended examination of the locality.

As to the occurrence of amber* in the Nicobars, a belief which seems to be entertained by some, I can offer no decided opinion. *Prima facie* there is no argument against it; on the contrary, the rocks are such as might be expected to produce amber; but with the exception of some fossil resin, a sort of pseudo-amber found by Dr. Rink, I have searched in vain in the accounts of the Nicobar islands for any reliable testimony of its occurrence, or even of its having been seen with the natives, though it is mentioned incidentally in one account as being one of the exports. I am strongly inclined to believe that the ambergris which is found on the shores and exported, has given rise to the belief in the existence of amber.

Fauna.

Mammals.

I did not succeed in obtaining any mammals; they appear to be very rare near the settlement. The evidence in favor of Buffaloes existing on the island of Camorta has as yet not received further confirmation than what we know from the records of Dr. Rink. The animal does not appear to have as yet been seen by any European, but foot-prints were observed. A few species of monkeys, bats and others† have been noticed by Mr. Blyth (J. Asiat. Soc., Vol. xv, p. 367), and in the Novara scientific report.

Birds.

During the short period of my stay in the Nicobar islands on the hulk anchored off the new settlement on Camorta, my time was principally taken up by long boat trips to various parts of the neighbouring islands of Nancowry and Trinkut; I had, therefore, but little leisure for making a collection of birds. I am unable to add to the scanty avifauna of the island, as already known, the description of a single new species. Two birds were, however, observed by me which have not hitherto been recorded, unfortunately I did not procure specimens of either: they were a small Quail, *Turnix sp.?* and a species of *Ægialitis* (possibly *Æ. minutus*).

* The reference to *amber* has no doubt originated in the word *ambra* which is generally used in German accounts, signifying *ambergris*. (Stoliczka.)

† I have lately obtained through my collector a very interesting species of *Murinae*, but it has not yet been identified (Stoliczka.)

That the number 45 which, so far as I can ascertain, is about that of the birds hitherto found in the Nicobars, represents more than a small proportion of the birds actually existing in the islands, is difficult to believe. Still it is singular that the collection made by Captain Lewis and Mr. Barbe, and described by Mr. Blyth in 1846, is, with a few exceptions, simply repeated by mine of the present year.

The principal result to be recorded is, that I have been able to compare several Andaman and Nicobar forms as to the identity of which some doubt existed; of these the principal to be noticed are, *Palæornis Nicobaricus*, Gould, *P. eryothrogenys*, Blyth; *Geocichla innotata*, Blyth, *G. albogularis*, Blyth; *Eulabes Andamanensis*, Tytler, &c.

From my specimens, the Andaman and Nicobar Imperial Pigeons would appear to be quite distinct species, the vinaceous tinge being present in the former and quite absent in the latter, which is also a slightly larger bird. This question has, however, already been discussed by Mr. Blyth.

1. Haliætus leucogaster.—A pair of fishing eagles, apparently belonging to this species, were frequently seen in Nancowry haven. They seemed to live chiefly on refuse from the ships which they picked off the surface of the water.

2. Palæornis Nicobaricus, Gould.—Proc. Z. S., 1866, p. 555; Birds of Asia, 1857, Pl. IX; *P. erythrogenys*, Blyth, J. A. S. B., 1846, XV, p. 23, and 1858, XXVII, p. 81. Ibis N. S. 1867, III, p. 319. Novara Exp., Vögel. 1865, p. 97.

This bird is very abundant both at the Andamans and Nicobars. I obtained two specimens in the latter islands. The natives also brought for sale some live birds, which they had captured with bird lime.

The adult male has the upper mandible a beautiful cherry red. The young male, as in other species of *Palæornis*, has the plumage and bill colored as in the female. The brilliant red of the cheeks fades much in dead specimens.

In the Andamans I used to see large flocks of these birds passing Viper island every day, going to and returning from their feeding grounds.

3. Todiramphus occipitalis, Blyth.—J. A. S. B., XV, pp. 23, 51; *Halcyon occipitalis*, Novara Exp., Vögel, p. 46.

This noisy bird may frequently be seen perched on the bushes in the clear spaces near the new settlement on Camorta. It also frequents trees on the sea coast.

4. Nectarinia pectoralis, Horsf.—Pl. Col. 138. I shot a female on Camorta. The bird appeared common in the forest near the old Danish settlement on Nancowry.

5. Zosterops palpebrosus, Tem.—Pl. Col. and J. A. S. B., XV, p. 370. Shot a female of this species also on Camorta.

6. Hypsipetes virescens, Blyth.—J. A. S. B., XV, p. 51; *H. Nicobariensis*, Horsf. and Moore, Cat. East India Mus., I, p. 257; Novara Exp., Vögel, p. 76, Pl. iii, fig. 2. Probably abundant on Camorta, shot one specimen.

7. Myragra azurea, Bodd.—Birds of India, I, p. 450. *M. cœrulea*, Blyth, J. A. S. B., XV, p. 370. My specimen which was shot on Trinkut, appears to be the young of this species, but it is not in sufficiently good order for one to be certain of its identity.

8. Geocichla innotata, Blyth, J. A. S. B., XV, p. 370; *G. albogularis*, Blyth, J. A. S. B., XVI, p. 146; Ibis N. S., III, 325. My specimen from Camorta corresponds exactly with one in the Indian Museum labelled by Blyth, *G. innotata* from the Nicobars, but for which he suggested *l. c.* the name *albogularis*. Both have the wing ⅜ of an inch shorter than an Andaman specimen, while they are exactly the same size as in another specimen, apparently too from the Andamans.

9. Oriolus macrourus, Blyth.—J. A. S. B., XV, p. 46; Novara Exp., Vögel, p. 74. This well marked Oriole seems tolerably abundant; I also saw another species, distinct from *melanocephalus*.

10. Eulabes Andamanensis, Tytler.—Ibis, New Series, III, p. 32; *Gracula Javana*, Cuv., in Exped. Novara, Vögel, p. 88; *G. intermedia*, A. Hay, apud Blyth, Adventures and researches among the Andaman Islanders, Appendix, p. 359.—Procured a specimen of this Maynah on Camorta. A very much injured skin given to me in the Andamans, enabled me to compare the birds from both localities. I can detect no difference between them; this confirms Lord Walden's belief as to the bird extending to the Nicobars. (Vide "Ibis," New Series, III, p. 331).

11. C. INSULARIS, Blyth.—Adventures and researches among the Andaman Islanders, Appendix, p. 361; *Carpophaga sylvatica*, var. *Nicobarica*, Tickell, J. A. S. B., XV, p. 371; *C. Aenea*, var. *Nicobarica*, Novara Exp., Vögel, p. 105. As to the distinctness of this bird from true *sylvatica* there can be no doubt. It is in every respect a larger bird than the one from the Andamans which is identical with specimens of *sylvatica* from Cachar and Manbhúm, Damin-i-Koh, &c.

	Bill to gape.	*Wing.*
Nicobar Bird, ...	1½ inch	10 inch.
Andaman Bird, ...	1¼ inch	9¼ inch.

There is a total absence of the vinaceous tinge on the lower parts of the Nicobar bird. The feathers of back, wings and tail are a bluish bronze, those of the Andaman and Indian birds being greenish bronze.

12. CARPOPHAGA MYRISTICIVORA, Scop.—J. A. S. B., XV, 371; *C. bicolor*, Scop. Blyth, Cat, 1406; Novara Exp., Vögel, p. 107. This bird is tolerably abundant, feeding on the same fruits as the last species.

13. CHALCOPHAPS INDICA, Linn.—J. A. S. B., XV, 371; Novara Exp., Vögel, p. 110. I saw this bird on several occasions, but did not procure a specimen. When startled, it often flies close past one's face.

14. MACROPYGIA RUFIPENNIS, Blyth.—J. A. S. B., XV, 371; Novara Exp., Vögel, p. 109. A small flock of these birds was seen during my stay on Camorta.

15. CALÆNAS NICOBARICA, L.—J. A. S. B., XV, 371; Ibis N. S. III, 332; Novara Exp., Vögel, p. 110. This beautiful bird cannot be very common, as I did not succeed in seeing a single specimen. Probably, as Mr. Wallace found in the Malayan Archipelago, it is chiefly confined to the very small islands where it can feed unmolested on the fallen fruits. The Novara Expedition procured a specimen on the small island of Treiss.

16. MEGAPODIUS NICOBARIENSIS, Blyth.—J. A. S. B., XV, 372; Novara Exp., Vögel, p. 110, Pl. iv, figs. 1—3. This bird seems to be tolerably abundant on Camorta. I shot three specimens one morning close to the settlement. The first of them had flown into a tree, much in the manner that Indian jungle fowl do when suddenly startled.

It has a peculiar not easily describable call, consisting of a guttural sound, reminding one of the croak of a bull-frog; it may be perhaps represented by the syllables *Kiouk, Kiouk, Kŏk Kŏk Kŏk* repeated. Some who had heard this call, assured me that there were peacocks on the island, but it has no resemblance to the cry of a peacock. Unfortunately, by an accident, I did not examine the birds myself; but if my bird-skinner has not deceived me, there is but little if any difference between the sexes. By a most fortunate chance, on the very day upon which I got the birds, the Nicobarese brought two of the eggs to the ship for sale.

The dimensions of a bird measured in the flesh are as follows :—

Length, bill to tail,	$15\frac{1}{2}$	inch.
Length, bill to claw,	$19\frac{1}{2}$	,,
Wing,	$9\frac{1}{4}$	,,
Extent, about	27	,,
Bill, from gape,	$1\frac{1}{8}$	,,
Tarsus,	3	,,
Claws,	$\frac{7}{8}$	,,
Girth,	$9\frac{1}{2}$	,,

Eyes, dull orange yellow.

	Length.	*Circumference.*
Egg, No. 1,	$3\frac{5}{16}$	$6\frac{5}{8}$
Ditto, No. 2,	$3\frac{1}{8}$	$6\frac{3}{8}$

Colour, brick red.

The only remaining egg in the Indian Museum of those mentioned by Blyth has become quite white.

17. TURNIX SP. ?—Saw several specimens of a small dark quail, one which I shot was lost in the long grass. The legs appeared to be deep orange, as in *T. Dussumierii.*

18. NUMENIUS PHÆOPUS, Linn.—I saw a small flock of whimbrel perched on some trees bordering a creek on the island of Trinkut; one which I shot is almost identical in length of bill and other variable characters with a specimen obtained by Mr. Blyth in the Calcutta bazar, and which is now in the Indian Museum. This bird is also recorded from the great Nicobar by the Novara expedition.

19. ÆGIALITIS, SP. ?—I saw a small plover, either *Æ. Philippensis* or *minutus*, feeding near the water line on the beach at Nancowry.

20. DENUGRETTA CONCOLOR, Blyth.—*Ardea concolor*, Blyth; Novara Exp., Vögel, p. 122. I procured a specimen of this bird near the western entrance of Nancowry haven, where it was feeding along the shore.

I saw several young birds of I believe the same species in captivity at the Andamans. The dimensions of the bird which I shot, measured in the flesh, being somewhat different from those given by Mr. Blyth, I append them here. Colour senty ashy throughout, darker on the inner web of the secondaries and tertiaries and on the tail; underneath the wings silvery ashy, occipital plumes consisting of decomposed feathers about 1½ inches.

Scapulars much developed, some extending to the end of the tail.

Wing,	10¾	inch.
Tail,	4	,,
Extent,	38	,,
Bill,	3½	,,
Tarsus,	3	,,

Legs dirty yellow, inside of toes bright yellow. Iris bright yellow, pupil large.

20. *Ardeola leucoptera*, Bood.—I think I saw an individual of this species perched on the mangrove roots in a creek on the island of Trinkut. He escaped wounded, so that I cannot be sure of his identity.

21. *Onychoprion melanauchen*, Temm.—Very abundant both on he Andamans and Nicobars, breeds on the rocky islets.

NOTES ON THE FISHES; *by* Surgeon F Day.

I have examined 21 specimens of fish presented to the Calcutta Museum, by V. Ball, Esq., who collected them at the Nicobars; they belong to the following eleven species.*

* During my short visit to the Nancowry haven in October last, and afterwards through my collector, whom I have sent on two subsequent occasions

1 *Serranus Sonnerati*, C. V.
2 *Ambassis Dussumieri*, C. V.
3 *Caranx hippos*, Linn.
4 *Sillago sihama*, Forsk.
5 *Trypauchen vagina*, Bl. Schn.
6 *Atherina Forskalii*, C. V., 5 specimens.
7 *Pomacentrus punctatus ?* Qu. and Gaim.

D $\frac{13}{15}$, A $\frac{2}{14}$, L. l. 28.

Height of body $\frac{2}{5}$: length of head $\frac{1}{4}$: of caudal $\frac{2}{9}$ of the total length. Preorbital denticulated, longer than deep, a notch between it and the suborbital ring, caudal lobed, the upper the longest. The dorsal spines gradually increase in length to the last. Colour brownish, head dotted, a light spot on each scale ; a blackish brown band, anteriorly edged with white, exists upon the free portion of the tail posterior to the dorsal fin : opercles darkest superiorly.

8. *Nuria malabarica*, Day (variety), two specimens each 2½ inches long. Pectorals elongated reaching to the middle of the ventrals, barbels extending to the base of the ventrals. A well marked black spot at the root of the caudal fin.

9. *Clupea Neohowii*, C. V., five specimens.
10. *Chatoëssus chacunda*, H. B.
11. *Temera Hardwickii*, Gray.

General remarks on the Mollusca, *by* G. Nevill, Esq.

The collection of Mollusca* made by Mr. Ball at the Andamans and Nicobars, though not very extensive, still includes a few very

to the Andamans and Nicobars for the purpose of chiefly collecting *Reptiles* and *Mollusca*, I have also obtained above 30 species of fishes, among which there are several new species. Dr. Day is at present engaged in an examination of these. (Stoliczka.)

* I now possess about 20 species of land-shells from the Nicobars, and a somewhat larger number from the Andamans; from both groups of islands there are several interesting new species, the descriptions of which are now in preparation. Of marine shells I obtained on my own visit, and through my collector who was most kindly aided by Capt. Rundall, about 200 species from the Nicobars, and about 300 species from the Andamans. From the latter I have a large number of little shells, chiefly obtained with the dredge.

important forms, to any one who takes any interest in this branch of the marine fauna of the Indian seas; amongst them is a species of *Corbis*, and several new and interesting forms of different genera, belonging to the *Mitridæ*, *Pleurotomidæ*, *Nassinæ*, &c. identical or very similar to Philippine species, and which I have never found, or heard of, from places further west, not even from the coast of India. From the data which I, up to the present, possess, the Marine Molluscous Fauna of the Andamans seems to me nearest allied to that of Arracan—of late most ably worked out by Mr. W. Theobald with the assistance of Mr. S. Hanley, that of the Nicobars approximating more closely to that of Singapore. There is one great difficulty everybody out here has to contend with, who is desirous of working on the range of species in the Indian seas, that is, the absence, in all of the Calcutta Libraries, of Krauss' "Süd-Afrikanische Mollusken," a standard work of primary importance for this subject. From the small collection I was able to make at Natal, and from that of Mr. Blanford's from Annesley Bay, I should say the species ranging as far as these places are but very few in number: *Cypræa annulata*, *helvola*, and *pellis serpentis*, *Purpura tuberculata*, *Nerita albicilla* and *polita*, *Natica mamilla* and one or two others, the number of species common to both increases considerably at the Seychelles and Bourbon, and still more at Ceylon. Of the 128 species collected by Mr. Ball, 70 are well known forms and widely spread in our seas; amongst the rarer or more local species, I may mention *Conus zonatus*, *marchionatus* and *mustelinus*, *Mitra plicata*, *Grüneri*, *semifasciata*, *cruentata*, *exasperata*, *flammigera* (?), and 3 probably new species. *Phos Blainvillei*, *Pleurotoma abbreviata* and *tigrina*, *Cerithium Traillii* and *alveolus*, *Strombus columba*, *Columbella* ?, *Rapa papyracea*, *Trochus fenestratus*, *Euchelus foveolatus*, *Polydonta incarnata*, *Purpura musica* and *bituberculāris*, *Murex nigri-spinosus* and *adunco-spinosus*, *Natica albula* and n. s. (?), *Actæon coccinata*, *Tectura Borneen-*

When at the Andamans I have with pleasure observed the collecting zeal of many of the officers of the settlement, and I have little doubt that their exertions will soon enable us to obtain a very fair knowledge of the Molluscous fauna of these islands. Dr. Day on his late visit in connexion with the fisheries has also collected largely mollusca, both land and marine shells. [Stoliczka].

sis (?), *Pyramidella auris-cati*, *Nassa albescens*, *costellifera livida* and *globosa*, *Scintilla* n. sp.; *Mactra* n. s. (?), *Tellina rhomboides*, *Venus affinis* and *alabastrum*, *Cæcella* n. s. (?) *Corbis fimbriata*, *Hemicardium cardissa*, *Rocellaria* n. s. (?), *Loripes* n. s. (?).

Notes on the Genus Hara,—*by Surgeon* F. Day.

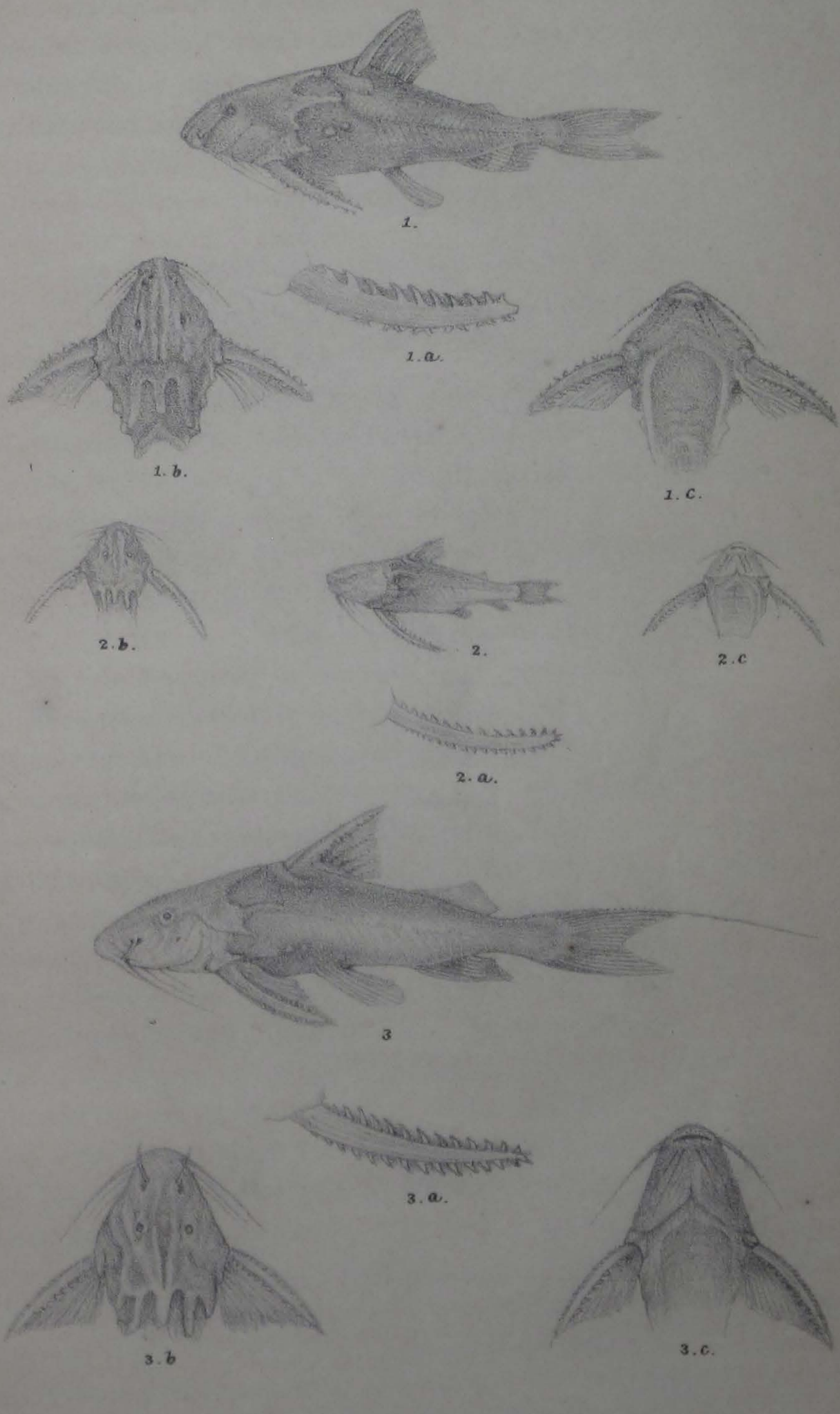
[Received 10th Feb., read 2nd March, 1870.]

In the *Proceedings of the Asiatic Society of Bengal*, for 1860, p. 152, Mr. Blyth proposed forming the genus *Hara*, for the reception of some siluroid fishes which had been described by different naturalists, and he placed the four following Indian and one Chinese species as component parts of it.

1. *Pimelodus hara*, H. B. termed *Hara Buchanani*, Blyth.
2. ,, *conta*, H. B. ,, ,, *conta*.
3. ,, *aspera*, McClelland,, ,, *aspera*.
4. ,, *carnaticus*, Jerdon, ,, ,, *carnatica*.
5. *Hara filamentosa*, Blyth.

Further enquiry, however, appears to show that this list requires revision; first as regards *Hara ? (Pimelodus) aspera*, McClelland, the description is far too vague to be able to decide whether his fish really belongs to this genus, whilst his figure is equally unsatisfactory, and useless for the purpose. It appears very like the *Hemipimelodus (Pimelodus) cenia*, H. B., which is also re-figured in Sykes' *Fishes of the Deccan* as *Pimelodus itchkeea*, Sykes, a species which extends from the Bombay side of the Deccan, and the Mahanuddee, certainly as far as the Irrawaddi. However, without further materials, or an examination of the original specimen, the species must remain doubtful, which is not material with reference to the Indian Fish fauna, as it came from Chusan.

Omitting then McClelland's fish, we have, according to Mr. Blyth, four Indian species remaining, but of these one does not appear to belong to this genus, namely, the *Pimelodus carnaticus*, Jerdon, which is the young of the *Bagarius Yarrellii*, Sykes. I obtained an identical specimen to the one described from the same locality, the Bowany river in the Madras Presidency.



1. *Hara Buchanani;* 2. *H. Jerdoni;* 3. *H. Conta;*

Hara filamentosa, Blyth, as I have already remarked in the *Proceedings of the Zoological Society*, is the same as *Hara (Pimelodus) conta* of Hamilton Buchanan. This reduces the Indian species to two, to which, however, I will add a third one, *Hara Jerdoni*, a new species which I shall describe and figure from a specimen given me by Dr. Jerdon, who lately obtained two in the Sylhet district.

Before, however, describing the new species, I propose offering some remarks on the genus *Hara*, as it does not appear that any Indian specimens have reached European Museums, neither have any drawings been published. Amongst the original sketches in H. B. MS. collection is a very good figure of the *Pimelodus Hara*, H. B.

The genus has been referred to the group *Bagarina* defined by gill membranes not confluent with the skin of the isthmus, their posterior margins being free, even when united together, &c., but in reality it forms a portion of the group *Bhimoglanina*, defined by gill membranes confluent with the skin of the isthmus, anterior and posterior nostrils close together with a cirrus between; rayed dorsal, if present, short, and belonging to the abdominal portion of the vertebral column; the ventrals (except in one genus, so far as is known) being inserted behind it.

Genus—Hara, Blyth.

Head somewhat depressed, osseous superiorly, mouth small, terminal or sub-inferior, gill openings narrow, and the membrane confluent with the skin of the isthmus; cirri eight, the maxillary ones having broad bases; eyes small, subcutaneous. Villiform teeth in the jaws, and in a band on the palate. First dorsal with a serrated osseous spine and 5 or 6 rays; adipose dorsal of moderate length, ventral with six rays, and rather short, caudal forked.

The geographical distribution of the genus in the British Indian Empire, appears to be from the Mahanuddee on the west to the Salwin in the east, whilst I have taken them as far inland as Mandalay in Upper Burma. I have not obtained specimens in any of the Madras rivers, although one would contend that they are probably present in the Kistna and Godavery, whose fish fauna in the siluroid family generally resembles that of the Mahanuddee.

These little fishes in their external appearance are so generally similar to the *Bagarius*, that the native fishermen of Orissa persisted that they were merely their young. They frequent the same localities, namely rivers which are swollen to floods during the rainy season. They get beneath vegetation and under stones, and are generally found mixed with the shells, slime, and refuse which is drawn by nets to the shore, but being small and valueless as food, are frequently overlooked.

Hara Jerdoni, sp. nov. Pl. IV, figure 2 *a. b. c.*

D.$\frac{1}{5}$ P.$\frac{1}{6}$? V.6. A.10 C.12.

Length of head $\frac{1}{4}$, of caudal $\frac{1}{4}$ of the total length.

Height of body $\frac{1}{4}$ of the total length.

Eyes, three diameters from the end of the snout.

Head depressed, half wider opposite the opercles than high, and slightly wider than long. Its upper surface rugose, and its superior longitudinal furrow extending nearly to the base of the occipital process, where it terminates in a small pit. Snout rounded, mouth small, transverse, with the upper jaw slightly the longest. The nasal bones terminate in a small spine on either side above the centre of the mouth. Maxillary cirri reach the gill opening, all the others are shorter. Occipital process $1\frac{1}{2}$ times as long as wide at its base. Shoulder bone moderately triangular, rugose, and with two prominent ossicles posterior to, but in a line with it; between it and the occipital process and parallel with them is an intermediate bony prolongation reaching to opposite the basal bone of the dorsal fin.

Fins.—The dorsal spine equals the length from the posterior margin of the orbit to the end of the snout, it is serrated posteriorly. The length of the base of the adipose fin is a little more than half that of the dorsal fin. Pectoral spine flattened and slightly longer than the distance between the snout and the base of the dorsal fin, when laid backwards it reaches nearly as far as the end of ventrals; it is strongly denticulated internally with 12 curved teeth, whilst externally it has 26 smaller ones directed backwards; ventrals inserted posterior to the base of the dorsal, caudal forked, none of its rays elongated.

Skin smooth.

Colours—brownish, irregularly banded with a darker tinge, cirri annulated with black.

The three species of Indian *Hara* may be distinguished one from another by the following characters :—

Hara Buchanani, Fig. 1, *a. b. c.*, skin with blunt spinate ossicles; pectoral spine as long as the head from the base of the occipital process to the end of the snout, its external spines alternately directed forwards and backwards, no elongated caudal ray.

Hara Jerdoni, Fig. 2, *a. b. c.*, skin smooth ; pectoral spine as long as from the base of the dorsal fin to the end of the snout, its external spines directed backwards, no elongated caudal rays.

Hara conta, Fig. 3, *a. b. c.*, skin tuberculated (having smooth tubercles, giving it the appearance of that of a Geckoid lizard) ; pectoral spine as long as the head, from the base of the occipital process to the end of the snout, its external spines directed backwards. An elongated ray in the upper lobe of the caudal fin.

Statistical Data on the Area of Asiatic Russia, *compiled by* **Mr. W. Venuikof;** *translated from* No. III, 1865, *of the Notes of the Imperial Russian Geographical Society, by* Mr. R. Michell, F R. G. S., and *communicated*, by Lt.-Col. J. T. Walker, R. E.

[Received 13th February, 1868.]

On his return from Asiatic Russia in 1860, Mr. Venuikof, made a calculation of the surface of the Asiatic provinces of Russia, with the aid of all the best maps of that period, the results of which were published in a monthly Almanack of the Russian Academy of Science for 1864. The figures he then arrived at have again been revised and amplified by him this year, after the issue of Schwartz's map embracing the whole of South Eastern Siberia, and the re-issue of corrected maps of Western Siberia, and of the Orenburg region. On the two last named maps, the distinct outline of the Russian limits to the South and East of the Kirghiz Steppes was not preserved, so that Mr. Venuikof had still to be guided by the old boundaries of the Empire, as he found them in 1860.

His authorities in his later calculations have been:—

(1.) The General Map of Asiatic Russia, published at the Military Topographical Depôt in 1860, on the scale of 200 versts (133⅓ English miles) to the inch. This map, however, only served to assist him in his calculations as to the extreme northern parts of Western Siberia from 65° northwards.

(2.) The General Map of Western Siberia on the scale of 50 versts (33⅓ English miles) to the inch, corrected to the end of 1861, and to 1863, as regards the southern limits of Issik-kul.

(3.) A similar map of the Orenburg region, corrected to 1863.

(4.) The Map of Eastern Siberia, published at Irkutsk in 1858, by which Mr. Venuikof made a calculation of the superficial extent of all those portions of Eastern Siberia which were not shown on Schwartz's Map. The Western boundary of the Government of Yeniseisk he drew from the map of Western Siberia, and the Southern boundary of the Yakutsk region he traced from Schwartz's map, so as to reconcile his calculations for the separate provinces with those for the entire country.

(5.) The map of the countries of the Amoor river and of portions of the Lena and Yenisei rivers.—Schwartz, published by the Russian Geographical Society in 1863.

(6.) The map of the Khanat of Kokan, constructed by Mr. Venuikof himself in 1861. From this map he obtained the area of the Trans-Chui country.

In compiling his statistics, Mr. Venuikof adopted the following limits:—

In the *North*—the Ocean; the islands therein situated are estimated separately, and necessarily only approximately, their outlines being but imperfectly known, as are those also of the Taimyr peninsula.

In the *East*—the Pacific Ocean from the embouchure of the Tumen-Ula to Behring's Straits. Here the areas of the Islands are more accurately computed. The Island of St. Lawrence does not enter into his calculations.

In the *South*,—the Caspian Sea from the mouth of the Ural to 44° of latitude; the 44th parallel; the northern shore of the Sea of Aral, and the Jaxartes. With reference, however, to this portion of the Steppe, Mr. Venuikof made use of the known results of former calculations. Those lands of which he has freshly calculated the areas, are bounded in the south by the rivers Chui, Kostekara, the upper course of the Jaxartes, Karkara and Charyu, and by the conditional frontier line along Drungaria and Mongolia—as traced on the maps—to the Argun, Amoor, Tungachan, and to the Tumen-Ula.

In the *West*,—the Ural Mountains, the boundaries of the Governments of Peru and Orenburg, and the region of the Orenburg Kirghizes to lake Telekul. Although Mr. Venuikof has not himself calculated the areas of the Steppes of the little horde of Kirghizes, that having been done with sufficient accuracy at the General Staff, he has, from the sum total of these areas, deducted the figure for that portion of the Steppes which is apportioned to the Kirghizes of the Jaxartes. By the Trans-Chui region, he comprehends the country between the Chui and the Talus extending to a line connecting Aulieta with Turkistan.

From this he obtained the following results —

Zones and Countries.	Areas in British square Miles.		
	In Western Siberia.	In Eastern Siberia.	Totals.
North of 70° lat. exclusive of islands. ...	13,800	271,530	285,330
Between 70° and 65° latitude.	119,670	969,260	1,088,930
" 65° " 60° "	249,460	1,077,730	1,327,190
" 60° " 55° "	328,090	769,690	1,097,780
" 55° " 50° "	354,790	620,330	975,120
" 50° " 45° "	280,010	126,430	406,440
South of the 45th Parallel to the river Chui. ...	59,980	34,620	94,600
Islands of the Arctic and Pacific Oceans, ..	....	24,630	24,630
Totals, ...	1,405,800	3,894,220	5,300,020
Country of the Orenburg Kirghizes, ..	....	348,180	373,500
" " " Kirghizes of the Jaxartes, ..	....	25,320	
Trans-Chui land, approximate	....	....	22,610
Total, ..	....	....	5,696,130

Adding 92,570,—the extent of the Trans-Ural portion of the Governments of Peru and Orenburg,—the whole surface of the Russian dominions in Northern and Central Asia is found to measure 5,788,700 square miles British.

The total of 5,696,130 is made up of the areas of Governments, territories and regions as under —

Region of Orenburg Kirghizes, ...	348,180
Country of Syr-Daria, ...	25,320
Trans-Chui Country, ...	22,610
Region of Siberia Kirghizes, ...	313,450
Ditto ditto Semipalatinsk including the Balkhash, ...	204,650
Carried over,	914,210

Brought forward,	914,210
Governments of Tobolsk,	552,550
Ditto ditto Tomsk,	335,150
Ditto ditto Yeniseisk,	972,960
Ditto ditto Irkutsk with the Baikal,	279,800
Region of Yakutsk with Islands of the Arctic Ocean, ..	1,587,050
Trans-Baikal Region,	234,490
Amoor ditto,	155,650
Maritime Region with Islands of the Pacific,	664,270
Total ..	5,696,130

These figures Mr. Venuikof compares with the figures of the Academician Keppen, and with those given in the "Almanack de Gotha" for 1864, and he is confident that the results of his more recent computations are more correct than either of those with which he compares them, but more especially as regards the general total. He does not pretend that they are strictly accurate; it is almost impossible that they can be so, while there is not that mass of trigonometrical and astronomical determinations which is so necessary for the construction of fresh maps. In this respect, there is a great deficiency as regards the Russian possessions in Asia; for instance, as to the Governments of Tobolsk, Yeniseisk, the regions of Yakutsk and of the Siberian Kirghizes.

Mr. Venuikof adds the further particulars relative to Asiatic Russia.

(1.) On the length of the land, fluvial and maritime frontiers.
(2.) On the areas of such separate lands as peninsulas and islands.
(3.) On the dimensions of the principal river basins.
(4.) On the plains of large lakes, and
(5.) On the proportions of lands suitable or otherwise for permanent settlement.

1. Asiatic Russia is bounded on three sides by Seas: On the North, East and South-West. The length of coast in the Arctic region from the Kara-Bight to Behring's Straits is not less than 11,000 versts (7,333 Engish miles). The length of the shores of the Pacific from Cape Chukotsk to the mouth of the Tumen-Ula is

about 9,100 versts (6,067 English miles). The shores of the Caspian and Aral Seas may be computed at 1,750 versts (1,167 English miles). So that the proportion of coast line to area is 14,567 to 5,696,130, or 1 linear mile of coast to 391 square miles of country; a proportion which might be considered advantageous, if it were not a fact that half of the Siberian waters are not available for navigation. Taking then into consideration only the Pacific Ocean and the Caspian and Aral Seas, the relative proportion of coast line to Continental area is 1 linear mile to 790 square miles, a circumstance as unfavourable as in the case of purely Continental Africa.

The land frontier of Asiatic Russia, from the Caspian and Aral Seas to the mouth of the Tumen-Ula is about 10,000 versts (6,667 English miles). Of these 3,300 versts (2,200 English miles,) are described by the course of the Jaxartes, Charyn, Argun, Amoor, and Usouri, the remaining 6,700 versts (4,467 English miles) are open land frontier. One half, however, of this extent of 6,700 versts is occupied by mountains, such as the Celestial, Alatau, Altai, and Sayan mountains, and the spurs of the Yablonoi range, all of which generally speaking are difficult of access.

2. The Mainland of Siberia has only two striking and well defined tongues, Sapalin area 23,554 square miles, and Kamschatka* 99,770 square miles;—the entire area of the islands of the Pacific and Arctic Oceans does not exceed 24,630 square miles, so that in the aggregate the members are to the body as 1 is to 38, which is another proportion as unfavourable as in Africa. Although to these might be added, the peninsula between the Obi Bight and the Kara Sea, and the Taimyr peninsula which even beyond the parallel of the 75° of latitude, measures about 18,300 square miles, yet both these tongues of land project into a sea which is ice-bound, and which can never serve to establish relations between them and other countries.

3. Siberia has four first class river-basins: those of the Obei, Yenisei, Lena and Amoor. The watersheds of the second class rivers, *viz.* the Olenen, Yana, Indigirka, Kobyma, Anadyr, Udaure Ili, although great in themselves, are nevertheless so inconsidera-

* The northern boundary of Kamschatka is described by a line drawn between the mouths of the Penjyna and Olintora.

ble as compared to the four principal ones, that there is found to be no necessity for calculating their surface, the more so as all of the latter basins are quite without the pale of historic life. The Jaxartes which might be included in the number of great rivers, has no affluents within the limits of Asiatic Russia.*

With respect to the extent of the basins of the chief rivers, and the lengths of their main torrents within the boundaries of Siberia, they may be thus expressed in figures :—

For the Ovi (Irtysh)	1,119,500	square miles,	2,090	linear miles.
,, Yenisei (Seleuza)	958,000	,,	2,300	,,
,, Lena	732,000	,,	2,420	,,
,, Amoor (Onon)	473,500	,,	2,530	,,

Of the best of these basins (that of the Amoor) more than one-third lies outside of the Russian limits. On the other hand the fact of these four main rivers embracing in their aggregate 3,283,000 square miles, or three-fifths of the whole of Asiatic Russia, points to the conclusion that sooner or later cheap water communication will extend throughout the greater portion of Siberia, from Yakutsk and the Pacific Ocean to the foot of the Ural mountains, and from Turukhausk to Barnaul, Alinousiusk, Kiakhta, and to the country of the Asouri river. There may occur not more than two land stages in each of these water ways, but these stages may be improved by the construction of railroads.

4. There are several large lakes in the interior of Asiatic Russia, which afford much scope for local fishing industry and serve to moisten the dry continental atmosphere. There is navigation on some of these, but in Siberia, as generally in the case of lakes every where else, the lakes do not form centres for the settlement of large industrial populations.

The areas of those lakes whose dimensions exceed 200 square miles inclusive of the Zaisau on which there are Russian fisheries, are as follows : —

	sq. m.		sq. m.		sq. m.
Baikal	12,400.	Hinkai	1,420.	Sumy	410.
Balkhash	8,530.	Chany	1,270.	Kulundinsk	280.

* The Arys and Chirchik are now *de facto* Russian since the occupation of Chemkend and Tashkend.

Issyk-kül	2,500.	Alakul	600.	Chukchagyr	260.
Piasino	2,410.	Dengiz-Citter	560.	Barun-torei	210.
Zaisau	1,490.	Abyshkau	540.		

The following were Mr. Venuikof's rough estimates in 1860 of the areas of land in Asiatic Russia, unsuitable for settled life.

	sq. miles.
Steppes in Western Siberia, and in the Orenburg region,	753,000
"Tundras" (marshes) and frozen land in Western and Eastern Siberia, ..	2,584,000
Mountainous country and highlands in the Thian-Shan, Alatau, Sayau, Altai, Yablonoi and Stanovoi Mts. &c.	431,000
Total, English miles	3,768,000

In other words, the extent of country unfitted for harbouring a settled industrious population in Asiatic Russia, constitutes two-thirds of the whole country; the rest or 1,930,000 square miles is less than European Russia, and throughout that extent the only portions that are naturally capable of attracting voluntary settlers are: 1. Sahalin. 2. The basin of the Amoor, and especially the Usowri district. 3. The Trans-Baikal region south of that lake. 4. The Minousiusk district. 5. The Western portion of the Altai, and 6. The sub-mountain zone of the Trans-Ili and Trans-Chui regions.

Narrative Report of the Trans-Himalayan Explorations made during 1868, drawn up *by Major* T. G. Montgomerie, R. E., G. T. Survey of India, from the original Journals &c., of the trans-himalayan exploring parties.

[Recd. 15th December, 1869.]

Early in 1868, preparations were made for sending an exploring expedition beyond the eastern watershed of the Upper Indus river.

The explorations of the Pundits during 1867, had supplied tolerably certain information as to various Tibetan districts lying between Rudok and the Thok-Jalung gold field, and between the latter and the Tadum monastery, on the great Lhasa road; more vague information had also been received, as to an upper road running from Thok-Jalung through various gold fields to the great Tengri-noor, or Nam-tso-Chimbo lake, and thence to Lhasa: several traders had been met with who had actually travelled along this upper road, but they were all rather reluctant to tell the Pundits much about it, being afraid of spoiling their market. Having the above information to go upon, Major Montgomerie decided upon sending the exploring party to Rudok, and thence through the districts of Rawung and Tingcho, to the north of the great Aling-Gangri group of peaks, which were discovered last year.

From Thok-Jalung the exploration was to be carried, if possible, along the upper road to the Tengri-noor lake and thence to Lhasa; failing that, to take the route through Majin and Shellifuk towards the Tadum monastery.

The Chief Pundit required a rest after his last expedition, and the 3rd Pundit was consequently selected for the work.

This Pundit assumed the character of a Bisahiri, and taking a few loads of merchandize started in April with a party of real Bisahiris (or men of Koonoo) whom he had induced to accompany him. He made his way from Spiti, through the upper part of Chumurti and Ladak, to Demchok on the upper Indus. Here the 3rd Pundit measured the velocity of the Indus by throwing a piece of wood into it, and then noting how long it took to float down 300 paces. The velocity turned out to be $2\frac{2}{10}$ miles per hour, with a depth of 5 feet, and a breadth of about 270 feet in the month of July. From Demchok he went northwards through Churkang and Rooksum, (or Rokjung), to Rudok.

Churkang was found to be a favourite place for holding monthly fairs. Rooksum turned out to be a large standing camp where one great annual fair only is held, but that a very large one, the Jongpon (or Zongpon) always attending it in person.

Rudok has hitherto never been actually visited by any European, for although Captain H. Strachey reached a point about 12 miles to the east of the Fort, and Captain Godwin-Austen another point about the same distance to the north, they were neither of them able to advance any farther, and could never get an actual view of the place itself, owing to the jealousy of the Jongpon who resides there, and governs this most north-westerly district of Tibet.

Though there was but little doubt that the position assigned to Rudok was nearly correct, it was hardly satisfactory not to have a trustworthy account of the place, and the 3rd Pundit was ordered to get all information about it, and to take observations, for its latitude and height, and this he succeeded in doing.

He found that the Fort was built on a low rocky hill, rising about 250 feet above the flat ground at its base, having the Budhist monasteries of Sharjo, Lakhang, Marpo and Nubradan close up to it on the east, south, and west, with about 150 scattered houses along the foot of the hill.

A stream called the Chuling-chu passes the Fort, and flowing in a north-easterly direction for 3 or 4 miles, joins the Churkang-chu, another large southern feeder of the great Pangkong lake which is about 9 miles from the Rudok Fort.

The 3rd Pundit heard that there is a small lake about 2½ miles north of Rudok, which has not hitherto been shown on any map; it swarms with wild fowl and is celebrated on account of a place called Kalpee Mhai, on its north-eastern shore, where the ground is so intensely hot that it smokes, and readily burns any wood, &c. that may be thrown into it. This place is much resorted to for the purpose of worship. The three monasteries round the Fort contain about 150 monks.

The 3rd Pundit remained a couple of days at Rudok, and in his assumed character as a Bisahiri, he and his party excited no suspicion though they were summoned before the Jongpon.

Leaving Rudok on the 22nd of July the party marched back to Rooksum, and then turning eastward by a new road, advanced through the districts of Rawung and Tingche to Dak-korkor, a large standing camp, where an annual fair is held. Several small lakes and a large salt lake called Rawung-Chaka, or Phondok-tso, were passed on the way. These lakes supply salt to Bisahir, Spiti, &c.

During the last three marches to Dak-korkor no water of any kind was met with, and the party were forced to carry a supply in skins. In this arid part of the country, the soil was of a dazzling white, a peculiarity which extended as far as the Pundit could see.

The Pundit was informed that 5 days' march to the north, there was a large district called Jung Phaiyu-Pooyu, and that throughout its whole extent, the earth is of the same white kind as that they were crossing over, so white in fact that the eyes of people who are unaccustomed to it, get inflamed from its glare, just as if they were suffering from snow-blindness. The district is inhabited by Dokpa people; it is under Lhasa, but said not to form part of Narikhorsum, having a separate Sarpon, or gold commissioner, of its own. The largest encampment in it is called Thok-daurapa said to have at least 200 tents. The district abounds in small tarns. It must be very elevated, as the inhabitants are said to eat very little if any grain.

A large river is said to flow from Jung Phaiyu-Pooyu northwards and then to the east towards China. The district is said to take its name from some high snowy peaks which are probably those at the eastern end of the Kiun-Lun range.

The Whor (or Hor) country is said to be due north of the district, and from information gathered elsewhere there is little doubt but that Whor (or Hor) is the Tibetan name for eastern Turkistan.

As to the district of Phaiyu-Pooyu, with its river flowing towards China, it is difficult to decide whether it is known by any other name, but it probably lies considerably to the east of north, communicating with Lhasa by the Tengri-noor lake district. A similar white soil has been noticed to the east of the Chang-chenmo, and Mr. Johnson, when seven marches to the north of that valley at a place called Yongpa, reported that "on looking down from a height the whole plain has the appearance of being covered with snow." He attributed this to saltpetre. Mahommed Ameen, in the route he supplied, said that "beyond the pass (north of Chang-chenmo) lies the Aksai-Chin, or as the term implies the the great Chinese white desert or plain. It is sandy and gravelly and covered with brush-wood. Its breadth here from south to north may be reckoned to be about sixty kos. It extends into Chinese Territory, to the east. There are several lakes and gold mines in it, &c." This quite answers to the accounts that the 3rd Pundit heard, a separate gold Commissioner proving the existence of many gold fields. No high peaks were seen to the east of the Chang-chenmo, Mr. Johnson having noticed from the peaks he ascended large plains to the east and south-east, which are believed to merge into the Chang-thang plains of Rudok. Whilst he also gathered that the Kiun-Lun range only ran about 100 miles east of the Karakash river and then terminated on an extensive plain also communicating with the Chang-thang plains.

The Pundit whilst marching from Rudok to Thok-Jalung saw no high peaks to the north or east, evidence which all tends to prove the existence of a large plain in that direction, the term Changthang meaning moreover the great plain.

According to modern maps this plain extends a great way east, nearly up to the end of the great wall of China near the city of Sewchoo, to which place the Chief Pundit appears to have got a rough route when in Lhasa. In his first journal he referred to a place, which he called Jiling, about one month's journey north of Lhasa. This turns out from farther inquiries made by Major Montgomerie to be the same as Siling. The Chief Pundit says that the Lhasa people call it Jiling, but he heard others calling it Siling, and from what he says it is evidently identical with Siling or Sining in North Latitude 37°, East Longitude 102°, which Astley describes as "a great and populous city, built at the vast wall of China, through the gate of which the merchants from India enter Katay or China."

Lord Strangford, who took great interest in the travels of the Pundit, and was able to identify nearly all the places mentioned by him, was greatly puzzled by the Pundit's description of Jiling, given in his first journal, where it is said to be in Tartary and to produce gold lace, silks, carpets, and other products of a tolerably civilized country. At first the Pundit understood that it was a month or two months' journey to the north of Lhasa, but from farther inquiries during his second expedition, he made out that it was considerably to the east of north, and having this hint, there was no great difficulty in identifying it with the large town of Sining on the borders of China proper, the only place from which such civilized products were likely to reach Lhasa from the northwards.

The Dak-korkor Camp, which the 3rd Pundit reached, lies about 20 miles to the north of the Aling Gangri peaks, on the right bank of the Aling-chu river and not very far from the Thok-Nianmo gold field. He arrived just as the annual fair was commencing; about 150 tents were already pitched and both the Jongpon and Sarpon were present; but in spite of their presence a band of mounted robbers came down upon the camp and threatened to loot it. These robbers seem to be numerous all over Tibet. This particular band was said to come from the great Nam-tso (lake) district. The men actually began to rob, but the Jongpon told them to stop, and he would make each tent contribute something as black mail. The Jongpon then made out a list of those assembled and ordered each tent to contribute a parcha (of about 5 lbs.) of tea, and each trader to give from 1 to 2 rupees according to their means. This arrangement was agreed to, and the proceeds having been collected were handed over by the Jongpon to the robbers who took their departure.

The Chief Pundit, in describing the above, expressed an opinion that the Jongpon was in some mysterious way benefited by the contributions, possibly retaining a considerable share, as it is well known that the robbers never succeed in looting his camp nor that of the Sarpon; both of them perfectly understanding how to defend themselves against all comers on the plateaux of Tibet.

The 3rd Pundit paid his contribution and saw the robbers depart, but he came to the conclusion that they might appear again at any time, and that it would not be safe to take his merchandize with him, he consequently, after consultation with his Bisahiri friends, decided upon sending the greater part of his goods back by the Indus so as to meet him at Lhasa, or on the great road to that place. One of his men was despatched for this purpose; his adventures will be adverted to.

The 3rd Pundit, starting again from Dak-korkor, continued his march eastward down the Aling-chu river till it fell into the Hagong-tso, a large brackish lake which appeared to have no exit for discharging superfluous water, though the Aling-chu river which feeds it was found to be 150 paces in width with a rapid stream just before it fell into the lake. The shores of the lake had marks which showed that it had once been more extensive. Continuing his journey the Pundit passed the Chak-chaka salt lake from which the greater part of the Tibetan salt, which goes down to Almorah, Nepal, &c., is extracted. The salt from Tibet is preferred by the people of Kumaon and most hill men, though the salt from the plains is to be had at much the same price.

The Pundit heard of another salt lake to the east of Chak-chaka, which with other similar lakes probably supplies a portion of that which is generally understood to come from Chak-chaka.

The next place of importance seen by the Pundit was Thok-Sarlung which at one time had been the chief gold field of the district, but had been in a great measure abandoned on the discovery of the Thok-Jalung gold field. The Pundit passed a great excavation, some 30 to 40 feet deep and 200 feet in width and two miles in length, from which the gold had been extracted. He heard of another gold field to the west, but his route took him direct to the Thok-Jalung gold field, which he found in much the same state as when visited by the Chief Pundit. The Pundit and his party excited no particular notice, and they were consequently able to march on after halting a day to rest.

From Thok-Jalung they passed through the Majin country, partly undulating and partly quite level, but all about the same altitude, viz.—15 to 16,000 feet above the sea. The drainage sloped towards the east, and nothing but comparatively low rounded hills were visible in that direction; whilst on the west the party skirted a large plain of a yellowish colour said to be drained by the Upper Indus.

The party passed numerous lakes producing salt and borax, and after 9 days' journey in a south easterly direction, found themselves at Kinglo, a large camp on the banks of a river called the Chu-sangpo, which is so large that it cannot be forded during the summer. This river flows eastward and falls into the lake called Nala-Ring-tso or Tso-Sildu, said to be about the same size as the Mansarowar lake; it has a small island in the centre. The lake is reported to receive a large stream from the south, another from the east, and a third from the north, the latter draining part of the Phaiyu-Pooyu district. Though receiving so many streams, (one of which, as noted above, is a large one), the lake is nevertheless said to have no exit.

To the south of the lake there is a well known monastery called

Shellifuk, the residence of a great Lama. Still farther to the south there are some high snowy peaks, and a district called Roonjor, while to the north are the districts called Gyachun and Girke, the latter probably adjoining Phaiyu-Pooyu. To the east he heard of another district called Shingwar.

From Kinglo the Pundit wished to march on to Lhasa by the northern route past the Tengri-noor lake, but the Chief of Majin (Kinglo) would not permit it, and the party were consequently obliged to take a south-westerly route to the Mansarowar lake.—They followed the course of the Sangpo-chu nearly to its source, crossing one very high range called Nakchail, and another called Riego, and finally descending to the Mansarowar lake. The Nagchail and Riego ranges are evidently off-shoots of the Kailas peak. The Nagchail peaks appeared to be very high both on the east and west.

When crossing the range the Pundit saw a very large herd of wild yaks; his party counted over 300 of all sizes before the herd ran off: the yaks were all black. These wild yaks are called "Dong;" they were mostly seen between Majin-Kinglo and the Mansarowar lake. Great herds of wild asses were seen throughout; sometimes as many as 200 were in sight at the same time when the plateaux were extensive. The Hodgsonian antelope, wild goats, and sheep, (the latter including the gigantic *Ovis ammon*), were all seen in numbers. Large grey wolves were constantly seen, but never more than two or three at a time, though packs of them were often heard yelling at night. Numbers of reddish hares and a kind of fox were seen on every march. Marmots were very numerous, their subterranean villages being met with wherever grass and water were at hand. Quantities of geese, ducks, and storks were seen on the lakes. Eagles and vultures appeared to be the same as those in the Himalayas, and were seen every where.

Whilst marching from Rudok to Thok-Jalung the Pundit heard descriptions of no less than 7 separate gold fields, viz. those of Thok-Sarkong, Thok-Dikla, Thok-Ragyok, Thok-Thasang, Thok-Maroobhoob, Gunjee-Thok and Thok-Nianmo, besides those of Thok-Sarlung and Thok-Jalung which he actually visited, and those of Phaiyu-Pooyu of which he heard vaguely. The Pundit understands the word "Thok" to mean a "mine."

Several salt lakes were passed and others heard of. He describes the celebrated Chak-chaka salt lake as being all but connected with the Hagong-tso (lake,) and stated that an area of about 20 miles by 10 is all about on a level with those lakes. This space is filled with salt, the water having evidently at one time covered the whole.

Borax fields were seen at Rooksum and Chak-chaka, and numbers of people were working on them. No gold or salt mines were seen or heard of between Thok-Jalung and the Mansarowar lake; but numerous borax fields were seen, at one of which about 100 men were at work near a camp of some thirty tents. The other fields were not being worked when the Pundit passed. The borax generally was said to find its way down to Kumaon, Nepal, &c. Altogether this portion of the third Pundit's route has brought to light the positions of a large number of gold, borax, and salt fields, testifying to an amount of mineral wealth, as to the value of which we have hitherto had no information. In marching south from Thok-Jalung the Pundit appears to have left the gold-bearing rocks, and from the information he received, the line of gold fields is continued more to the north; but it is evident that this part of Tibet contains an inexhaustible supply of gold.

As to borax, there appears to be any amount of it to be had for the digging, the Lhasa authorities only taking a nominal tax of about 8 annas (or a shilling) for ten sheep or goat loads, probably about 3 maunds or 240 lbs. Borax sufficient to supply the potteries of Staffordshire and all Europe would be forthcoming, if the supply from Tuscany should ever run short.

The salt fields appear to be the source from which the hill population from Nepal to Kashmir draws the greater part of its supply of salt.

Throughout his march, the Pundit was at an elevation of over 15,000 feet, and yet an encampment was met with nearly every day. Thieves were numerous, and threatened the party several times; but on seeing that the Pundit's party were armed, they invariably went off again, not liking the look of an English gun. The party arrived at Mansarowar in safety; and the Pundit decided upon waiting for the Ladak Kafila, which was known to be on its way to Lhasa. Whilst there, the Pundit made a careful traverse of the Mansarowar lake, with bearings to the peaks north and south. A map of the lake will be given hereafter. Though the water was sweet no exit was seen: at one point on the west the ground near the Ju monastery was low, and looked as if water had perhaps at one time flowed through, towards the Rakas Tal lake, though it is now too much above the lake to admit of it.

The Pundit was unable to join the Ladak Kafila; but made his way by himself along the great road to Shigatze, where he was stopped. This he found was by an order of the Gartok Garpon sent after him by the couriers. He was unable to advance farther. Whilst marching between the Mansarowar and Shigatze he was able to take bearings to various peaks north and south of the road, which no doubt will add considerably to our knowledge of the mountains on either side of that route; but as the Pundit has only just returned, there is no time to give any further account of his route and adventures in the present report.

His servant, who was sent back from Dak-korkor, managed to join part of the Ladak Kafila, and reached the Tadum monastery; but the mounted messengers of the Gartok Garpon found him out there, and prevented him from advancing farther. He very narrowly escaped being sent back to Gartok, and would have been lucky to have escaped severe punishment. The Ladak merchant fortunately remembered his old friend the Chief Pundit, and on being told that the man was carrying merchandize on his account, did what he could to protect him; and though he said it was impossible to take him to Lhasa, he managed to get him released, and ultimately the man was allowed to cross over the Himalayas by a southerly road past Muktinath into Nepal. In this way he was able to join on to the route the 2nd Pundit traversed during their first explorations. The permission to take a new route, is surprising, as the Lhasa officials are always careful to make suspected individuals return by the road they entered, so that they may at any rate not get fresh information as to the country. Their carelessness in the present instance was probably due to the humble and rather stupid look of the man, but it has supplied an important link between the Tadum monastery and the Muktinath shrine on the Saligrami, a great feeder of the Gunduk river. The man, an inhabitant of Zaskar, in spite of his appearance, has a shrewd idea of distances and of the points of the compass ;

he was able to give a very intelligible though rough route between the two points, which agrees very fairly with the positions assigned to them by the 1st and 2nd Pundits.

When this Zaskari found that he would not be allowed to go to Lhasa, he told the Ladak merchant that an agent of the Chief Pundit had gone on ahead, to whom he was to have delivered some goods, and requested that he would see that they were delivered to the agent: the merchant promised to do this and took charge of the packages. The Zaskari then put his own baggage on a couple of sheep and started off south. Though early in December he was able to cross the Brahmaputra river on the ice, which was then strong enough to bear laden yaks. The first day he reached the Likche monastery, where he found two men from Lohba in the Mustang district, north of Muktinath. These men had gone beyond, to the north of Tadum, for salt and were returning with it. The Zaskari managed to make their acquaintance, and on hearing that he was a Bisahiri (or man of Koonoo) going to worship at Muktinath, they agreed to take him with them. Their salt was laden on about sixty yaks, each carrying from 1½ to 2 maunds (120 to 160 lbs). The two men were able to manage this large number of yaks as the road was a good one.

From Likche they ascended gradually over a great plain or plateau, with plenty of grass and scrub; the latter making good fuel even when green. Three easy marches took them over this plain and landed them at Lohtod, four or five miles beyond or south of the Himalayan watershed. The plain had a few small knolls on it, but was otherwise flat or undulating. The ascent, even up to the watershed, was very slight indeed. From the pass, which the man hardly thought worthy of calling a pass, there was a slight descent or four or five miles. He got a good view of Lohtod, a village of sixty houses surrounded by a number of scattered houses, which he thought might make a total of several hundreds: the houses were all built of sun-dried bricks. He noticed a great many fields, and found that they cultivated barley, buckwheat, mustard, radishes, and a small proportion of wheat, all indicating a moderate altitude, though the only trees visible were two or three poor willows. This is confirmed by the easy slope of the ground to Muktinath, which the 2nd Pundit found to be 13,100 feet. The next day the Zaskari reached Loh-mantang, where the Loh Gyalbo (or Raja) lives in a stone fortlet, near a small town of some 200 houses, surrounded by a great deal of cultivation.

From Loh-mantang three days' easy march landed the Zaskari at Muktinath. On the route he passed a large village called Asrang, where the Gyalbo has a house, and at every three or four miles he saw a group of a few houses, mostly to the west of his road, but he met with no tents south of the Himalayan watershed.

Muktinath (or Lohchumik) stands in an open spot, with 4 villages of about 50 houses each, lying a mile to the south of the shrine.

The Zaskari has given some farther routes which are new and will no doubt prove useful hereafter. The route given above is more especially interesting, as giving another line across the Himalayas: it makes the crest very much as given in the map with the first report of the Pundit's explorations, and shows how very far behind, or north of the great peaks, the Himalayan watershed actually lies, and what a great breadth the highest parts of the range cover.

Another explorer was employed to the east, who made a route-survey of 1,190 miles in length, advancing by one route 640 miles and returning by another 550 miles in length.

A small portion of this man's route was quite new, as he managed to penetrate behind or north of the great Mount Everest peak. His progress in that direction was checked by the obduracy of the Lhasa officials on the Tingri-maidan. As far as it goes this portion of the route is, however, interesting, insomuch as it gives another determination of the Himalayan watershed, and throws a little more light on that part of the mountains which lies behind or north of the great peaks, seen from the Hindustan side.

The remainder of the route is in a great part new; but some of the former explorations went over portions of the same ground, and the positions of several places have been entered on published maps from various information, though hitherto without any regular connection. These new routes will supply the necessary connection, and when combined with former explorations, will add much towards the elucidation of the Eastern Himalayas. A map will be prepared on this basis, but no reference can for obvious reasons be made to names &c., whilst the work is in progress, the explorers having been somewhat impeded by the publicity given to the results of former expeditions.

On the north western frontier of India a Mahommedan gentleman, generally known as the Mirza, has been employed for some time in exploring the countries beyond the Hindoo-Koosh, the Mustagh, and Karakoram ranges. The Mirza was regularly trained, and having acquired the necessary facility in the use of a sextant, and in the method of route-surveying practised in these explorations, was started on an expedition viâ Afghanistan. He made his way to Candahar; but there his progress was for a time arrested owing to the war which resulted in re-seating the Amir Ali on the Cabul throne.

The Mirza, it may be as well to state here, was one of the lads brought originally from Herat by Pottinger, and had received a partial English education, by which he has benefited considerably. Being a native of Afghanistan he has kept up his acquaintance with that country, and though for some time in the British service, has spent the greater part of his life in that country. His former residence in Cabul more especially favoured him, and he was at once able to accompany the Amir. He witnessed various actions that took place during the Amir's advance from Candahar, and supplied our Government with accounts of them and the general state of affairs; accounts which at the time were rather valuable, as it was difficult to get any other accurate information. The Mirza was detained for some time at Cabul, owing to the disturbed state of the country, but ultimately was able to pass over to Badukshan, thence he ascended, through the Upper Valley of the Oxus, to Lieutenant Wood's Sirikul (or Victoria) Lake. From this lake he made his way through a part of Sirikul district to Tashkurgan, crossing the watershed which divides the Oxus from Eastern Turkistan. At Tashkurgan, he was placed in a sort of open arrest, being allowed to do what he pleased, though always watched. From Tashkurgan he made his way over the mountains direct to Kashghar, still accompanied by men from Tashkurgna, who insisted upon seeing him into Kashghar; fortunately they did not interfere with his using his instruments, and he was able to continue his route-survey.

At Kashghar he was detained for some time by the Koosh-Begie, or Atalig Ghazi. He asked for permission to go on to Kokhan, but it was refused; and he was ultimately glad to be allowed to return viâ Yarkund and the Karakoram pass to Ladak, and thence into British territory.

The Mirza has just returned, and there has only been time to roughly plot his routes, which are complete from Cabul to Kashghar, and from the latter to the vicinity of the Karakoram.

His route from the Sirikul lake to Kashghar, is entirely new, and promises to be the most interesting portion of his work. It may perhaps throw some light on Marco Polo's route from Europe to China, as that traveller stated that he went direct from Budukshan to Kashghar without passing through any larger town.

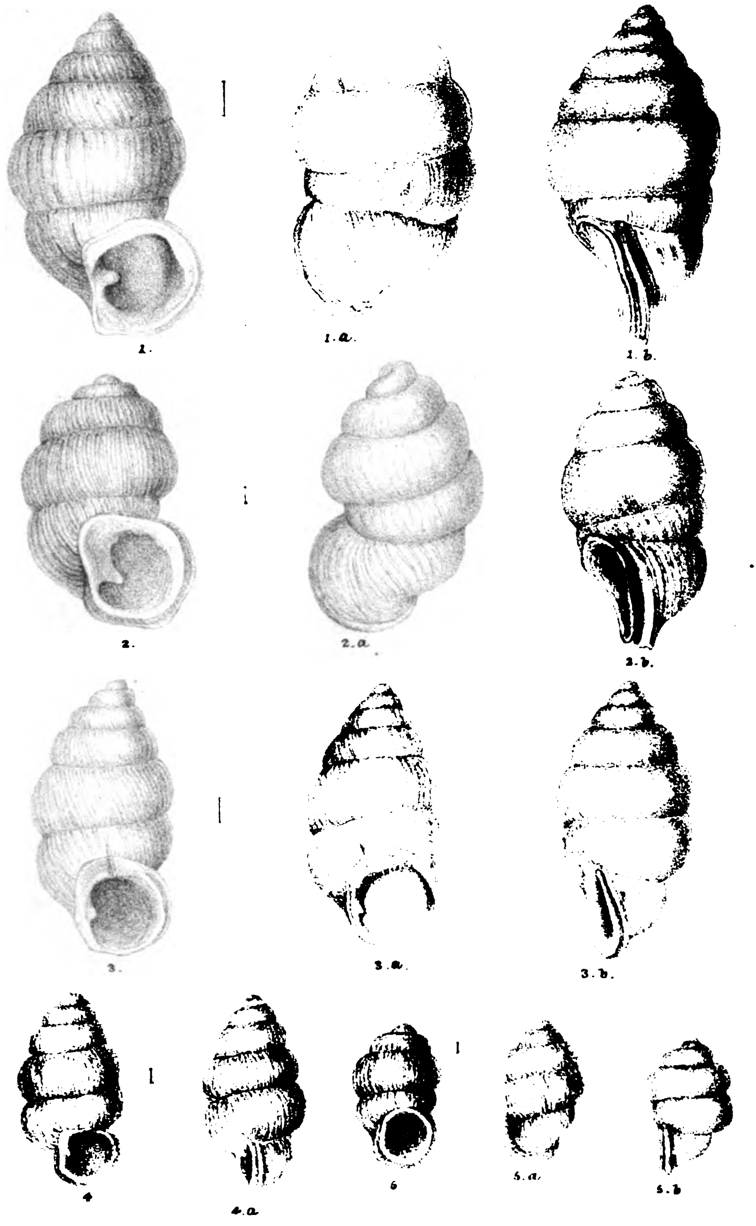
No particulars can be given as to the Mirza's work, but the whole of his route-surveys, &c. will be reported on as soon as they have been worked out and tested.

With reference to farther explorations, an attempt will be made to advance farther along the margin of the Aksai Cheen, or great white desert, and if possible to cross it, and generally to explore farther east towards the end of the great wall of China; but the jealousy of the Chino-Tibetan officials renders success very doubtful.

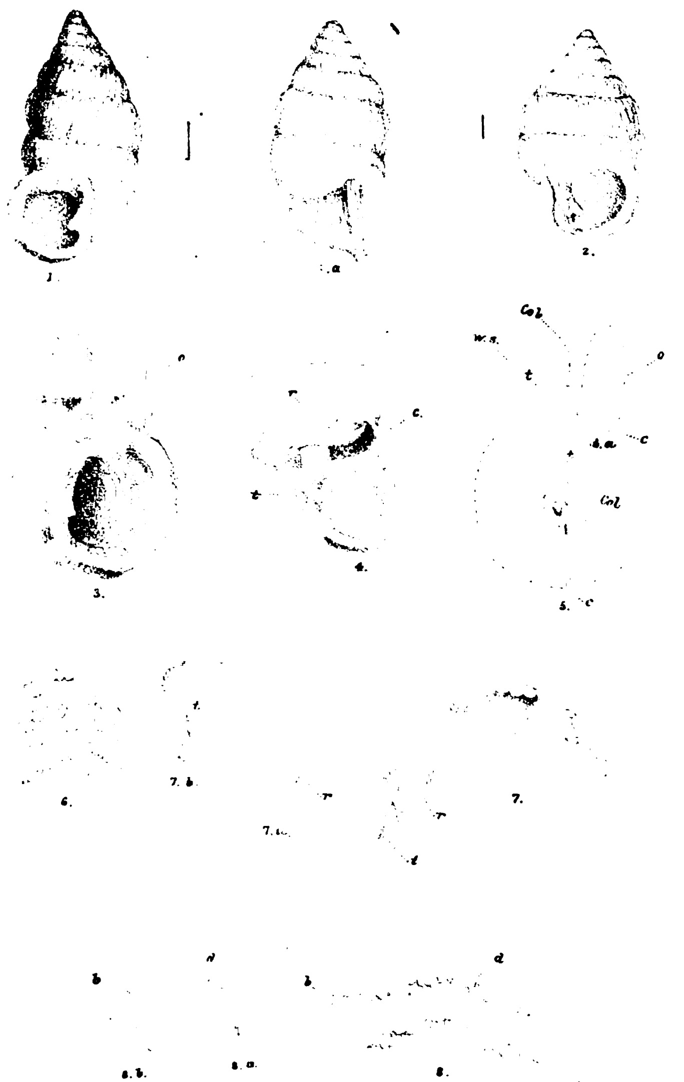
Expeditions are being organized to carry the explorations still farther to the north of the Hindoo-Koosh, so as to account for the geography of the upper branches of the Oxus, of the Pamir Steppe, &c.; and there is some chance that in the present state of Afghanistan, it will be possible to carry out these projects and thus to reduce the absolutely unknown ground in that direction to a small area within a reasonable time.

Further routes will be made with a view to complete our knowledge of the geography of the Eastern Himalayas; and it is hoped that the obstacles in that direction may be surmounted within a short time.

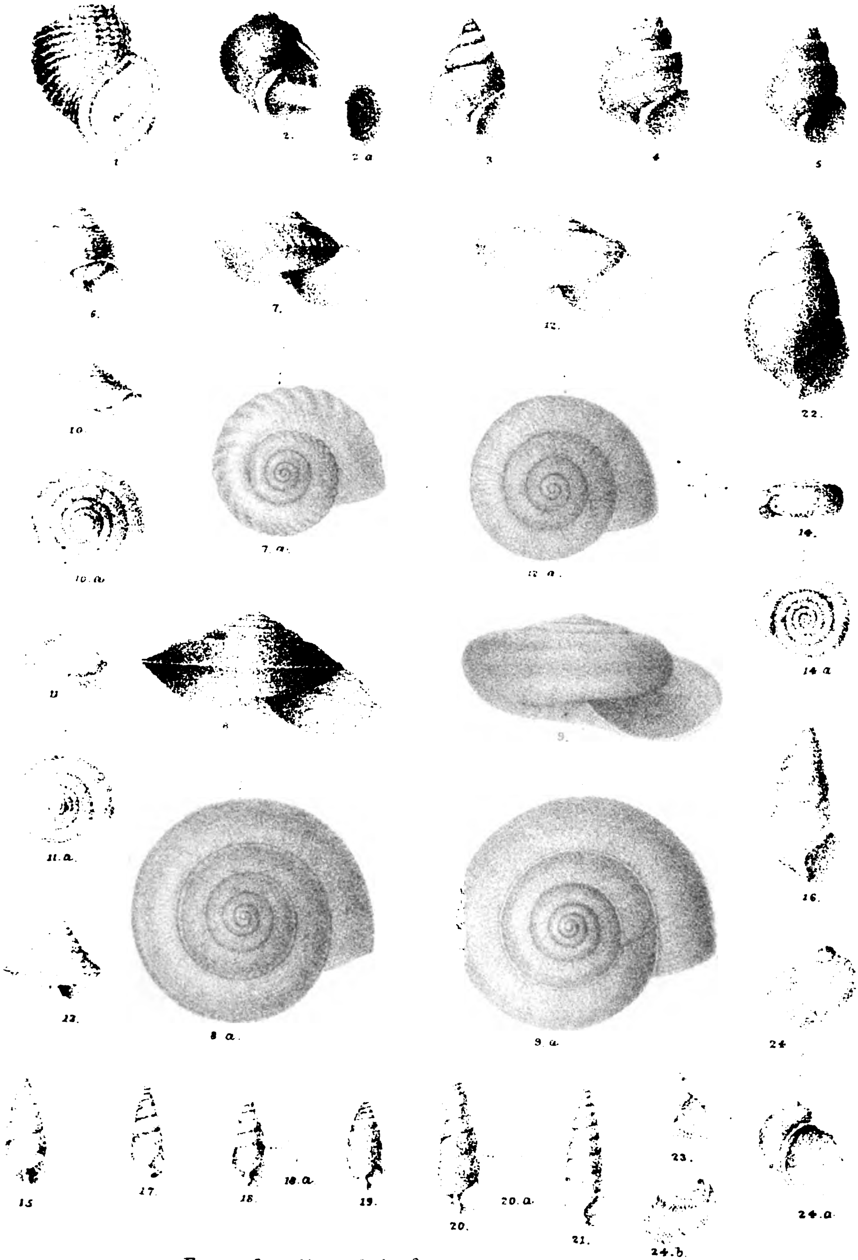
The total length of route-surveys amounts to 1,820 miles with 66 latitudes and 61 heights of various places. The area of altogether new ground of which the geography has been determined, is about 20,000 square miles, irrespective of a very large area of partially new country, for the geography of which improved materials have been collected.



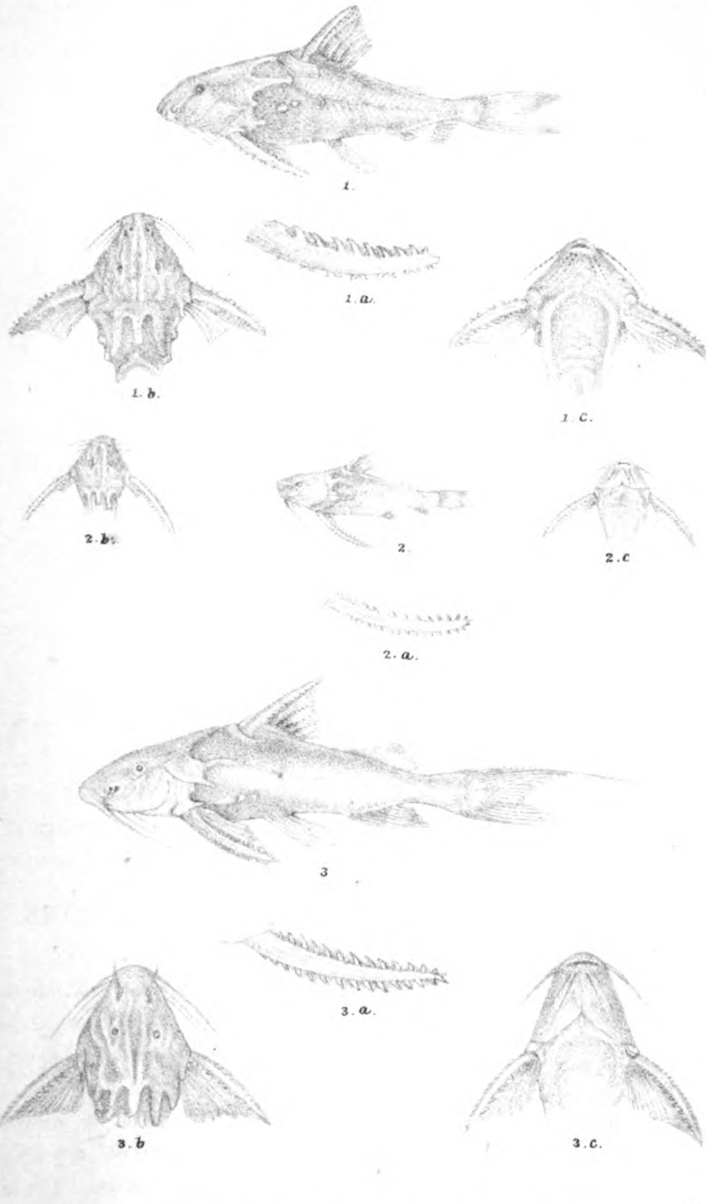
1. Dipl. Jatingana. 3. Dipl. Sherfaiensis
2. — depressa. 4 — polypleuris. var.
5. Dipl. parvula.



1. *Diplom. insignis*; 2. *Diplom. tumida*.
3-5. *Dipl. pachycheilus*, vide p. 7.
6. Lingual ribbon of same, vide p. 8.
7 " " of an *Alycæus* (like *Ingrami*,) p. 8.
8 " " " *Pup imbricifera*, Bens., p. 8.



For explanation of the figures see p. 24.



1. *Hara Buchanani*; 2. *H. Jerdoni*; 3. *H. Conta*;

// JOURNAL

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PART II.—PHYSICAL SCIENCE.

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ON SOME NEW OR IMPERFECTLY KNOWN INDIAN PLANTS,—

by S. KURZ, ESQ., *Curator of the Calcutta Herbarium.*

[Received 12th December, 1869, read 5th January, 1870.]

(With plates V-VII.)

RANUNCULACEÆ.

1. *Clematis floribunda*, Kurz, in Seem. Journ. of Bot., V, 240.—This specific name is to be changed, as Mr. Bentham has given previously the same name to a Peruvian plant. I now propose to call the species *C. subumbellata.*

ANONACEÆ.

2. *Uvaria cordata*, Wall., Cat. 6486, is united with *U. macrophylla*, Roxb., by the authors of the "Flora Indica, but it certainly is different from that species. It is identical with Blume's *U. ovalifolia* which is, in my opinion, a good species.

3. *Uvaria Hamiltonii*, Hf. et Th., Fl. Ind., I, 96.—Some forms of this are so near to *Anomianthus heterocarpus*, Zoll., (*Uvaria heterocarpa*, Bl. ?) that I should be inclined to unite both, but I have no fruits to compare.

4. *Miliusa Roxburghiana*, H f. et T h., Fl. Ind., I. 150.—This has a solitary erect ovule, quite similar to that of *Phæanthus nutans*, to which it shows close resemblance ; it will, therefore, be necessary to refer the former to the same genus, and as *Uvaria dioica*, Roxburgh, Fl. Ind., II, 659, is identical with it, the species may be called *Phæanthus dioicus*.

MENISPERMACEÆ.

5. **Pachygone dasycarpa,** *n. sp.*—Frutex scandens, ramulis novellisque tomentosis ; folia ovalia, 1½—2 poll. longa, petiolo gracili tomentello ½—1 pollicari suffulta, obtusiuscula, v. rarius emarginata, mucronulata, coriacea, glaberrima, nervosa, lucida ; racemi pedicellique crassi, flavicante tomentosi ; drupae oblique obovales, dense flavicante tomentosæ, pisi majoris magnitudine.—Siam, Kanbúrí (Teysmann in Hb. Bog. No. 5993.)

Besides the very different indumentum of the drupes and inflorescences the shape and nervature of the leaves differ considerably from those of *P. ovata.*

Tinomiscium pyrrhobotryum, Miq., in Ann. Mus. Lugd. Bat., IV, 81 = *Tinom. phytocrenoides*, Kurz, in Tydsch. Nat. Vereen. XXV.

CAPPARIDEÆ.

6. **Capparis roydsiæfolia,** *n. sp.*—Frutex scandens,g laberrimus ; folia oblonga v. elliptico-oblonga, breve et crasse petiolata, basi rotundata v. obtusa, apice obtusiuscula et mucronata, subcoriacea, 6-8 poll. longa, glabra, in sicco flavescentia, subtus nervis prominentibus percursa et laxe reticulata ; aculei stipulares, breves, patentes, stricti ; flores 4—5-ni, supra foliorum axilla orientes, breve pedicellati, racemum terminalem formantes ; sepala marginibus lanata ; petala cire 6 lin. longa, obovato-lanceolata, floccoso-puberula ; gynophorum abbreviatum, circ. ½ lin. longum, unacum ovario glaberrimum ; stamina numerosa ; baccæ...—Siam (Teysmann, in Hort. Bogor.)—A very distinct species, closely resembling in foliage *Roydsia suaveolens.*

7. **Capparis flavicans,** *n. sp.*—Frutex habitu *Cadabæ Indicæ*, novellis omnibus unacum foliis fulvo v. flavicanter tomentosis,

aculeis brevissimis, rectis, patentibus armatus; folia variabilia, obovata, oblonga v. subcuneato-obovata, basi rotundata, acuta v. obtusa, breve et gracile petiolata, $\frac{1}{2}$—1, raro $1\frac{1}{2}$ poll. longa, retusa v. obtusa, chartacea v. coriacea, juniora dense fulvo-pubescentia, mox glabrescentia, nervis subtus prominentibus; flores parvi, solitarii v. gemini, pedicellis 6-8 lin. longis dense fulvo-tomentosis suffulti, vulgo in apicibus ramulorum brevium tomentosorum siti et saepius racemum v. corymbum spurium formantes; sepala dense fulvo-tomentosa; petala extus glabra, intus dense lanata, circ. 4 lin. longa; gynophorum crassum cum ovario dense fulvo-tomentosum; baccæ pisi maximi magnitudine, puberulæ, ovatæ, apiculatæ, 2-loculares, loculis monospermis.—Siam, near the village Kankian, Radbúrí (T e y s m a n n in Hb. Bog.)

VIOLACEÆ.

8. **Alsodeia longiracemosa**, *n. sp.*—Arbuscula parva v. frutex glaberrima; folia decidua, oblongo-lanceolata, breve et graciliter petiolata, utrinque acuminata, serrata, chartacea, glabra; racemi elongati, 3-5-poll. longi, parce puberuli; flores parvi, virescente-albi, pedicellis strictis longiusculis suffulti; calyx puberulus; capsulæ pedunculatæ, glabræ.—Martaban (Dr. B r a n d i s.)

POLYGALEÆ.

9. *Polygala arvensis*, W i l l d.—There exists great uncertainty amongst the different varieties of the above species and others nearly allied to them, especially with regard to *P. triflora* of L i n n é. Mr. E d g e w o r t h has seen the authentic specimens of *P. triflora*, and declares them to be *P. rosmarinifolia*. If this be the case, *P. arvensis* would really have to be identified with *P. triflora*, as Dr. A n d e r s o n has done in his "Florula Adenensis;" but *P. Vahliana*, *erioptera* and their allies cannot, in that case, be connected with it, on account of the very different structure of the wings. By the form of the latter many Indian forms, now described under different names, might be brought together into natural groups. Thus we should obtain for the group with thick herbaceous green and acuminated sepal-wings, *P. glomerata* and *P. arvensis* with a long series of synonyms, all these having short racemes;

those with elongated racemes would be *P. ciliata*, WA., *P. elongata*, Heyne (including *P. macrostachya*) and *P. Wightiana*, which latter requires close comparison with the former.—The other group with coloured thin obtuse and usually petal-like wings would comprise *P. Vahliana*, *P. Heyneana* and *P. Javana* (the 2 latter species being rather too closely allied), *P. Persicaria* and *P. elegans* (including *P. Khasyana*, Hassk.). The latter species forms to some degree a connecting link between the two groups.

GUTTIFERÆ.

10. *Discostigma fabrile*, Miq., Suppl. Fl. Sumatr., 496, (*Garcinia fabrile*, ejusd., in Ann. Mus. Lugd. Bat., I, 808), is not different from *G. cornea*, *L.*

11. *Xanthochymus* cannot be retained as a genus, different from *Garcinia*, for there occur pentamerous and tetramerous flowers on the same tree of *X. pictorius*, as I had several times the opportunity of observing.

12. *Calophyllum cymosum*, Miq., Suppl. Fl. v. Sumatr., 497, is the same as *C. spectabile*, Willd.

13. *Calophyllum plicipes*, Miq., Suppl. Fl. v. Sumatr., 499, is identical with *C. pulcherrimum*, Wall.

TERNSTRŒMIACEÆ.

14. *Ternstrœmia macrocarpa*, Scheff., in Obs. Phyt., 15, does not differ from *T. Penangiana*, Chois.

15. *Schima crenata*, Korth., Verh. Nat. Gesch. t. 29, 143, is undoubtedly identical with Roxburgh's *Gordonia oblata*, (Fl. Ind., II, 572) and the name should, therefore, be changed into *Schima oblata*.

DIPTEROCARPEÆ.

16. *Dipterocarpus tuberculatus*, Roxb., Fl. Ind., II, 614; DC. Prod., XVI, 614,—differs from *D. grandifolius*, Miq., simply in having the leafbuds, the leaves underneath, and the inflorescences quite glabrous, not puberulous; the fruits are the same in both species.

17. *Dipterocarpus cordifolius*, Wall., in DC. Prod., XVI, 612. —De Candolle describes this species as having winged fruits, bu

I suspect these fruits must have come by some mistake to the leaves, which latter are decidedly those of *D. obtusifolius*, Teysm., in Miq. Ann. Mus. Lugd. Bat., I, 214 ; DC., l. c. 608.

18. *Dipterocarpus pilosus*, Roxb., Fl. Ind., II, 615 ; DC. Prod., XVI, 614.—I have no doubt that *D. Baudii*, Korth., is the same species as the above. The fruits are alike, the flowers of the former, however, unknown. *Anisoptera Palembanica*, Miq. (only leaves) is not distinguishable from some forms of *D. pilosus*.

SYNAPTEA, Griff.

Calycis tubus brevissimus, toro adnatus, lobis manifeste valvatis subaequalibus. Stamina 15—18 ; filamenta minima, antheris breviora, connectivum glandulâ brevi acutâ terminatum. Ovarium calyci adnatum, 3-loculare, stylus filiformis, stigmate capitato-trilobo. Calycis fructigeri lobi 5, omnes aucti, quorum 2 multo longiores. Nux globosa, matura calycis usque ad ⅓ partem longitudinis adnata, monosperma.

19. *Synaptea grandiflora*, (*Hopea grandiflora*, Wall., DC. Prod., XVI, 634 ; *Sunaptea odorata*, Griff., Not. Dicot., 516. t. 585, A, f. 5 ? I cannot follow Bentham and Hooker in their identification of this species with *Vatica Chinensis*, as the authors do not state, whether they have seen Linne's specimens. It is impossible to retain this species in the genus *Vatica*, on account of the distinctly valvate calycine lobes, &c., so perfectly dissimilar to what Lamarck has figured. With *Hopea*, where De Candolle places it, the species has nothing to do at all, but it is evidently very similar to *Anisoptera*.

S. Bantamensis (*Anisoptera Bantamensis* Hassk) is another species which is very nearly allied to the above but at once distinguished by the much broader lobes of the calyx, &c.

20. *Shorea leucobotrya*, Miq., Ann. Mus. Lugd. Bat., I, 218, and *Sh. obtusa*, Wall., *apud* DC. Prod., XVI, 629, are one and the same species.

PARASHOREA, n. gen.

Calycis tubus brevissimus. Stamina 12-15 ; filamenta antheris breviora, æqualia ; antheræ oblongo-lanceolatæ, connectivo in mucronem minutam producto adnatæ. Ovarium liberum, 3-loculare, stylus filiformis, stigmate truncato. Tubus calycis fructiferi haud auctus; lobi calycini 5, valvati, basin versus attenuati, omnes valde aucti et aliformes, aequales v. 2 paullo breviores, subpatentes. Nux monosperma, libera, nec loborum basibus arcte contorto-cincta, ut in *Shorea.*—Arbores ingentes, foliis lucidis et floribus albidis dense racemoso-paniculatis.

21. **Parashorea stellata,** *n. sp.* Arbor ingens, glabra; folia ovato-lanceolata, acutiuscula v. apiculata; lobis calycis fructigeri aliformes, æquales et subpatentes; nux ovata v. oblongo-ovata.—Martaban (Dr. Brandis).

22. *Parashorea lucida* (*Shorea lucida,* Miq., Suppl. Fl. Sumatr. 487), differs from the former by the smaller more shining leaves, which are shortly acuminate. It has also the wings of the fruitbearing calyx shorter and broader, and the nuts are smaller and almost globular.

A third species of *Parashorea* will be *Shorea longisperma,* Rxb., (DC., Ind., II, 618) which has the nuts longer than any of the foregoing two species, but nothing is known of it except the fruit.

23. *Shorea Siamensis,* Miq., Ann. Lugd. Bat., I, 214; DC. Prod., XVI, 631, is identical with *Pentacme suavis,* DC. (Prod. l. c. 626) and the name has, therefore, to be changed in *Pentacme Siamensis.* The tube of the fruitbearing calyx remains unchanged, with all the 5 lobes wing-like enlarged, two of them about ⅓ shorter, the remaining 3 about 4 inch long, obovate-lanceolate, obtuse, very narrowed towards the broad imbricate base, glabrous; nut ovoid, acuminate by the persistent style, glabrous.

MALVACEÆ.

24. **Decaschistia parviflora,** *n. sp.* Suffrutex? v. herba perennis, ramosus; folia oblongo-lanceolata v. oblonga, longe petiolata (petiolo fere pollicari gracili puberulo), acuta, obsolete dentata, coriacea, supra dense puberula et scabriuscula, subtus albo- v. gilvo-tomentosa; flores parvi, iis *Urenæ lobatæ* non absimiles, breve rigideque pedicellati, in axillis foliorum superiorum solitarii et racemos terminales formantes; involucri phylla calyce

multo breviora, linearia, rigida, puberula; calycis lobi e basi latâ lanceolati, acuminatissimi, medio valde costati, 3—4 lin. longi, dense puberuli; capsulæ dense stupposo-tomentosæ.—In the jungles of Kanbúrí, Siam (Teysmann in Hb. Bogor. 6979).—A very distinct species, not unlike in habitus to certain *Urenas*.

STERCULIACEÆ.

25. **Helicteres plebeja** *n. sp.* Fruticulus, partibus junioribus stellato-scabris, gemmisque canescente tomentosis; folia ovato-lanceolata v. ovato-oblonga, breve graciliterque petiolata, basi rotundata, circa 3—5 poll. longa, magis minusve regulari-dentata, acuminata, membranacea, supra parce hispidula v. sub-glabra, subtus minute stellato-hispidula et scabra, juniora, rarissime etiam adulta, dense canescente-tomentosa; flores parvi, flaviduli v. pallide lilacini, breve pedicellati; cymi pauciflori axillares stellato-puberuli graciles; calyx circiter 2½ lin. longus, parce stellato-pilosus; petala calyce paullo longiora; capsulæ 8—10 lin. longæ, stellato-tomentosæ et muricatæ, carpellis mox separatis et subulatis.—Arracan, frequent in the Pynkadú forests of the lower sandstone hills in Kolodyne valley, &c.

TILIACEÆ.

26. **Brownlowia argentata**, *n. sp.* Arbor parva? partibus omnibus novellis argenteo-v. subcupreo-lepidotis; folia ovata v. late ovata, 4—5 poll. longa, petiolis 5 lin. usque ad 2 poll. longis, lepidotis demum glabrescentibus suffulta, acuminata, basi rotundata v. subcordata, coriacea, supra glaberrima, subtus argenteo-lepidota et ferrugineo-punctata; paniculæ elongatæ, racemiformes, terminales et axillares, argenteo-lepidotæ atque glabrescentes; flores 2½ lin. circiter longi, breviuscule pedicellati; calyx ferrugineo- v. argenteo-lepidotus; carpella juvenilia lepidota.—Moluccas, Búrú Okie (Teysmann in Hb. Bogor.). Atún laut inc.

27. *Leptonychia glabra*, Turcz., in Bull. Mosc., 1858, I, 222, is evidently the same plant as *Grewia heteroclita*, Rxb., Fl. Ind., II, 590, and will, therefore, have to be called *Leptonychia heteroclita*.

28. *Echinocarpus murex*, Bth., (Linn. Soc. Proc. v. Suppl. 72) is the same as *E. Sigun*, Bl., Bydr., 56. The only difference,

which I can point out between the two is, that in the latter the prickles of the capsules are very crowded and in the former very lax and distant. Clos, and after him Bentham, describe the prickles of *E. Sigun* as subfoliate, but this is evidently a misprint in Clos' Treatise for "subfalcatis."

29. *Elæocarpus Griffithii* (*Monoceras* Griffithii, Wight, III., I, 84). To this I add as synonyms: *Monoceras trichanthera*, Griff., (Not.,Dicot. 518, t. 619, f. 3), *M. odontopetalum*, Miq., Suppl. Fl. v. Sumatra, 409, and *M. holopetala*, Zoll. et Cumm., in Bull. Soc. Mosc., XIX, 496. I am not quite sure about the identity of *Monoceras leucobotryum*, Miq., l. c., which differs from the above simply by more coriaceous leaves and the densely silky-villose ovaries. Prof. Miquel says that the anthers are furnished with two bristles, but authentic specimens show only a single one.

30. *Elæocarpus floribundus*, Bl., Bydr., 120; Miq., Fl. Ind. Bat., I-2, 210. To this species belongs *E. serratus*, Rxb., Fl. Ind., II, 596, as a synonym.

LINEÆ.

31. *Erythroxylon Burmanicum*, Griff., Not. Dicot., 468, t, 581, f. 3; to this belongs *E. retusum*, Bauer apud Teysm. et Binnend. in Tydsch. v. Naturk. Ver. Ned. Ind., XXVII, 71.

GERANIACEÆ.

32. **Oxalis (Biophytum) gracilenta**, *n. sp.* Herba annua, delicatula, erecta, cauli nudo circ. 6-pollicari gracili, nonnunquam subacaulis v. caulescens; folia abrupte pinnata, petiolis filiformibus, foliola 5—8-juga, lutescente-viridia, tenera, oblique oblonga v. ovata, utrinque magis minusve truncata, mucronulata; pedunculi axillares, plerumque 4—6, et foliis breviores, glandulosi, apice incrassato umbellam paucifloram gerentes; flores minuti, aurantiaci v. lutei; sepala lineari-subulata, 3—5 nervia; capsulæ obovatæ; semina minuta, iis *Ox. sensitivæ* dimidio minora, tuberculata, rubescentia.—Chittagong, frequent along the roads of the station, under the shade of trees; Western Bengal, Sikkim-Terai, &c.

The species is easily distinguished from *Ox. sensitiva* by its slenderness and the uniformly and irregularly tubercled small seeds.

In *Ox. sensitiva* the seeds are elegantly transversely tubercled-sulcate on the thickened blackish back, and less so on the convex and paler facets.

33. *Connaropsis Griffithii*, Planch. apud H f., in Linn. Soc., Trans. XXIII, (1862), has to be changed into *Connaropsis diversifolia*; for *Rourea diversifolia*, Miq., Suppl. Fl. Sumatr. (1860) 528, is undoubtedly the same plant. Prof. Miquel describes the ovary as consisting of 5 carpels, but I think, he mistook the 5 furrows for them. I have unfortunately no flowers to examine, and a withered flower-rudiment did not show me exactly the parts, but the arrangement of the pedicels and inflorescences, and the whole structure of the leaves clearly shews that the species is a *Connaropsis*.

RUTACEÆ.

34. **Luvunga calophylla**, *n. sp.*—Glabra; folia larga, 3-foliolata, petiolo terete 8—9 poll. longo; foliola 10—12 poll. longa, 4 poll. lata, obovato-lanceolata, basi in petiolum brevissimum attenuata, breve acuminata, integra, marginibus sub-revolutis, chartacea, glaberrima, utrinque nitentia, costa subtus acute prominente, nervis lateralibus conspicuis; flores cymosi; cymæ breves, glabræ; calyx truncato 5-dentatus, majusculus, glaber; petala, stamina &c. desunt; baccæ immaturæ oblongæ v. ovato-oblongæ, styli basi coronatæ, vesiculoso-papillosæ.—Island Banca near Sumatra, at Jébús (Teysmann in Hb. Bog. 3223). Límáútán, inc. A very distinct species, with leaves much resembling those of *Zanthoxylon euneurum*, Miq.

Luvunga sarmentosa (*Triphasia sarmentosa*, Bl. ?) is identified by Prof. Oliver with *L. eleutherandra*, but it differs from it considerably by the hairy filaments. I am not at all sure whether Blume's *T. sarmentosa* is really the same, as the present species, for Blume describes the floral parts to be trimerous.

35. *Atalantia (Paramignya) citrifolia (Limonia citrifolia*, Roxb., Fl. Ind., II, 579). What Prof. Oliver has taken for *Paramignya citrifolia*, Rxb., is a perfectly distinct plant from the Roxburghian, which has a very short style, perfectly unlike that of Oliver's plant, and the flowers of very small size.

I cannot detect any distinctive characters of generic value between *Atalantia* and *Paramignya.* The shape of the anthers, whether oblong or linear-oblong, can surely not be of very great importance. The torus is in *Atalantia Missionis* equally raised and stalk-like as in any true *Paramignya.* The general habit of both genera is exactly the same. *A. monophylla* certainly has a very peculiar calyx, but even this character becomes of less importance when we compare such forms as *Sclerostylis,* and others.

37. *Citrus Hystrix,* D C., Prod. I, 539. (*Lemon Papeda,* Rumph., Herb. Amb., II, t. 27; *Limo tuberosus,* Rumph. l. cit. t. 26, f. 1; *Limo ferus,* Rumph., l. cit. t. 26, f. 3 et t. 28; *Citrus papeda,* Miq., Fl. Ind. Bat. I/2, 530; *Papeda Rumphii,* Hassk., Cat. Bog., 216).—Arbuscula v. frutex ramosissimus, spinis brevioribus v. longioribus strictis axillaribus armatus, glaberrimus; folia ovalia v. ovata, 1½-2, raro 3 poll. longa, vulgo obtusa et retusa, subintegra, v. crenata, glabra; petiolus 1-1½, saepius 2-3 poll. longus, foliaceus et saepius laminâ ipsâ major, obcordatus v. obovato-oblongus, basi simplex et re verâ petioliformis; flores parvi, albi, pedicellis brevissimis glabris suffulti, fasciculos parvos axillares formantes v. subsolitarii; calyx parvus, 4- v. 5-dentatus; petala circ. 3 lin. longa v. paullo longiora; ovarium obovatum, stylo crasso brevissimo terminatum, bacca obovata v. irregulari globosa, rugosa et tuberculata, subinsipida, cortice crassissimâ luteâ.—Sumatra, Priaman (Diepenhorst in Hb. Bogor. 1375.) Limau saring, inc.

This is a well-marked species. It has very small flowers, usually 4 or 5 stamens, and a very short style. The leaf-like petiole is not seldom larger than the blade itself.

Great difficulty is experienced amongst the species of *Citrus,* and Prof. Oliver, from whom we should have expected the best elucidation of the same, has left the genus as he found it. The English and native names are for the present the best distinguishing marks and will remain so, as long as botanists fail to define their species properly. The difficulty to recognise the real limits of the species of *Citrus,* is I believe, due to the fact, that nobody as yet has attempted to study the wild growing forms before examining the cultivated ones.

38. *Limonia pentagyna,* Roxb., Fl. Ind., II, 382, = *Bursera serrata,* Wall.

MELIACEÆ.

39. *Mallea subscandens*, T. e t B., (Natuurk. Tydsch. v. Ned. Ind. XXIV), does not differ specifically from *M. Rothii*, now *Cipadessa baccifera*, M i q., (Ann. Mus. Lugd. Bat. IV, 6).—It is chiefly founded on the somewhat scandent habit. It is a fact, however, that many erect species assume a climbing or scandent character, when transferred from a dryer to a moister climate, or when growing in dense moist forests.

40. *Didymochiton*, B l. This genus has been incorrectly identified with *Dysoxylon*.* The distinctive characters are the following :—

Dysoxylon. Calyx parvus, 4-v. 5-dentatus, alabastro jam apertus. Petala valvata, libera. Antheræ 8—10, tubo stamineo denticulato v. obsolete denticulato inclusæ. Ovarium 3—5-loculare. Capsula pyriformis, loculicide 3—5-valvis. Semina exarillata.

Didymochiton. Calyx parvus v. magnus, 5—7-sepalus, sepalis manifeste imbricatis ; petala valvata, tubo stamineo lobato v. dentato fere usque ad ½ partem adnata. Capsula globosa, baccæformis et loculicida. Semina exarillata.

Schizochiton. Calyx vulgo campanulatus, obsolete 4-raro 5-dentatus, alabastro jam apertus ; petala valvata v. imbricata, cum tubo stamineo lobata v. dentata usque ad ⅓ v. ½ partem ipsorum longitudinis connata indeque tubulosa. Ovarium 3-4-loculare. Capsula vulgo pyriformis, loculicide 3-4-valvis. Semina complete v. incomplete arillata.

Hartighsea excelsa, J u s s., is a true *Dysoxylon*. *Hartighsea mollissima*, J u s s., and *H. angustifolia*, M i q., are no *Dysoxyla*, but more probably belong to *Didymochiton*.

41. *Amoora Rohituka*, (WA. Prod. I, 119), is probably not different from *A. Aphanomyxis*, R o e m. et S c h u l t., which often has the leaflets underneath shortly puberulous ; but as I have only fructificating specimens of the former, and no flowers, I do not venture to unite them at present.

I restrict the genus *Amoora* to those species which have ternary petals ; I am not acquainted with any true *Amoora* with 5 petals.

* Also Prof. M i q u e l in his annals which reached me only while these sheets were going through the press, has followed B e n t h a m and H o o k e r in their identification of the genus.

Monosoma, Griff., is *Carapa obovata*, and *Dysoxylon Championii*, H f. et Th. in Thwaites' Enum. Pl. Zeyl., is a species closely allied to it, and most probably the *Carapa* (*Xylocarpus*) *carnosa*, Zoll.

42. *Amoora spectabilis*, Miq. in Ann. Mus. Lugd. Bat. IV, 37 = the male plant of *Amoora cucullata*, Roxb.

43. *Walsura trichostemon*, Miq. l. c., IV, 60 = *Walsura villosa*, WA., Prod. I, 120, (in adnot.)

44. *Heynea frutescens*, T. et B., is a good species, not a variety of *H. Sumatrana*, Miq., in Ann. Mus. Lugd. Bat. IV, 60. The latter is identical with *H. quinquejuga*, Roxb.

OLACINEÆ.

45. *Cansjera zizyphifolia*, Griff., Not. Dicot. 360, t. 537 f. 1.—To this species *Olax Sumatrana*, Miq., (Suppl. Fl. Sumatra, 342,) has to be referred as a synonym.

46. *Gonocaryum gracile*, Miq., Suppl. Fl. Sum. 343 (1860), is in my opinion the same as *Platea Griffithsiana*, Miers, Contr. I, 97, t. 17. Prof. Miquel states that the former possesses 2 cells in the ovary and one ovule. Authentic specimens, however, show that the ovary is really one-celled and to judge from the sterile fruits, 2-ovuled. The abortive seed in the fruit is suspended from the apex just beneath the acumen, and there can be observed also the rudiment of the second superposed ovule. There appears to me to be also no doubt of *Phlebocalymna*, Griff., and *Gonocaryum*, Miq., being identical.

G. Lobbianum (*Platea Lobbiana*, Miers, Contrib. Bot. I, 97, t. 17), is a second species of this genus.

ILCINEÆ.

47. **Ilex daphnephylloides**, *n. sp.*—Arbor magna, novellis parce pubescentibus; folia oblonga v. subovato-oblonga, petiolis circiter pollicaribus, tenuiter acuminata, basi saepius parum inæquali-rotundata v. obtusa, integra, coriacea, 4—5 poll. longa, punctata, supra nitida, subtus glauca, transverse venosa et reticulata; flores virescenti-albidi capitulum magis minusve densum axillare pedunculatum formantes; pedicelli breves, minute pubescentes, crassi; pedunculus $\frac{1}{2}$—1 pollicaris, apice incrassatus et dense bracteatus, puberulus; calycis lobi corollæ adnati, minuti, rotundati,

pubescentes et dense ciliati; petala 5, nonnunquam 6—7, oblonga, obtusa; stamina 10, inæqualia; antheræ 5 interiores sessiles v. subsessiles et vulgo minores, 5 exteriores majores et filamentis inæquilongis suffultæ; ovarium glabrum; drupæ......— Sikkim Himalaya, in the oak forests of Tongloo, &c.

CELASTRINEÆ.

48. *Evonymus Javanicus*, B l., Bydr. 1146, I am unable to distinguish from this *E. Sumatranus*, M i q., Fl. Ind. Bat. I 2,589, and *E. Bancanus*, M i q., Suppl. Fl. Sumatr. 513.

49. *Hippocratea angulata*, G r i ff., Not. Dicot., 473, t. 581, f. 1,—appears to be a new species of *Evonymus* which might be called *E. Griffithii.*

50. *Nothocnestis Sumatrana*, M i q., Suppl. Fl. Sumatr. 531. et Ann. Mus. Lugd. Bat. III, is the same as *Celastrus robustus*, Roxb., Fl. Ind. I, 626, and is also identical with *Kurrimia pulcherrima*, Wall. —As R o x b u r g h's name is the oldest, the tree will have to be named *K. robusta.*

Is it possible that *K. paniculata*, A r n., is the same as *Pyrospermum calophyllum*, M i q.? The foliage of the latter resembles very much that of *K. Zeylanica.*

51. *Lophopetalum*, W g h t.—This genus appears to have been mixed up with true species of *Evonymus*, such as *E. grandiflorus*, and its generic characters became on this account rather unintelligible. This also appears to be the cause that a new genus *Kokoona*, T h w., was proposed, which Mr. T h w a i t e s has correctly placed in the *Hippocrateaceæ.*

The genus might be divided into 2 natural groups, the one with fimbriate or lamellate petals and large flowers (*Lophopetalum*), the other with naked petals and small flowers (*Kokoona*).

RHAMNEÆ.

52. *Zizyphus Horsfieldii*, M i q., Fl. Ind. Bat., I, 643, is evidently the same as *Z. glaber*, R o x b., Fl. Ind. Bat., I, 614.

47. *Zizyphus ornata*, M i q., Fl. Ind. Bat., I, 642, is identical with *Z. calophylla*, W a l l. (in R x b. Fl. Ind.).

AMPELIDEÆ.

53. *Cissus hastatus*, Miq., in Suppl. Fl. Sumatr. 517, is the same as *Vitis glaberrima*, Wall., in Rxb. Fl. Ind. (ed. prior) II, 476.

54. *Vitis pentagona*, Voigt, in Cat. Suburb. Calcutta, 28. (*Cissus pentagona*, Roxb., Fl. Ind., I, 408). This species is very frequent in the forests of Arracan, where I found it flowering. I add the description of the flowers to the short characteristic given in Roxburgh's Flora.

Flores parvi, flaviduli, cymulas glabras simplices v. raro subcompositas oppositifolias formantes; pedicelli circ. 1-1½ lin. longi, crassi, glabri; calyx truncatus; petala 4, oblongo-lanceolata, cucullato-acuminata, lineam fere longa; stamina 4; stylus breviusculus, simplex.—It is a very distinct species with glossy obtusely 5-angled and thick stems, and may be placed near *V. repens*, WA.

55. *Vitis elegans*, Kurz, in Nat. Tydsch. v. Ned. Indie, is the same as *V. cinnamomea*, Wall., in Roxb. Fl. Ind.

SAPINDACEÆ.

56. *Schmiedelia aporetica* (*Ornitrophe Aporetica*, Roxb., Fl. Ind. II, 264.)—Fruticulus 2-3-pedalis, novellis pubescentibus; folia majora, 3-foliolata, petiolo 3-5-pollicari parce pubescente, foliola oblonga v. obovata, cuneata, lateralia sub-inæqualia, breve crasseque petiolulata, breviter acuminata, 6-8 poll. longa, remote irregularique serrata, membranacea, glabra, nervis subtus plus minus pubescentibus et supra dense fulvo-villosis; flores parvi, flaviduli, fasciculati, pedicellis brevibus gracilibus glaberrimis, bracteis longis lineari-subulatis hirsutis sustenti; racemi robustiores, simplices, axillares, fulvo-villosi, petiolis breviores; petala obovato-cuneata, emarginata, intus supra medio valde lanata; filamenta glabra v. basi lanata; ovarium villosum; drupæ abortu vulgo solitariæ, raro geminæ, pisi majoris magnitudine, globosæ, miniatæ, lucidæ.—Very frequent in the Forests of the lower hills of Arracan, on sandstone, up to 1200 feet.

This species is easily recognised amongst the trifoliolate forms with pubescent rachis by the long linear-subulate bracts.

SABIACEÆ.

57. *Sabia ? floribunda*, Miq., Suppl. Fl. Sumatr. 521, is the same as *Meliosma simplicifolia*, Bl.

ANACARDIACEÆ.

58. *Mangifera sylvatica*, Rxb., Fl. Ind. I, 644.—Prof. Miquel has incorrectly identified this species with *M. Indica, L.*, from which it is at once distinguished by the very different white flowers, the disk, and the acuminated fruits.

59. *Mangifera Horsfieldii*, Miq., Fl. Ind. Bat. I-2, 632, is the same as *M. foetida*, Lour.

60. **Semecarpus acuminatus,** *n. sp.*—Arbor glaberrima; folia cuneato-obovata v. cuneato-oblonga, basi angustatâ obtusa v. acuminata, ½-1 ped. longa, petiolis glabris 1-2-pollicaribus acuminata, integra, subchartacea, utrinque glabra, subtus glauca, nervis tenuibus sed acute prominentibus venulisque laxis et conspicuis reticulata; flores parvi, pedicellis 1-2 lin. longis gracilibus glabris, racemulosi, paniculam terminalem ramosam gracilem et glaberrimam foliis breviorem formantes; calycis dentes lati et acuti; petala lineâ longiora, oblongo-lanceolata, acuminata; discus fulvo-v. flavescente-hispidus; ovarium glaberrimum; nux oblique oblonga, latior quam alta, podocarpo carnoso ipsius magnitudinis miniato suffulta.—Very frequent in the Forests of Arracan, on sandstone, up to 1000 ft. elevation; also in Chittagong.

61. *Swintonia Griffithii*, (Sw. sp., Griff. in Duch. Rev. Bot. II, 330; Walp. Ann. I, 200; *Astropetalum sp.* 2, Griff. Not. Dicot. 412). This species is very different from *Astropetalum sp.* 1, Griff., Not. Dicot. 411, t. 565 f. 2, b-d. The leaves are uniformily green and glossy, the pedicels 3 to 5 lin. long, petals about 2 lin. long, while the latter, which is identical with *S. Schwenckii*, T. et B., (in Cat. Hort. Bog. 230), has the leaves underneath glaucous and opaque, the pedicels only ½ to 1 lin. long and the petals hardly a line long.

62. *Robergia hirsuta*, Rxb., Fl. Ind. II, 455, (1832), is the same as *Phlebochiton extensum*, Wall., in Trans. Med. Phys. Soc. Calc. (1834) VII-2, 231, now referred to *Tapiria hirsuta.*

CONNARACEÆ.

63. *Connarus monocarpus*, WA., Prod. I, 143, (non Linn.), is not a *Connarus*, for it has a sessile follicle and glabrous panicles, and may most probably be the same as *Rourea santaloides.*

64. *Rourea dasyphylla*, M i q., Suppl. Fl. Sumatr. 528, is a synonym of *Cnestis platantha*, G r i f f., Not. Dicot. 434, to which also *C. ignea* and *foliosa*, P l a n c h., belong.

Cnestis flammea (errore typico *flaminea*) G r i f f., l. c. 433, t. 608, f. 2, appears to be the fruiting state of *C. platantha*.

What is *Cnestis ramiflora*, G r i f f., l. c. 432, from Mergui? It differs from the above in being a low shrub and in having the leaflets alternate and acute.

65. *Connarus Diepenhorstii*, M i q., Fl. Sumatr. 529, is identical with *Tæniochlæna Diepenhorstii*; and *Rourea acutipetala*, M i q., l. c. 528, is the same as *Tæniochlæna acutipetala*. Both species are very different from *T. Griffithii*.

66. *Troostwyckia singularis*, M i q., Suppl. Fl. Sumatr., 531. As a synonym of this I have to note *Hemiandrina Borneensis*, H f., in Linn. Trans. XXIII, 171, t. 28. Both are surely the same plant, and not only nearly allied, as suggested by Prof. M i q u e l in Ann. Mus. Lugd. Bat. III, 88.

LYTHRARIEÆ.

67. **Ammannia (Rotala) dentelloides**, *n. sp.*—Herbulæ habitu *Dentellæ repentis* virides, prostratæ, 2-4 poll. altæ, glabræ; folia opposita, obovato-linearia v. linearia, basin versus attenuata, breve petiolata, 3-4 lin. longa, obtusa; flores solitarii, sessiles; calyx fructifer 1½ lin. fere longus, viridis, 5-costatus, 5-fidus, laciniis lanceolatis acuminatis sparse ciliolatis; petala minuta, albida v. parum cyanescentia, eroso-ciliata? capsulæ inclusæ.—Frequent in Northern Bengal, as in Purneah, Kissengunge, Titalaya up to the Sikkim Terai, in dried up ponds and ricefields, shortly after the rains; also in Behar, and Arracan in Kolodyne valley, Akyab, &c.

In habit resembling *A. pygmæa*, K u r z, which I found abundantly all over Bengal from Calcutta up to the base of the Himalaya, as also on the Rajmehal hills and in Pegu. The purple very differently shaped calyx, and the usually reddish stems and leaves of *A. pygmæa* readily distinguish this from *A. dentelloides*.

BEGONIACEÆ.

68. *Begonia Malabarica*, R x b., Fl. Ind. III, 648, and *Casparea*

oligocarpa, D C., Prod. XV/1, 276, are one and the same plant; and, therefore, the name *Beg. Roxburghii*, D C., l. c., 398, may be the most appropriate one for it.

FICOIDEÆ.

69. *Tryphera prostrata*, B l., Bydr., 549; D C. Prod. XIII-2, 424, is *Mollugo Glinus*, A. R i c h., Fl. Abyss. I, 48.

ARALIACEÆ.

70. *Brassaiopsis palmata*, (*Panax palmatum*, R o x b., Fl. Ind., II, 74). This species is identified by Dr. S e e m a n n with *B. Hainla*, but this latter has quite different leaves and the younger parts &c. whitish-tomentose, while in *B. palmata* they are all of a rusty colour. The albumen is decidedly even and not ruminate. The fruits usually contain only a single, seldom 2 pergamaceous pyrenes.

CAPRIFOLIACEÆ.

71. **Lonicera (Lycesteria) gracilis**, *n. sp.* Glaberrima, subscandens, ramis gracilibus, teretibus; folia ovato-lanceolata v. oblongo-lanceolata, circ. 3-4 poll. longa, acuminatissima, membranacea, remote denticulata v. subintegerrima, subtus glauca; spicæ breves, axillares, solitariæ, gracillimæ; flores distichi, virescente albidi, sessiles, in axillis bracteolarum solitarii; bracteolæ oblongo-lanceolatæ, acuminatæ, glaberrimæ, ovario multo breviores; corolla 6-7 lin. longa, infundibuliformis; baccæ glabræ, longitudinaliter sulcato-striatæ.—Sikkim Himalaya, in the sub-tropical forests of the Bunno valley towards the Phalloot, not uncommon. I thought at first, I might compare this species with *L. glaucophylla*, H f. and T h., but judging from the description only it differs in every respect. It is a *Leycesteria*, a genus which, however, does not seem to me to differ from *Lonicera.*

CAMPANULACEÆ.

72. **Lobelia dopatrioides**, *n. sp.* Herba erecta, glaberrima, simplex v. parce ramosa, ½ ped. alta, caulibus succulentis obsolete angulatis; folia inferiora, saepius suborbicularia v. oblongo obtusa et minora, superiora lanceolata v. rari ɔ s oblongo-lanceolata,

in petiolum brevissimum attenuata v. subsessilia, ½-1 poll. longa v. breviora, acuminata v. subacuminata, vulgo grosse serrata, herbacea; flores conspicui, pulcherrime cœrulei, longe graciléque pedicellati, racemosi; bracteolæ lineares v. subulatæ, pedicello 4-5 lin. longo breviores; corolla 2-2½ lin. longa: labii inferioris trilobi lobi oblongo-lanceolati, obtusiusculi, concavi, medio bigibbosi et ibidem lineis 2 albidis notati; calycis laciniæ lineares, tubi corollae longitudine v. paulo breviores: filamenta basi puberula, antheræ apicibus lanato-penicillatæ.—Frequent amongst long grass along the borders of the left-bank of Kolodyne river, towards Tentroop, Arracan.

This species is very nearly allied to *L. Griffithii*, and may possibly turn out to be a luxuriant state of it, but it has true leaves, and the flowers are much larger.

ACANTHACEÆ.

73. *Nelsonia tomentosa*, Dietr.—This species is variously named by different authors. Bentham adopts Rob. Brown's *N. campestris*, but *N. origanoides*, Roem. et Schult., (*Justicia origanoides*, Vhl.) and *Justicia nummulariaefolia*, Vhl., are both of much older date, and as the first name is comparatively the more appropriate one, it may with advantage be adopted. There are more such species, for which the oldest names have priority before others, more recently introduced into botanical literature. From the list of Dr. T. Anderson's Indian Acanthaceae I would now note the following :—

Ebermaiera argentea, N E., is the same as *E. lanceolata*, Hassk., to which also *E. trichocephala*, Miq., belongs.

Ebermaiera velutina, N E., is *E. incana*, Hassk.

Hygrophila spinosa, T. And., is *H. longifolia* (*Barleria longifolia*, L.).

Hemiagraphis elegans, N E., is *Hemiagraphis Pavala* (*Ruellia Pavala*, Roxb.).

Strobilanthes scabra, N E., is *S. flava* (*Ruellia flava*, Roxb.).

Daedalacanthus tetragonus, T. And., is *D. Salaccensis* (*Eranthemum Salaccense*, Bl.).

Lepidagathis hyalina, N E., is *L. incurva*, Hamilt.

Blepharis boerhaaviaefolia, Juss., is *B. Maderaspatensis*, Roth., (*Acanthus Maderaspatensis*, L.).

Justicia peploides, T. And., is *J. Vahlii*, Roth. (1821)=*T. quinquangularis*, Koen. apud Roxb. (1820).—

Rhinacanthus communis, N E., is *R. nasuta (Justicia nasuta*, L.).

Graptophyllum hortense, N. E. is *G. pictum*, N. E., apud Griff., Not. Dicot. 139 (*Justicia picta*, L.).

Eranthemum crenulatum, Wall., is *E. latifolium (Justicia latifolia*, Vahl., Symb. II. 4.)

Eranthemum Andersonii, H f., Bot. Mag. t. 5771, is *E. Blumei*, Teysm.

Asystasia Parishii, T. And. is *A. Neesiana*, N. E.

74. **Acanthus longibracteatus**, *n. sp.*—Herba annua decumbens v. adscendens 1-1½ pedalis, caulibus teretibus petiolisque 1-2-pollicaribus dense puberulis ; folia longe petiolata, ovato-v. elliptico-oblonga, utrinque acuta, basi subinæqualia, 5-6 poll. longa, membranacea, remote dentata et inter dentes curvatos minute setulosa, supra sparse hirsutula, subtus secus nervos subpubescentia ; spicae terminales, iis *A. leucostachyi* simillimæ, rhachide pilosâ ; bracteæ ad spicæ basin breves, lanceolatæ, acuminatæ, integræ, florales ¾ poll. longæ, obovato-cuneatæ, apice obtusissimæ et spinoso-mucronatæ, lateribus utrinque 2-3 dentibus spinosis munitæ, pubescentes, 3-5-nerviæ ; bracteolæ æquilongæ, anguste lineares v. subulatæ, pilosæ, integræ ; calyx ultro poll. longus, adpresse pubescens et nervosus, segmentum inferius profunde 2-fidum, lobis lanceolatis acuminatis ; corolla circiter 1⅓ poll. longa, 5-loba, fauce minute adpresseque hispida, extus glabra et loborum margines versus subpilosa.—Pegu (Dr. Brandis.)

75. **Phlogacanthus insignis**, *n. sp.*—Suffrutex glaber caulibus subteretibus albis lineis 4 elevatis notatis ; folia cuneato-oblonga, breve acuminata, basi cuneata v. attenuata in petiolum brevem contracta, integra, membranacea, glaberrima, 7-8 poll. longa ; racemi terminales, petiolis circiter duplo v. triplo longiores, minute puberuli v. glabri ; bracteolæ lineares, acuminatæ, subtilissime puberæ, pedicellis bilinealibus duplo breviores ; calyx basi paullo sphericus, segmentis linearibus acuminatis coriaceis puberis circiter 2 lin. longis ; corolla pollicaris, puberula ; tubo amplo

calycis longitudine, lobis lanceolatis acutis, superioribus brevioribus, intus fauce et ad filamentorum insertionem tombacino-villosula; capsulæ lignosæ, iis *Ph. thyrsifloræ* simillimæ, pollicares, circa 10-sperma.—Pegu (Dr. Brandis.)

76. *Justicia flaccida*, Kurz.—Planta annua, erecta, glabra, 1-2 ped. alta, simplex v. parce ramosa; folia cuneato-oblonga v. cuneato-elliptico-oblonga, sessilia cum basi rotundatâ auriculatâ, acuminata, integra, flaccida, membranacea, lutescente viridia, 7-10 poll. longa, utrinque minute lineolata; flores sessiles v. subsessiles, interrupte spicati, paniculam puberulam terminalem basi foliolis 2 breviter petiolatis lanceolatis parvis supportam formantes; bracteæ bracteolæque minutæ, lineari-subulatæ, glanduloso-puberulæ; calycis segmenta linearia, obsolete albido-marginata, minute adpresse pubescentia, circ. $\frac{3}{4}$-1 lin. longa; corolla pallide lutea v. testacea, circ. semipollicaris, extus parce puberula, tubo gracili; labium superius oblongum, subintegrum; inferius brevius, 3-lobum; antherarum loculi inferiores basi curvato-corniculati; capsulæ circ. semipollicares v. paulo longiores, parte sterili compressâ quam fertilis oblonga acuta paulo longiore v. æquilongâ, 4-spermæ, dum immaturæ parce glanduloso-pubescentes.—Pegu (Dr. Brandis).

Resembling *J. vasculosa*, but at once distinguished from it by the sessile leaves, &c.

SELAGINEÆ.

77. **Gymnandra spectabilis**. *n. sp.* Herba 1-2 pedalis glaberrima, caulibus crassis teretibus apicem versus foliatis; folia radicalia non vidi; caulina obovato-oblonga, obtusa v. obtusiuscula, sessilia v. basi attenuata semiamplexicaulia, crassa, glaberrima, nervis venisque subindistinctis, spicae elongatae, terminales, dense bracteatae; bracteæ obovatæ, sessiles, deorsum majores et gradatim foliaceæ, acutatæ, dentatæ; flores sessiles, bracteolis paullo longiores v. subæquilongi.—Rare in shady rocky ravines on the Phalloot, at about 13000 ft. elevation in Sikkim Himalaya. Evidently allied to *G. borealis*, Pall., but this differs by the shape of the corollas, which are more than double the length of the bracteoles.

78. **Gymnandra globosa**, *n. sp.*, Pl. VII, Fig. 1. Herbæ

1. *Gymnandra globosa*, Kz 2. *Schizostachyum Zollingeri*, Steud.

4-6-pollicares, glaberrimæ, caulibus aphyllis teretibus ; folia radicalia longe petiolata, pinnatifida, segmentis lineari-oblongis obtusis, carnosula, glauco-viridia ; spicae terminales, abbreviatæ, globosæ, bracteatæ ; bracteæ ovato-oblongæ, $\frac{1}{3}$ usque poll. fere longæ, obtusæ, nervosæ, chartaceæ ; flores... ; capsulæ sessiles, 2-lin. longæ.—Western Tibet, Therichan Pass, at 15 to 16000 ft. elevation, amongst slaty rocks, &c. (Revd. Heyde.)

This is a very distinct species, with large flowerheads, in foliage resembling some of the fleshy-leaved species of *Corydalis*. Fig. 1 represent the plant in natural size ; 1a, capsule, natural size ; 1b, the same somewhat magnified.

VERBENACEÆ.

79. *Gmelina Hystrix*, Schult.*—Frutex scandens ? ramulis subangulatis, junioribus hispido-pubescentibus, ramulis brevibus oppositis axillaribus foliatis v. aphyllis sæpius spinescentibus armatus, folia elliptico-oblonga, obtusiuscula, petiolis fulvo-pubescentibus glabrescentibus gracilibus circ. 3-4 lin. longis suffulta, 1½-2 poll. longa, glabra, chartacea, supra lucida nervisque utrinque prominentibus percursa, subtus glauca ; spicæ strobilinæ in ramis ramulisque terminales, breviusculæ ; bracteæ magnæ, lato-ovatæ, pollicem longæ v. longiores, acutiusculæ, albidæ ? venulosæ, plerumque 5-nerves ; flores conspicui, lutei, sessiles ; corolla cum tubo pollic. circiter longa ; tubus gracilis ; limbi 5-partiti labium oblongo-lanceolatum, valde productum, acutum ; calyx sparse adpresse pubescens, truncato 5-dentatus.—Siam, Bangkok, in gardens. (Teysmann in Hb. Bogor. No. 5946.)

PRIMULACEÆ.

80. **Primula rotundifolia,** Wall., Fl. Ind. II, 18.—Herba perennis, prolibus magnis dense albo-farinoso-tomentosis, nunc 5-6 pollicaris, nunc 1-1½ pedalis ; folia cordato-rotundata v. late ovato-cordata, in speciminibus majoribus 3-3¼ poll. longa et lata, obtusa, grosse dentata, dentibus nervis excurrentibus mucronatis, mem-

* This is the name which I found attached to this plant somewhere in the Library of the Botanic Gardens, Buitenzorg, but I am unable, at present, to give a reference to the work in which it occurred.

branacea, supra glabra, subtus (praesertim juniora) dense sulfureo-farinacea; petioli 3-4 v. 6-9 poll. longa, puberuli, juniores farinosi; scapus pennæ scriptoriæ crassitudinis, puberulus, usque pedalis et altior, nonnunquam etiam 5-6 poll. tantum altus; flores verticillati; involucri phylla lineares pedicellis fructiferis circ. pollicaribus puberulis multoties breviora; calyx usque ad basin fere profunde 5-partitus, laciniis oblongo-lanceolatis, acutiusculis, uni-nerviis, sulfureo-farinosis; corollæ hypocraterimorphæ lobi ovati obtusi; capsulæ calyce fere duplo longiores.—Sikkim-Himalaya, under shady rocks at the summit of Phalloot, at about 13500 ft. elevation, frequent in fertile black soil. Found only fruits in October.

It is most probable that this species will range with *Primula prolifera*, Wall., (*P. imperialis*, Jungh.) and their allies but not in the section *Aleuritia*, where Choisy has placed it.

THYMELEACEÆ.

81. **Linostoma Siamense,** *n. sp*—Frutex scandens? novellis tomentellis; folia oblonga v. ovali-oblonga, 4-5-poll. longa, breve petiolata, petiolis crassis tomentellis, basi acuta v. acutiuscula, apice obtusa v. raro subemarginata, mucronulata, integra, coriacea, supra glabra, v. in nervis parce tomentella, subtus fulvo-tomentella, nervis lateralibus parallelis confertiusculis; flores...; paniculæ laxæ, fulvo-tomentellæ, terminales; folia floralia opposita v. subopposita, rarius alterna, chartacea, elliptico-lanceolata, 1-1½-poll. longa, petiolis brevissimis tomentellis fulta, utrinque praesertim in costâ nervisque utrinque prominentibus puberula, obtusa, basi rotundata; drupæ ovales, pedunculis sursum incrassatis tomentellis, nigrescentes, parce adpresse setosæ, calyce chartaceo extus tomentello glabrescente inclusæ et perigonii laciniis dense fulvo-tomentosis coronatæ.—Siam, Bookit Kathay near Kanbúrí. Búkit? (Teysmann in Herb. Bog. 5986.)

This species is nearly allied to *Lasiosiphon scandens*, which latter cannot, however, be retained in that genus, differing very conspicuously already in general habit. It forms, along with the above species, the genus *Linostoma*, a very natural group, and easily recognised at the first aspect by the two discoloured floral leaves above the base of the long slender peduncles. Prof. Miquel in his Supplement to the flora of Netherland's India (Flora of Sumatra) has established a new genus of THYMELEACEÆ, under the name of *Psilæa.* I have before me authentic specimens of the type species and lately, when in Burma, I met the same shrub growing abundantly in the pine forests of the Karen hills at elevations from 3 to 4,000 ft. I cannot see how the species should differ from *Linostoma pauciflorum,* Griff.

The following is a conspectus of the species of *Linostoma,* Wall., hitherto known to me.

Subg. 1. *Nectandra* (*Nectandra,* Roxb., *Psilæa,* Miq.). Glabrous, erect shrubs; scales 10.

1. *L. pauciflorum,* Griff., (*Psilæa Dalbergioides,* Miq., Suppl. Fl. v. Sumatr. 355).—Leaves small, obovate, obtuse with a mucro. (Sumatra, Singapore and Karen hills in Burma).

2. *L. decandrum,* Wall.—Leaves rather large, ovate-lanceolate, acuminate. (Chittagong and Sylhet).

Subg. 2. *Linostoma.* Tomentose, scandent shrubs; scales 5, 2-cleft.

3. *L. scandens* (*Lasiosiphon scandens,* Endl.). Floral leaves coriaceous, petioles inserted with a broad base to a knob on the peduncle, and reflexed. (Malacca and Burma).

The floral leaves differ considerably from those of the following species, although the general habitus sufficiently agrees in both. They are much longer (about 2 inches long,) in a dried state, brownish (not whitish or straw-coloured), rigid, the veins and netvenation very glossy above, opaque underneath.

4. *L. Siamense,* Kurz.—Floral leaves thin, chartaceous, the petioles equal and not in the least thickened into a knob at the insertion. (Siam).

SCITAMINEÆ.

82. **Globba Arracanensis,** *n. sp.*—Herba perennis 1-2 pedalis, scapis foliatis; folia lato-lanceolata, brevissime petiolata, 5-9 poll. longa, glabra, subtus in nervo basin versus nonnunquam parce pilosa; vaginæ glabræ, sulcatæ, lingulâ lato-productâ truncatâ laevi; panicula terminalis, vulgo recurva, glabra, bracteis lato-ovalibus obtusis lilacinis lævibus usque 6 lineas longis munita, racemuli breviuscule pedunculati, bracteolis bracteis conformibus magnis involucrati; corollæ tubus brevis, albidus, lobi lilacini,

labium bifidum, nunc intense aurantiacum, nunc (casu ?) latere altero lilacinum, altero aurantiacum, lobulis obovato-oblongis obtusis ; filamentum arcuato-incurvum, longum, lilacinum, nudum ; anthera elliptico-oblonga, non marginata, connectivo supra antheram lobuliformi producto ; capsulæ ovatæ, calyce amplo 3-lobulato coronatæ, læves ; semina minuta, nigra, minute pubescentia, arillo basi parvo albo lacero instructa.—Very common in the Mixed Forests of the low sandstone hills of Arracan, in Akyab District. I found the flowers and fruits in October, 1869.

This species so much resembles at the first aspect *Globba spathulata*, Rxb., (*Mantisia spathulata*, Schult.), that it might easily be taken for it; but it has the panicles terminal on the leafy scapes, and no trace of those long subulate (not spatulate, as erroneously described by Roxburgh) appendages on both sides of the filamentum, and a different anther.

HYPOXIDEÆ.

83. *Hypoxis** *orchioides*, Kurz, in Miq. Ann. Mus. Lugd. Bat., IV, 177.—To this species I refer again *Franquevillea major*, Zoll., as a synonym, although Prof. Miquel suggests that it rather belongs to *H. aurea*, Lour., than to the former species. My identification is based upon authentic specimens, and Prof. Miquel evidently mistakes the long slender tube of the perianth for a pedicel.

ORCHIDEÆ.

84. *Didymoplexis pallens*, Griff.—I have suggested in Dr. Seemann's Journal of Botany, 1866, p. 40, that this species may be identical either with *Gastrodia Javanica* or *Hasseltii*. I had since an opportunity of seeing Blume's Java *Orchideæ*, from which is appears that none of them is identical, but that Blume himself has adopted Wight's *Aplectrum* as a distinct genus which, however, must give way to the older name of Griffith.

CYPERACEÆ.

85. *Anosporum cephalotes* (*Cyperus cephalotes*, Vhl., Enum., II, 311).—To this belong *Cyperus monocephalus*, Roxb., Fl. Ind. I, 193;

* Or, as some wish to write, *Hypoxys*.

Wall. Cat. 3441.=*Anosporum monocephalum*, N E., in Linn. IX, 287 ; Wight. Contr., 92 etc. ; Boeck. in Bot. Ztg. 1869, 23 etc., and *Trentepohlia bifoliata*, Boeck., in Bot. Ztg., 1858, 249.—The genus *Anosporum* appears to be a good one, representing the genus *Cyperus* amongst Hypolytreæ.

How *Cyperus pallidus*, Heyne (=*C. canescens*, Vhl.) is referable to the genus *Anosporum*, as proposed by Boeckeler, is by no means clear.

86. *Choricarpha aphylla*, Boeck., in Flora, 1858, 20, is another of Boeckeler's supposed novelties, and is to be referred to *Lepironia mucronata*, R. Br.

87. *Scirpodendron*, Zipp.—I have lately obtained more fructificating specimens of this genus, from which it is clear that also in the Javanese plant the drupes are 6 to 12 sulcate, so that there can be no doubt of Thwaites' *Pandanophyllum costatum* being really identical with Zippelius' plant, (See Journ. As. Soc. B. XXXVIII., 85).

88. *Fimbristylis cylindrocarpa*, Wall., in Kth. Enum. II. 222.—To this belong *Fimbr. abjiciens*, Steud., *F. Arnottii*, (Thwait., Enum.) and *F. schœnoides*, *var. β. monostachya*, N. E., in Wight. Contrib. 97, as well as the superfluous genus *Mischospora efoliata*, Boeck., in Flora 1860, 113.

COMMELYNACEÆ.

89. *Aneilema ochraceum*, Dalz. *var. Griffithii* (*A. crocea*, Griff. Not. Monocot. 235),—planta variabilis, nunc vix pollicaris et uniflora, nunc 5-7 pollicaris florumque fasciculis axillaribus terminalibusque, basi ramosa et procumbens; caules crassi, glabri; vagina supra ciliata ; folia oblongo-lanceolata v. oblonga, acuta; flores nunc 3, nunc 1 lin. tantum in diametro, ochracei ; sepala et pedicelli dense puberuli ; petala orbiculari-oblonga, ½-1½ lin. longa, ochracea, in sicco cyanea ; filamenta stricta, fertilium 3 alternantia longiora ; stylus striatus, violaceus ; capsula 3-quetra, sepalorum longitudine ; semina biserialia, perforata, pallida.—Arracan, very frequent on open grassy pastures round Akyab and in the Koladyne valley. Flowers and fruits in October. Also in Tenasserim (Griff.)—

I do not venture to separate this variety from Dalzell's *A. ochraceum* specifically, for there are no other differences except the pubescence of the sepals and pedicels. Some doubt may be raised against the identity of an Arracan with a Concan species, as the plant has not yet been found in intermediate stations, but I met with several other Concan plants in Arracan, amongst them also *Smithia dichotoma*, Dalz.

GRAMINEÆ.

90. *Leptochloa urceolata*, R. Br.—A synonym of this species is *Nastus humilis*, Hassk., known only by name. Dr. Hasskarl had only sterile plants before him, when he proposed the name, and probably misled by the native name, Tjangkorreh diook, (*Dinochloa Tjangkorreh* being called Tjangkorreh gedé by the Javanese) brought his plant in connection with bamboos. I have seen the authentic growing specimens in the Botanic Gardens, Buitenzorg.

91. *Bambusa auriculata*, Kurz,* in Cat. Bot. Gar. Calc. 79.—This species has been identified by Col. Munro with the common and well-known *B. vulgaris*, Wendl., (*B. Thouarsii*, Kth.). I do not know what may have been sent from the Botanic Gardens, Calcutta, under that name, but I feel certain that my plant has nothing to do with that bamboo, except that both belong to the section *Ischurochloa*. I add here the diagnose from my manuscript on Indian BAMBUSACEÆ.

B. auriculata ; Arborea ; turionum vaginæ virides, lateribus adpresse atrofusco-setosæ, ore minute auriculato lævissimæ et politæ ; folia mediocriter petiolata, subtus scabrescentia ; vaginæ plus minusve sericantes, ore auriculo nudo polito intense viridi terminatæ, flores etc. incognitæ. Burma, Assam, etc.

92. *Bambusa Rumphiana* (*Leleba Rumphiana*, Kurz, in Cat. Bogor. 1866, 20, *B. lineata*, Munro ; *B. Amahussana*, Ldl., *B. atra*, Ldl. ; *B. picta*, Ldl. ; *B. brava*, Ldl.). Fruticosa, culmis simpliciter ramosis ; turionum vaginæ patenter setosæ, ore auriculato rigide fimbriatæ ; folia vulgo largissima, spurie semiam-

* The following remarks on Indian *Bambusaceæ* are for the present restricted to a few species only, particularly those in connection with which my name has been mentioned by Col. Munro in his Monograph of that tribe of GRAMINEÆ.

plexicaulia, subsessilia ; foliorum vaginæ ore longe rigideque fimbriatæ ; spiculæ saepe tortuoso-elongatæ, sessiles v. pedicellatæ ; florum hermaphroditorum valvula interior in angulis ciliata ; antheræ luteæ ; stigmata alba, purpureo-pilosa. (Diagn. in MS. Kurz). This is a very remarkable species which will require a separate section being established for it.

Sect. *Leleba* : Spiculæ densifloræ, carinato-compressæ, valvulæ sursum deorsumque breviores, flosculus summus hermaphroditus ; rhachillæ omnes abbreviatæ, persistentes ; lodiculæ nullæ ; antheræ apiculatæ.—Gramen fruticosum, habitu valde peculiari ab omnibus Bambusis Indicis valde discrepans, foliisque maximis gaudens ; turionum vaginæ laminâ membranacea discretâ. (*Leleba* [gen.] Rumph. et Teysmann). I had opportunity to examine all the Rumphian varieties without exception, some of which, as *L. lineata* and *L. picta* would form one of the most charming introductions for the European hot-houses, as they have red, green and white striped stems, or have them beautifully mottled with the same coloure.

93. *Gigantochloa atter*, Kurz.—*Bambusa atter*, Hassk.—The genus *Gigantochloa* cannot be retained, as I will shew on some future occasion. Col. Munro writes (in Linn. Trans., XXVI, 125), "Kurz, in his notes, identifies this species (*Gig. atter*) with *B. aspera* and *B. Bitung*, Roem. et Schult., but the latter &c." I do not understand this interpretation in which I am said to have identified 2 such species, as those alluded to, which differ *toto cælo !* As far as I am aware I have identified *B. aspera* with *B. Bitung*, but surely not those two with *B. atter*. The one is (sententiâ Munroanâ) a *Dendrocalamus*, the other a *Gigantochloa*. I give here the diagnosis from my MS.—

B. aspera, Roem. et Schult. Arborea, culmis canescente-tomentosis ad nodos valde incrassatos radicoso-annulatis ; turionum vaginæ adpresse canescente setosæ, ore auriculato rigide fimbriatæ ; lingula fisso-fimbriata ; folia margine scabra ; vaginæ foliorum albido-hispidæ, ore parum producto hispido-fimbriatæ ; valvula interior in angulis marginibusque albo-ciliata ; antheræ luteæ ; caryopsis mucronulata.—Indian Archipelago, from the Moluccas to Singapore.

94. *Oxytenanthera nigro-ciliata*, Munro.—At least 3 species are united by Col. Munro, of which perhaps only the Javanese specimens of Zollinger (sine numero) really belong to *B. nigro-ciliata*, Büse. My *Bambusa Andamanica* also seems to have been merged into the same suite of species. I give, therefore, diagnoses of the true *B. nigrociliata*, Büse, and *B. Andamanica*, retaining a further elucidation of the various species for my revision of Indian bambús.

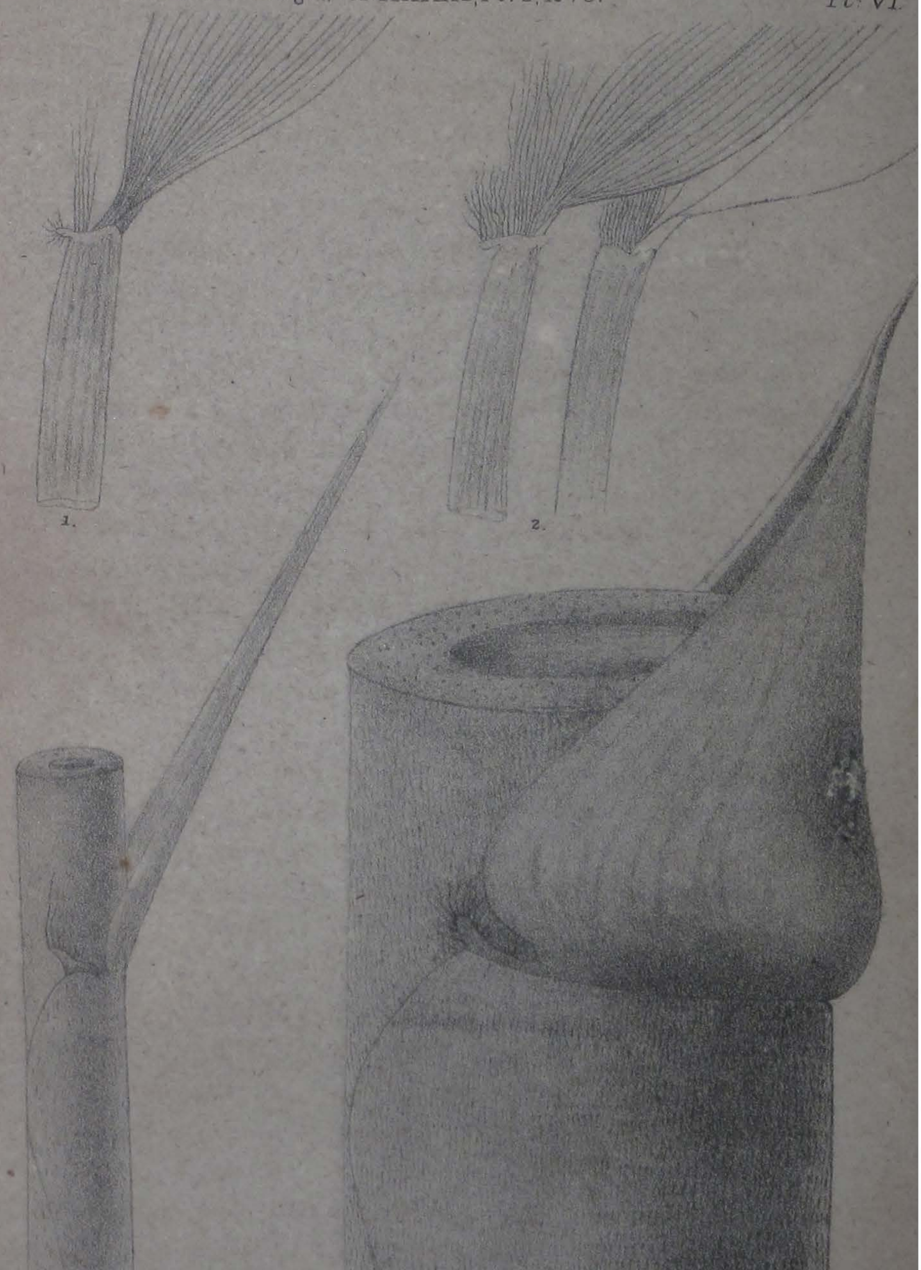
Bambusa (Oxytenanthera) nigro-ciliata, Büse Arborea; turionum vaginæ adpresse fusco-setosæ, ore decurrenti-auriculato fimbriatæ; lamina imperfecta patens; folia subtus pubescentia, marginibus scabra; vaginæ adpresse fusco-setosæ, ore minute auriculato rigide fimbriatæ; spiculæ 1-1¼ poll. longæ, curvatæ, valvulis marginibus rigide fusco-ciliatis; valvula interior in angulis a medio fulvescente v. albido-ciliata; stigmata purpurea.—A large species, resembling *B. atter* so much that it is difficult to distinguish it, when out of flower, or destitute of young shoots.

Bambusa Andamanica, Kurz, in And. Report.—Arborescens; turionum vaginæ adpresse atrofusco-setosæ, ore minute auriculato nudæ, auriculis intense viridibus politis; folia glabra, marginibus scabriuscula; spiculæ pollicares, strictiusculæ; valvulis marginibus rigide atrofusco-ciliatis; valvula interior in angulis parce pilosula; antheræ purpureæ; stigmata alba.

95. *Melocanna gracilis*, Kurz, apud Munro, is *Schizostachyum chilianthum*, (*Chloothamnus chilianthus*, Büse). The difference between *Melocanna* and *Schizostachyum* rests entirely in the fruit, and not in the absence of the upper palea, as suggested by Col. Munro.

96. *Melocanna Zollingeri*, Kurz, = *Schizostachyum Zollingeri*, Steud.—Here is another mixture of at least 3, if not 4 well marked species. Had Col. Munro had an opportunity of observing the growing plants, he would never have thought of uniting them. What would the Javanese say, if they were told, that their bambú írattén, mayang, sírít kúdá and búlú were all the same?

Schizostachyum Zollingeri, Steud., Pl. VII, Fig. 2. Arborea, culmis 2-poll. crassis; turionum vaginæ adpresse-setosæ, ore



1. *Schizostachyum longispiculatum*, Kz. 2. *Sch. brachycladum*, Kz.

large auriculato longissime fimbriatæ; lamina imperfecta erecta, ventricosa; foliorum vaginæ glabræ, ore auriculato longissime (6-80 lin.) fimbriatæ; spiculæ 3-4 lineares, flosculo penultimo hermaphrodito; valvula exterior fl. herm. marginibus lævis; lodiculæ nullæ; antheræ virescentes; stigmata alba.

Schizostachyum brachycladum, Kurz, Pl. VI, Fig. 2. (*Melocanna brachyclada*, Kurz, in Cat. Bog. 1866, 20; *M. Zollingeri β. brachyclada*, Munro, l. c. 134,—certissime non Kurz).—Arborea, culmis brach. hum. crassis; turionum vaginæ adpresse setosæ, ore minute auriculato fimbriatæ, lamina imperfecta ventricosa; foliorum vaginæ albido v. fulvescente setulosæ, ore auriculato longiuscule (4-6 lin.) fimbriatæ; spiculæ 4-6 lin. longæ, flosculis duobus summis hermaphroditis; valvula exterior marginibus ciliata; lodiculæ ciliatæ; antheræ purpureæ, dein lutescentes nigro-marginatæ; stigmata alba.—A bambú of a very peculiar habitus, growing to a height of from 30 to 40 ft., with the lateral branchings very short and meagre, hardly 3-3½ ft. long.

Schizostachyum longispiculatum, Kurz, Pl. VI, Fig. 1. (*Melocanna longespiculata*, Kurz, in Cat. Hort. Bog. 1866, 20; *M. Zollingeri*, *γ longespiculata*, Munro, l. c. 134, haud Kurz).—Fruticosa, culmis digit. crassis; turionum vaginæ adpresse albido-setulosæ, ore auriculato setoso fimbriatæ; foliorum vaginæ glabræ, ore auriculato rigide-fimbriatæ; spiculæ ultra pollicares, flosculo penultimo hermaphrodito; valvula exterior fl. hermaph. marginibus lævis; lodiculæ nullæ; antheræ lutescente-virides; stigmata purpurea. —An elegant dense shrub, with very long usually semiscandent slender stems.

[Pl. VI, Figs. 1 and 2, shew the upper parts of the sheathes of the young shoots of *Schizostachyum longispiculatum* and of *Sch. brachycladum* respectively—(both natural size). The leaf-sheathes above the shoots belong to the figures of the sheathes just below them.—Pl. VII, Fig. 2, is the upper part of the sheathes of *Sch. Zollingeri.*]

97. *Melocanna ? Kurzii*, Munro, l. c. (*Bamb. schizostachyoides*, Kurz, in And. Report)=*Teinostachyum schizostachyoides*, Kurz, a species nearly allied to *T. attenuatum*, Munro.

98. *Beesha elegantissima*, Kurz, apud Munro, l. c., 146= *Schizostachyum elegantissimum*, Kurz.

SALVINIACEÆ.

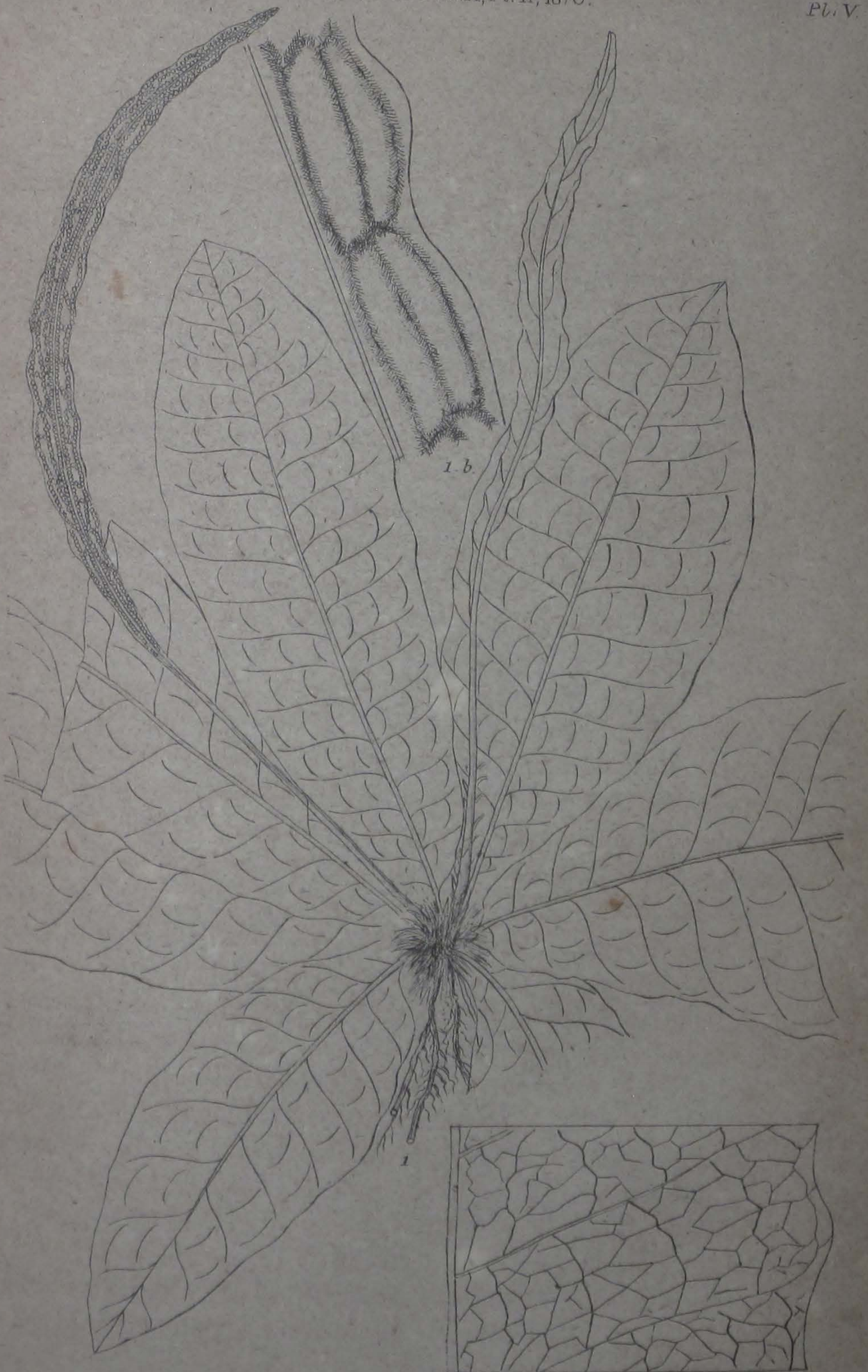
99. *Salvinia verticillata*, Roxb., in McClelland Calc. Journ. of N. History, IV, 469, and *S. elegans*, Hassk., are both identical with *Salvinia natans*, Hoffm.

100. *Marsilea erosa*, Willd., a plant which grows abundantly in Bengal in dried-up rice fields &c., is a state of growth (not only a variety) of *M. quadrifoliolata*, L. Prof. Al. Braun attempted to distinguish amongst many other supposed species also these 2, considering among others as a distinctive character the form of the pedicels, whether they were more or less grown together, &c. I have observed that all my specimens of *M. erosa*, however small plants they were, with the leaflets very coarsely toothed, invariably turned within 3 or 4 weeks into robust and large specimens of *M. quadrifoliata*, with quite entire leaflets, whenever put in deep water.

FILICES.

101. *Hemionitis Zollingeri*, Kurz, in Tydsch. v. Ned. Ind. deel XXV, 400—H. fronde membranaceâ dispari ; sterili ovali-oblongâ, obtusiusculâ, basi cordata, attenuatâ, repandâ ; fertili subhyalinâ, stipitatâ lineari-lanceolatâ, undulatâ.—Hab. in Java, probabiliter e Banjúwangí in hort. Bogor. attulit Zollinger.—Caudex obliquus, crassus, radiculis crebris firmis obsitus. Frons dispar ; frondes steriles rosulatæ, ovali-oblongæ v. oblongæ, obtusiusculæ, basi quidquam attenuatâ cordatæ et crispatæ, membranaceæ, læte virides ; stipites breves, paleis brunneis lineari-lanceolatis dense vestiti. Frons fertilis linearis v. lineari-lanceolata, acuminata, basi decurrente, stipitata, undulata, 2 poll. longa, 3-4 lin. lata, subhyalino-herbacea, lutescente-viridis ; stipes pollicaris, herbaceus, pennæ corvinæ crassitie paleis brunneis secedentibus adspersus. Sori subcontinui. (Kurz, l. c. 400.)

Mr. John Scott, in his list of higher cryptogams cultivated in the Bot. Gardens, Calcutta, quotes this species as an *Acrostichum, sect. Gymnopteris*, but a mere superficial examination of the plant



Hemionitis Zollingeri, Kurz.

shews that it cannot be referred to that genus. It is, as a species, evidently allied to *H. lanceolata*, Hook.

[Pl. V, *Hemionitis Zollingeri*, Kurz, Fig. 1, whole plant, natural size ; ; fig. 1*a*, a portion of the sterile frond, fig. 2*b*, a portion of the fruit-bearing under surface of the fertile frond,—the sori are removed. The 2 latter figures magnified.]

LYCOPODIACEÆ.

102. *Selaginella imbricatum* (ought to be *imbricata*, as is also the case with *S. semicordatum, aristatum, &c.*), J. Scott, in the list of higher *Crypt.*, 62,—is probably *S. tenella*, Spring. The var. *a. normale* (loc. cit.) is the same as *S. Belangeri*, Spring, and the var. *β. erectum* (ibiden) differs in no way from *S. Junghuhniana*, Spring.

A List of Birds obtained in the Khasi and North Cachar Hills, *by Major* Godwin-Austen, F. R. G. S., *Deputy Supdt. Topographical Survey of India.*

[Received 1st January, read 5th January, 1870.]

The following list of Birds obtained in the Khasi Hill Ranges is here given, that it may prove useful to Indian Ornithologists, interested in the range and distribution of different species ; for it adds, as might be expected, very little to our previous knowledge of the Birds of India in general, thanks to the researches of Blyth, Jerdon and others. In the N. Cachar Hills, we have arrived at the confines of a Natural Province, the Indo-Chinese, where, it may be expected, a great commingling of purely Indian, Himalayan and Chinese forms takes place; with many it is probably near the extreme western limit of the one, and the extreme eastern of the other. In the Burrail range,—so little known to us, and almost unknown to the Naturalist,—new species it was thought might be found, and this hope led me to enter on a pursuit I had never before taken up. In possession of Dr. T. C. Jerdon's volumes on the Birds of India, this pursuit soon became one of intense interest, which relieved the monotony of the hours passed buried in the forests of that range, and the miles a surveyor daily marches through them. To Dr. Jerdon I owe many a pleasant hour, and much valuable information, that I should never have otherwise known, and I only trust that, as in my own case, the "Birds of India" may lead others in the same way, to first take an interest in, and then collect specimens in the regions they may visit; only thus can we appreciate the labours of the many Naturalists who have worked before us.

I have followed Dr. Jerdon's classification throughout, and those birds not included in his purely continental Indian fauna, have been placed under the numbers of their nearest allies. In most cases, these birds are mentioned in the above work. I must here acknowledge the very great aid I have received from Dr. Jerdon, who has named many doubtful species, and some that I had been unable to identify.

All measurements taken from the fresh bird have been given, with differences of colour &c. noted. In the case of rare birds, a description has been added, for the information of those who may not be in possession of original Ornithological works. The present list contains 207 birds, and I hope to add hereafter, from time to time to it, and thus complete the birds of these Eastern Hills. Should circumstances prevent the carrying out of my present intention, such as the removal of the Survey to some other part of India, I only hope that some one else may take up the work and finish the series.

Order, *RAPTORES*.

Sub.-Fam, FALCONIDÆ.

17. *Tinnunculus alaudarius*, Briss.

Sub.-Fam. ACCIPITRINÆ.

22. *Astur (Lophospiza) trivirgatus*, Tem.

A fine live specimen of this bird caught by the Nagas of Asálu was brought to me and was kept some time in confinement. The diurnal families of this order are not by any means numerous in the North Cachar Hills, and I do not remember ever having seen the common kite. A large Eagle was occasionally seen near the higher peaks of the Burrail, but never ventured within shot.

Sub.-Fam. AQUILINÆ.

34. *Limnaetus niveus*, Tem.

39. *Spilornis cheela*, Daud.

Sub.-Fam. MILVINÆ.

55. *Haliastur Indus*, Bodd.

Feet yellow, irides dull yellow, extent 47 inches.

56. *Milvus Govinda*, Sykes.

This bird is not a visitant to Cherra, until rains begin to cease, early in September.

58. *Baza lophotes*, Cur.

Only one specimen of this handsome bird was seen and shot at the head of the Jhiri, the country being all dense forest for miles. Length 14 inches; extent 30″; wing 9¾″; tail 5¼″; plume 2¼″; tarsus 1″; spread of foot 2¾″; irides inner circle madder brown shading off into pink grey. Primaries 3rd and 4th the longest.

Family, STRIGIDÆ.

61. *Strix candida*, Tickell.

Obtained on the border of the grass country near the Kopili river.

75. *Ephialtes Lempigi*, Horsf.

Dr. Jerdon, who saw this bird, pronounced it to be *E. Lempigi*, resembling the Malabar variety; I had set it down as *pennatus* var. It certainly is a very rufous type of the former named species, and as these birds differ so much in plumage and size from various localities, I give a description taken down before the bird was skinned.

Above, chesnut rufous, feathers on top of head black shafted, barred black and dusky rufous on back, scapulars edged white on outer web with a subterminal black spot. Primaries distinctly barred with white and rufous, having narrow black lines bordering the white bars of the outer web, inner webs greyish black, breast a paler, but rich, tint of rufous, indistinctly spotted with black,—perhaps streaked would be most correct; more white on belly, the under tail coverts being pure white; legs rufous to end of tarsus, tail barred dusky on outer feathers, with fine black on the two central. Buff brown, feathers barred black and tipped brown. Irides light golden yellow, bill pale yellow, legs almost white or palish flesh colour. Length about 8 inches; extent 18½″; wing 5·8″; tail 3½″; tarsus 1·3″.

76. *Athene Brama*, Tem.

79. *Athene cuculoides*, Vigors.

Order, *INSESSORES*.

Fam. Hirundinidæ.

82. *Hirundo rustica*, L.

Breeding at Asalú in April in the high roofs of the Naga houses. The specimens shot were small, only 12 inches in extent. Jerdon mentions this bird as arriving early in July in Upper Burma; they thus probably breed along the whole line of high hills from the Burrail and Patkoi ranges into North Burma etc.

102*a*. *Cypselus tectorum*, Jerdon, Proc. Asiat. Soc. Bengal, Feb., 1870, p. 61. Differs from *C. batassiensis*, Gray, in being far darker with a shorter tail, the feet and claws of the latter species being also much stronger and larger. Dr. Jerdon, to whom I gave a specimen of this bird, pronounced it at once a different species.

This little Swift was numerous in the Naga villages around Asalú in March and April, and was then breeding in the roofs of the houses; a nest that I obtained was attached to the upper surface of a kind of palm leaf, in the thatch of a house; it is a neat very shallow construction of a fluffy grass seed, stuck together with saliva, a feather or two intermingled with the grass. The eggs were two in number, pure white, resting against the lower side of the nest, which is just of sufficient depth to retain them, so that the parent bird can hardly be said to sit on her eggs in the nest, but rather hangs on to it, in apparently a most uncomfortable position, and how the young when hatched remain with safety in the nest, it is difficult to understand, unless the power of hanging on by the claws is thus early developed. The nest is about 2½ inches in diameter.

On the Peak of Hengdon at the head of the Jhiri river, at an elevation of 7000 feet, the ridge on its west face being almost perpendicular for several 100 feet, a very large Swift was common, flying with great velocity, it may have been *Acanthylis caudacuta*, Lath., but I was unable to bring one down; they shot past like lightning and often well within shot.

Family, TROGONIDÆ.

116. *Harpactes Hodgsoni*, Gould.

Family, MEROPIDÆ.

117. *Merops viridis*, Lin., extent 11½ inches.

Family, CORACIADÆ.

124. *Coracias affinis*, McClelland.

Family, HALCYONIDÆ.

127. *Halcyon Gurial*, Pearson.

134. *Alcedo bengalensis*, Gmelin.

Not often seen in the higher hills, I obtained one at the head of the Jhiri. A large species was noticed once or twice in North Cachar.

136. *Ceryle rudis*, Linn.

Family, EURYLAIMIDÆ.

138. *Psarisomus Dalhousiæ*, Jameson.

This bird was common at the head of the Jhiri river, 20 or so together in the heavy jungle, and by no means shy. It is a smaller bird than the size given in Jerdon, though agreeing precisely in plumage; it is a truly beautiful bird. Length 10 inches; tail 4″; wing 4″; tarsus 1·2″; bill at front 0·65″, breadth 0·70″, height 0·35″.

139. *Serilophus rubropygia*, Hodgson.

I obtained two specimens of this bird, one having a fine collar of shining white.

Family, BUCEROTIDÆ.

146. *Aceros nipalensis*, Hodg.

Whole body black with glossy green tinge on back and wings, only the tips of the four first primaries and end of tail, for 6 inches, white. Head well covered with long hairy black feathers, drooping backward down the neck, feathers above the tarsus, very long and slightly tinged with rufous; nacked space on throat vermilion, heart-shaped, bounded on throat by a narrow grey black band, confined to the base of the lower mandible and side of neck; around the eye blue, under eyelid pink; eyelashes well developed; beak curved and very pointed, no casque; colors pale waxy yellow with two well marked black bars at base of upper mandible, the lower has a pale soiled appearance for about 1½ inches.

Length 3 feet 6 inches; wing 16 inches; tail 1 foot 5 inches.

Length of bill to gape 6½ inches, girth 7½″ ; foot from fore claw to hind claw 4½″ ; tarsus 2¾″.

146*a*. *Rhyticeros plicatus*, Latham.

The whole of the head, neck, back, breast, and wing black, with a green sheen. Head finely crested with a plume of black hairy feathers, tail all white. The naked space on the throat pale green and blue with an indigo band; orbital skin dull red; mandible pale waxy buff, casque small, irides pale brown, feet yellow, claws black, strong. Length 3 feet 2 inches ; extent 5 feet 2 inches ; wings 18½″ inches ; tail 1″, spread of foot including claws 5 inches ; mandible 6½″, its girth at base 8″, depth 3″; this bird was shot at Garilo near Asalú where the hornbills were particularly numerous in January and February ; in May very few were to be seen. The Nagas are very clever bird-snarers and brought into camp great numbers of birds for sale, among them a few Hornbills, of other birds Barbets were particularly numerous.

146*b*. *Aceros ?*, sp. *indet*. Yellow throated Black Hornbill.

Whole of body and wings black with a tinge of blue; neck, extending from over the eyes, and tail pure white. From the base of the upper mandible a line of reddish brown feathers commence, and widening and lengthening these cover the whole of the back, part of the head and neck, merging into a black line as it approaches the back. Orbital skin pink, eyelashes long, irides a bright red, like red sealing wax ; naked part of throat bright yellow ; casque small with seven indistinct ridges pale coloured—separated by black bars, base of both mandibles barred in same manner, the bars being narrow ; this thickening at base of the bill extends for 2½ to 3 inches. General colour of bill greenish white. Length 3 feet 9 inches, expanse 5 feet 4 inches ; tail 1 foot 1 inch ; wing 19 inches ; bill to gape 9 inches ; depth 3½″, casque 3½″.

146*c*. *Anorhinus galeritus*, Temm. (Jerdon B. of I, p. 252). *A. carinatus*, Blyth, is the young of this species.

The whole of the upper parts of a pale slaty grey, having in certain lights a greenish tinge, throat and sides of neck white, dull rufous on the breast and belly, thighs and under tail coverts. Primaries greenish black, tipped and barred white, a white spot formed by the tip of the outer wing coverts, the base of primaries being also of this colour; secondaries edged whitish, tail tipped white, centre feathers same colour as the back. Bill yellowish white. Length about 31 inches; wing 13″; tail 13″; bill to gape 4½″; depth 2″; measurements taken from stuffed specimen.

Tribe, SCANSORES.

Family, PSITTACIDÆ.

149. *Palæornis rosa*, Bodd.

150. *Palæornis schisticeps*, Hodgs.

152. *Palæornis Javanicus*, Osbeck.

153. *Loriculus vernalis*, Sparrm.

Differed slightly from Jerdon's description, the beak was bright red, not dark yellow, wing and tail dark green, the tinge of blue being very faint; feet orange.

Family, PICIDÆ.

155. *Picus majoroides*, Hodgson.

Breast and belly are decidedly buff yellow, not isabelline. Length 9½″; extent 15″; wing 4¾″; tail 3¼″; bill 1⅜″, spread of foot 2″; shot on Hengdon Peak.

157. *Picus Macei*, Vieill.

Length 8 inches; extent 13″; tail 3″; bill 1″.

163. *Yungipicus rubricatus*, Blyth.

162. *Yungipicus pygmæus*, Vigors.

166. *Chrysocolaptes sultaneus*, Hodg. Length 13 inches.

173. *Chrysopholegma flavinucha*, Gould.

The lining of wings in this specimen is pale brown.

174. *Chrysopholegma chlorolophus*, Vieill.

186. *Vivia innominata*, Burton.

187. *Sasia ochracea*, Hodgson.

Shot near Nenglo, Asalú hills, in February in scrubby jungle; differs somewhat from Jerdon's description and may be *Picumnus abnormis*, Tem. Rich ferruginous on breast, belly and nape, darker and greener tinge on back, linings of wings pale blue grey, irides crimson.

Family, MEGALAIMIDÆ.

191. *Megalaima virens*, Bodd.

192. *Megalaima Hodgsoni*, Bonap.

At Asalú it is found at 3,600 feet. The specimens, I obtained, had the vent and under tail coverts of the same green as the lower breast; bill fleshy pink, tip of upper mandible dark.

195. *Cyanops Asiatica*, Lath.

196. *Cyanops Franklinii*, Blyth.

196*a*. *Cyanops cyanotis*, Blyth. (Jerdon, l. c., I, p. 315).

Has a crimson patch at back of occiput, no crimson at base of lower mandible as in the next species, in which it is orange.

Family, CUCULIDÆ.

204. *Cuculus striatus*, Drapiez.

Length 13 inches, wing 8″; tail 6½″.

209. *Polyphasia tenuirostris*, Gray.

Length 9½ inches; extent 12½″; wing 4½″; tail 5¼″; tarsus 6/8; bill at front 5/8″.

214. *Eudynamys orientalis*, Linn., a female measured in length 15 inches; tail 7″.

215. *Zanclostomus tristis*, Less.

218. *Centropus viridis*, Scopoli.

Family, NECTARINIDÆ.

223. *Arachnothera magna*, Hodgson.

225. *Æthopyga miles*, Hodgson.

No scarlet in the tail feathers whatever, below the breast dull green grey, no tinge of brown, if tinged at all it is with yellow down the centre. Length 5 inches; bill ⅞″, wing nearly 2⅛″.

229. *Æthopyga Nipalensis*, Hodgson.

231. *Æthopyga saturata*, Hodgson.

Length 4¼ inches; scapulars, interscapulars, side of neck and back maroon, a very marked band of yellow on the rump; in all other respects it agrees with Jerdon's description.

231*a*. *Anthreptes*—sp.—?

A single specimen was obtained at Teria Ghat and shown to me by Dr. Jerdon in December 1869. Head and upper back rich metallic green fading on lower back, but strong again on upper tail coverts; wing and tail black, the shoulder of the former has a tinge of blue, outer edges of centre tail feathers metallic green, ear coverts rich purple lake, with a streak on the side of the neck metallic magenta ; chin and throat rufous, or sienna ; rest of lower plumage bright canary yellow. Length 4·4 inches ; wing 2·05″, tail 1·7″ ; bill black, length at front ·55″ ; legs dark brown, tarsus ·65″.

236. *Dicæum coccineum*, Scopoli.

241. *Myzanthe ignipectus*, Hodgson.

My specimens also have a black streak down the centre of the abdomen, commencing at the red patch on the breast.

251. *Sitta cinnamomeoventris*, Blyth, lateral tail feathers deep black, not the centre ones.

252. *Sitta formosa*, Blyth.

Bill grey black ; lower mandible pale grey at base ; feet with pale yellow soles. I only obtained one specimen of this rare and lovely bird at Asalú, evidently as rare on this eastern side as in Sikkim.

253. *Dendrophila frontalis*, Horsf.

Family, Upupidæ.

254. *Upupa epops*, Linn.

This is a rare bird on the Burrail range.

Family, Laniadæ.

258. *Lanius tephronotus*, Vigors.

262. *Lanius arenarius*, Blyth.

263. *Tephrodornis pelvica*, Hodgson.

267. *Hemipus capitalis*, McClelland.

Bill black, legs dark brown. Length 5 inches ; wing 2⅓ ; tail 2¼″ ; tarsus 0·45″.

269. *Volvocivora melaschistos*, Hodgson.

270. *Graucalus Macei*, Lesson.

Irides rich brown, not lake ; a narrow edging of pale grey on the primaries.

271. *Pericrocotus speciosus*, Latham, ♀ obtained.

272. *Pericrocotus flammeus*, Forster.

273. *P. brevirostris*, Vigors.

274. *P. solaris*, Blyth.

275. *P. roseus*, Vieillot.

Length 7¼ inches ; wing 3¼″ ; tail 4″.

278 bis. *Dicrurus longus*, Horsf.

280. *Dicrurus longicaudatus*, A. Hay.

282. *Chaptia ænea*, Vieillot.

Length $9\frac{3}{4}$ inches ; wing 5″ ; tail $4\frac{3}{4}$″ ; extent 14″ ; tarsus $\frac{5}{8}$″ ; bill at front $\frac{3}{4}$″.

284. *Edolius paradiseus*, Lin.

287. *Artamus fuscus*, Vieill.

First seen at Asalú in April, generally flying about leafless trees, in the clearer parts of the country. The birds were breeding in Cachar in April and May, the young sitting out on the palm branches.

290. *Myiagra azurea*, Bodd., both ♂ and ♀ obtained.

291. *Leucocerca fuscoventris*, Franklin.

The *five* outer tail feathers tipped dull white, decreasing ; legs brown. Length $7\frac{3}{4}$ inches ; extent $8\frac{1}{2}$″ ; wing 3″ ; tail $4\frac{1}{4}$″ ; bill in front $\frac{3}{8}$″ ; tarsus $\frac{3}{4}$″.

294. *Chelidorhynx hypoxantha*, Blyth.

Under side of bill orange. Length $4\frac{1}{2}$ inches, extent $6\frac{1}{2}$″, wing $2\frac{1}{4}$″, tail $2\frac{1}{4}$″, legs umber brown.

295. *Cryptolopha cinereocapilla*, Vieill.

A specimen obtained at Cherra was bright yellow.

296. *Hemichelidon fuliginosus*, Hodg.

In the young bird the head was spotted with white, a white circle round the eye, edge of secondaries and wing coverts pale ferruginous, finely spotted with various shades of white and dusky brown on breast, albescent on belly and lower tail coverts, feet feeble, wing measured 3 inches in my specimen.

301. *Eumyias melanops*, Vigors.

308. *Cyornis magnirostris*, Blyth.

The description of a female has only been hitherto made. Dr. Jerdon to whom I showed my specimen pronounced it a male, and of which no specimen would appear to be in the Asiatic Museum, Calcutta, nor in the British Museum. I procured but the single specimen at Asalú,—the description is as follows :—

♂,—above dark verditer blue, paler and brighter over forehead and eyes ; shoulder of wing, chin, throat, and breast rich ferruginous, fading to fulvescent on lower breast, white on belly and under tail coverts ; wings pale black, edged pale verditer. Beak long and straight, well hooked, rictal bristles rather short, nareal well developed, irides dark brown. Legs pale flesh color, tarsus short, inner toe the shortest; claws moderate; length 6 inches, wing 3·3″, tail 2½″, tarsus $\frac{7}{10}$″, bill at front ½″.

314. *Niltava sundara*, Hodg.

Rather a common bird about Asálu.

315. *Niltava Macgrigoriæ*, Burton.

316. *Niltava grandis*, Blyth.

319. *Siphia strophiata*, Hodg.

321. *Siphia superciliaris*, Blyth.

Obtained on Hengdan Peak, 7,000 feet.

323. *Erythrosterna leucura*, Gmel.

Family, Merulidæ.

327. *Tesia castaneo-coronata*, Burton.

Hengdan peak, at 7,000 feet. This bird haunts thick and low brushwood, and is difficult to shoot in such cover; it emits a loud rather musical note from time to time, as it hops from bough to bough. The description in Jerdon's work being short, I give a fuller. Hinder part of head and back olive green, the feathers showing grey below when ruffled, front of head and ear coverts bright rufous, under throat bright yellow fading and becoming of a green tinge on belly, side, and thigh coverts; wing and tail green grey. Bill red brown, dark yellow below. Irides dark brown, legs brown.

328. *Tesia cyaniventor*, Hodg., a dark streak from the eye over the ear coverts. Length 3¾ inches, wing 2″, tarsus ⅞.

329. *Pnoepyga squamata*, Gould.

Tail of only 4 minute plumes and very short, tarsus 1 inch long, spread of foot 1½″, bill pink grey, eye large, irides dark brown; length 3¾ inches, extent 6½″, wing 2⅜″; obtained on Hengdan Peak, 7,000 feet, in thick underwood.

330. *Pnoepyga pusilla*, Hodg.

331. *Pnoepyga caudata*, Blyth.

332. *Pnoepyga longicaudata*, Moore.

Obtained at Cherra Punjí in July. The feathers are margined with black on the head and back of neck only, and with *faint* shafts, wings and tail dull rufous brown. Length 4¾ inches, wing 2, tail 2″, tarsus 0·9″, bill at front 0·5″.

The exact locality for this bird appears to have been hitherto very doubtful; Moore must have received his specimens from these Hills also.

336. *Brachypteryx Nipalensis,* Hodg.

337. *Brachypteryx hyperythra,* ♀, Jerdon and Blyth.

This bird was pointed out to me by Dr. Jerdon as probably a male of the above species. A single specimen was formerly obtained, at Darjeeling and as the bird is very rare I append a description.

♂.—The entire plumage of a dull indigo, a white streak above the eye, extending from the base of the upper mandible. Primaries dusky black, tail black, wing 2·6 inches, tail 2″, tarsus 1·15″. Shot at Asálu.

338. *B. cruralis,* Blyth.

Wing 2·5 inches, tail 2″, tarsus 1·3″, bill at front ·55″.

343. *Myiophonus Temminckii,* Vigors.

Called "Simtúng" or "Smelling bird" by the Khasias, perhaps from being a coarse or dirty feeder.

344. *Hydrornis Nipalensis,* Hodg.

347. *Hydrobata Asiatica,* Swainson.

351. *Petrocossyphus cyaneus,* Lin.

358. *Turdus chrysolaus,* Temm.

♀ Obtained at Cherra Punjí.

Whole upper part pale olivaceous, darker with brown on the head, a pure white supercilium, a dark band from base of lower mandible fading to side of neck, chin and throat white, breast pale buff, lower breast and belly white; the buff color extends along the side under the wing. Quills dusky, olivaceous; bill black above, yellow below. Irides dark brown, legs dusky yellow, sole of foot yellow. Length 9¼ inches, wing 5″, extent 14″, tail 3½″, tarsus 1·2″.

The measurements of this specimen are much larger than those given in the "Birds of India" and the bird being rather rare I have added a description.

361. *Merula boulboul,* Lath.

364. *Planesticus ruficollis,* Pallas.

Length 9½ inch, wing 5·3″, tail 4·1″, tarsus 1·3″, bill at front 0·7″ Supercilium paler than the rest of the ferruginous coloring.

365. *Planesticus atrogularis*, Tem. ♀

370. *Oreocincla mollissima*, Blyth.

374. *Paradoxornis gularis*, Horsf.

Shot at Asálu in January. Bill dark yellow, legs slaty green.

388. *Alcippe Nipalensis*, Hodg.

This bird has a conspicuous white ring round the eye, not mentioned in the description. Bill grey, feet pale fleshy pink, irides light brown. Length 5 inches, extent 6¾″, wing 2¾″, tail 2¼″, tarsus 0·8″.

391. *Stachyris nigriceps*, Hodg.

Irides pale pink. Length 5 inches, extent 6¾″, wing 2·4″, tarsus ·85″.

393. *Stachyris ruficeps*, Blyth.

Irides light red. Length 4¾″, wing 2″, tail 2″, tarsus ·10″, spread of foot 1¼″.

394. *Stachyris chrysæa*, Hodg.

395. *Mixornis rubicapillus*, Tickell.

A bird which I have little doubt is this species was obtained in the Jatinga valley, near Parie Ghat in dense bambú and underwood jungle; about 12 or 15 were together. The dimensions are smaller than those given in Jerdon's book, and it differed in a few points.

Bill blue grey, legs pale horny yellow, feet stronger yellow. Irides pinkish buff. Length 5 inches, wing 2·1″, tail 1¾″, tarsus 0·7″.

396. *Timalia pileata*, Horsf.

Lower tail coverts of the same pale ferruginous as abdomen, slightly tinged with olivaceous; tail very distinctly barred.

399. *Pellorneum ruficeps*, Swainson.

Tail with every feather tipped whitish.

401. *Pomatorhinus Phayrei*, Blyth.

Length 9 inches, extent 10¾″, wing 3·4″, tail 4½″, tarsus 1·45″, bill 1·15″. Irides pale yellow. This bird I noticed running up the boughs and hunting over them in the crevices of the bark with all the habits of a creeper or nut-hatch; obtained at Cherra Punjí.

402. *Pomatorhinus schisticeps*, Hodg.

405*a*. *P. McClellandi*, Jerdon.

This bird was first recorded in my MS. List as *P. erythrogenys* of Gould, but differs from this species by its much shorter bill. It was named and sent to Gould by Dr. Jerdon, who first discovered it in the Khasi Hills, but I believe it has never yet been described. I, therefore, give a description and measurements from the fresh specimen.

Plumage generally dull throughout, back olivaceous with a brown tint, tail coverts rusty. Throat and breast white, the former dingy, upper part of breast spotted faintly with greenish brown. Irides pale yellow. Bill much curved, blunt, no notch; legs dull brown, strong. Length 9 inches, extent 10″, wing 3·2″, tail 3¼″, tarsus 1½″. Spread of foot 1 $\frac{9}{10}$″, bill to gape 1·2″.

Obtained at Nenglo beyond Asálu, under the Burrail range. Dr. Jerdon informs me, it is by no means rare near Débroghur, Assam.

407. *Garrulax leucolophus*, Hard.

412. *Garrulax pectoralis*, Gould.

413. *G. moniliger*, Hodg.

416*a*. *Trochalopteron ruficapilleum*, Blyth.

Shot on Hengdan peak. Back dull olivaceous, top of head rich madder brown, darker under the throat and ear coverts. Breast, back of neck and upper back finely mottled with scale shaped black brown spots, these spots smaller on the breast and belly. Thigh coverts olive green with a yellow tinge; forehead, lores and round the eye grey. Primaries, secondaries and tail rich chrome yellow green, the first pale black on inner web; four last secondaries edged with grey green at tip. Scapulars maronne brown. Irides grey, legs pink brown, under tail and inside wings green black. Length 10½ inches, extent 12¾″, wing 4¼″, tail 4¾″, tarsus 1¾″, spread of foot 2″.

420. *T. squamatum*, Gould.

421. *T. rufogulare*, Gould, ♀?

My specimen differs in being olive, intermingled with black on the cap. Tail with broad black band, tipped rusty, outer edge of primaries pale ochre, faint rufous spot in front of eye, ear coverts pale rufescent. Bill grey, legs pale grey, orbital skin dark blue. Length 9 inches, wing 3·6″, tail 4½″, tarsus 1·45″.

422. *Trochalopteron phœniceum*, Gould.

422 *a*. **Trochalopteron Austeni**, Jerdon.

This bird was pointed out to me as new by Dr. Jerdon to whom I handed it over to describe; he has done so in the Ibis. To complete here the account of the bird, I give a description as well.—Above rufous brown, greenish upon the rump; feathers of the tail and neck pale shafted, most markedly on the side of neck behind the ear coverts; under the throat pale brown, gradually speckled on the lower breast with bars of whitish, each feather tipped with dark brown. The white bars increase in breadth towards the belly which is nearly all dusky white. Thigh coverts olivaceous, primaries black grey, outer web rich rufous brown, wing coverts same color, finely tipped white; secondaries also tipped white; four first primaries grey on outer web, gradually decreasing. Tail with two centre tail feathers rich rufous; four outer terminating in dark grey, tipped with white narrowly. Legs pale pinkish grey, strong in form. Bill black, short and well notched. Irides umber.

Length 9½ inches, extent 10½″, wing 4″, tail 4½″, tarsus 1½″, spread of foot ¾″, bill at front ·63″; found in underwood on Hengdan Peak, Principal Trigonometrical Station of observation at head of the Jhiri river, 7000 feet; generally in pairs, uttering a harsh croaking call, and answering each other from time to time.

427 *a*. *Actinodura* near *Egertoni*, Gould.

This bird differs from the above named in the crown and nape being ashy brown. Shoulder of wing and coverts olivaceous brown. Tail pale rufous brown, *all* the feathers distinctly barred. Beneath pale rufescent, no ashy tinge and pale rufous on the neck and breast; the principal point of difference is in the centre tail feathers, and its rather smaller size. Wing 3·2″, tail 4½″.

This bird was common on the high parts of the Burrail range, always seen hunting in the highest branches of the forest trees.

430 *a*. *Sibia gracilis*, McClell.

This bird was very abundant in the Burrail hills during the spring after March, generally in forest, I noticed it very busy after insects on the large flowering forest trees, the Simul or Cotton tree was a favorite.

Fam. BRACHYPODIDÆ.

446 *a.* *Hypsipetes concolor*, Blyth.

447. *H. McClellandi*, Horsf.

448. *Hemixos flavala*, Hodg.

Obtained in January at Asálu.

449. *Alcurus striatus*, Blyth.

451. *Criniger flaveolus*, Gould.

451 *a.* *Spizixos canifrons*, Blyth.

From Surarim, near Cherra Punjí, shot by Dr. Jerdon who examined the stomach, and found that the bird is also an insect-feeder and does not live entirely on fruit.

453 *a.* *Ixos flavescens*, Blyth.

Obtained at Asálu in April.

456. *Rubigula flaviventris*, Tickell.

460. *Otocompsa jocosa*, Tem.

460 *a.* *O. monticolus*, McClell.

461. *Pycnonotus pygæus*, Hodg.

465. *Phyllornis aurifrons* Temm.

466. *Phyllornis Hardwickii*, Jard. and Selby.

469. *Irena puella*, Latham.

472. *Oriolus melanocephalus*, Lin.

474. *Oriolus Traillii*, Vigors.

Family, SILVIADÆ.

475. *Copsychus saularis*, Temm.

The wing has a white bar formed by the wing coverts and outer web of the last secondaries.

477. *Myiomela leucura*, Hodg.

483. *Pratincola Indica*, Blyth.

497. *Ruticilla rufiventris* Vieillot.

Length 5¾″, extent 9″, wing 4″, tail 2½″.

505. *Ruticilla fuliginosa*, Vigors.

506. *Chæmorornis leucocephala*, Vigors.

Length 7½ inches, extent 11¼″, wing 3¼″, tail 3″.

508. *Ianthia cyanura*, Pallas.

509. *Ianthia hyperythra*, Blyth.

524. *Horornis flaviventris*, Hodg.

A dull yellowish ring round the eye, same color on breast, wings and tail dull olive grey with brown. Length $4\frac{7}{8}$ inches, wing 2″, tail $1\frac{3}{4}$″, tarsus $\frac{7}{8}$″.

531. *Orthotomus coronatus*, Jerdon and Blyth.

Irides dark brown, length $4\frac{3}{4}$ inches, extent 6″, wing $1\frac{7}{8}$″, tail $1\frac{7}{8}$″, tarsus $\frac{9}{16}$″. One specimen shot at Cherra Punjí in October.

539. *Cisticola schœnicola*, Bonaparte.

543. *Drymoipus inornatus*, Sykes.

Bill grey at base beneath, legs pink.

549. *Suya atrogularis*, Moore.

♀ with a black patch on the throat extending to breast which is whitish.

561. *Phylloscopus affinis*, Tickell.

563. *Reguloides occipitalis*, Jerdon; from the head of the Jhiri river, N. Cachar.

Irides very dark brown; bill above pink grey, below orange; tarsus grey; feet yellow. Length 4 inches, wing 2·2″.

565. *Reguloides proregulus*, Pallas. Obtained at Cherra Punjí, in October.

567. *Reguloides viridipennis*, Blyth.

569. *Culicipeta Burkii*, Burton. Asálu in January.

572. *Abrornis xanthoschistos*, Hodg.

Bill dark brown above, orange beneath, tarsus fleshy grey.

575. *Abrornis poliogenys*, Blyth.

The loreal feathers tipped with greyish white was not seen in my specimen, obtained at Cherra Punjí, in July. Two ill-defined broad dark grey streaks on the head, chin greyish white merging into pale yellow on the throat.

584. *Enicurus maculatus*, Vigors.

585. *Enicurus immaculatus*, Hodg.

Length 9 inches, extent $11\frac{1}{2}$″, wing $3\frac{5}{8}$″, tail $4\frac{3}{4}$″. Chin and throat black.

588. *Enicurus nigrifrons*, Hodgs?

Obtained at Cherra Punjí.—A young bird.

Description.—Above black with a ferruginous tinge and a few scattered pale brown spots on the tips of the feathers of the head. Breast black with ashy brown tinge, centre feathers streaked with whitish, upper tail coverts, belly, bar on wing, tips of secondaries decreasing from the last, the two outer tail feathers, and tips of the central ones, white. Pale ferruginous tint on the tips of the white feathers, forming the wing band. Length 7·5 inches, extent 10·75″, wing 3·6″, tail 3·5″, tarsus 1·2″, bill in front 0·6″.

590. *Motacilla luzoniensis*, Scopoli.

592. *Calobates sulphurea*, Bechstein.

At Cherra in September; this specimen had the white wing band very indistinct.

596. *Pipastes agilis*, Sykes.

599. *Corydalla Richardi*, Vieillot.

Obtained in October at Cherra. Length 7¾ inches, wing 3·7″, tail 3″, not fully grown, bill at front 0·55″, hind toe and claw 1⅛″.

600. *Corydalla rufula*, Vieillot.

601. *Corydalla striolata*, Blyth.

Obtained on Mahadeo Peak, Asálu; outermost tail feathers 2-3rds white obliquely,—penultimate with a white spot on inner web at tip.

605. *Anthus cervinus*, Pallas.

Winter plumage olive brown, and two moderately pale wing bands. Length 6·5 inches, wing 3⅜″, tail 2½, tarsus ·9″, hind claw ·4″, extent 10½″.

Family, Ampelidæ.

609. *Pteruthius erythropterus*, Vigors.

Tail feathers are tipped yellow and the head dark ashy.

611. *Allotrius œnobarbus*, Temm.

Obtained at Hengdan. Top of head, back, and tail bright olive green, white circle round the eyes, with another outer circle of grey extending behind to the nape; ear coverts yellow green edged with a line of yellow; a marked very dark grey line on side of neck, a patch of brown on each side of chin, centre being buffy white, fading rapidly into the canary yellow of the breast and belly; wing and shoulder of wing grey. Bastard wing black. Wing coverts banded black and chesnut, 2 bands of each color; tail same as noted in Jerdon's description.

Length 4 inches, extent 6½″, wing 2⅜″, tail 1½″, tarsus ⅞″, legs flesh colored, irides dark brown. In another specimen obtained at Cherra the wing bars were white, the under tail coverts bright yellow, and a whitish ring round the eye.

613. *Leioptila annectans*, Blyth.

Obtained at head of Jhiri river, close under the Burrail range.

615. *Leiothrix argentauris*, Hodg.

The redder color of the upper tail coverts marks the distinction between male and female.

616. *Siva strigula*, Hodg.

Irides red brown. Length 6 inches, extent $7\frac{3}{4}''$, tail $2\frac{1}{2}''$, legs and bill grey. I noticed that these birds, when feeding together along the tops of the forest trees, are particularly noisy, a chattering twitter.

617. *Siva cyanouroptera*, Hodg.

619. *Minla castaniceps*, Hodg.

Tail pale slaty, chin and throat buffy white, primary coverts rich black, forming a spot on the shoulder. Length $4\frac{1}{4}$ inches, extent $6''$, wing $2\frac{1}{4}''$, tail $1\frac{1}{4}''$, tarsus $\frac{9}{10}''$, irides red brown, bill grey, legs yellow ochre.

620. *Minla cinerea*, Blyth.

623. *Ixulus flavicollis*, Hodg.

Feathers of the throat with dark shafts, forming a few faint streaks. Bill pinkish grey, legs pale yellow, irides brown. Length $5\frac{1}{4}$ inches, wing $2{\cdot}7''$, tail $2''$, tarsus $\frac{7}{8}$.

624. *Ixulus occipitalis*, Blyth.

625. *Ixulus striatus*, Blyth.

Head with feathers of anterior part scaly, pale, margined rufous brown on the occiput and ear coverts, irides dark red. Length $5\frac{1}{2}$ inches, extent $8''$, wing $3''$, tail $2''$, tarsus $\frac{7}{8}''$.

630. *Erpornis xantholeuca*, Hodg.

At 5000 feet under Hengdan Peak, head of the Jhiri river.

631. *Zosterops palpebrosus*, Temm.

Legs grey,—one specimen wing 2, tail $1\frac{1}{2}$; another specimen wing $1\frac{7}{10}''$, tarsus $\frac{5}{8}''$, bill $\frac{3}{8}''$.

649. *Machlolophus spilinotus*, Blyth.

650. *Melanochlora sultanea*, Hodg.

Tribe, CONIROSTRES.

Family, CORVIDÆ.

673. *Cissa Sinensis*, Brisson.

One of these birds kept by me at Cherra Punjí sang a number of different bars, in a very loud key, one so piercing, it was quite disagreeable to be near it,—yet he would often twitter in a low very melodious way. These different calls never followed each other in succession, but after long intervals, and when he commenced a song, it was kept up for some time. On the sight of a fresh shot bird, its favorite food, he became extremely noisy, or to call attention to its wants on approaching the cage would make a gurgling noise in the throat. He hung the food about the bars of the cage, or stuck it away in corners. After about six months in confinement, he became very imitative, picked up the crowing of a cock, and was perfect at the cackling of a hen after laying. These birds never retain their lovely chrysophrase green colour in captivity, they soon lose it, and although the above bird moulted in confinement, the new feathers were a dull antwerp blue, with the slightest tinge of green on the head at first, which very soon disappeared.

674. *Dendrocitta rufa*, Scopoli.

Irides dark brown; called "Kashkussi" in Cachar. Length 17 inches, wing 7″, tail 10″.

676. *Dendrocitta Sinensis*, Lath.

683. *Sturnopastor contra*, Lin.

Irides pale yellow. This bird is as common in Cachar, as the Myna, *A. tristis*, next mentioned. The Cachar bird is *S. superciliaris* of Blyth. The white supercilium and white on forehead is very marked in the birds from this eastern side of India.

684. *Acridotheres tristis*, Linn.

688. *Temenuchus Malabarica*, Gmelin.

693. *Eulabes intermedia*, H. Hay.

Family, Fringillidæ.

694. *Ploceus baya*, Blyth.

698. *Munia rubronigra*, Hodg.

699. *Munia undulata*, Lath.

735. *Hæmatospiza sipahi*, Hodg.

This bird is often captured by the Khasias at Surarim and brought in for sale.

742. *Propasser rhodochrous*, Vigors.

A ♀ obtained on Mahadeo Peak, Asálu ;—there is some doubt as to whether it is the above species.

Order, *GEMITORES.*

Family, TRERONIDÆ.

773*a*. *Crocopus viridifrons*, Blyth.

776. *Osmotreron Phayrei*, Blyth.

778. *Sphenocercus sphenurus*, Vigors.

The primaries and secondaries are also edged with yellow, very narrow on the former.

779. *Sphenocercus apicaudus*, Hodg.

781. *Carpophaga*, (sp. not determined),—There was no coppery gloss whatever on the back, rump, and upper tail coverts of a species from Asálu, these parts were of a dark neutral grey tint, tail dark indigo,—1½ inches from the end much paler, undertail coverts dirty white, irides pale grey.

Sp.	Length.	Tail.	Extent.
1	18 inches	7″	27½″
2	18″	7½″	30″

I am sorry to say that no specimen was kept of this fine bird, it was very numerous in the forest above Garilo (Chota Asálu) in January, and several were shot, being excellent eating, the skinning of one for a specimen was always postponed, and in February they had disappeared. Lieut Beavan observed *Carpophaga insignis* and this species at Molshai in the North Cachar Hills, and shot several of both, I am indebted to him for the following descriptions and measurements.

No. 1, *C. insignis*, Hodg.—Above, head slate color, back wings and tail darker with a bronze tinge, under parts light slate, tail and wing feathers darker. Length 16·5, inches, expanse 29″, wing 9·5″, tail 6″, tarsus 1 5″, bill 1″, centre claw 1·9″, hind 1·3″. Bill breadth at base 0·4″, breadth of lower mandible 0·5″. Irides, dark red with gold specks apparent in the sunshine. Legs and feet pink, feathered half way down the tarsus.

No. 2, *Carpophaga*, species (unknown).

General color slate, head and under parts light, upper parts dark, especially the larger wing and tail feathers, extreme two inches of tail lighter than the rest, forming a transverse band.

	Length,	extent,	wing,	tail,	tarsus,	centre claw,	hind claw.
Sp. *a.*	18·6 in.	29·4″	9 6″	8″	1·5″	1·9″	1·3″
„ *b.*	17·5 „	28″	9·4″	7″	1·4″	1·9″	1·3″

Bill one inch, soft and curved at tip, flesh colored,—upper compressed at base, lower the broadest, breadth ·4″, lower mandible in sp. *a*, 0·7″, in sp. *b*, 0·6″, nostril elongated, in which point it differs from *P insignis*. Irides, light bluish grey.

791*a*. *Macropygia tusalia*, Hodg.

The bird I obtained on the top of Mahadeo differs somewhat from this species, there was no tinge of lake on the bill. Orbits were black not red as in *M. tusalia*, the inner circle of the irides yellow, in the colaration of the throat and lateral tail feathers it agrees with *Columba leptogrammica* of Temmink. Length 15½ inches, extent 21½″, wing 10″, tail 7½″, tarsus 1″, bill 1⅝″, legs and feet dull red, bill black.

795. *Turtur suratensis*, Gmelin.

The female is not only smaller but decidedly of duller plumage.

798. *Chalcophaps Indicus*, Lin.

Of the Rasores very few have been collected, and of the Grallatores, all obtained are so widely distributed and so wellknown that the record is of little value until more have been noticed.—The whole order is badly represented in these Hill ranges.

Additional Observations regarding some species of Birds noticed by Mr. W. T. Blanford, in his "*Ornithological notes from Southern, Western and Central India,*"— *by* Allan O. Hume, Esq., *C. B., Commissioner of Customs, Agra.*

[Received 11th January, read 5th February, 1870.]

The following remarks on Mr. W. T. Blanford's "Ornithological notes, &c." which appeared in Part II of the Journal of the Asiatic Society for 1869, are submitted as an additional information regarding several species which Mr. Blanford has noticed in his paper. Some of the data had been collected many years previous, but they had not as yet been placed on record.

I would premise in regard to the 3 species which, Mr. Blanford particularly notices in his introductory notes, viz. *Salpornis spilonotus*, *Hirundo fluvicola* and *Cyornis Tickelliæ*, that no one of these is by any means so rare as he supposes.

As regards *Salpornis spilonotus* my collection contains specimens from Oudh, (collected by Mr. R. M. Adam, and another of my coadjutors, Mr. R. Thompson, I believe), from the north of the Saharunpúr district or the Dhún, (collected by Mr. G. F. R. Marshall), from the foot of Mt. Abú, (collected by Dr. King), and from the neighbourhood of Murrie, (in a purchased collection).

Hirundo (Lagenoplastes) fluvicola, is the commonest of our swallows in Upper India, from the Tonse river, near Mirzapúr to the Sutledge near Ferózpúr; it abounds wherever there is water, cliffs or ruined buildings, against which it can plaster its huge mud, honey-comb-like, congery of nests. In Ajmere, at Ahmedabád in Guzerat, in Saugor in the Central Provinces, I have noticed numerous colonies, and I have been familiar with this bird, its nest and eggs for the last 20 years, although I did not know its correct name, until shortly before the first volume of Dr. Jerdon's work appeared.

As for *Cyornis Tickelliæ*, I have received more specimens of it than of either *rubeculoides* or *Jerdoni*, all, however, from the Jhansee, Saugor and Hoshungabád divisions, and fully two years ago Mr. E. C. Mum sent me the nests and eggs of this species with the female shot by himself off the nest.

Turning now to some of the species separately enumerated, I note :—

18. *Tinnunculus Cenchris.*—This species may be at once discriminated from *T. alaudarius* by the colour of its claws. These are black in the last named species, white or yellowish white in *T. Cenchris.*

50. *Circus cyaneus.*—It is impossible ever to confound this species with *C. Swainsoni*, the pure white upper tail coverts, at all ages and in both sexes, suffice, as Col. Sykes long ago pointed out, to separate the European Hen Harrier from the pale-chested Harrier. I have specimens from near Indore and have seen others from near Jhansee.

53. *Circus melanoleucus.*—I agree with Mr. Blanford that this bird never occurs, except perhaps as an isolated straggler, in Northern or Western India; my specimens, and all in fact that I have yet seen, were from lower Bengal, Assam and Tippera.

56, bis.—*Milvus melanotes ?* I have or have had several specimens, young and old, of the large kite referred to by Mr. Blanford; males with the wing 20 inches and upwards and females with the wing up to 22. The young, so far as plumage goes, correspond exactly with Gustav Radde's figure of the young of *Milvus melanotes*, and hitherto I have been inclined to identify our large Indian race with this species. In Part II of my "Rough Notes," I hope to discuss this question more fully.

104. *Dendrochelidon coronata*, though locally distributed is by no means a rare or uncommon bird. It breeds freely, to my certain knowledge, in the sub-Himalayan track, below Kumaon and Gurhwal, in parts of the Mirzapúr district, in the Mandla district of the Central Provinces,(from which locality Mr. R. Thompson sent me an exquisite little nest), in the Nilgherries (whence also I have received its egg) and Ceylon, and many other localities too numerous to record here.

95. *Acanthylis sylvatica.* I also have never obtained specimens of this bird from the Central Provinces. I have them, however, from Conoor (Nilgherries) and Gurhwal, in which latter locality they are common.

631. *Zosterops palpebrosus.*—This species is anything but rare

in Saugor, Central Provinces. I have, I find, five nests, and at least a dozen eggs, from that locality.

85. *Hirundo erythropygia.*—It has not yet I believe been pointed out, that while this species of mosque swallow belongs as a resident to the plains of India, *H. daurica*, which is the resident species of the Himalayas,—breeding freely for instance about the bungalows of Simla,—also during the cold season visits the plains reaching at least as far south as Agra. I quite agree with Gould in separating *Cecropis rufula, daurica* and *erythropygia*, although occasionally somewhat intermediate forms are met with in Syria and Northern India.

86. *H. fluvicola.*—It is not at all unusual for this species to breed against high cliffs. To give one single instance, (and I could give fifty) visiting the river Chambal where the Etawah and Gwalior road crosses it, and following its course downwards to its junction, at Bhurrey, with the Jumná, one will meet with at least an hundred colonies of this species, all with their clustered nests plastered against the faces of the high clay cliffs which overhang the river. I take this opportunity of noticing that the differences remarked by Mr. Gould in his Indian specimens are merely due to sex and age. The presence, or absence (more or less entire) of the white marginal spot on the tail feathers is sexual, the white being always strongest in the old males, while the presence of striæ on the head is a sign of immaturity.

90. *Ptionoprogne concolor.*—I cannot (with very large series of each before me) concur in what Mr. Blanford says of the eggs of this species and *L. fluvicola* and *H. ruficeps*. The eggs of *concolor* are certainly not more spotted than those of *ruficeps*. So far as the character, extent and intensity of markings go, they are intermediate between those of *fluvicola* and *ruficeps*. The ground color is white, and they are all more or less thickly speckled, spotted &c., though rarely blotched, with different shades of yellowish and reddish brown. Unlike those of *fluvicola*, which are as often pure white as not, these eggs are always pretty thickly marked, but the markings, though better defined and darker than those of *fluvicola*, are neither so bold nor so bright as in *ruficeps*. As in both these species, the markings are always most dense towards the broader

end, where a more or less ill-defined zone, or irregular and partial cap is not uncommon.

Again the nests are not, I should say "precisely similar" to those of the Indian wire-tailed swallow, but are deeper and smaller, coming to a well-defined point below.

91. *Ptionoprogne rupestris.*—I quite agree with Mr. Blanford that this species is not confined to the higher Hills; it is only the other day that I procured a pair at the Taragurh Hill, at Ajmere, a solitary rocky outlier of the Aravallis only some 3000 feet in height, but at the same time the only breeding places that I know of are some 8000 feet high in the Himalayas. Amongst the lower rocky ranges I have hitherto believed them (though in this I may err) to be only winter and spring visitants, retiring in India to colder and more elevated localities to breed in.

293. *Leucocerca leucogaster.*—I have this species from as far north as Mt. Abú, to which locality, I may notice, *Gallus Sonerati* also extends, as well as *Cursorius Gallicus* and *Houbara Macqueeni* from the North West.

310. *Muscicapula superciliaris*, extends during the cold weather all over the plains of India. Mr. Brookes procured a specimen in Etawah I think, and I have one from the same locality, another from near Lucknow and several from Saugor.

325. *Erythrosterna acornaus.*—The only specimen that I have of this species was also a female—and was shot along with an *E. maculata.* I have not gone minutely into the question, but I would suggest that possibly *acornaus* is only the female of *maculata.* Anyhow, all the specimens that I possess of the latter were males.

323. *Erythrosterna parva.*—This is the *only* species in upper India. I am not sure if I have ever seen a true *leucura* from any locality, except perhaps Tippera.—I have several European specimens, and am perfectly certain that the huge series that I possess from all parts of Rájpútana, the N. W. and Central Provinces and Oudh, are one and all *parva.*

268. *Volvocivora Sykesi.*—Not very uncommon about Saugor, I got the nest and eggs both of this species and of *Graucalus Macei,* this year for the first time, from this district.

257. *Lanius erythronotus.*—I wonder whether Mr. Blanford got hold of either *Lanius caniceps* or *tephronotus*. It is curious how often these three species are confounded, yet they are really very distinct, as the subjoined comparative table will show :—

	Frontal band.	General colour of upper parts.	Extent of rufous on upper surface.	Colour of tail feathers.
L. erythronotus, ...	From 0·1″ to 0·3″ in width.	Somewhat pale ashy grey.	Whole lower back, rump, upper tail coverts and longer scaplars.	Central tail feathers black, or blackish brown, laterals brown, with a grey tint.
L. caniceps,.........	Ditto.	Ditto.	Rump and upper tail coverts only.	Ditto.
L. tephronotus, ...	Almost entirely wanting.	Somewhat dark ashy brown.	Ditto.	Central tail feathers deep rufous brown, laterals growing paler as they recede from the centre, all rufous brown.

Besides this, *caniceps* has the middle portion of the abdomen right down to the vent white, while in *erythronotus* the lower portion of the abdomen, the feathers above the vent, are bright ferruginous.

460. *Otocompsa fuscicaudata.*—This species extends northwards to Mt. Abú, where I found it very abundant; specimens there obtained are in every respect identical with those from Conoor (Nilgherries). In Oudh and in Bengal, this species is replaced by *Otocompsa emeria*, and east of the bay of Bengal by *O. jocosa*—Mr. Blanford says, that he has never met with an *Otocompsa* in Central India ; I presume he means of the *jocosa* type, with red whiskers, because *O. leucotis* occurs, though rarely both, in Saugor and Hoshungabad.

467. *Iora Zeylanica.*—This species and *typhia* are one and the same species. I have more than 100 specimens from all parts of

India, some from even as far east as Comillah in Tipperah, and there is not the slightest doubt, I believe, that both forms represent different sexes and stages of plumage of the same species. Mr. Blanford might, therefore, well kill a perfectly intermediate specimen.

473. *Oriolus Ceylonensis.*—None of the supposed specimens of this species, from Ahmednugger sent me by Messrs. Fairbank and Bruce were, in my opinion, *Ceylonensis,*—at least if *Ceylonensis* be a good species. The chief distinctions supposed to exist between *melanocephalus* and *Ceylonensis* consist — 1st, in the black of the throat coming much further down on the breast of *melanocephalus,* than of *Ceylonensis ;* 2nd, in *melanocephalus* having the secondaries and tertiaries broadly tipped yellow, and the outer webs of the latter yellow, while in *Ceylonensis* only the tertiaries are tipped, and this only on the outer webs, with yellow.

Messrs. Fairbank's and Bruce's Ahmednugger specimens, though somewhat intermediate, pertained rather to the *melanocephalus* than the *Ceylonensis* type. As a matter of fact, I have shot good typical examples of both races in the same localities in the Bhabur, below Gurhwal, and in Oudh Terai, and I at present utterly disbelieve in *Ceylonensis* as a distinct species. Perhaps, however, I have never seen a true *Ceylonensis,* my museum unfortunately contains no Ceylon specimen.

353. *Orocætes cinclorhynchus.*—Stragglers of this species (and what is more remarkable of *Oreocincla dauma*) occur every cold weather in the plains of the N.W. Provinces and the northern portion of the Central Provinces. When our Avifauna comes to be more closely watched, a vast number of the Himalayan species, now considered to reside exclusively in the Hills, will be found to visit the plains during the cold weather. I killed a fine specimen of *Tichodroma muraria* on the clay cliffs of the river Jumná, at Sheregurh, some 20 miles due north of Jaloun.

354. *Geocichla cyanota.*—Mr. Blanford may be right in considering the olive tint on the back a sign of immaturity, but it is curious, that out of a large series of this species and *citrina,* no single male exhibits this peculiarity, but a large proportion of the females do. This may be accidental.

488. *Saxicola opistholeuca.*—This species will not stand, the points relied on by Blyth, Strickland and Gould are not constant, as the examination of a large series shows.

515. *Acrocephalus brunnescens.* I have specimens from numerous parts of India. The proportions of the primaries vary a good deal, not locally but individually, and the tone of coloration also varies greatly.

645. *Parus cinereus.*—I have specimens from all parts of India,—from Cashmere to Comillah, and from Kotgurh to Conoor. Individuals differ; the species is one and the same; Javanese specimens do seem to be persistently smaller; I have not, however, seen a sufficient number of examples to make sure that this difference is really constant.

604. *Agrodroma sordida.*—As I have pointed out in a paper which will appear in an early number of the Ibis, neither of our Indian birds known as *A. sordida* and *cinnamomea,* can well be identical with Rüppell's birds. It is needless to discuss the matter here, but if I am correct and with Rüppell's careful Latin and German descriptions of both, and his plate of *sordida* before me, I can scarcely be in error; the Indian birds will stand, the supposed *A. cinnamomea* as *A. similis,* Jerdon, and the supposed *A. sordida* as *A. griseo-rufescens,* nobis.

768. *Alauda Malabarica ?* Unless I am much mistaken (which I very likely may be) this bird of Mr. Blanford's is the true *Spizalauda Deva.*

The Rev. Mr. Fairbank favoured me with three specimens of a lark killed at Khandalla, which he (or perhaps Mr. Blanford) had named *Alauda Malabarica.* On examination, they proved to have hind claws only 0·4 in length, and the 1st primary 0·6 in length. It was quite clear that these were not true (restricted) *Alauda.* On closer examination there remained no doubt that these were the true *Spizalauda Deva* of Sykes, although the dimensions somewhat exceeded those given by Jerdon. On comparing these with the Upper Indian race which I had hitherto confounded with Sykes's bird, and of which it is not impossible that Jerdon owing to a similar error, gave the dimensions, I found that conspicuous differences existed, rendering the separation of the Upper Indian race as a distinct species necessary.

I proceed to give some dimensions of the Southern and Northern Indian races, premising that to the latter I have given the specific name of *simillima.*

		length,	wing,	1st prim.	tail,	bill at front,	tarsus,	hind toe and claw,
S. Deva,	♀	6·25	3·60	0·60	2·05	0·53	0·86	0·75
(Southern	♂	6·10	3·65	0·62	2·16	0·53	0·81	0·72
India.)	♂	6·00	3·57	0·80	2·00	0·57	0·86	0.75
S. simillima,	♀	5·20	3·15	0·38	1·75	0·45	0·70	0·64
(Northern	♀	5·50	3·26	0·40	1·85	0·43	0·72	0·65
India.)	♀	5·20	3·00	0·42	1·70	0·50	0·70	0·68

The plumage of the two species is of precisely the same character, but the colouring of the Upper Indian bird is paler and less rufous, and this is especially conspicuous in the outer webs of the first long primaries and exterior tail feathers, which are rufous buff in *Deva,* and pale fawn colour or yellowish white in *simillima,* and in the wing lining and rufous margins to the interior webs of the quills. Altogether the bird has a paler and sandier cast, so much so, that the first glance at the birds is sufficient to attract the attention of even a superficial observer to the difference. The crest of the adult Northern bird too is, I think, longer than that of the Southern, some of the feathers of the former measuring fully 0·9″ in length. This bird bears the same relation (so far as type of colour goes) to *S. Deva,* than *A. gulgula* does to *A. Malabarica.*

Spizalauda simillima occurs throughout the upper portion of the N. W. Provinces and Cis-Sutledge States of the Panjab, and I have specimens sent me from Jhansee; but what the limits of its range are, I do not yet know, having until recently always confounded it with *S. Deva.*

I may here note that Capt. Mitchell of Madras sent me specimens of *Alauda Malabarica* from Ootacamund labelled *A. gulgula;* accepting his name and noticing the striking difference in appearance between these birds and our northern representative race, I separated the latter, as *A. gulgulensis,* (*vide* my Catalogue), but subsequent careful examination has shown me that the Ootacamund birds are really *A. Malabarica,* while our northern race is the true *A. gulgula* of Franklin.

From this it will appear that Mr. Blanford's bird, having the hind toe claw only 0·4, cannot be identified with *Alauda Mala-*

barica, a restricted *Alauda* with a *long* hind claw. Of course the bird recorded by him as *Spizalauda Deva* is the *Spizalauda simillima*, nobis.

716. *Emberiza Huttoni.*—This bird is common almost throughout Northern, Western and Central India, wherever there are rocky hills. It abounds in the Salt Range, in the Panjab, and throughout the Aravalli range; Taragurh at Ajmere and Mt. Abú, being amongst its most favourite resorts. I have it from near Mirzapúr, from the Siwaliks and from the Saugor Division and Mr. Brookes has shot it in Etawah. Probably like *Emberiza striolata*, which I this year found breeding at Ajmere (see a separate paper on this species, which will appear in an early number of the Ibis) *E. Huttoni* is a permanent resident and not, as has been supposed, a visitant from the Himalayas. This is of course the bird referred to by Sykes as *E. hortulana.*

800. *Pterocles fasciatus.*—It is strange that I have never noticed the crepuscular habits of this bird. I have shot scores of it. One day, Mr. F. R. Blewitt and myself bagged over a dozen within a circle of half a mile at Tirkee in Goorgaon, not many miles from the famous sulphur springs at Soria. Only the other day I shot a pair not far from Kishengurh in Rajpútana in bright daylight, as they came down to drink, and I have seen them at the water's edge in the mornings at least a dozen times. They are very common in Upper India wherever there are low rocky hills with a little scrub jungle at the base, quite as common as *P. exustus* in the sandy open plains. I have shot both these species and *arenarius* in the same morning in the Goorgaon district, but *alchata*, our fourth Indian species very rarely I think crosses the Indus, though it is abundant enough in the cold season at Hot Murdan and other trans-Indus Panjab posts, where it is known to sportsmen as the bronze-winged Sand-grouse.

819 bis. *Francolinus* n. sp.—I do not doubt that the Cutch species is distinct, I propose to name it after my valued friend and contributor, Dr. King, whose paper on the Birds of Goona is noticed more than once by Mr. Blanford. I had intended describing this species in the Ibis, but the only specimen I had, was such a vile rag, that I hesitated to do so, and in a weak moment, sent it to

a brother sportsman in Kattywar, whence it had been received, to show the species of which I wanted specimens. Now, I am sorry to say, I can neither get the original specimen nor better ones out of my friend, and my only hope is, that seeing this notice, he may be conscience-stricken, and do me the favour of returning me my own bird, with a good series of the same species.

P. S.—I take this opportunity of intimating my dissent to the propriety of elevating the Mahableshwar race of *Alcippe poiocephala* to the rank of a distinct species.

To the kindness of Mr. H. R. P. Carter I owe a noble series of the Nilgherry bird, and to the Rev. H. Bruce, two specimens of the supposed *A. Brucei.*

I admit freely that, as a rule, *A. poiocephala* is somewhat smaller than the specimens of *Brucei* which I possess, but some specimens of the former are fully as large. *Brucei*, to judge from the specimens before me, is certainly not darker as a rule, than the majority of *poiocephala*, nor is it less ferruginous, and these three points are, what Mr. Fairbank in the original description which he sent me chiefly relies on.

The fact is the shade of colour varies in individuals. *Brucei is* darker and less ferruginous, or lighter and more ferruginous than some, and absolutely identical in colour with other specimens of *poiocephala* that I possess.

The rounding of the tail, the wideness and firmness of the inner webs (other points insisted on by Mr. Fairbank) varies in individuals, and in these respects also, the specimens sent me of *Brucei* are intermediate between those now before me of the Nilgherry bird.

It may be said that *Alcippe Nipalensis* which I admit as a distinct species, differs only very slightly in plumage from *poiocephala* and this is true, but, the bill, legs and feet (the former conspicuously) of this latter, are invariably larger than those of *Nipalensis,* while they correspond exactly with those of *Brucei.* In the one case (and I speak after comparing numerous specimens), we have a constant and very material structural difference, while in the other there appears to be an absolute structural identity.

On certain protracted irregularities of Atmospheric pressure in Bengal in relation to the Monsoon rainfall of 1868 and 1869,—*by* Henry F. Blanford, *Meteorological Reporter to the Government of Bengal.*

(With plate VIII.)

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When the Meteorological system, recently established in Bengal, began to afford trustworthy results, one of the first objects of enquiry that engaged my attention, was the variation of the monsoon rains. The year 1868 was marked by a rainfall in Lower Bengal (more especially at Calcutta and the S. Western part of the Gangetic delta) of almost unprecedented amount, while in the N. W. Provinces and the Panjab, the deficiency was such as to cause a very considerable failure of the crops and much consequent suffering. This year (1869), the rains have been comparatively light throughout Northern India, including Bengal, except in the districts to the North of the Pudma* river; and it is fresh in the recollection of all residents in Northern India, that large tracts in the N. W. Provinces, Central India and the Panjab, have been preserved from the imminent horrors of famine only by the timely rains at the very close of the ordinary monsoon season. My object, in the present communication, is to bring to notice certain peculiarities in the distribution of the barometric pressure, which seem to throw some light on the causes, the proximate causes at least, of these notable and important variations.

In watching the daily and monthly reports received from the Meteorological stations in Bengal, I early observed that sometimes for periods of several months, the barometric readings at certain stations, when reduced to the sea-level, shewed an apparently anomalous depression or elevation; anomalous, that is to say, as not conforming to the general law of the barometric gradient for the time of year, as then known. I was at first inclined to suspect that the assigned elevation of certain of the stations might be erroneous, or that, possibly, the barometric registers might be vitiated

* The name given to the main stream of the Ganges below Rajmahal.

by errors arising from faulty position or manipulation of the instruments. Accordingly I took every means in my power to verify the elevations, and either by personal inspection or otherwise, to satisfy myself that the instruments were properly placed and observed. The barometers had all been compared with the Calcutta standard before they were issued, and the errors thus ascertained had been applied as corrections to their readings. At stations that I visited,* I repeated the comparison with one or two mountain barometers which I carried with me, and which had been compared with the standard before my departure and were again compared on my return. In no case did the result of the second comparison differ from that of the first by more than a quite trivial amount. Some of the stations,† moreover, have been supplied with duplicate barometers since the peculiarities above noticed first attracted my attention, and in these cases, a comparison was made between the two instruments as soon as possible at the station, and their recorded errors thus made to furnish a check on each other. I mention these details because in this country the barometric variations are so small in comparison with those in Western Europe, that it is of the utmost importance in order that the conclusions based on their readings may be trustworthy, that all merely instrumental errors be most carefully eliminated. Any confidence that my facts may lay claim to, will depend on the assurance that all ascertainable causes of error have been carefully ascertained and allowed for.

These precautions then having been duly observed, and not having afforded any explanation of the observed anomalies,‡ the conclusion became legitimate, that they were real atmospheric phenomena and not apparent and instrumental only: and this conclusion was confirmed by the fact, that in some cases the same peculiarity was shewn by two or more neighbouring stations. Finally during the last cold weather (1868-69) I observed that certain stations which, during the S. W. monsoon, had shewn an excessive barometric depression, now exhibited an opposite tendency, an excess of atmospheric pressure; and that this like the former pecu-

* Dacca, Chittagong, Shillong and Monghyr.
† Saugor Island, Cuttack and Akyab.
‡ With one exception. The elevation of Chittagong had been erroneously reported, as shewn by my verification.

liarity, affected not one only, but two or three neighbouring stations in different degrees, and lasted for some months.

It was not, however, until another S. W. monsoon had afforded me the means of comparing the barometric features of the same season in two consecutive years, that I could be justified in assuming any correllation between these local peculiarities of atmospheric pressure, and the variations in the rainfall. There has hitherto been very little systematic observation of the barometer in India, that is susceptible of comparative treatment, and very much remains to be done to ascertain the normal distribution of atmospheric pressure during our monsoons. To determine whether any local peculiarity is normal or abnormal, at least two registers for corresponding seasons must be compared. This has now been done for the SW monsoon, and I am justified in concluding, that the local depressions which I shall now describe, and which appear to me to be intimately related to those variations of the rainfall which I have already noticed, are peculiar to the year and not recurrent.

I take first of all the SW monsoon season (May to September) of 1868. The following table (extracted from my official report) gives the mean barometric pressure* of each of the monsoon months, at all the stations from which I have reports for the period in question. They are reduced to 32° Fahr. and mean sea level.

	May.	June.	July.	Aug.	Sept.
Port Blair, ...	?	29·810*	29·835*	29·819*	29·853*
Madras, ...	29,800	·742*	·756*	·772	.792*
Akyab, ...	·850	·753	·756	·720	·797
False Point, ...	·736	·567	·562	·575	·654
Cuttack, ...	·754	·613	·615	·568	·735
Chittagong, ...	·802	·626	·657	·630	·740
Saugor Island, ...	·736	·522	·535	·475	·616
Calcutta, ...	·781	·570	603	·601	699
Hazaribaugh, ...	·720*	·546*	·509*	?	?

* The means are obtained from the observations recorded four times daily viz. 4 A. M., 10 A. M., 4 P. M., and 10 P. M. on every day in the month, except those marked wlth an (*) which are the means of the 10 A. M. and 4 P. M. observations only. I have shewn, in the Report, that the means thus obtained are comparable to within ·01 of an inch.

	May.	June.	July.	Aug.	Sept.
Jessore, ...	·761	·541*	·584*	?	·695*
Berhampore, ...	·777*	·547*	·590*	·590*	·715*
Dacca, ...	·831	·614	·636	·605	·739
Monghyr, ...	·701	·515*	·542*	·564*	·679*
Patna, ...	·740*	·549*	·542*	·574*	·684*
Benares, ...	·747	·570	·573	·621	·710
Roorkí, ...	·694	·491	·517	·523	·658

It will be observed that in June, (with the exception of the comparatively distant stations, Monghyr and Roorkí,) and in August and September, (without exception as far as the table shews, Hazaribaugh being, however, wanting in these months,) Saugor Island shews the lowest mean barometric pressure. False Point also shews a low mean pressure, which is however, 0·1 above that of Saugor Island in August, and 0·03 to 0·04 in the other months after May. The Calcutta mean readings are from 0·045 to 0·12 higher than those of Saugor Island throughout, and those of Cuttack (except in August when this station shews the lower mean pressure,) from 0·018 to 0·08 higher than those of False Point. There was therefore, a persistent barometric relative depression extending from Saugor Island to the SW. It was somewhat changeable both in intensity and position, but the minimum always lay nearer Saugor Island than any other station. The mean barometric gradient between Calcutta and Saugor Island (70 miles) was in

May,	one inch	in	1555	miles.
June,	,,	,,	1458	,,
July,	,,	,,	1029	,,
Aug.	,,	,,	555	,,
Sept.,	,,	,,	843	,,

and it did not finally disappear until December.

There was another area of barometric depression to the NW. and NNW. of the above, (as is shewn by Hazaribaugh and Monghyr) which would seem to be more regularly recurrent than that which lay about the Sand Heads, and is probably due to the elevated and hilly character of the country. In July the mean pressure at Hazaribaugh was lower than at Saugor Island.

Saugor Island as has been already remarked was the lower in June, and in all probability in August also.

Now the rainfall tables shew that the months of June and August were those of the heaviest rainfall in Bengal generally; but the excessive falls were very local. In June the maximum was at Balasore and Contai; in August at Hooghly and Kishnagur; in both cases apparently, (certainly in the latter,) not at the place of greatest mean depression but at some distance (about 100 miles) to the north of it. This is shewn by the following table extracted from the general rainfall table in the official report—

Rainfall in inches.

	June.	July.	Aug.	Sept.
Poorí,	11·00	10·90	12·90	5·05
Cuttack,	17·30	10·12	8·92	9·80
False Point,	9·20	12·75	9·95	20·40
Balasore,	36·20	5·60	14·30	9·60
Saugor Island,	27·40	11·86	16·07	21·50
Contai,	34·43	8·76	12·69	17·74
Midnapore,	22·80	5·40	19·30	13·20
Calcutta,	26·61	11·17	24·83	15·69
Howrah,	23·20	14·80	25·30	21·10
Bancoorah,	15·25	6·55	15·30	17·10
Hooghly,	15·80	9·55	40·50	21·40
Burdwan,	8·20	10·80	29·60	14·50
Jessore,	16·62	12·24	20·53	9·49
Kishnaghur,	10·75	11·50	30·20	7·30
Berhampore,	12·71	8·40	18·07	9·36
Soory,	8·85	8·85	10·45	9·20
Rampore Beauleah,	14·45	13·20	10·75	11·20

Calcutta and Howrah received about the same quantity of rain in June and August, but in the former month they lay to the north, in the latter to the south of the area of greatest rainfall. In June the fall exceeded 20 inches over an area including Balasore, Saugor Island, Contai, Midnapore, Calcutta and Howrah. At Bancoorah, Hooghly and Jessore it was between 15 and 17, and at Cuttack rather more than 17 ins. In August the fall exceeded 20 inches at Jessore, Kishnagur, Hooghly, Burdwan, Calcutta and

Howrah, and was nearly of that amount at Midnapore in one direction and at Berhampore in the other.

In both months there was within these areas a focus of greatest rainfall, around which, the quantity diminished with the distance. This focus was about Contai and Balasore in June, where the quantity registered was between 30 and 40 inches, and in August was situated about Hooghly, where the register exceeds 40 inches for this month.

The resultant directions of the winds at Calcutta, Saugor Island, False Point, Cuttack and Jessore, as calculated from all the observations in each month are given in the following table; comparative prevalence being expressed by a number proportional to the whole number of observations taken as 100.

	May.	June.	July.	August.	Sept.
Jessore, ..	58 S.19E.	56 S. 6W.	74 S.22E.	27 S.16E.	55 S. 12E.
Calcutta, ..	80 S. 5E.	75 S.14W.	88 S .2E.	61 S.24W.	68 S. 18E.
Saugor Id.,	85 S. 5W.	77 S.29W.	72 S.12W.	45 S.37W.	37 S. 12W.
False Pt.,	81 S.24W.	60 S.47W.	68 S.55W.	58 S.87W.	40 N.83W.
Cuttack, ..	70 S.11E.	48 S.35W.	47 S.47W.	42 S.79W.	18 S. 39W.

Now on comparing in this table the mean directions for June and August with those of the other months, it will be observed that the former are characterized by a comparative excess of westerly elements. Thus at Calcutta for example, the wind is East of South in May, July and September, but West of South in June and August. This general characteristic becomes very distinct when the anemometric resultants are laid down on a chart, [see Plate VIII,] as wind arrows, the lengths of which vary as the figures expressing prevalence. At Jessore the August mean is an apparent exception, but the figure expressing prevalence, is so much reduced as to indicate a considerable deficit of Southerly and increase of Northerly elements.* A similar difference is shewn by the mean of Berhampore.

A comparison of the June and August wind resultants with those of the same stations for any of the monsoon months of 1869 entirely bears out the above inference as to the unusual prevalence of a

* The detailed table from which the mean resultant is computed shews this to be the case.

Westerly element in the former, in other words of a deflection of the monsoon from its normal course towards the East. The winds do not indeed follow a spiral course around, and in to a place of minimum depression as they would do in a cyclone, but they are deflected from their normal direction to the Eastward, in all probability to feed an ascending current over Lower Bengal. Hence the excessive rainfall already noticed at certain stations in Lower Bengal, and as a consequence, the deficiency experienced by stations to the NW. in the Ganges valley, with the predominance of Westerly winds which characterized the greater part of the monsoon of 1868 in the N. W. Provinces. Of these features the existence of a persistent barometric depression in the head of the Bay seems to offer a consistent explanation.

I now pass to the monsoon of 1869, the barometric features of which differed considerably from those of the previous year, and which brought to the delta of Lower Bengal a rainfall somewhat below the average, while in the NWP. the deficiency of rain up to almost its close, was as marked as in 1868.

	May.	June.	July.	Aug.	Sept.
Port Blair,......	29·817*	29·770*	29·789*	29·810*	29·829*
Madras, ...	·733*	·673*	·717*	·751*	·777*
Akyab, ...	·782	·656	·701	·724	·804
False Point, ...	·763	·609	·626	·719	·748
Cuttack,........	·710	·572	·626	·716	·733
Chittagong, ...	·742	·600	·638	·731	·745
Saugor Island, ..	·705	·548	·566	·668	·704
Calcutta, ...	·680	·531	·566	·666	·708
Hazaribaugh, ..	·588	·481	·527	·624	·677
Jessore, ...	·669	·521	·554	·651	·701
Berhampore, ...	·665 ?	·517 ?	·562 ?	·668	·709
Dacca,..........	·704	·566	·601	·684	·739
Cachar, ...	·752	·594	·630	·698	·761
Monghyr, ...	?	·482	·527	·596	·644
Patna,..........	·601	·494	·522	·619	·675
Benares,........	·625	·505	·567	·641	·688
Roorki, ...	·560	·362	·510	·581	·663

The distribution of atmospheric pressure shown by this table is very different from that shewn by the table for 1868. The Saugor Island means are throughout equal to or higher than those of Calcutta, and those of False Point equal to or higher than those of Cuttack. Of the area of depression in the head of the Bay, which was so marked and constant during the monsoon of 1868, not a trace reappears. This season the seat of minimum pressure is transferred to Hazaribaugh and Monghyr,* and here it was persistent nearly to the close of the monsoon, deflecting the winds and apparently determining the distribution of the rainfall, just as the Saugor Island depression of the previous year had done in the lower part of the delta.

This depression first became marked in April, in which month the lowest mean readings are those of Hazaribaugh and Patna, Monghyr being wanting. In May the difference was greater and in June these three stations alone lay within the isobaric of 29·5. In June and July the pressure was about the same at Hazaribaugh and Monghyr, but in August and September it rose at the former more rapidly than at the latter station, and the barometric minimum lay above Monghyr.† Throughout the three first months of the rains, and indeed nearly to the end of September, the vapour bearing monsoon was then arrested in its normal course towards the N. W. Provinces by a persistent atmospheric depression in the region of the Curruckpore hills and Hazaribaugh, and it was not

* In the abstract of the paper given in Proc. As. Soc. for January 1870, it was stated (p. 93) that in March, a slight depression appeared over a region including Berhampore, Monghyr, &c., that in May it was intensified especially over the first named station and reached its lowest point in June, and that there was a mean difference of 0·14 of an inch between Calcutta and Berhampore. On re-examining the registers and laying down their barometric means of the stations for each day in curves, an instrumental error has been detected in the Berhampore register which affected it from the 15th April to the 15th July, and which caused the mean pressure to be recorded as rather more than 0·1 too low. A corresponding correction has been applied to the register in the above table, but since the correction can be determined only for the beginning and end of the period, and is assumed to be the same throughout, the results are marked with a [?]. It results from this that the depression did not move westward as originally stated, but changed as now stated in the text; and that the cyclone of June did not move direct to the place of minimum pressure, though (as I am still of opinion) its course was probably affected by the existence of the local depression.

† Except Roorkí which in this month was lower than any of the Bengal stations, but the barometer has not been compared and there is much reason for the belief that it reads low.

until the end of September that the contraction of this depression allowed the N. W. Provinces to receive their usual rainfall, as it would appear, by leaving the winds from the Bay to follow their normal course across Hazaribaugh and Chota-Nagpoor towards the Upper Provinces.

In June the heaviest rainfall occurred at Julpigorí (41·29 ins.) and Rungpore (36·7 ins). At the stations of Dinagepore, Pubna, Malda, Buxa, (Bhotan Doars,) and Goulpara more than 20 inches were registered, while at Darjiling at which the average rainfall for this month is 27·50* ins., 19.85 inches only fell. At Calcutta the rainfall for the month amounted to 18·84 inches; but of this, 11 inches fell in one day, during the Cyclone of the 9th June, the centre of which passed very near Calcutta. Berhampore received 21·74 inches of which 5·7 fell during the passage of the Cyclone and Rampore Beauleah, which was also near its track, 18·05 inches, in all of which 6 inches fell on the day of the storm. It would appear then that the heaviest fall was to North East of the depression, the maximum being at 150 miles from the seat of greatest depression much as in August of the previous year. In the present case, however, the place of maximum rainfall was probably determined by the proximity of the hills.

That the winds in May and June were greatly influenced by the local barometric depression, and instead of blowing up the Ganges valley, drew in towards the depression with a tendency to circulate round it, is shewn by the following table, which exhibits also the increase of Easterly components in September when the rains reached the Upper Provinces.

It may be noticed, however, that as in the previous year, the influence of the local depression was sufficient only to modify and weaken, not to counteract that of the probably more extensive area of low pressure, which many circumstances lead me to believe must exist in Central India, as a normal phenomenon of the S. W. monsoon.

	May.	June.	July.	Aug.	Sept.
Cuttack, ...	79S 6°E	58S 3°E	58S 49°W	55S 19°W	30S 17°E
False Point,..	63S 15°W	53S 25°E	72S 67°W	63S 56°W	41S 39°W

* Mean of 7 years.

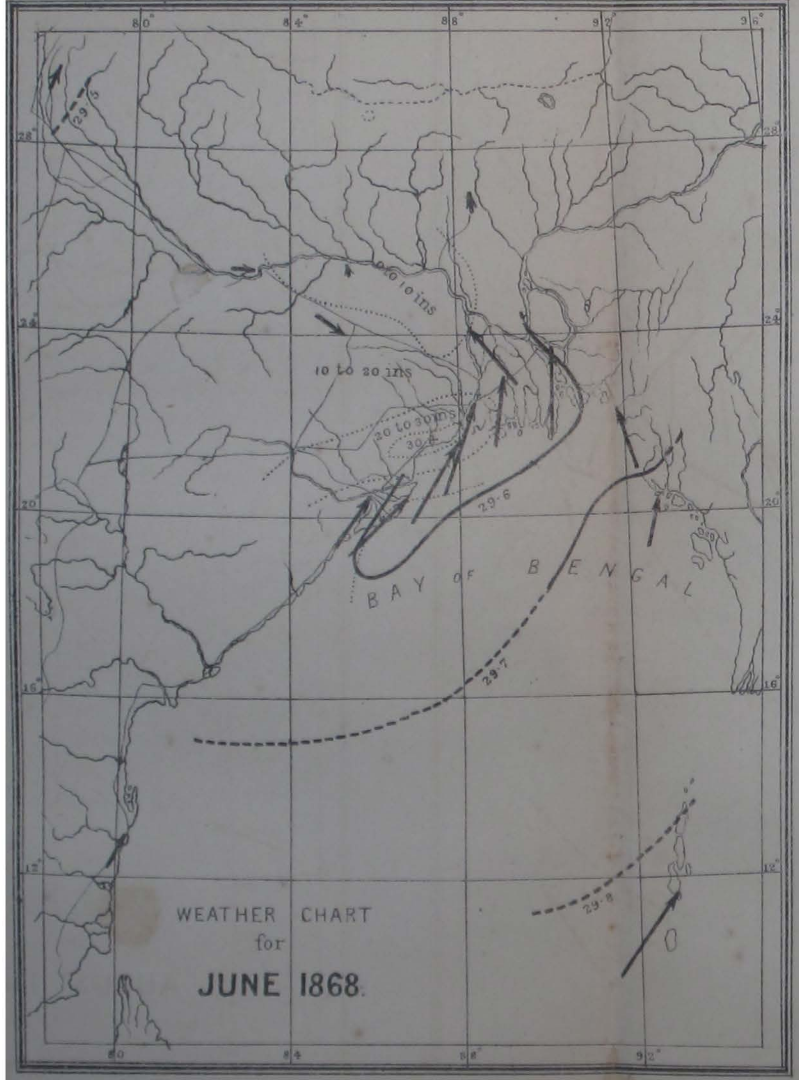
	May.	June.	July.	Aug.	Sept.
Saugor Island,	82S 38°W	65S 32°W	74S 55°W	77S 47°W	68S 11°W
Calcutta, ...	82S 7°W	70S 6°E	84S 5°E	85S 1°E	85S 23°E
Jessore, ...	55S 11°E	72S 30°E	82S 18°E	70S 7°E	85S 35°E
Dacca, ...	69S 31°E	87S 45°E	93S 37°E	90S 9°E	60S 33°E
Berhampore,..	63S 43°E	57S 38°E	74S 52°E	64S 23°E	75S 53°E
Monghyr,....	43N 89°E	63N 86°E	61S 89°E	22S 75 E	63S 84°E
Patna, ...	84N 7°W	92N 3°W	71N 6°E	72S 29°E	
Benares, ...	58N 5°W	37N 41°E	27 E	14N 48°W	56N 8°E
Gya, ...	?	23S 84°E	42S 77°E	22S 1°E	71S 78°E
Hazaribaugh,	32S 27°W	40S 15°W	32S 18°E	32S 19°W	61S 42°E

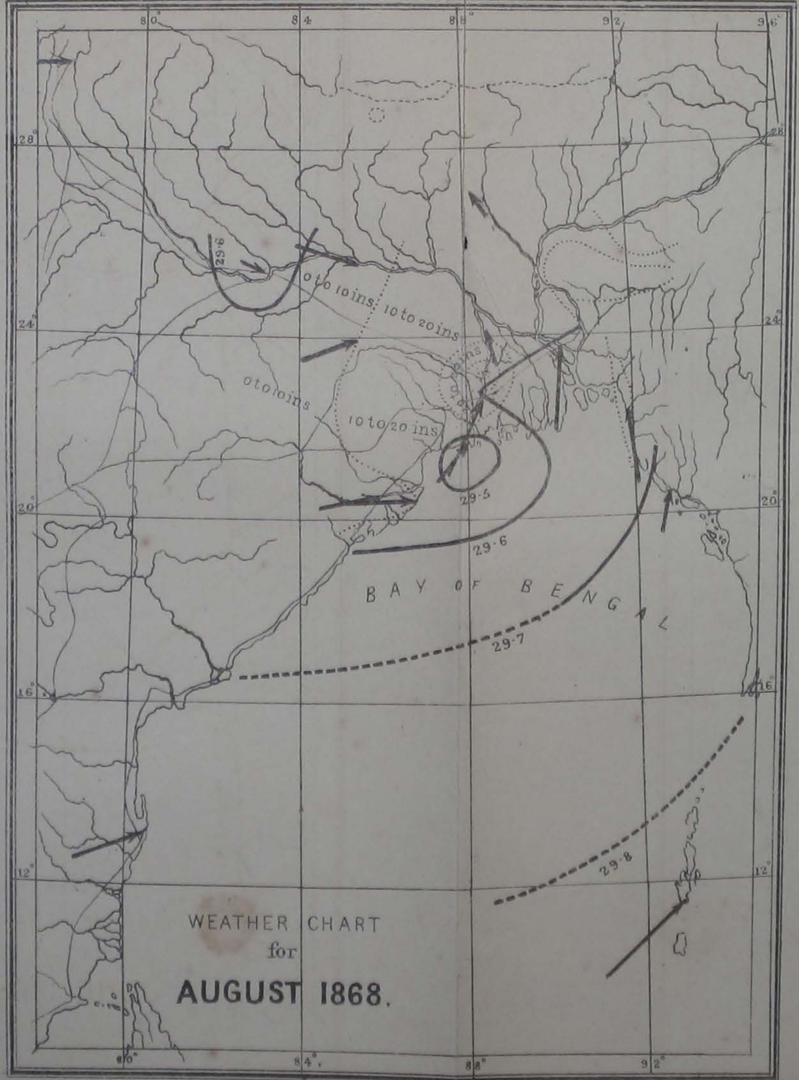
To sum up the principal facts brought out in the foregoing discussion.

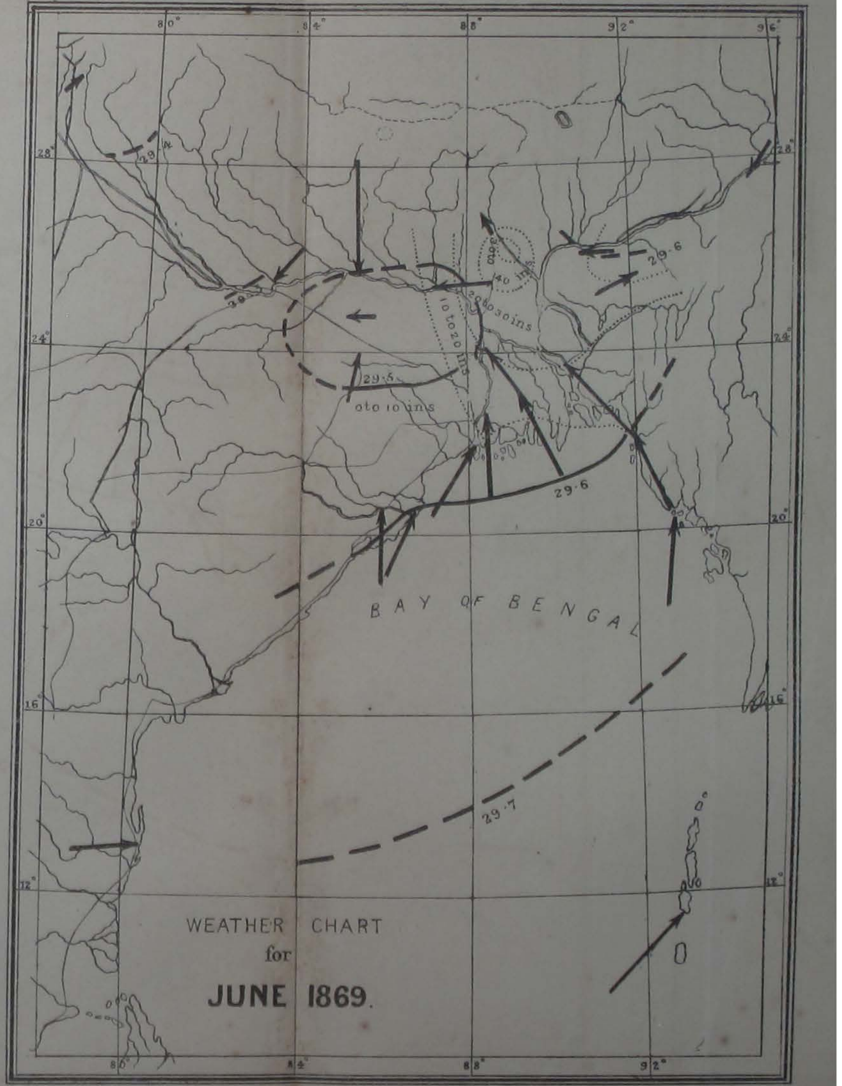
In the monsoon seasons both of 1868 and 1869, there was an area in or on the borders of Lower Bengal, in which the atmospheric pressure was persistently low, and which was partially or entirely encircled by a region of relatively high barometer. It originated with the general redistribution of barometric pressure at the beginning of the S. W. monsoon in April, and became intensified with the first fall of the rains in June. In 1868 it retained its initial position with a slight variation throughout the monsoon season, the depression being most intense in June and August, after which latter month it gradually decreased in intensity, but did not disappear till December. In 1869 it contracted or retreated northward and as far as can be judged did not entirely disappear, although its influence was diminished until quite the end of the monsoon. Its position was different in the two years, being in the former in the N. W. corner of the Bay of Bengal, in the latter in the hilly country to the west of the delta.

It influenced the vapour bearing winds from the south by deflecting them towards it, and necessarily by determining an ascending current, it produced an excessive rainfall to the north of its position, the maximum fall being at from 50 to 150 miles from the place at which the barometer was lowest. Finally it impeded the passage of the vapour-bearing winds to the N. W. Provinces, and thus deprived that region of a great part of its usual annual supply.

H. F. BLANFORD, Journ. Asiat. Soc. Bengal, Vol. XXXIX, Pt. 2, 1870. Pl. VIII







Explanation of the Charts, Pl. VIII.

The Charts shew the mean isobaric lines, the resultant wind directions and distribution of that rainfall for each of the three months, June and August, 1868, and June, 1869. The two former data are obtained from registers kept at the stations:

Roorkí	Monghyr	Dacca	False Point
Benares	Darjiling	Jessore	Madras
Patna	Berhampore	Calcutta	Chittagong
Gya	Goalpara	Saugor Id.	Akyab
Hazaríbaugh	Shillong	Cuttack	Port Blair

in the case of the Charts for June 1869. A few of these are wanting in the charts of the previous year. The rainfall data are obtained from a larger number of Stations.

The isobaric lines are obtained by reducing to sea level the means of (in most cases) four observations daily, reduced for temperature and corrected to the Calcutta standard. The lines represent differences of $\frac{1}{10}$ of an inch. To determine their position, the distances between each pair of neighbouring stations, lying on opposite sides of a line, were divided into parts proportional to the excess or defect of their mean readings on the even tenth, and the line was drawn through the series of points so determined. If the stations are very distant, or the exact course of the line for other reasons doubtful, it is represented by a broken line.

The wind resultants are represented by arrows, the points of which indicate the position of the stations to which they belong. The direction of their flight indicates the mean motion of the wind, as deduced from the number of observations, and without regard to differences of velocity. The relative predominance of the resultant direction is indicated by the length of the arrow, taking $\frac{3}{4}$ inch as the maximum or as representing exclusive prevalence.

The distribution of rainfall is indicated by light dotted lines, each line corresponding to a difference of 10 inches of fall during the month.

Observations on some Indian and Malayan Amphibia and Reptilia,—by Dr. F. Stoliczka, *Palæontologist of the Geol. Survey of India; Hon. Secretary, Asiat. Soc. Bengal.*

(With plates IX—XII.)

[Read and received 6th April, 1870.]

The materials upon which the notes, recorded in the present communication are based, have been derived from various sources. By far the greater number of the specimens noticed had been collected on my last year's trip along the Burmese and Malayan coast, at Penang and near Singapore, as well as on the Nicobar and Andaman islands. Only a few specimens were received through a friend from Java, and from Upper Burma, but some of the species from these countries are of great interest, as I shall have occasion to notice further on.

As regards the Indian fauna proper, I have little to say. Dr. Day furnished me with some materials which confirm the distinctness of the two species of *Enhydrina* figured by Russell, namely, his *Hoogli-pattee* and *Valakadyen*. My collectors have also procured in the Sutlej and Kulu valleys, and in the neighbourhood of Simla, some species which I did not wish to omit, because doubts had been expressed against the correct determination of some of them. I particularly allude to such species as Blyth's *Platyceps fasciatus*, which is a *Compsosoma*, *Dipsas multifasciata*, Blyth, *Compsosoma Hodgsoni*, Günth., *Tropidonotus platyceps*, Blyth, with which Steindachner's *Zamenis Himalayanus* is identical, and to a few others. There is at present less occasion to remark much on the fauna of India proper, as it will shortly be published in detail by Dr. T. C. Jerdon in his forthcoming work the "Reptiles of India."

However, the Amphibia and Reptilia of the Andamans and Nicobars had a special interest for me, because the fauna of these islands was as yet less known than that of other parts of India and Burma, and not only promised to yield some novelties, and to elicit the geographical distribution of several Malayan forms, but upon examination of some type specimens in our Museum, described from these islands, there appeared several doubtful points to be settled. I was, therefore, most anxious to obtain as large a material as was possible, and on two different occasions despatched my collector to those islands. With the very kind assistance of Capt. J. Avern, of the Steamer "Scotia," Capt. Rundell, Assistant Superintendent of the Nicobars, Th. Ad. de Röepstorff, and Mr. Homfray, at the Andamans, I have not only procured nearly all the species which had been already recorded as occurring on these islands, and several others previously known from India, Burma, Penang and Java, but also a few as yet undescribed forms. It was to be expected that the Amphibien and and Reptilien fauna of the Andamans and Nicobars will shew a great similarity to each other; several species of lizards and snakes are common to both, and the whole fauna greatly resembles the Malayan, gradually passing into the Burmese fauna, both being in a great many points very closely related to each other. The detailed lists of species known to occur on the islands will exhibit this more clearly. They will not only shew the distribution of some of our common Burmese and Indian species, but at the same time indicate the peculiarity of each of the small geographical provinces alluded to.

The number of Amphibia as yet known is very small, and there cannot be the least doubt that many more species of frogs will yet be discovered on both the Andamans and Nicobars; tree-frogs especially ought to be numerous in the damp jungles of the Andaman and South Nicobar islands. Of Lacertilia there are several peculiar species, and the genera mostly agree with Malayan forms, such as *Tiaris*, *Ptychozoon*, *Cyrtodactylus*, *Phelsuma*, *Peripia*, *Bronchocele*, and others; a few more are of Indian and Burmese type. Among the Ophidia, the genera are more generally distributed all over India, such as *Python*, *Dendrophys*, *Gonyosoma*, *Compsosoma*, *Tropidonotus*, *Ptyas*, *Ablabes*, &c. Most of the species from the islands belonging to these genera are also found in Burma, in the Malayan peninsula, and the neighbouring Philippine islands. One of the most marked features in the Reptilian fauna of the Nicobars and Andamans consists in* the great number of *Trimeresurus*; particularly at the Nicobars, where the jungle appears to swarm

* *Hydrophidæ*, or the poisonous water-snakes, appear to be comparatively rare, they prefer sandy shores to those surrounded by coral reefs.

with them. Those I obtained from the latter islands only belong to two distinct species, *T. Cantori*, Blyth, and *T. mutabilis*, n. sp., but the number of specimens, particularly of the former species, is very great. An idea of this may be formed from the fact that my collector procured, within a comparatively short time, some 60 specimens of the former and about 30 of the latter species. Fortunately these vipers do not seem to be as dangerous as their allies usually are. I shall speak of their poisonous properties further on, when noticing the various species of the genus *Trimeresurus*.

T. Cantori is also common at the Andamans, but *T. mutabilis* seems to be there much rarer. Beside these two, a third species is to be met with at the Andamans; it was called *T. porphyraceus* by Blyth, and also does not appear to be common. It seems to be sufficiently distinct from either *T. carinatus* and *purpureus*, with which it has been considered as identical by different herpetologists.

The following species* have up to the present been observed from the Andamans.

AMPHIBIA.

1. *Rana gracilis*, Wiegm., var. *Andamanensis*.
2. *Bufo melanosticus*, Schneid.

REPTILIA.

3. *Hydrosaurus salvator*, Laur.
4. *Gecko stentor*, Cant.
5. " *verus*, Merr.
6. *Phelsuma Andamanense*, Blyth.
7. *Peripia Cantori*, Günth.
8. *Hemidactylus frenatus*, Schleg.
9. " *maculatus*, D. and Bib.
10. *Cyrtodactylus rubidus*, (*Puellula rubida*, Blyth).

* I will mark those species which have been recorded as occurring on the islands, but of which I have not seen specimens, with an asterisk (*). I may as well notice that the only species which have been described from these islands are those by Blyth, (see Appendix in Mouat's Adventures and Researches among the Andaman islanders, &c., 1863, p. 364), by Theobald in his Cat. of Burmese Reptiles, and some others by Steindachner, published in the scientific results of the "Voyage of the Austrian Frigatte Novara," Amphibia and Reptilia, 1865.

11. *Tiliqua carinata*, Schneid.
12. *Hinulia maculata*, Blyth.
13. *Tiaris subcristata*, Blyth, (= *Coryphylax Maximiliani*, Fitz. apud Steindachner).
14. *Ptyas mucosus*, L.
15. *Gonyosoma oxycephalum*, Boie.
16. *Compsosoma melanurum*, Schleg.
17. *Tropidonotus quincunctiatus*, Schleg. (= *T. Tytleri*, Blyth, and *T. striolatus*, Blyth apud Theobald.)
18. *Dipsas hexagonotus*, Blyth.
19. *Dendrophis picta*, Gm.
20. *Lycodon aulicus*, L. (=*Tytleria hypsirhinoides*, Theobald.)
21. *Cerberus rhynchops*, Schneid.
22. *Ophiophagus elaps*, Schleg.
23. *Naja tripudians*, Merr.
24. *Trimeresurus porphyraceus*, Blyth.
25. ,, *Cantori*, Blyth.
26. ,, *mutabilis*, n. sp.
27.* *Caouana olivacea*, Esch.
28. *Chelonia virgata*, Schweig.
29. *Caretta squamata*, Bont.

From the Nicobars the following are on record—

Amphibia.

1. *Rana gracilis*, Wiegm., var. *Nicobariensis*.
2. *Hylorana Nicobariensis*, n. sp.
3. *Bufo melanosticus*, Schneid., var., (=*Bufo spinipes*, Fitz. =*B. gymnauchen*, Bleek.)

Reptilia.

4.* *Crocodilus* sp.

There is no doubt of the occurrence of a Crocodile on the Nicobars. Capt. Rundell informed me that he obtained a small live specimen of one, but it unfortunately did not reach me in time before the steamer left; it is most likely *C. porosus*, Schneid.

5.* *Hydrosaurus salvator*, Laur., (recorded by Blyth).
6. *Ptychozoon homalocephalum*, Kuhl.

7. *Hemidactylus frenatus*, Schleg.

8.* *Tiliqua carinata*, Schneid, (recorded by Steindachner).

9. ,, *olivacea*, Gray.

10. ,, *rugifera*, n. sp.

11.* *Euprepes* (*Lygosoma*) *macrotis*, Fitz. (recorded by Steindachner).

12.* *Typhloscincus Nicobaricus*, Fitz. (recorded by Steindachner).

13.* *Calotes mystaceus*, Daud. (recorded by Blyth.)

14. ,, *ophiomachus*, Merr.

15.* *Bronchocele cristatella*, Kuhl, (recorded by Steindachner.)

16. ,, *jubata*, D. and Bib.

17. *Tiaris subcristata*, Blyth.

18. *Ablabes Nicobariensis*, n. sp.

19. *Dendrophis picta*, Gmel.

20. *Lycodon aulicus*, L.

21. *Python reticulatus*, Schneid.

22. *Pelamis platurus*, L. (= *bicolor*, Schneid.)

23.* *Platurus laticaudatus*, L. (recorded by Steindachner.)

24.* ,, *Fischeri*, Jan, (,, ,, ,,)

25. *Trimeresurus mutabilis*, n. sp.

26. ,, *Cantori*, Blyth, (= ? ? *Trim. labialis*, Fitz. apud Steindachner, see further on)

27.* ,, *purpureus*, Gray. This species is also recorded by Steindachner, but as he says that the specimens are in bad state of preservation, they may prove to be unicoloured varieties of *T. mutabilis*, though *purpureus* may also occur, but I have not as yet seen any specimens from the Nicobars.

28-29. Blyth mentions fragments of *Chel. virgata* and *imbricata*, and very likely some more of the Pelagic species will be found. I have myself seen fragments of turtle bones and of their shells with the natives, but I would not venture to identify the species.

Accidentally the number of species upon record from both groups of islands is the same, but the Nicobar fauna appears to be richer, especially in the Scincidæ and Agamidæ, and no doubt may more snakes will also be found. There were several species obtained by the Austrian expedition, which we have not yet received in Calcutta from these islands. The almost total want of Colubridæ on the Nicobars is remarkable.

From Penang I have to add to the Amphibia a form which appears to be a third interesting variety of the very variable *Rana gracilis*, and two new species, *Polypedates Hascheanus* and *Ansonia Penangensis* (n. gen. et sp.). Among the *Ophidia* I procured a new *Trimeresurus*,—*T. convictus*,—rather closely allied to the Himalayan *T. monticola*, Günth., and a very interesting species of *Mabouya*,—*M. Jerdoniana*—which I got on the little Pulo Tickus, close to the northern shore of Prince of Wales island.

I have also added a complete description of the rare *Gecko Smithii*, Gray, a specimen of which was sent to me from Java, and that of what appears to be a full grown specimen of *Tetragonosoma effrene*, Cant., from the island Banca.

From Amherst, near Moulmein, I have recorded a new species of the rare genus *Cantoria*, and from Martaban a very interesting small *Riopa*. At the last locality, I also obtained Jerdon's *Diplopelma Carnaticum*, *Caloula pulchra*, Gray, *Hylorana Tytleri*, Theob., *Hinulia maculata*, Blyth, and some others.

The following is a complete list of the species noted in the present paper; the families are quoted, according to Dr. Günther's work on "Indian Reptiles."

AMPHIBIA.

Batrachia.

1. Rana gracilis, Wiegm., typical.
   ,, ,, ,, var. Andamanensis.
   ,, ,, ,, ,, Nicobariensis.
   ,, ,, ,, ,, pulla, (from Penang hill.)
2. Rana cyanophlictis, Schneid.
3. Pyxicephalus breviceps, Schneid.
4. Polypedates Hascheanus, n. sp.
5. ,, maculatus, Gray.
6. Hylorana Tytleri, Theob. (? = *erythræa*, Schleg).
7. ,, Nicobariensis, n. sp.
8. Ansonia Penangensis, n. gen. et sp.
9. Diplopelma Carnaticum, Jerd.

10. Caloula pulchra, G r a y.

11. Bufo viridis, L a u r.

12. „ melanosticus, S c h n e i d. (= gymnauchen, B l e e k., = spinipes, F i t z.

REPTILIA.

Lacertilia.

13. Phychozoon homalocephalun, K u h l.
14. Gecko guttatus, D a u d.
15. „ stentor, C a n t o r.
16. „ Smithii, G r a y.
17. Phelsuma Andamanense, B l y t h.
18. Peripia Peronii, C a n t o r.
19. „ Cantoris, G ü n t h.
20. Hemidaclylus frenatus, S c h l e g.
21. „ maculatus, D. & B.
22. Cyrtodactylus rubidus, (*Puellula rubida*, B l y t h).
23. „ affinis, n. sp.
24. Tiliqua carinata, S c h n e i d., (Eup. rufescens, S c h a w. apud G ü n t h e r.)
25. „ rugifera, n. sp.
26. „ olivacea, G r a y.
27. Mabouya Jerdoniana, n. sp.
28. Hinulia maculata, B l y t h.
29. Riopa lineolata, n. sp.
30. Calotes mystaceus, D. & B.
31. Bronchocele cristatella, K u h l.
32. „ Moluccana, L e s s.
33. „ jubata, D. & B.
34. Tiairis subcristata, B l y t h.
35. Draco volans, L i n n.

Ophidia.

36. Cylindrophis rufus, L a u r.
37. Ablabes melanocephalus, G r a y.
38. „ Rappii, G ü n t h.
39. „ collaris, G r a y.
40. „ Nicobariensis, n. sp.

41. Ptyas mucosus, L.
42. „ hexahonotus, Cant., (*Xenelaqhis idem* apud Günther).
43. Compsosoma radiatum, Reinv.
44. „ melanurum, Schleg.
45. „ semifasciata, Blyth, (*Platyceps idem*).
46. „ Hodgsoni, Günth.
47. Tropidonotus quincuntiatus, Schleg. (*T. Tytleri* and *striolatus*, Blyth).
48. „ stolatus, L.
49. „ platyceps, Blyth, (*Zamenis Himalayanus*, Steind.).
50. Gonyosoma oxycephalum, Boie.
51. Dendrophis picta, Gmel.
52. „ caudolineata, Gray.
53. Chrysopelea ornata, Shaw.
54. „ rubescens, Gray.
55. Psammophis condanurus, Merr. (*Phayrea isabellina*, Theob.)
56. Tragops fronticinctus, Günth.
57. Dipsas hexagonotus, Blyth.
58. „ multifasciata, Blyth.
59. Lycodon striatus, Shaw.
60. „ aulicus, L. (*Tytleria* of Theobald).
61. Tetragonosoma effrene, Cant. (var.).
62. Python molurus, L.
63. „ reticulatus, Schneid.
64. Hypsirhina plumbea, Boie.
65. Cerberus rhynchops, Schneid.
66. Hipistes hydrinus, Cant.
67. Cantoria Dayana, n. sp.
68. Bangurus cœruleus, Schneid.
69. Ophiophagus elaps, Schleg.
70. Naja tripudians, Merr.
71. Callophis intestinalis, Laur.
72. Enhydrina Valakadyn, Boie, (= *E. Bengalensis*).
73. „ shistosa, Daud.
74. Pelamys bicolor, Schneid.
75. Trimeresurus gramineus, Shaw.

76. Trimeresurus erythrurus, C a n t.
77. ,, carinatus, G r a y.
78. ,, porphyraceus, B l y t h.
79. ,, mutabilis, n. sp.
80. ,, Cantoris, B l y t h.
81. ,, convictus, n. sp.
82. Halys Hymalayanus, G ü n t h.
83. Daboia Russelii, S h a w.

CHELONIA.

84. Emys crassicollis, B e l l.

AMPHIBIA.

BATRACHIA.

Fam. RANIDÆ.

1. *Rana gracilis*, W i e g m. (G ü n t h. l. cit. p. 409.)

This species is very common in the Sundarbans, all along the coast of Arracan, near Rangoon, Moulmein, Tenasserim, the Welesley Province, Penang, and apparently also at the Andamans and Nicobars; it usually does not hesitate to take to sea or brackish water, and is, as a rule, a true litoral species.

In specimens from all these localities the coloration is typical, the spots on the back,* the band between the eyes, and the spots on the lips are never absent, there is, however, no rule as to the presence or absence of the pale dorsal streak; generally it is present and occasionally (on some specimens from Rangoon and Penang), almost as wide as the interspace between the eyes. The body of the largest specimen, I have collected at Akyab (Arracan coast), measured about 2½ inches in length; this specimen has four ruddy spots on the back between the shoulders, forming a cross. Specimens with the body 2 inches long are comparatively very common. The external surface of the vocal region is black in the male. The length of the snout slightly varies, but it is usually conspicuously attenuated, apparently more so in the males than in the females. In specimens with a narrower snout, the ridges of the vomerine teeth almost touch each

* In young specimens there is only one transverse somewhat undulating dark band above the middle of the body; the skin is generally distinctly tubercular.

other, in those with somewhat broader snout, the interspace between the dental ridges is more or less widened. As regards the proportions of the length of the legs compared with those of the body, the Arracan and Rangoon specimens are the most true to the type; the legs being stout and the distance from the anus to the metatarsal tubercle equal to, or very little longer than, the length of the body; the toes are half webbed, but in young specimens the webbing appears a little stronger, because the toes are thin and of moderate length, while in old ones, the fourth toe especially is much elongated, and more so in the males than in the females.

In several specimens from the neighbourhood of Moulmein and some others, obtained near the coast at Penang, the distance between the anus and the metatarsal tubercle is conspicuously* more than the length of the body, the difference amounting to about $\frac{1}{8}$th of the length of the body, the specimens are also a little more slenderly built, but no other specific difference exists, except that in some specimens, the toes are conspicuously slender and elongated, so as to make the webbing appear to be still less than in Arracan specimens.

a. As variety **Andamanensis** may be distinguished, the form occurring on the Andamans. I have examined four specimens from Port Blair. Of the smallest the body is about one-third of an inch long, of the two next above one inch, and of the fourth $2\frac{1}{3}$rd inches. In all the specimens the snout appears a little shorter and more obtuse than in typical *gracilis*, and the hind feet are decidedly more slender, and proportionately longer than in that form. In the first specimen the difference is equal to $\frac{1}{7}$th of the length of the body, in the two of middle size it is $\frac{1}{5}$th in one and a little less than $\frac{1}{5}$th in the other, in the large specimen it is very nearly $\frac{1}{6}$th; one of the specimens has a thin vertebral streak, the others none; the chin and breast are spotted with black, mostly conspicuous in those of median size.

The rest of the characters and the coloration remains true to the type, except perhaps the webbing of the toes, appearing to

* In one specimen, noted in the list of measurements as *e*, the feet are proportionately very long, but they are not slender to the same extent, as they are in the Andaman variety.

be a little stronger than in most other specimens; the web reaches to the tip of the third, but not to that of the fifth toe; the fringe on the external edge of the fifth toe is almost obsolete. The tubercles which are in young specimens very distinct on the body, and above the eyes, become also nearly quite obsolete in the old frog.

Although at the first sight the greater length of the legs and the obtuse snout appear to be striking differences, I don't think that they are sufficient to regard this insular form as distinct from the continental, particularly so, when we observe the changes in the length of the legs of the Arracan and Rangoon specimens, and those from the Welesley province. Possibly the above noted differences may in time become better developed, and may then be considered as of specific value: that is — a *local race* may in time *become a species*.

b. var. **Nicobariensis.** From the Nicobars, in the neighbourhhood of the Nancowri harbour, I obtained one peculiar young specimen. The body measures $1\frac{1}{4}$th inch, and the distance between the vent and metatarsal tubercle is slightly more than that of the length of the body, thus in this point coming up very near to the typical Arracan specimens, but it has the short snout of the *var. Andamanensis*, and of the next variety from Penang. It differs, however, from both in the very slight webbing of the feet, the toes being considerably elongated and slender, the fourth equals in length to very nearly half the body, the disks are slightly swollen, and the web is almost only basal, it hardly extends to half the length of the toes; the cutaneous fringe on the edge of the fifth toe is slight but distinct, and the tubercle at the base of the fourth toe obsolete. The skin is, like in other young specimens of *gracilis*, finely tuberculated, and the whole habitus and coloration identical with type specimens; the lower side is finely mottled with dusky, as in *Andamanensis*.

c. var. **pulla.** As a further variety of *R. gracilis* I regard two specimens which I obtained in a small pool of water at a height of about 2,000 feet on the Penang hill. One is only $\frac{6}{8}$th, and the other $\frac{7}{8}$th of an inch long; they agree with the Andaman variety in the somewhat obtuse form of the snout, spotted chin and breast and the slenderness of the feet; in the first the difference of the distance between the anus and the metatarsal tubercle, and that of the body is ⅛th more of the length of the latter, in the second specimen it is nearly one-sixth; but in both specimens the toes are proportionately shorter and more fully webbed; the fifth toe has the cutaneous fringe as distinct as in typical *gracilis*. The colour of the fresh specimens was a light brown with green spots, perfectly identical in distribution with those of *gracilis*, with which also the tubercles on the back entirely agree; these two specimens have no dorsal streak.

When viewed independently from other specimens, nothing would be easier than to regard the above noted Penang small variety as a distinct species, for, in addition to the obtuse form of the snout, and the greater length of the legs noticed in the Andaman variety, we have in this a complete webbing of the toes. However, there is in any case, at present no sufficient reason for doing this. For I have already noticed that in young specimens of typical *gracilis* the toes appear stronger webbed than in old ones, and as the two specimens from the Penang hill are evidently young ones, they may shew this development accidentally more, than perhaps other specimens in the same locality would do. Until this has been sufficiently ascertained, the other more constant characters consisting in the form of the body, and also the very characteristic coloration must be regarded as more important than the peculiarity of a known variable character.

In all these varieties quoted above the constancy in coloration is most marked. I do not regard the more or less pointed or obtuse snout as a character of great importance, for it varies considerably in specimens of one and the same locality in different stages of age, and apparently also in the sexes. Neither would the reference to the greater or lesser length of the hind limbs appear to be very important, but that the webbing of the toes should vary so considerably as noted above, is really very remarkable; and I would certainly have separated the Andaman and the small Penang form as distinct species—on account of shorter snout, longer limbs and stronger webbing of the toes,—had I not obtained from the Nicobars, situated geographically between both, a form which has the short snout of the two last varieties, but the proportionately short limbs of the type form; on the other hand, however, a very slight webbing, distinct from all others!

I hope to be able to give illustrations of all these forms, as soon as I may be placed in possession of more extended materials which, I trust, will be sufficient either to confirm the present determination, or to shew that what I pointed out as varieties are in reality to be considered as distinct species. I can now only repeat that, whatever anxiety some herpetologists may feel regarding the consistency of the species in question, I cannot view those insular forms, on comparing them with hundreds of specimens which I myself collected in the Sundarbans, Arracan, Rangoon and down the Tanasserim coast to Penang, as anything else but local varieties of one and the same species. I shall now only add the actual measurements of the principal forms.

Measurement in inches.	Typical form, Arracan, toes half webbed.		Moulmein, toes half webbed.		Penang, the low land form, toes $\frac{2}{3}$th webbed.		var. *Andamanensis*, toes $\frac{3}{4}$th webbed.		var. *Nicobariensis* toes $\frac{1}{3}$th webbed.	var. *pulla*, toes fully webbed.
	a	b	c	d	e	f	g	h	i	k
Length of body, ...	$1\frac{6}{16}$	$2\frac{9}{16}$	$1\frac{7}{16}$	$2\frac{3}{16}$	2	$1\frac{11}{16}$	$1\frac{2}{16}$	$2\frac{6}{16}$	$1\frac{5}{16}$	$\frac{14}{16}$
Distance from vent to metatarsal tubercle, ...	$1\frac{7}{16}$	$\frac{10}{16}$	$1\frac{8}{16}$	$2\frac{7}{16}$	$2\frac{8}{16}$	$1\frac{14}{16}$	$1\frac{5}{16}$	$2\frac{11}{16}$	$1\frac{7}{16}$	$1\frac{1}{16}$
Length of fourth toe, ...	$\frac{23}{2}$	$1\frac{2}{16}$	$\frac{23}{32}$	$1\frac{1}{16}$	very nearly $1\frac{2}{16}$	$\frac{14}{16}$	$\frac{9}{16}$	$1\frac{2}{16}$	$\frac{11}{16}$	nearly $\frac{7}{16}$
Total length of hind limb, ...	$2\frac{5}{32}$	$3\frac{12}{16}$	$2\frac{7}{32}$	$3\frac{8}{16}$	$3\frac{10}{16}$	$3\frac{21}{16}$	$1\frac{14}{16}$	$3\frac{13}{16}$	$2\frac{2}{16}$	$1\frac{8}{16}$

The varieties from Moulmein and (i) *Nicobariensis* are almost identical in measurements.

2. *Rana cyanophlyctis*, Schneid. (Günth. l. cit. p. 406).

This species has been collected by Dr. F. Day in Orissa where it appears to be common. Specimens measuring up to 3 inches in length of the body are also not rare in the Sundarbans, and the species here principally lives in pools of water which is more or less brackish.

3. *Pyxicephalus breviceps*, Schneid. (Günth. l. cit. p. 411).

A specimen was obtained by my collectors in the forests above Kotegurh at about 7000 feet; body measured $2\frac{1}{4}''$, the hind leg $2\frac{3}{8}''$.

Fam. POLYPEDATIDÆ.

4. **Polypedates Hascheanus,** n. sp. Pl IX, Fig. 3.

Body moderately slender, anteriorly rather wider than posteriorly and depressed; skin smooth or with few indistinct small tubercles except above the eyes; snout moderate, obtuse, slightly longer than the distance between the eyes; fore foot, when laid forward, exceeds the snout nearly by the whole length of the first finger; the distance between anus and heel is slightly less than the length of the body; tympanum round, smaller than the eye; the dorsal glandular fold is rather indistinct on the forepart of the body, but clearly traceable on the posterior half of it, a second glandular fold runs from the hind edge of the orbit above the tympanum to the upper arm; toes slightly webbed in young specimens, but in the largest specimen observed they are about one-third webbed; only the terminal disks of toes are conspicuously flattened and enlarged; the inner metatarsal tubercle is large and compressed the outer at the base of the fourth toe almost obsolete; vomerine ridges very small and distant, but present even in the smallest specimens less than half an inch long.

Colour above lighter or darker olive brown with few irregular small spots, (sometimes, though rarely pale, almost yellowish olive); with a black band between the eyes, edged with light in front, followed by a W mark, the ends of which begin almost behind the eyes, a pair of somewhat indistinct blackish spots below the middle of the body; sides of the front part of the body black, lips slightly spotted with white, a large white spot behind the angle of the mouth, sides of body mottled and punctated with white and black limbs with dark brown cross bands; lower parts whitish olive mottled and finely punctated with dusky, especially on the sides about the fore and on the hind limbs.

I found this species tolerably common all through the higher forests (about 1000 feet above sea level) in the island of Penang; it does not seem to grow to a large size, for though I have seen hundreds of specimens in different places of the island, the largest I obtained, only measures $\frac{15}{16}''$ in length of body, the distance from anus to heel, is $\frac{14}{16}''$ inches, the fourth toe $\frac{7}{16}''$ and the total of hind limb $1\frac{9}{16}$ inch. The usual size of the specimens is only $\frac{9}{16}$, and nearly $\frac{9}{16}$, $\frac{4}{16}$, $\frac{15}{16}$ inches in the other corresponding measurements. It is generally seen on the leaves of small bushes or on the ground between old leaves; it is very active and on account of its very small size rather difficult to secure.

I have great pleasure in naming this species after my friend Alfred Hasche who has very kindly assisted me in my researches on the island.

5. *Polypedates maculatus*, Gray, (Günth. l. cit. p. 428.)

A variety of this species is not uncommon in Penang. Live specimens were of a yellowish brown colour with greenish tinge, the head much darker than the rest and with a distinct bluish tinge, the whole of the upper surface very minutely punctated with dark speaks; a short blackish partially interrupted streak below the timpanoid fold; all four feet with indistinct cross-bands, the hinder side of the femora blackish, spotted with white: the extreme edge of the upper lip white; below uniform yellowish white. The skin in young specimens is very finely granular above, in old ones it becomes smoother, especially on the posterior half of the body.

6. *Hylorana Tytleri*, Theob. Pl. IX, Fig. 1.

Cat. Rept. Asiat. Soc., Museum, p. 84.

(an idem *Hylorana erythræa*, Schleg. Günth. l. cit. p. 425.)

I have collected near Moulmein two specimens which I was first inclined to regard as a variety of *H. erythræa*. There is no essential difference in the measurements of the two.

	a. full grown.		*b.* young.
Length of body, ...	2 inch.		$\frac{10}{16}$ inch.
Distance from vent to heel, ...	$1\frac{12}{16}$ „	nearly	$\frac{9}{16}$ „
Length of fourth toe, ...	$\frac{15}{16}$ „		$\frac{4}{16}$ „
Total length of hind leg,........	$3\frac{5}{16}$ „		$\frac{15}{16}$ „

The snout is somewhat narrow in the more fully grown specimen. The fourth toe is rather short, the web reaching to the tip of the third and fifth toe. The first toe has at its base a very prominent laterally compressed tubercle, and another considerably smaller tubercle is at the base of the fourth toe, the last is not mentioned by Günther or Dum. and Bibron in the description of *erythræa.* The upper glandular fold is as usually distinct, the lower begins above the base of the upper lip, is interrupted above the humerus, then bends downwards as a short fold and disappears without continuing along the side of the body. From the upper hinder edge of the tympanum also a short thickened fold runs to the humeral tubercle. This character also occurs on two other specimens of unknown habitat in the Asiatic Society's Museum, but in the one named *Tytleri* by Theobald, there seem to be, besides the short curved glandular ridge, slight traces of its lateral extension, it being broken up until it disappears on the posterior middle part of the belly. In this last specimen the toes are also fully webbed, and the fourth toe is little more than half the length of the body, as in typical *erythræa.* The lower portions of the femora are distinctly granular.

The Moulmein young specimen is dark brownish green above, black on the sides, the old one olive green above, blackish on the anterior half of the sides, and mottled with black on the posterior; the glandular folds are white, the upper lips with a white streak, but their edges are blackish; the lower parts are pale mottled with black on the anterior half; the hinder parts of the femora are also mottled or marbled with black, but the upper sides of both fore and hind limbs are brown banded. This last coloration is also never mentioned in the published descriptions of *erythræa,* though Schlegel's figure apparently seems to indicate it on the tarsal portion of the hind limbs.

It would seem, without a comparison of typical specimens of *erythræa,* rather difficult to state whether our Lower Bengal and Burmese specimens have to be specifically separated from *erythræa,* or not, but with all the apparent very great similarity they really seem to me to be distinct. In Theobald's type specimen* of

* This is the Dacca specimen to which Blyth alludes when he says of *Hylorana* (*Lymnodytes*) *macularia* (Journal, Asiatic Society, Bengal, XXIII,

H. Tytleri the measurements almost perfectly agree with those of *erythræa*, the body is by nearly half the length of the snout longer than the distance between vent and heel, and the fourth toe is slightly more than half the length of the body. There are, however, two distinct metatarsal tubercles of which the one on the first toe is very prominent and large, and the legs are banded brown above. If these last characters never occur in *erythræa* of the southern regions, the specific name *Tytleri* will have to be reserved for our form. The indistinct continuation of the lower glandular fold on the body cannot be taken into consideration, neither the somewhat elongated form of the fourth toe, for there can be no doubt that the two above mentioned specimens from Moulmein, and two others in the Museum, (either also from Lower Bengal or from Burma), are identical with Theobald's *Tytleri*, and in all these, the lower glandular fold bends down behind the fore limb and then disappears; the fourth toe also is slightly shorter than half the length of the body; in other characters all the specimens entirely agree.

Hylorana Nicobariensis, n. sp. Pl. IX, Fig. 2.

In its slender habit resembling the last, but the snout is narrower and more obtusely rounded than in that species, its end very little projecting above the lower jaw; canthus rostralis rounded; loreal region slightly excavated; tympanum round, almost circular and little smaller than the eye; skin in the males above, finely granular, more distinctly so posteriorly, lower side of the femora coarsely granular; in the females the skin is smoother; a distinct gland runs from behind the eye on each side of the upper edge of the back; a second gland is indicated by two tubercles, one behind the angle of the mouth and the second posterior to it above the humerus, and in some specimens there is even a third much smaller tubercle present from which a short rim bends downwards; all these glands, however, are much less distinct in very young specimens.

p. 299), that it differs from *erythræa* "by its shorter and stouter limbs and short anterior digits, &c." Günther's somewhat sarcastic remark (l. cit. p. 425) on that point is uncalled for, because Blyth's type of *macularia* is actually 2⅘ in total length, and the distance from vent to heel only two, consequently less than that of the body, and the limbs are thus actually stouter and shorter than in the specimen described by Günther, though both no doubt are the same species.

The disks of the fingers and toes are well developed, on the latter the web reaches fully up to the tip of the third and fifth toes. The second and fourth fingers are sub-equal, and the third is about one-third longer than the fourth. Two metatarsal tubercles are present, the marginal one at the base of the first toe is elongated and laterally strongly compressed, the other which is smaller and rounded is placed at the base of the fourth toe. The length of the body (measured in 8 full grown and 5 young specimens), is somewhat more than the distance between the anus and heel, and the fourth toe is shorter than half the length of the body. The following are the actual measurements of two of the largest specimens:

	♂	♀
Length of body, ...	2 inch.	$1\frac{14}{16}$ inch.
Distance from vent to heel, ...	$1\frac{12}{16}$,,	$1\frac{12}{16}$,,
Length of fourth toe, ...	$\frac{15}{16}$,,	$\frac{15}{16}$,,
Total length of hind limb,........	$3\frac{4}{16}$,,	$3\frac{3}{16}$,,

In comparing these measurements with those given of the Moulmein *H. Tytleri*, the two will be found to be almost identical. And this first led me to believe that the present species may only be a variety of *Tytleri* (*? erythræa*), but the larger tympanum of *Nicobariensis*, the usual total want of the short downward bent lower glandular fold, the better developed disks of the fingers and toes, the greater length of the third finger, then the presence of two almost sub-equal tubercles at the base of the toes, a distinctly larger gape of the mouth, somewhat more distant ridges of vomerine teeth, &c., &c., are so well marked in all the specimens examined that, on comparing them with the corresponding characters of *Tytleri*, the conclusion seems fully justified that the Nicobar form indicates a sufficiently distinct specific type.

Colour above olive greenish, much darker and almost black in some male specimens, upper glandular fold pale, upper lip whitish, lower glandular tubercles usually purely white; sides of body including the loreal region black, which uniform colour, however, fades on the posterior part of the body and is sometimes replaced there by a few dark spots. Lower parts more or less mottled with black, sometimes almost wholly black in the males, but yellowish between the thighs; in the females, the lower parts are whitish, either uniform or only slightly dusky. Fore limbs with few indistinct cross bands, a dark streak in front of the upper arm, and another one behind, as well as on the lower arm; hind limbs above banded with brown, behind indistinctly mottled with dark and yellow.

In coloration and in the development of the disks of the fingers and toes, &c., this species much resembles *H. temporalis*, Günth., (l. cit. p. 425) from Ceylon. But in this species the hind limbs appear to be in proportion longer, the snout is much broader, the third finger shorter, and it is said to have "no glands behind the angle of the mouth." In *Tytleri* the lower glandular tubercle commences between the tympanum and the upper angle of the mouth; in *Nicobariensis* that tubercle is situated behind and rather almost below the angle of the mouth.

Fam. RHINODERMATIDÆ apud Günther.

No maxilary or vomerine teeth; ear and tympanum developed; toes webbed; sacral vertebra dilated; no paratoids.

Ansonia, n. gen.

Body slender, elongated, rather depressed, uniform in width; sacral vertebra much dilated; muzzle short, obtuse; limbs long and slender; fingers four long, smooth, free and peculiarly cylindrical; toes five, not much developed, half webbed; disks of fingers and toes slightly swollen, rounded.

The great peculiarity of this genus rests in the slender form of the body and the great length and slenderness of the limbs, and especially of the fingers. In the general character it more reminds of *Phryniscus*, than any of the genera of the RHINODERMATIDÆ, referred to this family by Günther, but it is readily distinguished from the former genus by the tympanum and open eustachian tubes. I have associated with this new form, the name of my esteemed friend, Col. Anson, the present Governor of Penang, who has shewn the greatest interest in my natural history researches during my short stay on the island.

8. **Ansonia Penangensis,** n. sp. Pl. IX, Fig. 4.

Body slender and long, almost with parallel sides throughout; muzzle short and blunt in front, shorter than the interspace between the eyes; the whole of the upper and lower skin, except on chin and throat, tuberculated; tympanum distinct, smaller than the eye; tongue elongated, elliptical, rather thick, entire; fore limb as long as the distance between the hinder edge of eye to the posterior end of body, distance from anus to heel nearly as long as the body; hand on the inner side with a large ball; first finger shortest, then comes second, then fourth, and the third is longest, all are cylindrical and with slightly dilated and smaller disks at the end; toes half webbed, rather short; metatarsal tubercles indistinct, a large flat one at the base of the first toe and a small slightly more prominent one at the base of the fifth toe; in young specimens they are not developed. Above uniform ashy, marbled and reticulated with black; sides of head and body, and the limbs with rather large pale orange or yellowish warts or spots, lower parts dusky with small white spots, especially on the sides of the belly and in front of the shoulders; lower part of belly and the inner thighs of a beautiful rose colour in life specimens. The measurements of two specimens of different sizes are as follows:

	a.	*b.*	
Length of body, ...	$\frac{8}{16}$	$\frac{14}{16}$	inches.
Length of fore limb, ...(nearly)	$\frac{7}{16}$	$\frac{11}{16}$	,,
Distance from anus to heel, ..(nearly)	$\frac{8}{16}$	$\frac{12}{16}$	,,
Length of fourth toe, ...	$\frac{3}{16}$	$\frac{6}{16}$	,,
Total length of hind limb, ...	$\frac{13}{16}$	$1\frac{6}{16}$	,,

I have only obtained four specimens of this interesting species on Penang, two near the great water-fall (above the Alexandra bath), and two in a narrow gorge about half way up the Penang hill. In both cases, the specimens were found flatly attached to the side of the rock above the water, and did not make the slightest attempt to escape when taken from it. This habitat seems peculiar, and corresponds with that of a new species which Dr. Jerdon lately received from South India through Major Beddome (vide Proc. Asiat. Soc. for March, 1870, p. 85). In general form and style of colouring our species much reminds of *Ixalus opistorhodus*, lately described by Dr. Günther from a Nilgheri specimen (Proc. Zool. Soc., 1868, p. 484, pl. 37, fig. 3.)

9. *Diplopelma carnaticum*, J e r d., Pl. IX, Fig. 5.

Engystoma carnaticum, J e r d o n, Journ. Asiat. Soc., Beng. 1853, XXII, p. 534.

Body moderately stout with proportionate limbs; snout short, obtuse, its length being equal, or hardly equal, to the width of the head between the eyes; a front limb when laid forward exceeds the snout by half the length of the third finger; length of body equal to, or very little less, than the distance between the anus and the metatarsal tubercle; length of fourth toe equal to, or less than, half the length of the body; skin on the posterior part of the femora extended as in *Caloula;* fingers and toes with small rounded disks; two metatarsal tubercles, the one at the base of the first toe is elongated and compressed, the other at the base of the fifth toe either a little larger, or scarcely smaller and rounded; toes only webbed at the base, their length variable.

Color above isabella or yellowish brown, with a dark bottle-shaped mark along the back beginning between the eyes with a tris-cusped edge, after which it contracts, then again widens, and a little below the middle of the body divides in two pairs of branches, of which the posterior extends to the base of the femora; a triangular black mark about the anus, extending below; on each side of the median brown mark are undulating longitudinal dusky streaks, these lateral portion of the back are sometimes, during life, tinged with rose colour, similar to *Caloula pulchra;* limbs with brown cross bars, sides dark, purplish black, this color disappearing posteriorly, an oblique pale streak extending from the eye towards the shoulder; below dull whitish, mottled with dusky, especially on chin and throat.

This is, as Dr. J e r d o n (Proc. Asiat. Soc., March, 1870, p. 85) remarks, a wide spread species. I am indebted to him for the identification of my specimens, their colouring being almost perfectly identical with his original drawing from which the scanty notice of *Eng. carnaticum*, published nearly 20 years ago in the Society's Journal, was taken. It was originally described from the Carnatic; numerous specimens exist from Beerbhoom in the Asiat. Soc. Col.; Dr. J e r d o n obtained it in the Khasi hills, and I found three specimens under a large block of wood at Martaban (near Moulmein) in company with one small *Caloula pulchra* and young specimens of *Bufo melanosticus.*

The measurements of my specimens are as follows:—

	a.	*b.*	*c.*	
Length of body, ...	$\frac{12}{16}$	1	1	inch.
Distance from anus to metatarsal tubercle, ...	$\frac{14}{16}$	1	$1\frac{2}{16}$	,,
Length of fourth toe, ...	$\frac{13}{32}$	$\frac{15}{32}$	$\frac{8}{16}$	,,

Specimen *c* has a pale median dorsal streak extending the whole length of the body, the two others have none.

10. *Caloula pulchra,* Gray, (Günth., l. cit. p. 437).

In spite of the dilated disks of the toes and fingers, this remarkable Batrachian is by no means arboreal in its habit. I twice observed it near Moulmein. It appeared after sunset about the same time as *Bufo melanosticus,* crawling on old wood and feeding on white ants.

In external character both *Caloula* and *Diplopelma* are very closely allied, and young specimens of the former, in which the vomerine ridge is not developed, can strictly speaking hardly be distinguished from the latter, except by the slightly more dilated disks of the toes. I am even not quite certain whether the distinctions between the two are really such as to entitle them to generic rank, which doubt especially becomes apparent, when we compare the descriptions of the two other Burmese species of *Diplopelma* described by Blyth; in any case when kept distinct they should be classed close together in one family.

Fam. Bufonidæ.

11. *Bufo viridis,* Laur. (Günth., Cat. Bat. Brit. Mus. p. 58).

Steindachner (Nov. Exped., Amph. p. 40) already recorded this species as occurring in Spiti. It is found throughout the Sutlej valley from Kotegurh upwards, but is always rare. At Kotegurh, between 6 and 9000 feet, it is occasionally met within localities where *B. melanosticus* also occurs, but further to east in Kunavar, the latter is not found, and in Spiti only *B. viridis* is met with, usually between 11 and 13,000 feet, though far from common. At the village Gieumal, I found a small specimen at about 15,000 feet, which is probably the highest locality from which a Batrachian was ever recorded.

12. *Bufo melanosticus*, Schneid, (Günth., l. cit. p. 422). (Syn. *Bufo isos*, D. and B. = ? *B. gymauchen*, Bleek., = *B. spinipes*, Fitz.).

Younger specimens of this species are, as a rule, much more slender than old ones, and the same applies to the form of the paratoids; they are dark ashy (rarely light brown) variegated with black. There are, however, very many variations to be observed in both the length of the body and of the paratoids. The width of the head also greatly varies. The species is said not to possess a rim on the inner edge of the tarsus, some specimens have it, however, distinctly indicated, either as a short continuous fold, or as a row of somewhat enlarged tubercles; this can be seen in specimens from about Calcutta, and I observed the same also in some of the younger and half grown ones from near Moulmein, Penang, Malacca, Singapore, the Andamans and Nicobars. Himalayan specimens from the Sutlej valley, and some of the specimens from the interior of the Andamans, and one or two from Moulmein, hardly possess a trace of it, but all these are of large size, having the tarsus particularly thickened and rounded.

Steindachner (Amphibia der Novara Exped. p. 42,) justly, I think, questions the specific difference of *Bufo isos*, D. and B., (or ? *B. gymnauchen*, Bleek.), from *B. melanosticus*, stating that in the latter, considerable variations exist as to the more or less complete webbing of the toes. I also find that it is impossible to attribute to this character within certain limits much specific value. The pure land forms, such as those from the Himalayas, from Upper Bengal, from the interior of the hills east of Moulmein and from the jungles of the Andamans, usually have the toes more elongated, and consequently they appear to be only moderately webbed. The webbing extends on the fourth toe to about half its length, and is further on only indicated by a minute ridge on either side. In many specimens from Lower Bengal, particularly in some from the Sundarbans, in some from Moulmein, Penang, Malacca, Singapore, the Nicobars and in others from the Andamans,—that is, in such forms which are always found near the water,—the webbing appears stronger, principally on account of the toes not being so much elongated, or the webbing is in reality more developed; but the transition from one form into the other is so gradual, that no specific distinction can be attached to it.

Considering these differences in the webbing of the toes and the usual indication of a tarsal fold in authentic *melanosticus*, I can hardly see the reason for which Steindachner retained Fitzinger's *Bufo spinipes* from the Nicobars as a distinct species, (l. cit. p. 43). I have compared several specimens from Nancowry and Camorta, and cannot detect any specific distinction from *melanosticus*. The more slender form is only a character of young and middle age, though it is sometimes retained by specimens attaining a length of five inches. I have seen such specimens in abundance near Moulmein, on the sea coast at Malacca and the Welesley province.

The webbing in the Nicobar form is moderate, such as in some Andaman specimens, and the young from both islands are always rather dark ashy, much marbled with black, and the body is greatly elongated. My largest specimen from the Nicobars is 2½ inches, and one paratoid gland is somewhat less than one-third the length of the body, which is as a rule also the case in specimens of *melanosticus* from other localities; in Malacca specimens only it is sometimes nearly one-fourth; these have also an equally slender and long body as those from the Nicobars. Günther considers *spinipes* (Records 1867, p. 146) as identical with *gymnauchen* which he apparently acknowledges to be distinct from *melanosticus*, (see also Proc. Zol. Soc., 1868, p. 479).

The largest specimen of *melanosticus* I saw, is from near Moulmein, measuring 6½ inches in the length of the body.

[To be continued in the next number.]

EXPLANATION OF PL. IX.

Fig. 1. *Hylorana Tytleri*, T h e o b., 1, side view, the toes of the right hind limb shewn internally; 1 a. upper view of the head; 1 b, interior of the mouth, shewing the tongue and the vomerine teeth, &c., from Moulmein.

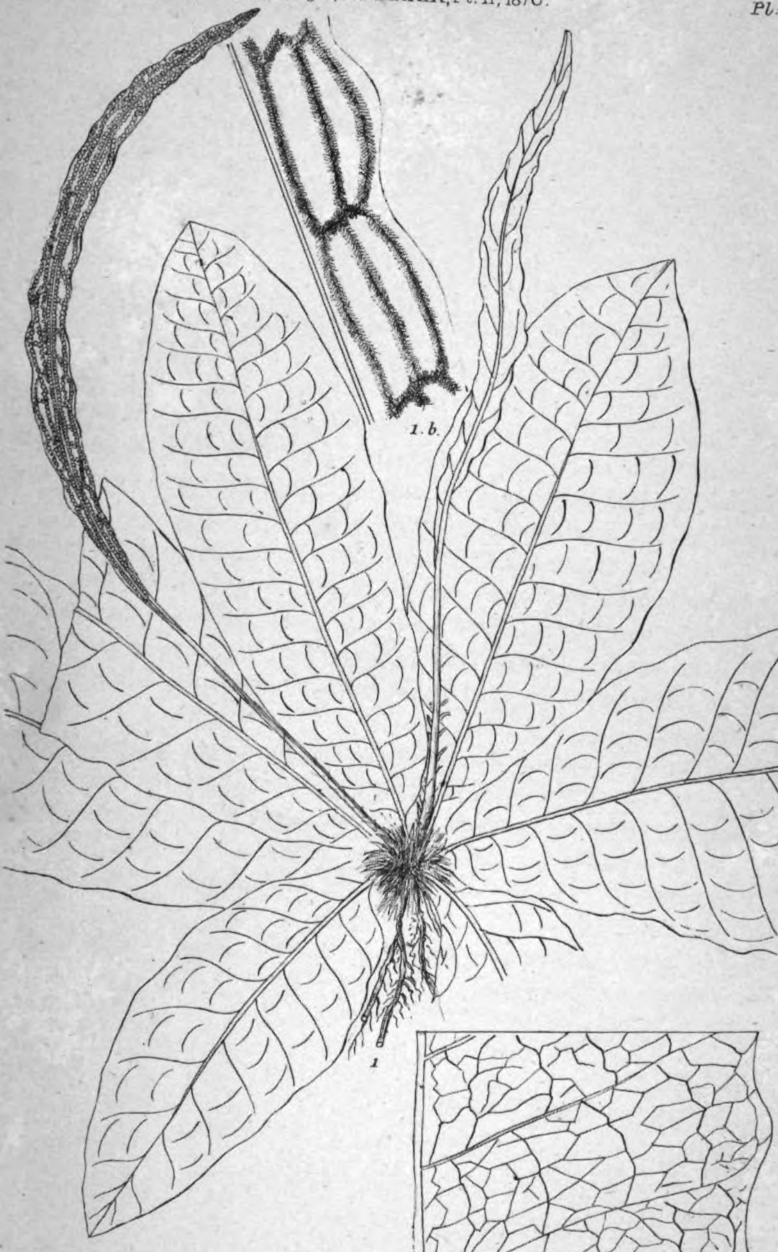
Fig. 2. *Hylorana Nicobariensis*, n. sp.; 2, side view; 2 a, head from above; 2 b, interior of the mouth; from the Nicobars.

Fig. 3. *Polypadates Hascheanus*, n. sp.; 3, view from above, 3 a, anterior half of the body from the side; 3 c, interior of the fore- 3 d, interior of the hind limb; the two last figures enlarged; from Penang.

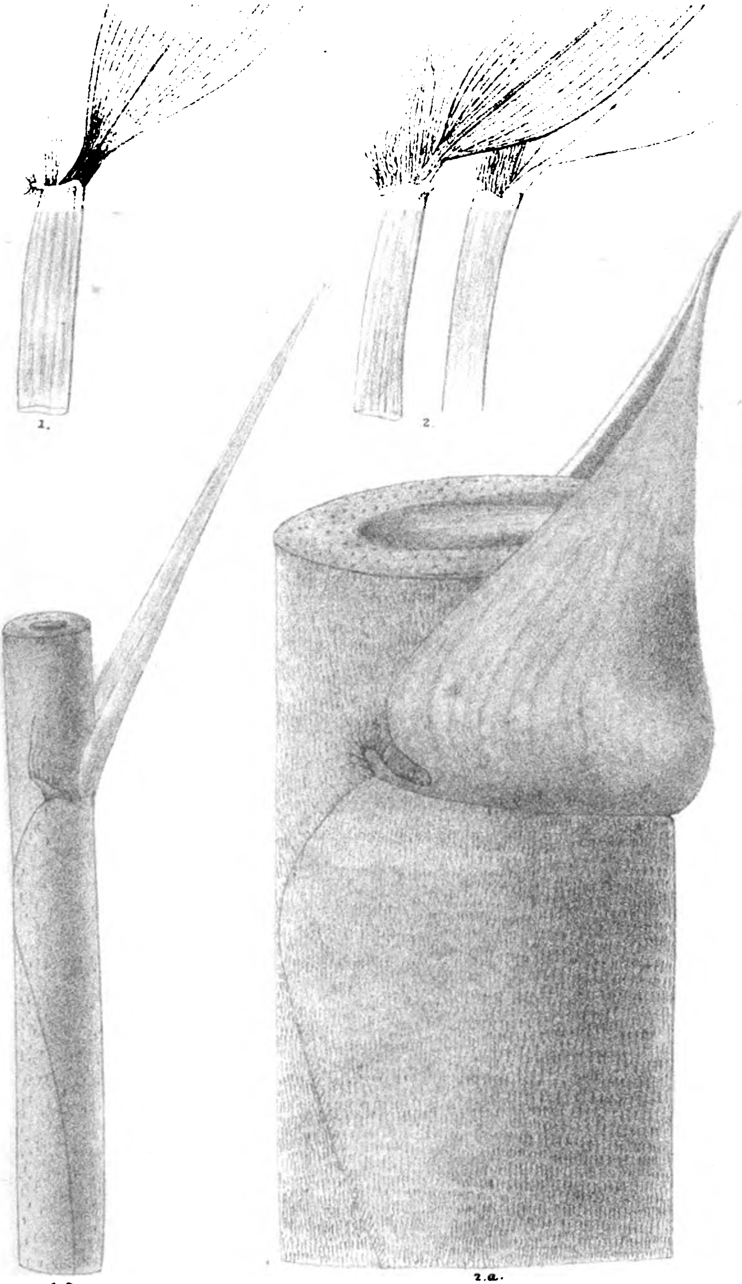
Fig. 4. *Ansonia Penangensis*, n. sp.; 4, 4 a, dorsal and ventral views, 4 b, side view of the head; 4 c, front part with the mouth opened, shewing the form of the tongue; 4 d, sacral vertebra with the coccygial style; 4 e, interior of the toes of one hind limb, 4 f, interior of the left hand, the two last figures enlarged; from Penang.

Fig. 5. *Diplopelma Carnaticum*, J e r d., upper view, from Martaban, near Moulmein.

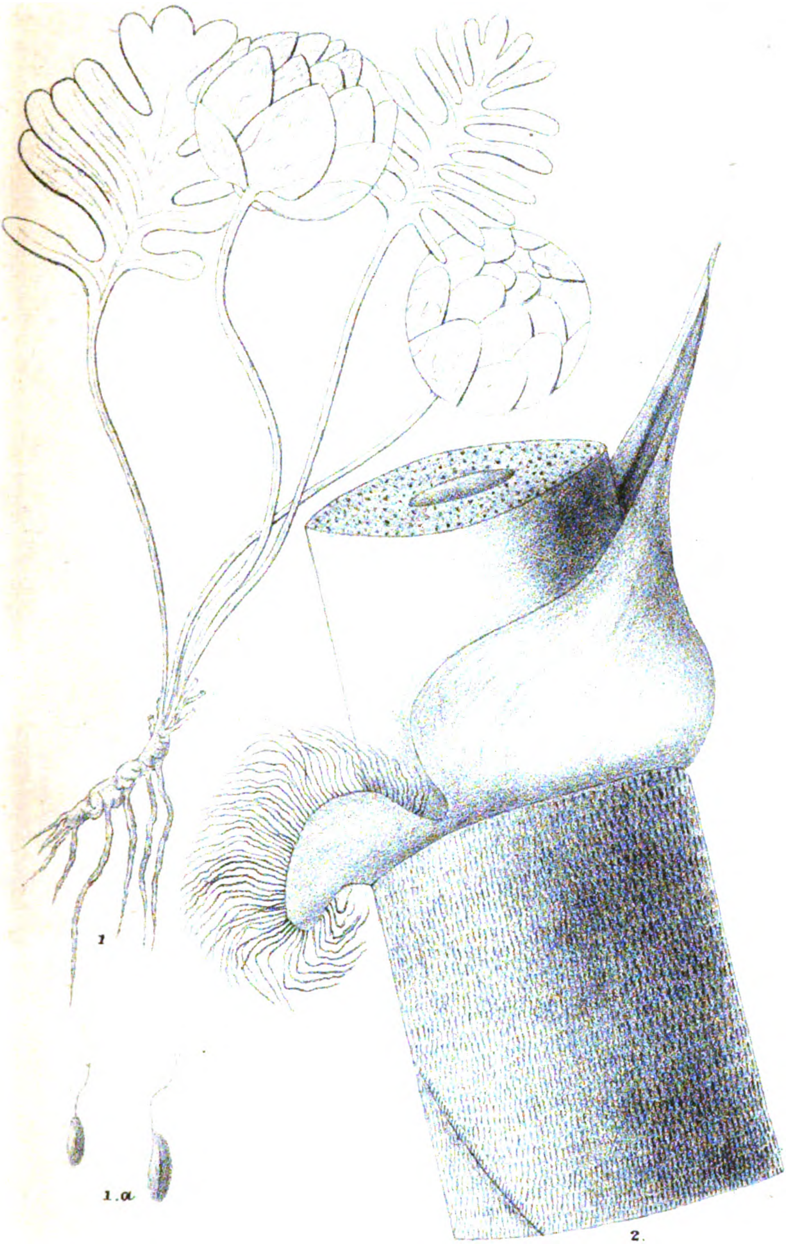
Pl: V.



Hemionitis Zollingeri, Kurz.

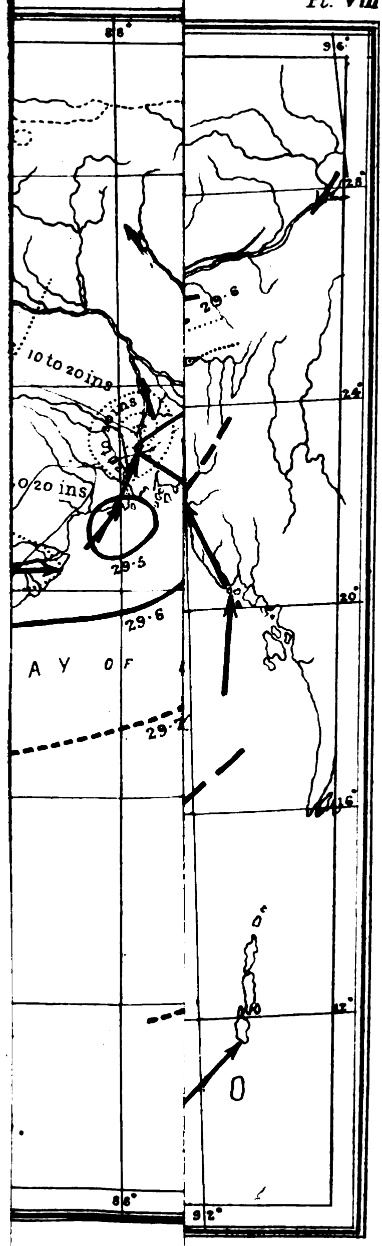


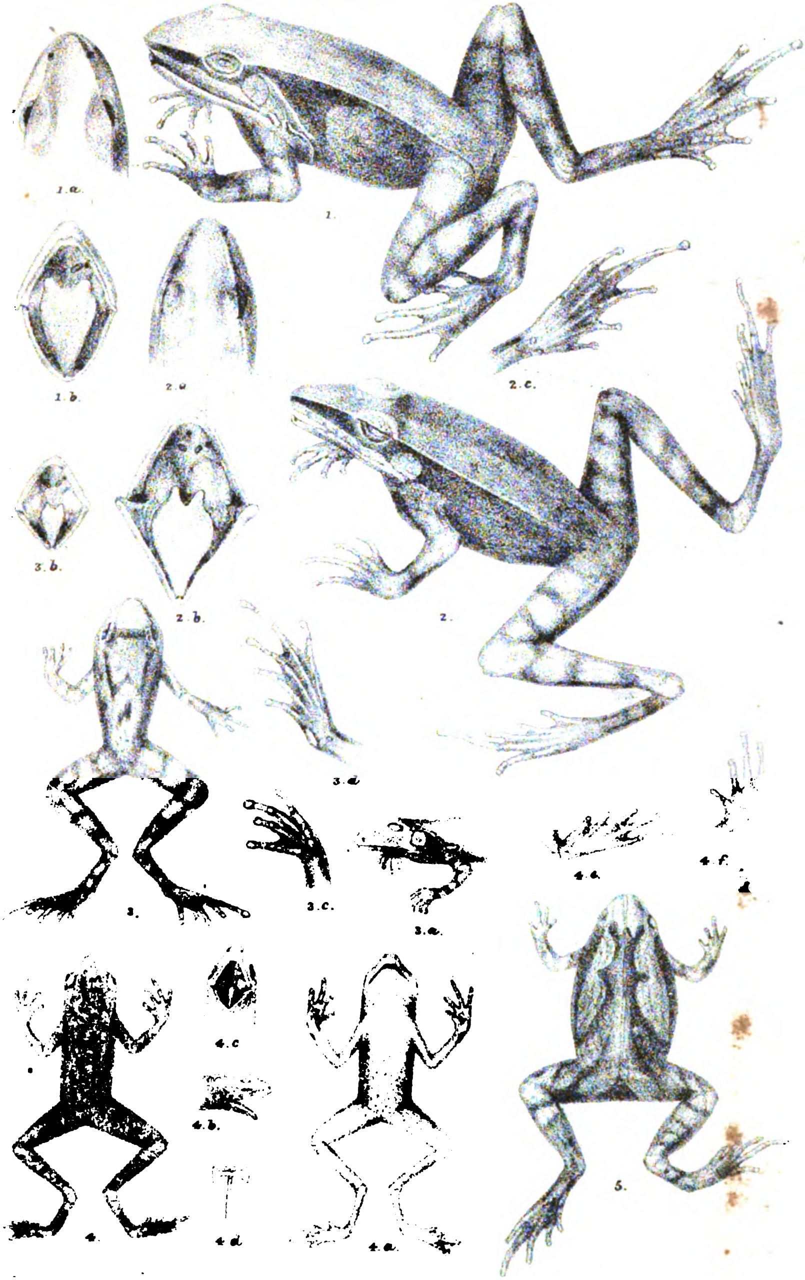
1. *Schizostachyum longispiculatum*, Kz. 2. *Sch. brachycladum*, Kz.



1. *Gymnandra globosa, Kz.* 2. *Schizostachyum Zollingeri, Steud.*

Pl. VIII





1. *Hylerana Tytleri, Theob.* 3 *Polypedates Hascheanus, n. sp.*
2. " *Nicobariensis, n. sp.* 4. *Ansonia Penangensis, n. g. et sp.*
5. *Diplopelma Carnaticum, Jerdon.*

1. *Hylorana Tytleri, Theob.* 3. *Polypedates Hascheanus, n. sp.*
2. " *Nicobariensis, n. sp.* 4. *Ansonia Penangensis, n. g. et sp.*
5. *Diplopelma Carnaticum, Jerdon.*

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ASIATIC SOCIETY.

PART II.—PHYSICAL SCIENCE.

No. III.—1870.

OBSERVATIONS ON SOME INDIAN AND MALAYAN AMPHIBIA AND REPTILIA,—by Dr. F. STOLICZKA.

(*Concluded from p.* 157.)

REPTILIA.

LACERTILIA.

Fam. GECKOTIDÆ.

13. *Ptychozoon homalocephalum*, Crev.-*var.*-(Günth. l. cit. p. 105).

This species has already been noticed by Steindachner from the Nicobars; it is rare in Tenasserim, and has also been obtained in Pegu by Major Berdmore. In Penang* it is not uncommon. I only got one specimen at the Nancowry harbour on Camorta, near the new settlement; it possesses some peculiarities.—The total length is 6½ inches, the body being half an inch longer than the tail. It is pale purplish brown, all over mottled and marbled with darker brown, partially with indistinct cross bands; the flaps are purplish fleshy, with

* Since writing these notes, I received a large collection of Amphibia and Reptilia from Penang and the Malayan country east of it, and I hope to be able to publish additional information about many species in a subsequent number of our Journal. [F. STOL.]

bluish, rather fine marblings. The shields on the flaps are considerably transversely elongated, rectangular. There is no flap in front of the femur, but it is continuous behind; and the thumb and nail on the first toe are rather small and semicircular. Above, there is only one row of enlarged tubercles, beginning quite laterally about the middle of the belly and continuing on the tail; this is segmented, the segments being indicated by cross series of two pairs of enlarged sub-conical tubercles; 13 upper, 10 lower labials, the lower rostral is small, the first lower labials on each side being conspicuously larger; the median pair of chin-shields is considerably elongated and forms a suture, all the chin-shields along the labials are slightly enlarged decreasing in size posteriorly; scales of belly small in about 20 longitudinal series, they are hexagonal; 19 enlarged preanal scales in an angular series, only about the 12 median ones are partially pierced, the adjoining scales below the angle are conspicuously enlarged, but the scales on the preanal edge itself are very small; most of the median sub-caudals are considerably enlarged and in two rows, but are by no means regularly placed.

14. *Gecko guttatus*, Daud, (Günth., l. cit. p. 102).

This is a well known Burmese inhabitant. It is very common in the houses about Rangoon, Moulmein, Amherst &c., and is also occasionally met with about Calcutta. Specimens taken in Dacca, and particularly those from the Khasi hills, are sometimes of different coloration, and the larger tubercles on the back vary in size, and number. In some specimens also, I have not counted more than 12 pre-anal pores, while in others the number rises to 32. Still more variable are specimens from the Arracan coast, and they constitute, as well as the Khasi variety, a local race. Good series of these Geckos are necessary for comparison. I am not certain whether the Arracan form does not exclusively belong to the next species, for unfortunately I have not kept many specimens.

15. *Gecko stentor*, Cant. (Günth., l. cit. p. 102).

Gecko Verreauxi, Tytler, Jour. Asiat. Soc, Beng. xxxiii, p. 546.

This rare Gecko occurs, as noticed by Theobald (Catal. Rept. Asiat. Soc. Mus., p. 29), also at the Andamans, and specimens of 14 inches of which the tail measures 6 or 6½ inches are by no means uncommon. It lives on trees; its general colour is ashy or pale brownish (without the green tinge of *G. guttatus*), with some dark brown markings on the posterior part of the head, the sides of the neck; the hind feet, partially, and the tail are encircled with darker brownish bands separated by pale whitish ones. This is often a sign of immaturity in other allied forms. The scales or shields on the head are very much smaller and more flattened than in *G. guttatus*, and the same applies to the shields of the chin. On the back, the middle 4 series of enlarged tubercles alternate and are comparatively small; they are separated by a rather broad interspace from the adjoining rows of considerably enlarged tubercles; of these there are usually 4 rows on each side (rarely only 3), and particularly some of the innermost rows are enlarged, black or dark brown with white tips. On the tail, the two median rows of enlarged tubercles disappear in about half the length, the other four tubercles which are sharply pointed and conical, continue on to the end.

I have also observed specimens of this species near Akyab (Arracan), and lately I saw a young specimen which was caught at Chittagong. Thus we may look out for *Gecko stentor* also in Southern and Eastern Bengal.

16. *Gecko Smithii*, Gray, (Günther, l. cit. p. 103).

The following is a description taken from an apparently nearly full grown specimen which I have received from Java.

Above, blackish brown, lighter on the head, the front part of which has a greenish grey tinge, occiput with two V form rows of white spots, the first being accompanied in front by a blackish edge; body with six transverse rows of white spots (the third imperfect, not reaching on to the left side), the sixth consists of only 3 distinct spots situated between the femora; base of tail marked with one central and one lateral spot on each side, not extending below, then follow 7 distant white rings, the last being the smallest, occupying the tip of the tail; feet spotted white.

Below, chin whitish, breast and belly pale marbled with grey, a number of dark spots are more distinct at the sides than along the centre; feet marbled like the belly; tail dark, especially towards the end. in addition to the white rings seen above, there is between each of the 1st and 2nd, the 2nd and 3rd and the 3rd and 4th one large white spot.

The head is rather long in proportion to the body, covered with small flattened sub-equal granules, slightly varying in size on the posterior part of the body and especially at the sides; there are 12 longitudinal rows round the body; one row of superciliary shields is slightly enlarged, rostral shield large, followed by a pair of supra-rostrals, 16 upper-, 12 lower labials; opening of the ear oviform almost vertical, broader below than above; pre-anal pores 15; total length 5.8 inches, of which the tail is 2·4 inch; head 0·8 inch, femur 0·4 inch, total length of one hind limb 1·1 inch.

I have not met with this species at Penang though it may occur there; the only known specimen in the Fort Pit Museum is said to have been obtained at Penang.

17. *Phelsuma Andamanense*, Blyth (Günth., l. cit. p. 112).

Gecko chameleon, Tytler, Journ. A. S. B., 1864, xxxiii, p. 548.

This is, as Mr. Blyth notes, in form and coloration a close ally to the Mauritius *Ph. Cepedianum*, differing from it by a longer snout; there are only a few larger shields next to the lower anterior labials, but hardly as large as in *Cepedianum.*

The type specimen has no femoral pores, and is evidently a female, but a row of slightly enlarged shields indicates their place. In male specimens an angular row of 28—30 femoral pores is present exactly as in the Mauritius species. In *Ph. Andamanense*, the subcaudals are enlarged; there are eleven upper labials, the two last being very small, and 9-10 lower labials.

The general style of coloration of both species is much the same, but the short mesial streak, beginning at the nape, appears characteristic of the Andaman form. When alive, the ground colour changes considerably from bright emerald green and a bluish tinge to almost dark brown bluish, with yellow, orange and reddish spots the lower parts are generally more or less bright yellowish.

The usual size is five inches, of which the tail measures nearly one-half, but it grows up to six inches; it is found also in houses, though usually only on trees which were no doubt its natural habitat before any houses on the Andamans were constructed. I did not find the species to be common about Port Blair.

18. *Peripia Peronii*, D. and B. (G ü n t h., l. cit. p. 110).
19. ——— *Cantoris*, G ü n t h., (ibidem).

The former is the most common house Gecko all over the island of Penang, along the sea coast as well as on the top of the Penang hill, at an elevation of 2,500 feet.

The young lizard is brown, with numerous rather large round pale spots all over the body, and each labial has a pale spot. Full grown specimens are pale ashy, sometimes almost white, all over densely and very minutely punctated with brown; some indistinct round pale spots are usually traceable on the posterior part of the head and about the shoulders; there are as a rule no brown spots on the labials, which are minutely punctated like the rest of the body, though the ground colour is paler.

In one specimen, captured on the Penang hill, the tail became injured. It grew afterwards particularly thick, short, with a separate short appendage above and another below on the side, no enlarged shields were formed below, in which character this specimen would agree with *P. Cantoris*, but it has the two pairs of enlarged chin shields followed by a few smaller shields on either side, peculiar to *P. Peronii*.

The former species, characterized by G ü n t h e r, I never met with on Penang, it must be extremely rare. But it is found at the Andamans, as noted by T h e o b a l d (Cat. Rept. Asiat. Soc. Mus. p. 30), though also very rarely. Col. T y t l e r named it (characteristic of his particular desire of renaming species) *Gecko Harrieti*, (Journ. Asiat. Soc., Bengal, xxxiii, p. 548). A specimen presented by Col. T y t l e r to the Museum is 2·8 inches long, it has thirteen upper, and ten lower labials, but the last shields of both are very small; central scales in forty-two series; the tail is depressed, and with minute spines on the edges of the front half. The general colour above is a sort of fawn colour with reddish brown and yellowish undulating transverse bands, between the shoulders, loins and on the tail interrupted by irregular blackish brown spots; a brown band extends from the rostral through the eye to the shoulder, and is edged above with yellowish.

P. Peronii is also recorded by Mr. Theobald from Burma. The name *Gecko pardus* (Journ. A. S., B. xxxiii, 1864, p. 547) appears to have been applied to it by Col. Tytler.

The largest specimen of *P. Peronii* collected was six inches. In some specimens, I find the posterior plates on the toes are only angularly bent and not perfectly divided, what clearly indicates that the distinction between *Gecko* and *Peripia* is only of subordinate importance, and that the species included in the latter should strictly speakiug form only a section of the former.

20. *Hemidactylus frenatus*, Schleg. (Günth., l. cit. p. 108)
Gecko chaus and *caracal*, Tytler, Journ. Asiat. Soc., Bengal, 1864, vol. xxxiii, p. 547.

This common Indian species also occurs in Penang; I only obtained it on two occasions, both times on the pillars of the verandah; it seems to have been expelled from the interior apartments by the much stronger *Peripia Peronii.*

It is also found in Burma, in the whole of Lower Bengal, at the Andamans, where it seems to attain a larger size, and at the Nicobars. The thumb and inner toe are always particularly small but with distinct claws; the middle portion of the back does not usually have any enlarged tubercles, but sometimes there are two alternating rows of them, the three rows on each side are, however, pretty constant. The tail when reproduced, usually becomes smooth, without enlarged spines. In an Andaman specimen, the subcaudal plates are very considerably enlarged. Specimens from Rangoon have a very conspicuous broad whitish band from the nostril continuing through the eye to above the ear; it is bordered below by black. The Nicobar specimens are small and have mostly only 36-38 series of scales on the belly; the thumb is almost obsolete, but there is no other specific difference. They were obtained on trees on Camorta, near the new settlement. The largest specimen I saw is from Moulmein, it measures 5½ inches with the tail 3 inches.

21. *Hemidactylus maculatus*, D. and B. (Günth., l. cit. p. 107).
Gecko Tytleri, Tytler, Journ. Asiat. Soc. Bengal, xxxiii, p. 547.

This is very common about Moulmein. The number of upper labials varies between 11 and 13, the last 4 or 5 being as usually very small; the lower labials vary from 8-10, and 9 is the most usual number, in the Tenasserim specimens at least. When the tail is reproduced, the spines don't grow again. The colour is sometimes uniform dark brown, sometimes pale with dark spots and broadish streaks, which usually have a tendency to arrange themselves in 5 longitudinal rows on the body. The blackish eye-streak is accompanied above and below by a light grey or pale yellowish band. In the brown varieties, the head above is generally spotted with pale. The usual size of Tenasserim specimens is 4 and 5 inches, of which the tail measures slightly more than one half.

I have also obtained specimens of this species near Port Blair (Mount Harriette) on the Andamans.

About Calcutta this Gecko is generally seen inside houses, while *H. Coctæi* is usually seen on the outer walls. There are, however, certainly two quite distinct forms which appear to have been regarded as *Coctæi:* The one is a small species rarely growing to a greater length than 6 inches, it has some enlarged tubercles on the back and the claw on the thumb is almost perfectly obsolete. The other species is much larger, but has no enlarged tubercles, and the claw on the tumb very distinct. I have seen specimens of this last measuring fully 10 inches, it is during life greenish with distinct transverse bands, lighter in front and dark posteriorly. I am now engaged in collecting all the *Geckotidæ* about Calcutta and hope to be able to trace the differences indicated more clearly. There are certainly 4, if not 5, distinct species of *Hemidactylus* alone in and on our houses; and perhaps some other genera will be found represented. They are extremely useful animals, for they destroy a very large number of obnoxious and molesting insects in the house, and should always be carefully protected against injury.

22. *Cyrtodactylus rubidus*, Blyth, sp.

Puellula rubida, Blyth, Journ. Asiat. Soc. Bengal, 1860, xxix, p. 109.
" " apud Günther, l. cit. p. 118.
" " Theobald, Cat. l. cit. et auctorum.
Gecko tigris, Tytler, Journ. Asiat. Soc., 1864, xxxiii, p. 546.

Body rather depressed, with numerous small and larger tubercles; head large in front, covered with equal, somewhat squarish sub-granular shields: tail round with larger tubercles near the base and gradually disappearing towards the end which is curled; toes and fingers free, slender with a few sub-tubercular shields at their bases, and with narrow shields on more than the front half; claws short but sharply curved; ten upper and lower labials; the nostrils are superseded by a somewhat larger shield, and there are several small shields posterior to the rostral which is rather low and broad; four enlarged chin shields, the lower rostral reaches between the first pair; sub-caudals not enlarged. The preanal pores are situated in the male in a short fold between the femora, there are three or four on each side at the internal edge of the fold. In the females, this fold is either obsolete, or slightly indicated, but the pores are always absent.

Ground colour above light, or rarely darker, brown with a fleshy tinge about the head and with two generally distinct marks, one on the nape beginning from the eyes, the other across the shoulders; rest of head on the top spotted, with some dark streaks in front and on the sides; body dark spotted and striped; tail when perfect cylindrical with numerous broad blackish rings, somewhat confluent below; when reproduced it is thicker, shorter and of a more uniform brownish color with small blackish spots; below uniform whitish pale fleshy, or sometimes even purplish. The usual length of specimens is about five inches, but it grows up to six inches and perhaps more, the tail exceeding the body by about one-fifth of its length. The species seems peculiar to the Andamans; I found it on trees, but Col. Tytler mentions that it also occurs under stones where it no doubt searches after insects.

The above description of the species taken from fresh specimens collected by myself, shews that the character of Mr. Blyth *Puellula* has to be cancelled, and that we have in the present lizard a typical *Cyrtodactylus*, as characterized by Gray in his Catalogue of Lizards, p. 173. I am inclined to retain this genus as distinct from *Gymnodactylus*, which it otherwise closely resembles, but while the species of this last genus are house-Geckoes the *Cyrtodactyli* are typical tree-Geckoes, and their tail is rounded instead of flattened, the situation of the preanal or femoral pores is also very peculiar and distinct from *Gymnodactylus*.

Having carefully examined my fresh specimens, I was of course reluctant to see what it may be that has caused Mr. Blyth to give such a different characteristic of his *Puellula*. On examining his originals the deception became clear. Evidently the specimens have been put in very strong spirit, or this had partially evaporated, and was refilled with perhaps double the strength. The skin of all specimens consequently shrunk along the back and on the sides, as well as between the femoral region, and these ridges had become so stiff and permanent, that it is by no means surprising they were taken as natural dorsal crest, and as folds on the side of the belly. However, a careful examination of these specimens shewed that the ridges are irregular, and in some places broken up so that there could be not the least doubt as to their being accidental. In fresh specimens nothing of all this exists, and the species is, as already noted, a typical *Cyrtodactylus*.

In external appearance and coloration, *C. rubidus* greatly resembles *Gymn. variegatus*, Blyth, from Moulmein (Günth., l. cit., p. 116), except that in this species the femoral pores are differently situated, the tubercles on the back and the scales on the belly are a little larger, the sub-caudals enlarged and the tail depressed, as in other *Gymnodactyli*.

I do not see Mr. Theobald's argument — Cat. Rept. Asiat. Soc. Museum, p. 32 — where he retains *G. variegatus*, under the genus *Naultinus* (vide Gray's Lizards, p. 169), for it does not agree with that sub-genus in the form of the tail, nor in the position and distribution of the preanal pores.

23. **Cyrtodactylus affinis**, n. sp. Pl. X, fig. 1.

Body rather depressed, covered with smaller and numerous enlarged sub-trihedral tubercles, each of which has 3-5 grooves; shields of head small, those in front slightly enlarged and flattened; rostral very large, reaching posteriorly to the top of head and grooved, a small shield above each nostril but not in contact; upper labials 12, very low; opening of the ear moderate, vertically elongated; lower rostral very large, sub-triangular, reaching backward; eleven lower labials; a few of the chin shields next to the rostral are squarish, very littlle larger than others, but none are elongated ; the scales of the belly are in about 30 longitudinal series, all are small, sub-tubercular and carinated ; no femoral or preanal pores, nor any enlarged scales indicating their presence the preanal region being regularly flattened ; tail round, with a few indistinct rings of enlarged tubercles near the base ; below on each side of the anus with 2 or 3 large polyhedral tubercles, further on, uniform scaly, tip curled ; no enlarged sub-caudals. The toes and fingers are very slender and elongated, and the claws very small, laterally compressed and sharp. The size of the fingers follows each other as 1, 2, 3, 5, 4, the 2nd and 3rd being sub-equal, and the 4th and 5th equally so, the thumb is a little more than half the size of the 4th finger. The toes follow each other as 1, 5, 2, 3, 4, the 1st is half the size of the 4th, the 2nd and 3rd sub-equal, and the 4th slightly longer.

General colour above pale vinaceous ashy, finely marbled and mottled with dark, especially on the head, sides of body and on the limbs. A V blackish mark on the nape, followed by a black spot on the neck, then follow five other angular blackish bands across the body, the first across the shoulders, the last between the hind limbs ; tail in front with four blackish broad bands gradually disappearing, and it then becomes almost uniformly ashy brown. The posterior portion has the appearance, as if it had been reproduced, but the anterior ¼th of its length is certainly original ; lower parts whitish with a slight purplish tinge.

The general form of the body with the elongated and slender toes and round tail, as well as the total absence of femoral pores or enlarged shields indicating them, and also the coloration so thoroughly agree with the females of *Cyrtodactylus rubidus*, that I prefer to describe the single specimen, as noted above, rather under this genus, than under *Gymnodactylus ;* for in *C. rubidus*, the females often have the preanal fold perfectly absent and no enlarged shield to indicate the few pores present in the male.

The only specimen I caught between the bark of a large tree near the top of the Government bungalow on Penang hill. I had at the time, I obtained it, considered it to be *Gymnodactylus pulchellus*, (Günth., l. cit. p. 113) which was also by Gray (Lizards, p. 173) described under *Cyrtodactylus*, but differs from that genus in the disposition of the femoral pores in an angular series. The coloration is quite the same in the present species as in *Gym. pulchellus* of which Cantor (Jour. Asiat. Soc. B. xvi., 1847, p. 632) says that is common in the houses on Penang hill; unfortunately I never saw this last one, though I looked very carefully after it. The present species, differs from this last by the peculiarly carinated scales, no enlarged chin shields or sub-caudals, and apparently more slender toes and fingers; it also has no enlarged femoral or preanal shield swhich, Cantor says, are in *G. pulchellus*, well developed, even in the female, though not pierced.

Total length 4 inches, the tail hardly less than the body.

Fam. SCINCIDÆ.

24. *Tiliqua carinata*, Schneid.

Eup. rufescens apud Günth., l. cit., p. 79.
Eup. carinatus apud Steindachner, Rept. Novara, p. 43.

The brown variety with indistinct pale bands on each side of the back, with numerous obliquely ascending black streaks, and with white spots each margined black above and below, is common about Moulmein and down the Tenasserim coast.

The same variety, but on the upper portion of the sides usually marked with blood red, is common at Penang and also on the coast of the Welesley Province. One specimen from the last locality has on either side, a large red orange spot (turning in spirits into white), and no small ocelli. It has the vertical posteriorly united with the anterior occipitals, and the adjoining shields are also more or less confluent,—apparently this part has once been injured. The pre-frontal very narrowly touches the rostral, but in other specimens, this is quite separated by the supra-nasals. None of the Malayan specimens have a distinct trace of a pale band on the sides of the back. All I saw were of the usual size, 12-15 inches. Steindachner also mentions this species from the Nicobar islands; possibly the specimen, if not well preserved, may belong to the next which I believe to be new.

The largest specimen, I ever saw, is one lately sent to me by Mr. Röepstorff from the Andamans; it measures twenty inches, of which the tail is very nearly twelve inches, this last is more flexible than in any other specimen I observed. The form of the head and the shields on it are perfectly the same as in other Indian and Malayan specimens; the supra-nasals form a short suture behind the rostral; there are only twenty-six longitudinal series of scales, these are large, tricarinate, the middle carina being weaker than the lateral ones. The specimen is above uniform, somewhat pale brown, paler on the sides towards the belly, and with a few indistinct darker spots, fore and hind limbs are above wholly spotted with white and dark brown; below yellowish white, tail leaden grey. It is a peculiarly large variety, but except in size and length of tail I can find no other specific distinction in the specimen. Possibly other specimens when found may exhibit greater variations from the type.

25. **Tiliqua rugifera,** n. sp., Pl. x, Fig. 3.

Body moderately stout, it and the head somewhat depressed, tail nearly one-third longer, sub-cylindrical, very gradually tapering. Fore-limb feeble, one when laid forward reaches to the anterior angle of the eye, hind limb very nearly as long as the distance between it and the fore-limb. The fingers are comparatively slightly developed: the thumb is moderate, shortest, the fifth finger about twice as long, the second very little longer than the fifth, and the third and fourth are sub-equal. The inner toe is the shortest, the second is double the length, then comes the fifth, then the third and the fourth is longest, being fully one-fourth longer than the third. Toes and fingers are slender and provided with small, moderately curved claws.

The rostral is broader than high, just reaching the top of the head; the pre-frontal forms a very narrow suture with it, as well as with the first pre-ocular on either side, and with the vertical, the larger sides between these narrow sutures being somewhat concave; post-frontals separated, on the side in contact with the two loreals; vertical elongated, tapering posteriorly, but terminating with an obtuse angle; four supraciliaries, moderately elevated, the fourth multicarinated and below followed by small shields; five occipitals, the first two narrow, forming a suture behind the vertical and scarcely reaching further posteriorly than the angle of the eye, median occipital broadly oval, small, posterior occipitals very large. A rather elongated supra-nasal; nostril large, round, extending almost over the entire height of the nasal; two loreals, the posterior being much the larger one, three small upper and two somewhat enlarged inferior ante-oculars; lower eyelid scaly; seven low upper labials, the fifth is the longest, situated below the eye; ear moderately open, its inner edge with minute tubercles; lower rostral moderate, the shield next posterior to it small, single, followed by two diverging pairs of chin shields, very little larger than the rest; seven lower labials; preanal edge occupied by scarcely enlarged scales; sub-caudals single conspicuously larger than the row of smooth scales on either side. Scales in twenty-six longitudinal rows round the body, large, the upper and lateral ones strongly five carinated, the carinæ continuing very distinctly on the scales of the tail, giving the lizard a very ornamental but rough appearance; twenty-three transverse rows of scales between fore and hind limb; eight longitudinal rows of smooth scales on the belly.

Colour above and on the sides dark brown, paler on the head, upper labials yellowish, a greenish iridescent narrow streak extends from the supraciliary edge on each side of the humeral region posteriorly, another similar stripe begins at the end of the upper labial, both are margined with blackish brown, and nearly entirely disappear in about the middle of the body. There are besides two narrow longitudinal darkish stripes observable along the centre of the back, but they remain very indistinct; very few of the lateral scales are edged with greenish. Yellowish white below, with a greenish iridescent tinge, especially conspicuous on the sides of the neck and of the belly.

The more depressed and triangular head, smaller number of scales which are five carinated, and the differences in the frontals and coloration readily distinguish this species from *T. carinata*, Schneid.

I have only obtained a single specimen of this beautiful species on Camorta, (Nicobars), in the forest near the new settlement; it measures $4\frac{7}{8}$th inches, of which the tail is $2\frac{6}{8}$th inches.

Steindachner (Novara Reptilien, p. 48) describes from the Nicobars an *Euprepes macrotis*, Fitz., which appears to belong to the sub-division *Euprepis*, and is entirely distinct from the present species. I have not as yet been able to obtain it from the Nicobars, but I have little doubt that Capt. Rundell who has taken a very great interest in the Reptile fauna of those islands will be successful in his endeavours.

26. *Tiliqua olivacea*, Gray (Günth., l. cit., p. 80).

Steindachner already notes the occurrence of this species on the Nicobars. It attains here the full size as at Penang. The specimens which I obtained from Camorta are of a uniform brown colour above, paler on the sides, greenish olive below, with some dark irregular spots along the lower labials, and an indistinct pale band along each side of the root of the tail; the edges of the eyelids are yellowish white.

The longer snout, smoother scales and very small opening of the ear readily distinguish this species from *T. carinata*, Schneid.

One of the specimens, measuring a little above eight inches, has twenty-eight long rows of scales, the other somewhat larger (with the body four inches, the tail being nearly 5) has only twenty-six rows of scales, and all the shields behind the occipital have grown together into one large shield, having evidently once been injured.

27. **Mabouya Jerdoniana,** n. sp. Pl. X, Fig. 4.

Habit moderately slender with a sub-cylindrical body, conical, somewhat depressed head and long tail, it being nearly one-third longer than the length of the body. One fore-limb, when laid forward, reaches a little in front of the eye; the hind limb is very nearly equal the distance between it and the fore-limb. The thumb and inner toe are the shortest; the second finger is double the length of the first, the fifth is sub-equal to the second, and the fourth is about one-fifth longer than the third. The second toe is fully twice as long as the first, the fifth distant, situated at the base of the sole and very little shorter than the third, but the fourth is one-fourth longer than the third. The palm and the sole are well developed and flattened, below covered with numerous sub-equal granular scales; toes and fingers are covered above and below with one row of transverse plates, the latter being considerably narrower than the former; claws moderatly curved and very sharp.

Rostral large, obtuse in front, forming a narrow suture with the pre-frontal, which is contracted on either side and posteriorly; posterior frontals form a very narrow suture; vertical, rather small, rectangular in front, and posteriorly reaching to about the middle between the eyes; seven supraciliaries, prominent and strongly arched, but the supraciliary edge itself is formed by about ten smaller scales; occipital sub-quadrangular, narrowly truncate in front, with concave front sides, broadest and angular below the middle, and slightly emarginated posteriorly; it is followed by several large post-occipitals, some of the temporals being also enlarged; one narrow, elongated supra-nasal on each side; nostril large, rounded; 2-3 loreals and 4 ante-oculars, the two upper ones being smallest; 8 upper labials, the sixth largest, situated below the eye, 8 narrow lower labials, the shields adjoining them being considerably enlarged, and the first chin shield is single and largest; lower eyelid with a large transparent disk; ear rather spacious, rounded without any perceptible spines or granules. Scales round the middle of the body in 37 longitudinal series, and there are about 60 transverse rows of scales between the fore and hind limb. The scales on the sides are only a little smaller than those on the belly and on the back; all are smooth, but with the lens many of the dorsal scales are seen in reflected light, very slightly longitudinally grooved. A series of eight scarcely larger scales forms the preanal edge; sub-caudals conspicuously enlarged.

Colour uniform, iridescent brown above, most of the scales with a large pale spot, and an indistinct pale band running from the nape on each side of the back and disappearing on the tail; below uniform yellowish white, leaden grey on the tail.

The only specimen figured was captured by me in a small temple on the little island Pulo Tickos, situated just to the north of Penang island; a few other specimens, I saw on the shore, but they escaped in crab holes under the refuse thrown out by the sea. A very similar, or the same species, I have also observed on one of the small islands near Singapore, but was not successful in capturing it.

The Penang specimen is $7\frac{3}{16}$ inches, the tail measuring 4, the posterior half appears to have been once injured, as the sub-caudal scales become rapidly much narrower, but occupying nearly the whole width.

I think Fitzinger's genus *Mabouya* should be accepted as emended by Gray (Lizards, p. 94), taking the West Indian *M. agilis* as type. It seems to form a very good natural group, apparently generically distinct from *Euprepes*, as restricted. The type of Wiegmanns *Eumeces* is according to Peters* *Scincus pavimentatus*, Geoff., and is the same as *Plestiodon* of Dum. and Bib., therefore *Mabouya* (as characterized by Gray) cannot be taken as subgeneric of *Eumeces*.

28. *Hinulia maculata*, Blyth, sp.

Lissonota maculata, Blyth, Journ. Asiat. Soc. Bengal, 1853, xxii, p. 653.
Mabouia maculata, apud Günther, l. cit. p. 84.
Hinulia maculata, apud Theobald, Cat. Rept. Asiat. Mus. p. 25.

Head rather short, sub-trigonal with an obtuse snout, rostral reaching far back to the surface of the head, the pre-frontal forms a suture with it and with the vertical, the post-frontals being rather small and widely separated; five supraciliaries, rather tumid; vertical, considerably narrowed posteriorly, almost terminating in a point, followed with the regular two pairs of occipitals, the hinder separated by an elongated shield; nostrils lateral at the base of a single shield reaching to the top of the head and bent over the canthus rostralis; fifth lower labial below the orbit, nearly as large as the sixth, which is often followed by a seventh small labial; two large loreals followed by two small shields superseding a single large one in front of the eye; eyelids scaly; opening of the ear elongately oval, vertical, rather large, with no spines in front.

There are 34-38 longitudinal series of scales round the middle of the body, and about 96 scales in one row between the front and hind leg; six pre-anal shields, the middle pair the largest and elongated; subcaudals enlarged. Fore foot when laid forward very nearly reaches the eye in some specimens, in others, it reaches even as far as the front edge of the eye; the hind-leg in some does not reach the axil, in others it does; as a rule, young specimens have longer limbs than old ones; the third and fourth fingers are subequal, the third being sometimes very little longer; the fourth toe is

* Monat. Akad. Berlin, 1864, p. 48.

very long and slender, about two-fifths longer than the third; thumb and inner toe are very short.

Brownish olive above, usually with two series of small black dots along the middle; sides with a black band above, commencing at the rostral, either uniform, or sometimes provided with white spots and margined above and below with an indistinct pale streak, continuing as a grey band with undulating margins to the tip of the tail; the lower half of the sides is in young specimens yellowish and spotted with black, as are likewise the upper and lower labials and the sides of the neck; in full grown specimens all these parts are densely marbled with blackish grey, the spots having become more or less confluent; the rest of the lower parts uniform whitish; the tail is in old specimens sometimes spotted with black; the legs appear to be above always spotted or marbled with the same colour.

I found this species very common at Martaban near Moulmein, but I scarcely observed a single specimen south of Moulmein, nor does it appear to extend further south into Welesley Province. Theobald says that it is very common in the forests of Pegu. My largest specimen measures 6¾ inches, of which the tail is 4 inches; it is proportionately longer in young specimens than it is in old ones.

The species is very closely allied to *H. indica*, Gray, (*Eumeces indicus* apud Günther, l. cit. p. 89, non *Mocoa Sikimensis*, Blyth), and I have given a detailed description of the former simply for the purpose of a close comparison of the two, for they may possibly turn out to be identical, the only appreciable difference of Blyth species from that of Gray, as recorded by Günther, being the larger number of supraciliaries and of the transverse series of scales between the front and hind limb. Are the latter really in such a small number present in *H. indica* as noted by Günther? If not, the two could scarcely be specifically different, and if the locality of the Cumingian specimen from Ningpo be correct, the species would after all seem to possess a wide geographical distribution.

H. maculata also occurs at the Andamans, though it is rare there.

29. **Riopa lineolata,** n. sp., Pl. X, Fig. 2.

Body very slender and long, almost of equal thickness throughout, sub-cylindrical or slightly depressed; tail half an inch longer than the body, becoming very gradually thinner, till it terminates into a sharp point; feet moderately elongated and slender : fore foot nearly equal the distance between the rostrum and the ear, the thumb very small, the second finger is somewhat longer than the fifth, and both are shorter than the third and fourth which are sub-equal, the third being slightly longer; the claws are moderately curved and very sharply pointed; the length of hind limb equals the distance between the axil and the eye; the toes follow each other in length as 1, 5, 2, 3, 4, the last two being sub-equal and the second about half the length of the fourth, the claws are equally sharp as on the fingers. Opening of the ear moderate, rounded, with smooth edges.

The snout is rather short and obtuse; supra-nasals form a suture behind the rostral; anterior frontal occupies the whole breadth of the snout, and forms a very narrow suture with the vertical, just separating the post-frontals from each other; vertical, long, gradually attenuating posteriorly ; supra-orbitals five, the last very small, somewhat tumescent; occipitals four, the anterior being united, and the one following it is rather small and triangular; upper and lower rostrals are large, obtuse; two loreals, the anterior smaller than the posterior ; seven upper labials, being rather large and high, six lower labials, elongated and very narrow; first chin shield single, followed by two pairs of somewhat enlarged shields, having a small one between them ; pre-anals very slightly enlarged. Scales smooth, transversely elongated and hexagonal, in 24-25 longitudinal series, and there are 60-65 scales in one row between fore and hind limb. The lower eyelid is scaly, but the scales are broad and more transparent in the centre than at the edges.

Colour greenish iridescent brown above, with an almost continuous series of small dark brown dots on each side of the back, beginning at the nape and margined above and below by a pale line ; the centres of all scales above and on the sides are paler than at the edges, and form straight longitudinal lines; below whitish with a vinaceous tinge and distinctly reddish on the tail; the sutures between the labials are darker than the shields themselves.

I have obtained two specimens at the old Portuguese settlement of Martaban, opposite to Moulmein; the species does not seem to be common. The larger specimen measures 3½ inches of which the tail is 2; the other is only 2½", of which the tail is very nearly 1⅝ inch, its head is considerably shorter and the snout more obtuse, than that of the larger specimen.

I consider *Riopa* to be a good distinct genus, or sub-genus, particularly characterized by the slender form of its body and feeble limbs. The present species appears very closely allied to *Eum. Bowringii*, (Günther, l. cit., p. 91,) but this one has twenty-eight longitudinal series of scales and only thirty transverse series between fore and hind limbs; the scales must be, therefore, much longer, as Günther's specimen is in measurements equal to the larger one from Martaban. Another allied form is *Riopa anguina*, Theobald, (Burmese Rept., p. 27 in Journ. Linn. Soc., London, Vol. X, Zoology), but this again has much shorter limbs, the hind one being "as long as from snout to ear, fore-limbs a trifle less," while in the present species the fore-limbs are considerably shorter than the hind limbs and the latter proportionately longer; the colour of *anguina* is also "uniform brown above with no markings." The number of scales &c. is not mentioned by Theobald, but even with the few differences noticed, it would impossible to regard them as belonging to one and the same species, though both come from the same region. Theobald in his Burmese Catalogue (p. 26) says of *E. Bowringii*, as having been captured at Thaiet-mio. The specimen, he states has "a minute lobe in front of the ear" and "an inconspicuous white streak from the eye down either side of the back, bordered below with black." These characters also don't agree with those of the species here described, but perhaps they do not exclude the possibility of either one or the other of Mr. Theobald's specimens being identical with *R. lineolata*.

Fam. AGAMIDÆ.

30. *Calotes mystaceus*, D. and B. (Günth., l. cit. p. 141).

The peculiar coloration of this species has been noted by Mr. Theobald in his Cat. of Rept. in the Asiat. Soc. Museum, p. 36, and in that of Burmese Reptiles (p. 33 in Ext. from Vol. X of Journ. Linn. Soc., London, Zool.). Male specimens when in breeding season have the lower labials, and the whole of the skin and throat beautifully blue black, the latter conspicuously mixed with red. One specimen from Moulmein (measuring 12¼ inches of which the tail is 8½) has the crest high on the neck, but it becomes almost obsolete in half the length of the body; scales in 52 longitudinal series round the body. The largest specimen I measured was 16 inches total length, and it may even attain a larger size, though I never saw one of 24 inches, but it is no impossibility, as which Mr. Theobald appears to regard Günther's quotation.

That the crest almost totally disappears at half the length of the body is, I find, of common occurrence in Burmese specimens which I possess from Arracan, Bassein, Rangoon and Moulmein, and the throat seems to become blue in males and females, during the summer season at least; in the males, however, the red colour on the throat is prevalent, while it is almost wanting in the females.

Young specimens, four and five inches in length, have the head very short, thick, the centre of the occiput with a large plate surrounded by a few larger scales; the head has numerous dark cross bands, which on the body are somewhat more distant and angular; these specimens look so different that one would be inclined to regard them as belonging to a totally distinct species.

Down at Penang, the Welesley Province and Singapore I have not met with this species, it seems to be there replaced by *Bronchocele cristatella*.

In Mouat's Advent. and Res. among the Andaman Islanders (Lond., 1863, p. 365) Blyth states that this species has also been received from the Nicobars. Its occurrence is by no means improbable, but I have not received it from there, nor can I find a specimen of that species from the Nicobars in the Society's collection.

31. *Bronchocele cristatella*, Kuhl, (Günth., l. cit. p. 138).

During live the prevalent colour* is bright green, but the changes are almost quite as varied and instantaneously effected, as in a

* See also Peters in Monatlisb. Berlin, Akad. for 1867.

Chameleon. The dorsal row of scales is in all appreciably enlarged. The labials are often black, and there are various black spots round the tympanum, and the sides of the belly or often partially or sometimes wholly black. In one specimen from Java, there are yellowish bands across the back as in *B. jubata.* The tail is usually light greenish or reddish brown, on the anterior half with some distinct whitish irregularly black-edged rings. There are also very commonly two small black spots on the top of the head, some distance behind the rostrum. Specimens from the Wellesley Province, Penang and Java have 38—40 scales on each side.

32. *Bronchocele moluccana,* Less. Peters (Berl. Akad. 1867, p. 16) considers this species as distinct from *cristatella.* One specimen from Singapore apparently belonging to this species has only 32 lateral rows of scales, but these are of perfectly the same small size and general character, as in *crystatella* from Penang. The specimen measures 16 inches, of which the tail is 13½ inches; the colour is uniform bright green, the orbit, the extreme margins of the labials, the tympanum, a spot behind the same, and the whole of the sides black; posterior part of the tail brownish. There is no difference in the shape of the head, or in the form and character of the scales on it and on the body from *crystatella.*

Steindachner (Rept. Nov., p. 27) mentions 2 specimens of *B. cristalella* from the Nicobars, possessing 29—31 rows of lateral scales; these would very closely correspond with the Singapore form of *B. moluccana.*

33. *Bronchocele jubata,* D. and B. (Günth., l. cit. p. 139).

A large specimen from Java is bright green with the orbital skin, edge of the tympanum, and the labials black; a yellowish elongated spot below the tympanum, five narrow cross bands of the same colour on the body, the first and last being between the fore and hind limbs; tail brownish.

A variety apparently of this species occurs on the Nicobars. I received from Camorta four specimens, each about 18 inches long of which the tail is 14 inches. The general form of the lizard, number and size of scales, form of the crest and the two enlarged rows of a few scales behind the eye are perfectly identical with those of *jubata*, but all four specimens have the head more depressed and the snout longer and somewhat narrower, than is the case in the Java specimen which I have for comparison. The upper labials are ten in the Nicobar and only eight in the Javanese specimen ; the upper rostral is also much larger in the former than in the latter. Still considering all the other more important characters in a species I can regard the Nicobar form only as a variety of the Javanese one.

All Nicobar specimens are bright green, some of them bright yellow on the head and neck, the occipital skin, tympanum aud sometimes a spot on the top of the head behind the restrum are black ; the gular sack bright brick red apparently in the male, and about four-fifth of the posterior portion of the tail is reddish brown.

Was the Pondicherry specimen, of which Dum. and Bibron speak, not received from the French Missionaries on the Nicobars through some friend in Pondicherry ?

34. *Tiaris subcristata*, Blyth, (Günth., l. cit. p. 151).

Syn. Coryphophylax Maximiliani, Fitz. apud Steindachner, Novara Rept., p. 30.

This is an extremely variable species both as regards scales as well as coloration. The scales on the top of the snout are usually somewhat enlarged, and the median ones form a short carina ; the canthus rostralis is sharp and continues on the supraciliary edge. On each side of the occiput, there is a group of large scales, and sometimes a distinct group in the middle between both. Irregularly scattered polyhedral scales are often found all round the tympanum, but they are scarcely in two specimens identically placed. In some large specimens there is one or two between the eye and the tympanum, one large one above it near the crest, and two somewhat smaller ones nearer the tympanum, one or two are situated behind, and one occasionally below. In young specimens these polyhedral scales are less numerous and sometimes reduced to but three. The centre of the tympanum is always hardened. There are eight or nine low, carinated upper labials, and generally 9 or 10 lower labials, similar in form to the others.

The scales of the body are very small, about 40—50 in a transverse series on each side, intermixed with some large ones. In some specimens, the larger scales are only very few, in others they are scattered irregularly, and again in some they are partially arranged in regular longitudinal rows, and distinguished besides by a blackish mark on either side of each scale. Nearly in all specimens, there are some enlarged tubercles near the base of the tail; the ventral scales are in from 18—22 longitudinal rows; the subcaudals are in two rows, very sharply carinated. In young specimens, the nuchal crest is only indicated by a row of slightly enlarged scales, in old females it is still very small, but in the old males it is more developed, being considerably higher than the dorsal crest which continues to the end of the tail; this last is considerably compressed, entirely resembling in this respect other species of *Tiaris*. There is a well developed gular sack in male specimens, and a distinct shoulder-fold in all. The extremities and tail are very long; the fore limb is about as along as the distance between it and the hind limb, and the latter when laid forward, nearly reaches to the end of the snout. The thumb is the shortest, then comes the fifth finger which is half the length of the fourth, then the second, and the third and fourth are sub-equal, the last being slightly longer. The tarsus is very elongated, the first toe very small, the others follow each other as 2nd, 5th, 3rd, 4th, the last being remarkably long.

Color variable. Young specimens which always have the head remarkably short and blunt, are greenish ashy brown with numerous dark brown spots above and dark cross bands on the head, one spot in front between the eyes being especially conspicuous. Other young specimens and females are more uniform greenish, but almost always with some dark stripes in front of the shoulder. Male specimens are variously reticulated and obliquely striped with dark brown on the sides, the light interspaces being variegated with yellow and red; sometimes the whole back along the centre is purplish red, and the gular sack in the male is also reticulated with reddish, yellow and black. The red and yellow colours fade away very soon after the death of the animal. Numerous short blackish streaks always radiate all round from the eye; the labials are either dark spotted, or sometimes wholly blackish brown; the tail in encircled with broad dark bands.

My largest specimen measures 15 inches, of which the tail is about 11 inches.

This is a true arboreal lizard, tolerably common at the Andamans, and very common at the Nicobars. I found the jungles on Nancowry and Camorta swarming with specimens. They are extremely quick, and almost within a moment after they were first noticed they are again seen some twenty or thirty feet high upon a tree; and when followed up they do not hesitate to leap from one tree to another. Without shooting them it is scarcely possible to procure a specimen. I obtained more than a hundred specimens from the Nicobars alone, thinking that there may be a possibility of tracing some permanently distinctive characters in the Nicobar form, but they all proved identical with the Andaman species which was first described by Mr. Blyth from Port Blair. There cannot be the least doubt of the two being the same, and I cannot even see any real generic distinction from *Tiaris*, as emended by Gray. Fitzinger's name *Coryphophylax* must, therefore, be considered as a synonym of the former.

35. *Draco volans*, Linn. (Günth., l. cit., p. 124).

This species appears to be more common in the jungles of the Wellesley Province and near Malacca, than it is on Penang itself. Cantor's description of the colours is excellent, the metallic bronze brown hue of the live lizard is wonderfully fine and brilliant. The black spot between the eyes appears quite constant, at least in male specimens. I only observed the gular sack to be uniform yellow, the lateral appendages and the throat are very pale or almost quite white and dark spotted. Limbs and tail are brown banded. There is behind the large rostral shield, a short longitudinal sharp ridge distinct, dividing in two, one branch leading to each eye. Beside the enlarged tubercular scale above the posteroir part of the orbit, there are 3—4 enlarged flattened scales placed in one row behind the orbit, and two small spines are above and one behind the tympanum. In most of the specimens there are also some larger spiny or tubercular scales conspicuous on the sides of the neck, as if indicating lateral crests which appear to be fully developed in *Dr. reticulatus*, Günth.

OPHIDIA.

Fam. TORTRICIDÆ.

36. *Cylindrophis rufus*, Laur. (Günth., l. cit. p. 179).

I have obtained specimens of this species from the hills north-east of Mandalay in upper Burma; it has already been recorded from Pegu by Mr. Theobald. The snout is sometimes considerably shorter in young specimens than it is in old ones and, therefore, its length in proportion to the width between the eyes is not a very good character for specific distinction, when compared with *C. maculatus*.

Fam. COLUBRIDÆ.

37. *Ablabes melanocephalus*, Gray (Günth., l. cit. p. 229).

I caught a specimen of this interesting species in the (so-called) botanic garden at Singapore. It measures 17¾ inches, of which the tail is 7¼ inches, a remarkably great length of the tail for an *Ablabes!* Ventrals 155, subcaudals 99, the last being as usually single, very much elongated and pointed. The distribution of the shields of the head perfectly agrees with Günther's description, and so does also the general character of colouring. The head is black, minutely freckled with white above, the upper labials white spotted with black at the lower margins and at the sutures; the white band continues a little beyond the gape, but is interrupted by a black spot on the 10th labial. The anterior half of the body is above brownish, the posterior blackish ashy; a pale brown somewhat indistinct band begins on either side of the back, behind the black collar, and is marked by a series of quadrangular equidistant black spots; it becomes a little more whitish on the posterior part of the body, and then the spots disappear. Lower parts whitish throughout; chin checkered with dark, each ventral with a black spot on either side; the spots, beginning to appear on the lower part of the neck, are first very small, increase gradually in size, until they form on the posterior part of the body a very distinct continuous strongly serrated black band.

38. *Ablabes Rappii*, Günther., (l. cit. p. 226).

A fine specimen was obtained by my collector in the neighbourhood of *Simla*. It measures 23 inches of which the tail is 5 inches; ventrals 196, subcaudals 67; uniform dark bronze brown above, yellowish white below, and on the lower part of the upper labials; chin and throat olive tinged; loreal small, nearly twice as long as high; temporals 1 + 1 + 2, the first very long, the others much shorter.

39. *Ablabes collaris*, Gray, (Günth., l. cit. p. 228).

This species appears to be rather rare in the low hills about Simla. One specimen obtained near Subathoo measured 22¼ inches, of which the tail is 7¾ inches; ventrals 184, anal bifid, subcaudals 113. General colour above greenish olive, head spotted with black, a short indistinct cross black band at the anterior- another near the posterior end of the vertical, a third curved one at the end of the occipitals; collar broad, black, edged with yellow posteriorly; the black spots forming the dorsal series on the fore part of the body very small, almost obsolete; tail with three blackish longitudinal bands; upper labials yellowish spotted with black, as is likewise the chin and partially also the throat. Lower parts dirty greenish white, purer posteriorly, each ventral and subcaudal with a black spot at the base forming a more or less continuous black streak.

The species also occurs near Darjeeling and in the Khasi hills.

40. **Ablabes Nicobariensis**, n. sp. Pl. XI, Fig. 1.

Body slender, head not distinctly separated from the neck, depressed, obtuse in front, scales smooth, in 17 series, ventrals 189, anal bifid, subcaudals 87. Rostral low, wide, not reaching to the top of the head, two pairs of frontals, anterior broader than long, about half the size of the posterior; vertical subtrigonal, large, with a very short point in front, and rapidly contracting posteriorly, somewhat longer than the supraciliaries; each occipital about one-fourth larger than the vertical, and extending anteriorly as low as the lower postocular; nasals in two shields; loreal united with the postnasal of which only a trace is visible on the left side, on the right side the postnasal is totally suppressed; preocular one, large, squarish; postoculars two, small; seven upper labials, the third and fourth enter the orbit, the last is the largest; temporals $1 + 2 + \frac{1}{1+1}$ on the left, $1 + \frac{1}{1+1}$ on the right side. As usually in this section of *Ablabes* the upper parts of the upper labials are apt to be detached from the larger body of the shields, and form additional temporals; the first pair of lower labials forms a suture, and is followed by two pairs of subequal chin shields. Each maxillary armed with 14 small subequal teeth.

Anterior half of the body reddish brown above, posterior blackish grey. Head above blackish, the three first labials with yellow spots, a short broad yellow streak extends from behind and below the eye posteriorly to the angle of the mouth; collar black, margined on both sides with an interrupted yellow band, of which the anterior is the more distinct one; an indistinct series of blackish grey dorsal spots, almost forming a dark undulating band; sides of the body marbled and freckled blackish grey, this colour being separated from the upper brown one by a series of closely set black spots which are partially conspicuous on the posterior part of the body; chin dusky; all the other parts yellow with a vermilion tinge, each ventral with a large black spot near its base.

This peculiar form has quite the general character of coloration of *Ablabes melanocephalus*, but the spots on the sides of the dorsal region are more numerous and closer together; in the number of labials it on the other hand agrees with *Ablabes sagittarius*. The position of the united loreals is very peculiar, and perhaps not normal, but it is almost quite similar on both sides of the head, which externally strongly reminds of a *Callophis*.

I have obtained only a single specimen at the Nancowry haven on Camorta (Nicobars); it measures 17½ inches of which the tail is 4½ inches.

41. *Ptyas mucosus*, L. (Günth. l. cit. p. 249).

This species is not uncommon on the Andamans. Young specimens have the scales quite smooth, each with two minute apical grooves; colour above pale brown finely reticulated with dark lines and narrow whitish cross bands; below uniform whitish.

An old specimen about 60 inches long, is uniform brown above, yellowish white below; scales quite smooth; 9 upper labials of which the 5th and 6th enter the orbit, the three first ones are small and of the 4th the upper hind margin is detached, forming a third anteocular, the large anteocular proper being divided into two.

On the southern slopes of the North West Hymalayas, this species is one of the largest snakes to be met with. I observed it near Kishtwar at an elevation of 6000 feet; in the Kulu valley it is common between 4 and 5000 feet, and in the Sutlej valley beyond Kotegurh I saw it up to 7000 feet, but not far in the interior. Specimens from the latter locality are somewhat different in colour. One, apparently a male, measures 66½ inches, of which the tail is 16½, the scales are all, with the exception of the two outermost rows on either side, very sharply keeled; the anterior half of the body below is white, on the posterior each ventral and subcaudal is black edged. Another specimen 68½ inches, of which the tail is 18 inches, is a female; it has the scales smooth, with the exception of the three median rows which are very faintly keeled; all the ventrals are black edged in front, the last ones and the subcaudals almost wholly black. On the right side are 8, on the left 9 upper labials; of the third and fourth labials the hinder margins are detached and form a second small lower pre-ocular. Whether the presence or absence of keels on the scales has anything to do with the sexual distinction, remains yet to be more fully ascertained.

42. *Ptyas hexagonotus,** Cantor, sp.

Xenelaphis id. apud Günther, l. cit. p. 251.

One full grown specimen from Penang measures 43 inches of which the tail is 13½ inches; scales in 17 rows, ventrals 200, subcaudals 118; uniform shining brown above, darker on the head and forepart of the body, paler almost leaden grey posteriorly, below albescent; six almost vertical blackish bands on either side of the neck, the first is shortest and situated at the angle of the gape.

I cannot see any sufficient reason for referring this species to a genus distinct from *Ptyas.* The entire habitus of the snake— moderate (17) number of rows of rather large smoothish scales,

* *hexahonotus* being to all appearance a misprint.

those of the vertebral series being generally larger than others, proportionate length of the tail (about or near ⅓) to that of the body, moderately elongated head, roundish body with no perceptible keel on the ventrals, great number of ventrals and subcaudals, regularly arranged shields of the head, small subequal teeth of the jaws, and at last the habitat generally near the water, are all characters which distinguish the genus *Ptyas*, and in all these the above mentioned species agrees with the well known *Ptyas mucosus* and *Korros* as closely, as any allied species can possibly do. I found *Ptyas hexagonotus* in a pool of a fresh water stream on the northern side of the Penang island; one had swallowed a small fish and was evidently in search for other specimens. When attacked with a stick, it burrowed itself deeply in the mud, but did not leave the water.

The only difference which distinguishes *Ptyas hexagonotus* from the two other Indian species, is the presence of only one loreal, but as *Ptyas mucosus* has sometimes two in place of three loreals and *Ptyas Korros* occasionally one instead of two, I cannot see how such an insignificant and evidently very variable character could be looked upon as possessing generic value.

43. *Compsosoma radiatum*, Reinw. (Günth. l. cit. p. 243).

I obtained an interesting variety of this species near Moulmein, between brushwood on the ground.

The body is remarkably strongly compressed and the head flattened, and depressed. Total length 32 inches, of which the tail is 6 inches; scales in 19 rows, those of the anterior half of the body almost perfectly smooth, on the posterior half sharply keeled, with the exception of the two outer rows on each side; ventrals 257, anal entire, subcaudals 100; shields of the head regular; the anteocular and hinder end of the loreal are distinctly granular. Colour light leaden grey above, brown on the head, yellowish white below on the anterior part of the body, leaden grey on the posterior, and whitish on the tail; the four longitudinal dorsal black bands begin on the posterior part of the neck and disappear in half the length of the body; the short longitudinal streaks on the sides, along the base of the ventrals, begin immediately behind the base of the tympanoid cross streak; sides of the body marked with indistinct vertically elongated whitish spots, margined with dark, and continuing up to the anal region, but disappearing on the tail.

44. *Compsosoma melanurum*, Schleg. (Günth. l. cit. p. 244). A fine specimen measuring 55 inches (of which tail is only 7 inch.) was collected by Mr. Homfray on the Andaman islands. The general colour is uniform brown with some interrupted dark bands on the anterior half of the body, the posterior half of which is uniform blackish brown; throat pale yellowish; no trace of a dorsal longitudinal band is present. The single large ante- and the two small post-oculars are granulated, the former more distinctly than the latter; the temporals are 2 + 3, much elongated; the other shields of the head and the markings on the sides of the head normal. Scales in 19 rows, elongately rhombic, the dorsal ones strongly keeled, the three outer rows one each side almost perfectly smooth; ventrals 235; anal entire, subcaudals 60, tip of tail truncate, having been apparently once slightly injured.

45. *Compsosoma semifasciata*, Blyth, sp. Pl. XI, Fig. 2.

Platyceps semifasciatus, Blyth, Journ. Asiat. Soc. B., 1861, vol. XXIX, p. 114.—Günth. loc. cit. p. 237.

Coluber id., apud Theobald, Cat. of Rept. Asiat. Soc. B., 1868, p. 52.

A young but perfect specimen was obtained by my collector in the lower hills about Subathoo, south of Simla; it measures 11½ inches, of which the tail is three; scales smooth, in 19 rows, each with two minute apical grooves. Head distinct from neck, large and remarkably depressed; rostral broad at the base, deeply indented, only half as wide above than at its base, rounded and reaching to the top of the head; anterior frontals about two thirds the size of the posterior; vertical five-sided, straight in front, with concave sides and a rectangle posteriorly, the two sides forming it being the shortest; supraorbitals large and obtusely pointed in front, a little shorter than the vertical; occipitals very large, each about one-third longer and in proportion also broader than the vertical; nostril between two rather large nasals; loreal moderate with the lower hind angle pointed; two anteoculars, the upper large, reaching to the top of the head and touching the vertical, the lower small, being strictly speaking only a detached portion of the third upper labial; postoculars two on the left side, upper larger than the lower (this appearing to be the normal state), three on the right one, the upper posterior edge of the sixth (or fifth) upper labial being detached from the rest; 9 upper labials, of which the fifth and sixth on either side enter the orbit, but it seems as if the third and fourth small shields should form together one, the third upper labial. Scales of the tail broadly hexagonal; ventrals 211; anal large, bifid; subcaudals 119. The first pair of lower labials forms a suture; two pairs of chin shields, the hinder slightly longer and moderately diverging.

Above, head brownish, with some dark markings on the occipitals; the rest of the body olive grey, with numerous short, rather broad blackish transverse bands, interrupted on the sides and alternating with lateral spots; all the dark markings disappear on the posterior two-fifths of the total length; pre- and post-oculars yellowish, a small dark, somewhat oblique spot below the eye. Below, uniform whitish throughout, with a slight dusky tinge; most of the ventrals have a small black spot at the base, at least as far as the upper black markings extend.

The form and general distribution of the largish shields of the head, the depressed, flattened head, numerous rows of scales, and the peculiar coloration of young specimens, all indicate the generic identity of the present species with *Compsosoma*, as has been suggested to me by Dr. Jerdon, after he had examined Blyth's original specimen, though this is not so perfect as the one here described.

46. *Compsosoma Hodgsoni*, Günther, (l. cit. p. 246).

Three specimens of this species were obtained by my collector in the lower hills to the south of Simla. In all of them the scales are elongantly hexagonal, but become considerably broader on the posterior part of the body.

a—Full grown; 63½ inches, of which the tail measures 13½ inches; ventrals 238, subcaudals 90; scales of the back distinctly though not very prominently keeled, each with two apical grooves; eight upper labials, the fourth and fifth enter the orbit, and of the third the upper hinder angle is detached and forms a small lower anteocular; uniform olive above, pale yellowish below and on the upper labials; some of the ventrals partially blackish near their bases, as recorded by Günther.

b. and *c.*—These are two young specimens, measuring respectively 16¾ (of which tail 3¼) and 14¾ (of which tail 2¾) inches; in both the ventrals are 244, and the subcaudals 85 and 89 respectively. The scales are smooth, only in some parts on the posterior body scarcely perceptibly keeled, all with minute apical grooves. In *b* the shields of the head are perfectly regular, as described by Günther, three upper labials enter the orbit; in *c*, the posterior portion of the third upper labial is detached forming, as in the old specimen, a small lower anteocular, and moreover the large anteocular extends so far to the top of the head that it touches the vertical. The colour of both young specimens above is a pale olive grey with a dark blotch on the top of the head, extending over the vertical and the occipitals; the middle of the back is marked with numerous, rather wide blackish cross bands separated by interspaces of equal width, they become gradually obsolete on the tail; sides of the body densely reticulated with black; all ventrals more or less distinctly edged with dark, the larger basal spots being very conspicuous throughout; subcaudals uniform yellowish white.

47. *Tropidonotus quincunctiatus*, Schleg.
(Günth. l. cit. p. 260).

Trop. Tytleri, Blyth, Journ. Asiat. Soc., Bengal, 1863, XXXII, p. 88.

Trop. striolatus, Blyth, apud Theobald, Cat. Rept. Asiat. Soc. Mus. 1868, p. 55.

Not common about Moulmein and to the south of it. One specimen measured 23½ inches of which the tail was only 1·4 inches; the black spots are at the neck in 5, round the middle of the body in 6 longitudinal series.

On the Andamans the species is also very common and attains a length of 40 inches, the tail being sometimes more than one third, in other specimens, however, scarcely more than one fourth of the total length. All the Andaman specimens are generally dark brown, and have on the back of the fore part of the body two longitudinal black bands edged with whitish, and a pale band is also noticed on either side of the body; the three median rows of black spots are more or less confluent; on the posterior part of the body the longitudinal bands become obsolete, and the 5 rows of spots are very distinctly traceable. The subcaudals vary from 60 to 90, and the ventrals from 125 to 150. The Andaman variety has received on account of its peculiar coloration a new name by Blyth. The specimen described by Mr. Theobald as *T. striolatus*, Blyth, is to all appearance the same as the one published by Blyth under the name *Tytleri*. Blyth had first affixed the former name to the Museum label, but in writing his note about the snake, or during the press of the paper, he appears to have changed the specific name into *Tytleri*. It is, as already noticed, certainly only a variety of *quincunctiatus*, and I have other specimens from the Andamans which perfectly agree with the type, having the longitudinal bands obsolete, and again others which are almost uniform brown, having the dark spots nearly quite obsolete. The streaks below and posterior to the eye are never absent.

48. *Tropidonotus stolatus*, Linn. (Günth. l. cit. p. 266).

Common about Moulmein and at Amherst. In several specimens the longitudinal bands were on the front part of the body indistinct, and the posterior edges of the supraorbitals, occipitals and of the vertical were spotted with black.

49. *Tropidonotus platyceps*, Blyth, (Günther, loc. cit. p. 264).

Zamenis himalayanus, Steindachner, 1867, Verhandl. zool. bot. Gesellsch., Wien, XVII, p. 513, pl. XIII, fig. 1-3.

I obtained lately through my collector three specimens of this species from the Kulu vally. One is injured, it is a young specimen, and has the whole of the epidermis taken off. The snake then has a light bluish or leaden grey colour, many scales with white specks and the whole surface is checkered with black.

Another specimen is a *male*, 19 inches long of which the tail is 4½ inches; ventrals 205, subcaudals 82, all scales with the exception of the two outer rows on either side finely but very distinctly keeled. Shields of the head regular, as noted by Günther, loreal squarish but somewhat longer than high, temporals 1 + 1 + 2. Colour above dark brown, with an indistinct laterally compressed long eliptical mark on the neck and two rows of small blackish spots along the dorsal line, disappearing altogether on the posterior half of the body. A very distinct yellowish streak from the rostrum along the upper edges of the upper labials is margined with black on either side and disappears on the sides of the neck which has, however, at its base another short white streak traceable. Below yellowish, all over finely mottled with a dusky green and with another more distinct blackish band on each side; a coral red band runs along the bases of the ventral shields, and separates the upper brown from the lower yellow coloration.

A third specimen is a *female*; the scales are almost quite smooth, only those of the middle four rows show very indistinct traces of keels; total length 20 inches of which the tail is 5 inches, ventrals 203, subcaudals 86; the *loreal* is on both sides *united with the posterior nasal;* temporals and all other shields normal, as in the previous specimen. Colour light brown above, with a distinct laterally compressed eliptical mark on the neck, beginning with a single black line on the suture of the occipitals; several rows of small blackish dots on the anterior part of the body; the white black edged streak on the side of the head distinct, below uniform yellowish white with a dark line on each side, and a very faint trace of reddish along the bases of the ventrals.

The examination of these specimens appears to indicate that in this species the males have often the scales more distinctly keeled than the females. That the loreal is united in the female to the post nasal is most likely only accidental; similar cases of the head shields becoming confluent are by no means rare in other COLUBRIDÆ. The male seems to be darker in coloration and with a more distinct coral red lateral band, than it is in the female. The species does not appear to be common, but it occurs almost throughout the Central and North West Hymalayas, Dr. Jerdon having obtained it also in Cashmir. There can be no doubt that Steindachner's *Zamenis* is identical with *T. platyceps,* his three specimens were all females with nearly quite smooth scales, and from the same locality as those noted above.

Fam. DENDROPHIDÆ.

50. *Gonyosoma oxycephalum*, Boie, (Günth. l. cit. p. 294).

This species is not uncommon in the forests of the Andamans, it is generally seen on bushes near brackish water creeks, and is always ready to take the water, like a *Tragops*. It also occurs at the Nicobars. The colour above has a bluish tinge in some specimens, while the dark eye-streak is sometimes scarcely traceable; the lower parts are pale green, all the ventrals have the front edgings white, and their lateral angles are also marked by a pale whitish line. The rostral usually reaches to the top of the head and the anterior frontals are obtusely angular and narrow in front. A young specimen from Port Mouat measures 30½ inches, of which the tail is 7½; ventrals 241, subcaudals 145.

51. *Dendrophis picta*, Gm. (Günth., l. cit. p. 297).

The bronze colouring alluded to by Günther chiefly refers to the epidermis, which is especially in specimens preserved for some time in spirit rather opaque*; the scales below it are bluish. Not unusually there are ten upper labials present instead of nine. In two specimens, obtained south of Moulmein, the lower lateral black stripe is very distinct, the upper faint, though it begins as a broad black band posterior to the eye, and is also marked in front of it, while on the contrary, the lower strip begins to be distinct only on the posterior portion of the neck and from there extends backward. This species is also common at the Nicobars and Andamans; the insular variety is always beautifully bright yellowish green during life, each dorsal scale is on the posterior half blackish, the cuticle on the adjoining six rows of elongated scales bronze brown, and the scales are more or less margined with black; the outer series of larger scales and all the ventrals are yellowish green, the latter with a slight bluish tinge. The ante and post-oculars are yellow, the black eye streak is rather thin, and in Nicobar specimens broken up into spots on the side of the throat; in some Andaman

* Of other *Dendrophidæ* and allied genera as well.

specimens it nearly entirely disappears on the throat, and there is no trace of it on the side of the body.

52. *Dendrophis caudilineata*, Gray, (Günth., l. cit. p. 297).

In a live specimen obtained at Penang, there are on the anterior half of the body six narrow black dorsal stripes beginning behind the neck, but as the epidermis is much opaque here, they are not very distinctly perceptible. In the middle of the body one stripe on either side of the two median dorsal ones becomes obsolete, and only four stripes continue up to the tail; the two lateral bands on each side are throughout distinct, the lower is much broader than the upper.

On no part of the body are there more than thirteen series of scales, (on the posterior only eleven). This is exactly the number observed on two Penang specimens by Cantor (vide Journal Asiatic Society, Bengal, vol. XVI, p. 933), while Günther gives "fifteen rows," which may either be a mistake, or possibly the Borneo specimens possess fifteen rows, for Günther's description may have been taken from them, there being no Penang specimen recorded in the British Museum Catalogue. Having alluded to the accurate description of Dr. Cantor, I hardly need to remark that there can be no doubt of the identity of the species with the one recorded by Günther.

53. *Chrysopelea ornata*, Shaw, (Günth., l. cit. p. 298).

The *var. a* of Günther is common on Penang. A vertebral series of spots occurs in all specimens, each spot being formed of three or four (or more) scales which are of a beautiful coral red in the live snake, but become yellow in spirit. In one specimen, the right loreal is on the left side united with its next posterior frontal, the other shields are normal; such abnormities in the arrangement of the shields of the head, differing on the two sides, are extremely common. In all specimens the ventrals have a narrow blackish edge, except those on the throat and for a short distance beyond, the *last two* in front of the anus are usually bifid. The maxilary teeth are all nearly equal, the last is often scarcely larger than the others, but in two apparently male specimens I have observed the 2nd and 4th anterior tooth to be distinctly larger than the rest.

As regards the habits of this snake, there seems to me to be a great deal of truth in Cantor's statement, that it is more frequently found on the ground between grass than on trees. I have myself caught on the Penang hill several specimens, all in grass or between low bushes along the edge of the foot path. Only once I saw a specimen on a bush, though not high up, but there can be little doubt that the snake makes also ample use of its eminent adaptness for movements on the trees. It is remarkable that this species seems to feed almost exclusively upon species of GECKOTIDÆ, six specimens that I have examined at Penang all had parts of them in their stomach.

54. *Chrysopelea rubescens*, Gray, (Günth., loc. cit. p. 299).

I obtained a single specimen on Penang hill; it appears to be rare. It has 15 rows of scales on which the apical grooves are scarcely traceable. The shields of the head are normal, the vertical remarkably narrow, the posterior two-thirds of its length with concave sides; the occipitals are large and with narrow obtuse ends posteriorly.

The ground colour of the snake is a pale ashy grey, all over very minutely checkered with brown and white; some of the scales of the vertebral series have larger brown blotches, forming on the posterior half of the body an interrupted vertebral series; the posterior part of the head and neck are distinctly rufous brown. A pale streak runs along the median suture of the two pairs of frontals, another whitish streak runs from behind the eye posteriorly, bounded above and below with a brownish streak, a longitudinal brown streak occupies the middle of the neck; the rest of the head above is checkered and marbled with minute white dots and brown streaks; the upper labials are white, partially marked with brown dots; the lower parts of the head also white with minute brown specks. The throat is in the live snake of a beautiful yellow, this colour fading gradually until in about one-third the anterior length of the body it has changed to greyish brown; the parts below have a more distinct brown tinge than above, where it is more grey. Total length 28¾, of which the tail is 8½ inches; ventrals 196, anal bifid, subcaudals 136 pairs.

Fam. PSAMMOPHIDÆ.

55. *Psammophis condanurus*, Merr, (Günth., l. cit. p. 291).

Idem, Theobald, Journ. Linn. Soc., Zool. 1867, vol. X., Cat. Burm. Rept., extract, p. 43.

Phayrea isabellina, Theob., ibidem, and Catal. Rept. Asiat. Soc. Bengal, 1868, p. 51.

The head in this snake is elongately oval, obtusely rounded in front, distinct from neck in young specimens, but a little less so in full grown ones; scales in 17 rows, smooth, lanceolate,* those of the two last rows on each side rather larger and sub-quadrangular. The rostral shield often reaches to the upper surface of the head, and is posteriorly broadly rounded. The nostril is, in all specimens which I have examined, in one long shield; it is situated almost centrally and a distinct slit divides the lower portion of the nostril, but the upper is entire, though generally a faint groove extends from the nostril to the upper margin of the shield.

The fourth and last maxillary teeth are remarkably strongly enlarged and grooved at the outer bases, the latter is enclosed in a special pouch. Sometimes the two small teeth between the first and fourth are barely traceable.

I have received several specimens of this species through my collector from the sub-Hymalayan hills south of Simla (between 2 and 5,000 feet), and judging from these, the snake does not appear to be locally rare. The coloration is in all very much like that of a Pegu specimen presented by Mr. Theobald to the Asiatic Society Museum, and differs considerably from that recorded by Dr. Günther.

Above, isabelline brown, little darker in young than in old specimens. A median yellowish streak runs from the base of the rostral shield along the suture of the two pairs of frontals, divides at the base of the posterior frontals, the two branches continuing in subparallel undulating lines to the end of the occipitals, enclosing two or three irregular yellowish spots, or a short streak, and then extending along the whole of the dorsal region of the body, becoming, however, obsolete at the upper base of the tail. A second yellowish

* I cannot see to which scales of the body Mr. Theobald refers, when he calls them "hexagonal."

band originates at the top of the rostral shield, continues on either side along the supraciliary edge, and up to the tip of the tail; these two lateral bands are broader than the dorsal ones. A third broad band begins at the base of the rostral shield includes the upper labials and also extends the whole length of the body to the tip of the tail; these two bands are the widest, and each occupies the base of the ventrals and half the width of the adjoining scale, it is below bounded by a black line which becomes first apparent on the posterior part of the neck. All the other yellowish bands noted above are also black margined.

Below, uniform yellowish or whitish, sometimes with a faint bluish tinge.

Fam. Dryophidæ.

56. *Tragops fronticinctus*, Günth., (l. cit. p. 304).

There are in this species slight variations to be observed in the arrangement of the shields, &c. One, or both, anterior points of the anterior frontals touching the nasal are occasionally detached. The so-called detached portions of the anterior upper labials do not as a rule correspond in number and position with the true upper labials; the latter vary in number from 6-8, each of the two last ones being sometimes (though not commonly) divided into two.

When alive, the colour is grass green with a yellowish tinge especially on the forepart of the body and a slight bluish tinge along the whole of the under side, except the chin which is white. Theobald, (Journ. Lin. Soc. Zool. vol. X,) says that the colour is "bronze brown" which I never observed, in the live snake at least; it may be local and refer to very old specimens, or such in spirit. It is a true brackish water species; I found it abundant on the bushes near the mouth of the Moulmein river subject to the influence of the tide. It is as readily seen diving and swimming in the water, as climbing up a high bush or tree, and hiding itself in the green foliage. It always takes refuge in the water when attacked.

My largest specimen is 35 inches long, and has 202 ventrals and 142 subcaudals; these numbers are slightly in excess of those recorded by Günther.

Fam. DIPSASIDÆ.

57. *Dipsas hexagonotus*, Blyth, Pl. XI, Fig. 4.

Idem, Blyth, Journ. Asiat. Soc. Bengal, XXIV, p. 360; Günther, l. cit. p. 311.

Body slender, laterally very much compressed, tail roundish; scales smooth, in from 17-21 series (according to age,) those of the vertebral series hexagonal and conspicuously enlarged, ventrals 250-270, anal bifid, subcaudals 120-140. Head very large as compared with the slender body, moderately convex above; rostral broader than high, scarcely reaching to the top of the head; anterior frontals half the size of the posterior, obtusely rounded in front, vertical moderate, pentagonal, with concave sides, broader posteriorly than anteriorly, the hinder sides forming a rectangle; supraciliaries large, as long as the vertical and each as broad as the latter near its posterior end; occipitals large irregularly pentagonal, the lateral front angle of each just touching the upper postocular. Nostril rather large between two nasals, loreal squarish, narrower above and somewhat higher than long; one large preocular, reaching to the top of the head, but not extending to the vertical; eye very large and prominent; two subequal postoculars, the lower a little smaller than the upper. Upper labials 8, low, third, fourth and fifth enter the orbit; temporals small usually 3 + 3 + 3 or 4, sometimes 2 + 3 + 4, occasionally with small portions detached from various shields; very often there are two pairs of moderately enlarged shields behind the occipitals. Lower labials 10-11, the first pair forms a suture, the 7th-9th are the largest; two pairs of enlarged chin shields, the first is the larger and forms a suture, the shields of the second pair are diverging and usually separated by a few smaller shields.

General colour a beautiful coral red, above and below, head with a greenish smaragdine tinge above, a small black spot on each of the occipitals appears constant, some have a similar black dot on the vertical, or a short median streak on the anterior half of it; again others have a short lateral streak on each of the occipitals; on the upper labials and below white; body above marked with very numerous transverse blackish slightly undulating bands, separated by equally broad interspaces and laterally extending down to the ventral shields.

I have lately obtained a beautiful small specimen of this species through Mr. Homfray from Port Blair, Andaman islands, and I think there can be little doubt of its being distinct from *D. bubalina*, Klein. The size of the head with its short broad snout, and the form of the vertical readily distinguish it from this last. My specimen is only 11¾ inches, of which the tail is 2½; the scales are perfectly smooth, on neck in 17, near the middle of the body in 19 series, the coloration perfectly agrees with that recorded by Blyth.

In the Asiatic Society's collection, there are four specimens, all rather bleached, the red colour having changed into a dull reddish grey; they are all from the Andamans (see Mouat's Adventures and Researches among the Andaman Islanders, 1863, p. 366). The largest specimen measures 18 inches of which the tail is 3¾, scales smooth in 21 rows, ventral 267, subcaudals 126; in another specimen, 17 inches long, there are very minute apical grooves perceptible on the middle rows of scales; it is possible that in the more adult snake, the apical grooves are better developed, though the species does not seem to grow to a very large size.

With regard to Blyth's *D. nigromarginata*, Theobald already observes (Cat. Rept. Mus. Asiat. Soc., 1868, p. 61) that its identity with *D. bubalina* is doubtful, and such certainly appears to be the case. The Khasi type specimen seems to be more slender, with a more distinct elongated head, and with markedly elongated pointed scales without apical grooves. Typical specimens of *bubalina* must be examined in order to decide the question, for in every other respect both species, no doubt, are very closely allied.

58. *Dipsas multifasciata*, Blyth, Pl. XI, fig. 6.
(Günth., l. cit. p. 313).

A very fine specimen of this species has been obtained by my collector in the hills about Simla; it measures 39½ inches of which the tail is 7½; scales smooth in 21 rows, those of the vertebral series conspicuously larger than others, most of which possess a very minute subapical groove; ventrals 248, anal large, semilunar entire, subcaudals 106. The shields of the head are regular and quite similarly distributed as those of *D. trigonata;* but the head itself appears to be a little longer than in that species. In the figured specimen the nasals are markedly long, and the loreal touches on both sides the orbit with its posterior lower angle, reducing the anterior anteocular to a considerably small size; this is, however, evidently not the rule, for in B l y t h ' s original specimen, the loreal is of a normal shape, though the posterior lower angle is greatly prolonged; on the right side it does not reach the orbit, on the left it does, however, touch it; on the right side there is only one temporal, on the left two narrow ones, touching the two postoculars.

General colour light brown above, with a dorsal series of black irregular spots, single on the neck, double and obliquely placed on the body; the sides are marked with short black bands which in position alternate with the dorsal spots, and in addition to these there are small black dots at the base of the ventrals, each again corresponding to one dorsal spot. In B l y t h ' s original specimen which is a young one, the interspaces between the dorsal black spots are yellowish white, which colour seems to disappear with age. Head marbled with black above, with two not very clearly defined subparallel blackish bands on the occipitals, one single median on the neck, and one extending from the eye towards and across the angle of the mouth; the sutures between the upper labials and parts of the lower labials are black. Lower parts greenish white, all ventrals minutely freckled with black, and each with one irregular larger black spot on either side.

The coloration of this species appears sufficiently characteristic to distinguish it from *D. trigonata*, in which the lateral bands are confluent with the dorsal, or in fact the latter only extend partially to the sides; but I cannot see what difference there exists between *multifasciata* and *D. Ceylonensis*, G ü n t h., (l. cit. p. 314); the coloration of both seems almost identical, only in the latter species the head is apparently shorter, and the preocular larger, almost reaching to the vertical.

Fam. LYCODONTIDÆ.

59. *Lycodon striatus* S h a w. (G ü n t h., l. cit. p. 318).

One specimen, obtained by my collector in the lower hills about Simla, measures 15½ inches, of which the tail is 3⅛; ventrals 182, subcaudals 57; anterior frontals narrowly truncated in front and becoming gradually wider posteriorly; vertical as long as broad anteriorly, occipitals about one-fourth longer; other shields normal. Colour above blackish brown, with an indistinct collar, and 58 broadish yellowish white cross bands, irregularly divided and connected with each other on the sides; the scales of the tail are broadly hexagonal, there are five undulating whitish longitudinal bands on it, the middle one is made up of some larger spots. Chin, especially in front, and the subcaudals mottled greyish, the rest, below, yellowish white; each ventral and subcaudal with a distinct black spot at its base.

This is, I believe, the first recorded specimen of this species from the North West Himalayas, and others will no doubt also be found; it appears to be common in South India, and was supposed to be peculiar to the Peninsula. In Russel's figure, the transverse dorsal bands are somewhat wider and less numerous than they are in the Himalayan specimen, but there is no other difference between the two.

60. *Lycodon aulicus*, Linn. (Günth., l. cit. p. 316).

Xenopeltis unicolor, Rein., Theob., ex parte, specimen *d*, quoted from the Andamans, Cat. Rept. Asiat. Soc. Museum, p. 64.

Tytleria hypsirhinoides, Theobald, (type) ibidem, p. 66.

" " " Journ. Linn. Soc., Zool. vol. X, extract, Cat. Burmese Reptiles, p. 49.

In his Catalogue of Reptiles in the Asiatic Society's Museum, which was written in 1865, but unfortunately not published till 1868, Mr. Theobald placed one full grown unicolored Andaman specimen under *Xenopeltis unicolor*,* and another still larger unicoloured specimen, also from the Andamans, he called *Tytleria hypsirhinoides*; this last is apparently the same which Blyth in Journal Asiatic Society, Bengal, 1860, vol., XXIX, p. 110 quotes as "*Lycodon aulicus*, (L.) Uniformly coloured variety."

I have examined both the specimens, and there can be no doubt as to their identity with *Lycodon aulicus*. The peculiar depressed head with a broad flat snout is alluded to by Mr. Theobald

* This evidently is an accidental mistake; the snake resembles in its uniform colour to X. *unicolor*, and Mr. Theobald, when noting it, evidently omitted to take it out of the bottle.

in his reference to the similarity of this snake with *Hypsirhina*, though I don't think that there really exists such a particularly great similarity between both. Among the 50 or 60 specimens of *Lycodon aulicus* which I saw, and of which I received numerous specimens from the Andamans and Nicobars, I found a good deal of variation (though no essential ones) among the shields of the head. In some specimens only the third and fourth upper labials enter the orbit, in others the fourth and fifth, but as a rule all three enter the orbit. I never found more than one elongated loreal and one anteocular, but there are either two or three postoculars, and the differences often occur in one and the same specimen on the two sides of the head. The temporal shields are usually quite similar to the other scales, generally there are two in contact with the postoculars, and the upper one is somewhat more elongated than the lower. Sometimes the upper is confluent with the occipitals, as likewise one or two shields following it; in other specimens again, the lower first temporal seems to have become obsolete or confluent with the adjoining labials; in both these cases, there is only one temporal in contact with the postoculars, and these differences are again often to be observed on the two sides of the head of one and the same specimen. There are almost invariably nine upper and ten lower labials; the first pair of the latter forms a suture, followed by two pairs of elongated chin shields, and the sixth lower labials are always the largest; the anterior frontals are always smaller than the posterior &c., &c.

Comparing Mr. Theobald's description of *Tytleria hypsirhinoides*, there is actually no difference in the structure of the snake from *L. aulicus*, as Mr. Theobald himself, I believe, now admits. In the specimen referred to *X. unicolor*, there is only one temporal in contact with the postoculars. In both, the dentition is typical, each has an enlarged front fang, followed by small teeth in the maxillary.

Young specimens usually are variously mottled with yellowish and brown. Some of the Andaman specimens only possess numerous small brown specks, the prevalent colour being yellowish white, others are chiefly brown with large yellowish transverse bands or blotches.

Full, or nearly full, grown specimens become uniform brown above, whitish below. The upper brown colour is distinctly defined from the lower white one at the lateral angle of the ventrals. In one of my Nicobar specimens this angle is pure white, and more than the basal half of each ventral is ashy brown, the subcaudals are nearly all white. This same specimen has the whole length of the body a median dorsal pale yellowish brown band, and one or two hardly conspicuous darker bands on either side. However, it must be remarked that this uniform colouring is not always a sign of maturity; it seems to be rather local, for there are often large specimens seen with various spots and blotches of brown and yellow.

Steindachner (Novara Rept. p. 74) quotes *L. aulicus* from Java and from Amoy, which again indicates the relation of the Nicobar to the Javaen Reptile fauna, and of both through the Andamans to Arracan and Burma. Fitzinger appears to have favoured the species also with a new name, *L. capucinus*.

61. *Tetragonosoma effrene*, Cantor, (*variat.*) Pl. XI, Fig. 3, (Günth., l. cit. p. 320).

I have obtained a fine specimen of what appears to be an adult of this species from Banca, but as it shews some marked differences from the type, I have given a view of the head and append a description, in order to facilitate comparison.

Body slender, head depressed, distinct from neck, long, with a broad rounded snout. Scales smooth in 17 rows, those of the back larger than at the sides, hexagonal or pentagonal; total length 31½ inches, of which the tail is 6½″, being very slender; ventrals 223, anal bifid; subcaudals 84.

Rostral shield low, much broader than high, deeply indented at the base, anterior frontals irregularly squarish, about one-third the size of the posterior; vertical subtrigonal, with convergent sides which are, however, somewhat irregular and incline to form an angle near the posterior end; supraorbitals of moderate size, shorter than vertical; occipitals much longer than broad, obtusely and narrowly truncate behind; upper labials 9, the first is the smallest, the second the largest, the third, fourth and fifth enter the orbit; the greater part of the second and the upper anterior edge of the third are in contact with the posterior frontal; anteocular one, postoculars three on the right, two on the left side, the lowest being united to the fifth labial; temporals 2 + pl.; pupil large, vertical; mental groove distinct; 9 lower labials, each nearly corresponding to each upper, the first pair forms a long suture; three pairs of chin shields, the first is divergent above, the last behind.

Colour deep blackish brown above with some very minute white specks at the sides of the head and on the body; uniform ruddy or dark brown below. The fifth and sixth teeth in the upper jaw are much enlarged; after a short gape they are followed by 12 smaller teeth, the next ones behind the fangs are the smallest and they gradually but slightly increase toward the posterior end; very numerous small teeth on the palate; the third tooth on each side in the lower jaw is the largest.

Comparing the form of the head of our specimen with Günther's figure of the type, the vertical is seen to be longer in the former and of a subtriangular shape, but there appears to be an inclination to pentagonal form; in the other shields there is no essential difference. The snout of our specimen is decidedly much broader, but I attribute this simply to the development of the front fangs of the jaws, for similar, or even greater, variations can be observed in the different stages of age in all the LYCODONTIDÆ; the preocular is placed a little higher in our specimen than in the type.

Dr. Günther says that in the young type specimen there are eleven distant buff coloured rings round the body and tail, but that the posterior become obsolete with age, only the three or four anterior remaining visible. This last observation evidently refers to the only other known specimen of the species, *Lyc. ophiteoides* of Bleeker, (from Borneo), which Dr. Günther considers identical with the former. My specimen is 4½ inches longer than Bleeker's type, and it may, therefore, not unreasonably be supposed that even the anterior rings became obsolete with advanced age; and that such is actually the case, I have but very little doubt. I only need to recall what I have said of the changes of coloration in old specimens of *Lycodon aulicus*, the adult of which is thoroughly unlike the young one! The change from variegated to uniform colouring in most of the LYCODONTIDÆ, as far as we know them when adult, is a remarkable fact which commends itself to further investigation by Herpetologists. I would have scarcely hesitated to describe the above noted specimen under a new specific name, had I not seen those most remarkable changes in coloration of *Lycodon aulicus*, for they appear simply to repeat themselves in *Tetragonosoma*.

Fam. PYTHONIDÆ.

62. *Python molurus*, Linn. (Günth., l. cit. p. 331).

In a young (1½ foot long) specimen from the Wellesley Province, there are on the left side 1 supra, 4 post-, 2 infra-, and 2 ante-oculars; on the right side only 1 infra-ocular; similar abnormities being very common in other snakes also. On each side there are 11 upper labials, the sixth's placed below the orbit, but none enters it, the two first are provided with long pits; 19 lower labials on each side, narrow and long, of the first eight each has above an irregular blackish spot, the second, third, fourth and fifth are slightly impressed but not deeply pitted; the 12th and 13th low labials each also has a black spot, and the large blackish blotch begins on one side on the 14th, on the other on 15th labial. The number of scales round the body was in several male specimens nearly normal, 65, as stated by Günther, but of six specimens which I have examined, scarcely in two were the number of shields and scales on the head perfectly similar and equally numerous. This species is certainly less frequent in the Malayan peninsula than the next, but I have seen several specimens obtained in the Wellesley province.

63. *Python reticulatus*, Schneid. (Günth., l. cit. p. 330).

Blyth (Journal, Asiatic Society B., XV, 1846, p. 377) was correct in supposing that it is this species which occurs on the Nicobars. I have lately obtained from Camorta one specimen measuring 110 inches, of which the tail is 14 inches; scales round the body in 72 series, ventrals 323, some of the before last bifid, last entire semilunar; subcaudals 98. Behind the posterior frontals there is one pair of largish shields, followed by two other pairs, in one line, the inner smaller than the outer, then comes the vertical;

three loreals, two smaller superseding a long lower one; three anteoculars, one large superseding two small ones, a single labial below the orbit. The five first upper labials are deeply pitted on either side, and of the lower labials the 9th—13th are pitted. Coloration typical, as in Malayan specimens.

Fam. HOMALOPSIDÆ.

64. *Hypsirhina plumbea*, Boie, (Günther, l. cit. p. 280).

A specimen from the Irravadi river near Mandaley measures 17 inches, the head being $\frac{8}{10}$ inch., and the tail $2\frac{1}{4}$ inches; ventrals 122 of which the last two are bifid, subcaudals 33; the anterior frontal is fully two-thirds the width of both the posterior, occipitals obtusely pointed behind; each anterior chin-shield fully one-third longer than one posterior. Colour above and on the front of the chin slightly extending backward, leaden grey, below albescent yellowish with a median brownish line on the lower part of the body extending to the subcaudals, where it is as usually most distinct. Other specimens from Moulmein don't differ from Günther's and Theobald's account of the snake.

65. *Cerberus rhynchops*, Schneid. (Günth., l. cit. p. 279).

This is a very common species about Amherst, occurring in brackish and in pure sea water together with *Hipistes hydrinus;* but unlike this last, it goes far inland, and haunts with equal ferocity after fish &c., in fresh water pools, &c. One half grown specimen from Amherst, measured 27 inches, the tail being 4·6 inches, it has has only 144 ventrals, but 64 subcaudals. Scales always in 25 rows. The largest specimens measures 50 inches. All specimens are above greenish grey, when young with numerous blackish cross bands above, and, below, sometimes almost wholly black with only a few whitish or pale blotches; with age the upper cross bands become less distinct, being partially broken up into spots, until they disappear; a black strip begins on either side at the snout, passes through the eye, touches the angle of the mouth and disappears on the posterior part of the neck; upper labials and sides of head pale.

The number of upper labials sometimes rises as high as 12; the last five being small and corresponding to only three superimposed shields which represent the true labials; all the upper as well as the lower labials, and all the shields of the head are finely granular. In a specimen from the Nancowry haven (Nicobars) there are ten upper labials, the last two corresponding to only one upper portion. This specimen is uniform dark greenish above, on the last three series of scales on either side conspicuously yellowish; ventrals, to a great extent, and the subcaudals wholly black; the black eye streak is hardly perceptible; total length 26 inches, of which the tail is 4¾ inches, ventrals 152, subcaudals 53.

A specimen from the Andamans measures 32¾ inches, of which the tail is 6½, being remarkably long; the dark cross bands above are rather distinct, and the whole of the lower parts is mostly black; there are 11 upper labials, the last four corresponding to only two upper portions; ventrals 149, subcaudals 63. Another specimen is quite similar, but has a row of large blackish spots on each side of the body, and a narrow central black line along the ventrals.

66. *Hipistes hydrinus*, Cant. (Günth., l. cit. p. 287).

This is a very common species at the mouth of the Moulmein river, especially near Amherst; it lives almost entirely upon fish, and may be said to be rather a brackish than a salt water inhabitant. The largest specimen, I obtained, measured 22½ inches, of which the tail is only 1½; ventrals 165, subcaudals 27. I have seen about 50 live specimens and all had the tail remarkably short, the number of subcaudals varying from 22-35, the terminal scale being always very strong and conically produced; the number of rows of scales varied from 38 to 42. The supraorbital is occasionally divided in two; there are two pairs of chin shields, one behind the other in one row, the two first are large, in contact with 4—5 broad labials, each second is only one-third of the length of one first; sometimes a third pair of chin shields is indicated.

Young specimens often have a marked yellowish green tinge; older ones are above dull greenish grey with 38—45 broad bluish black transverse bands, generally a little narrower than the interspaces; the lower parts are pale yellowish and the median portion of the ventrals mostly tinged or finely checkered with dark grey. The snake is considered by the natives to be poisonous, though of course without any reason. When placed on the ground it moves without difficulty and, as Dr. Cantor says, does "not offer to bite," but when excited it is very fierce, attacking everything that comes near. Having been assured by the natives of the dangerous bite of this snake, I took, on leaving Amherst, two live specimens in my boat, for the purpose of making some experiments during a prolonged row up the river, in order to see whether the bite would have any effect upon fish or fowl, but my men got so alarmed that I had to kill the snakes. There is, however, no doubt that the species is harmless.

Cantoria, Girard, (Günther, l. cit. p. 277).

E. D. Cope (Proc. Acad. N. S. Phil., 1866, p. 312,) first observed that *Hydrodipsas*, Peters, is identical with *Cantoria*, an opinion which is also endorsed by Reinhardt, and a comparison of Peters' figure in Monathsb. Berlin Akad., 1859, p. 270, fig. 1, leaves no doubt about it; the Bornean species *Hydrodipsas elapiformis*, Peters, also appears to be the same as *Cant. elongata*, in which case, however, the former specific name will have the priority.

67. **Cantoria Dayana,** n. sp., Pl. XI, Fig. 5.

Body long, slender, subcylindrical, head not distinct from neck, obtusely rounded in front. Scales smooth, elongately hexagonal, in 19 series, ventrals 268, anal bifid, subcaudals 56, in two rows. Rostral pentagonal, broad, deeply indented below, very narrow above, with concave sides; anterior frontal almost linear, in contact with the rostral, little widening posteriorly, separating the two large elongately quadrangular nasals, and scarcely longer than these; posterior frontals two, each irregularly hexagonal, forming a short suture, and being in contact with the anterior frontal, the nasal, loreal, pre- and supra-oculars; vertical large six sided, with an obtuse angle in front, with very slightly converging sides, posteriorly forming almost a rectangle; occipital considerably longer than vertical, obtuse and slightly diverging posteriorly; supraciliaries moderate. Five high upper labials, the suture of the third and fourth is below the eye, but none enters the orbit; loreal squarish a little longer than high; one narrow but high pre-ocular, reaching to the top of the head, and in contact with the posterior frontals; two post-oculars, the lower one forming the edge of the orbit and joining the pre-ocular; temporal $1 + \frac{1}{pl}$, there being one conspicuously large, second temporal behind the first in contact with the occipitals. Eight lower labials, the two first form a short suture and are followed by two pairs of subequal chin-shields.

Colour above dull yellow with numerous broad bluish black bands, separated on the back by narrower interspaces, becoming rapidly wider at the sides, and the black bands are obsolete before they reach the ventrals; on the posterior part of the body some of the bands are confluent, and on the tail they even partially form rings; head with a yellow band across the posterior frontals, dark on the top (including the eyes), with a few yellow spots on the occipitals and vertical; below uniform pale yellow with a dusky greenish tinge along the middle of the ventrals.

There are four teeth in each maxillary, the last is the largest and indistinctly grooved; on one side one small additional tooth is between the first and second, and another one between this and the third.

A single specimen was obtained by me near Amherst at the mouth of the Moulmein river in brackish water; it measures 30½ inches of which the tail is 3½. In coloration and general habit it strongly resembles *Hipistes hydrinus*, in company of which it was procured, but it appears to be very rare. Captain G. E. Fryer sent about ten fishermen for me to work; they brought in one morning at least 60 specimens of *Hipistes hydrinus* and a great many *Cerberus*, but only a single specimen of this new species. I have great pleasure in naming it after my friend, Surgeon F. Day, whose pleasant company made my short stay in the neighbourhood of Moulmein quite as instructive, as it was a source of recreation and of pleasure.

Fam. ELAPIDÆ.

68. *Bangurus cæruleus*, Schneid. (Günth. l. cit. p. 343).

A specimen obtained by Dr. Day at Bassein (Brit. Burma) measures 41 inches of which the tail is 5½ inches; ventrals 224, subcaudals 52; back crossed with 52 transverse oblique bands, indistinct on the neck, narrow along the vertebral series, but broad at the sides, some of them extending at their base over the length of 3-4 scales, others being bifid, and consequently narrow; some of the ventrals with lateral dark spots on the posterior two-thirds of the body, along the central line checkered with dark, and each of the subcaudals has a blackish spot near the centre.

This species appears to be very rare in Burma; Mr. Theobald (Cat. Rept. Brit. Burma, extract p. 62, Journ. Linn. Soc. Zool. vol. X) observes that he never obtained it himself, neither in Pegu, nor in Tenasserim.

69. *Ophiophagus elaps*, Schleg., Pl. xi, fig. 7; (Günth., l. cit. p. 341).

The variety described by Mr. Theobald from Burma (Journal Linn. Soc., Zool. vol. X, extract, p. 60) also occurs on the Andamans, but does not appear to be common. Mr. Röepstorff obtained near Port Blair a specimen of nearly six feet in length, it is uniform olive brown above on the anterior one fourth of the body, then a number of distant transverse yellowish bands with black edges begin to appear, and continue up to the tail, where each scale has a yellowish centre with black edges, and besides that there are numerous narrow black bands on it. Below, the front part is uniform yellowish white, in the middle only a few ventrals are black edged, on the posterior part all the ventrals and subcaudals are half yellowish half black. The three first subcaudals, two about the middle, and one a little further on are entire, all others bifid. The poisonous gland is rather elongated and situated immediately behind the posterior angle of the eye, extending to the tympanoid region.

Considering the general characters of this species, its form, coloration of the adult, number of rows of scales and the shields of the head, there would hardly seem sufficient reason for separating it as a genus distinct from *Naja*, the only difference from the latter being, the presence of two large shields behind the occipitals, and if these were not present, it would be often almost impossible to distinguish *N. tripudians* from *O. elaps*, for in many varieties of both the colouring is found to be quite the same, and in some of *tripudians* the temporals are in position, size and number perfectly identical with those of *elaps.* This last, when disturbed, raises the front part of the body exactly like a Cobra, but does not distend the neck to any considerable extent, though it has it distinctly flattened, as is also the case in some varieties of *tripudians.*

The young of *O. elaps* is so thoroughly different in coloration from the full grown snake, that few would hesitate in considering it a new species. Dr. D a y obtained N. E. of Moulmein a specimen (see fig. 7, pl. xi) measuring 20½ inches, of which the tail is 3½ inches, ventrals 262, anal very large, subcaudals 87, the first 5 entire, the others bifid. The head is broader and flatter, as compared with that of adult specimens, the snout is remarkably short, blunt, the occipitals longer than in any old specimens I have seen; other shields and scales normal. The coloration is pure jet black, the snout, a band in front of the eyes, a third posterior to them, broken up into large spots, a forth across the posterior end of the occipitals broken up into six spots, 32 narrow equidistant rings on the body directed forward along the dorsal line, and 11 rings on the tail as well as its extreme tip are yellowish white; chin and throat uniform yellowish; the rings of the body become much wider on the belly, leaving only black bands of 2-4 shields width between them; on the posterior part the black prevails, the white bands become interrupted, but on the tail the rings are again complete. Dr. G ü n t h e r notices the coloration of a young *O. elaps*, but as it is not usually known, I have given a figure of the specimen alluded to. In the old snake the white bands gradually become less distinct and sometimes nearly quite disappear, the black colour being also replaced by uniform brown. The general character of coloration of the young *elaps* most markedly recalls that of *Xenurelaps banguroides*, of which we as yet only know young specimens.

70. *Naja tripudians*, M e r r. (G ü n t h., l. cit. p. 338).

A young specimen, (14 inches of which the tail is 2½ inches) from the neighbourhood of Kotegurh (elevation between 5 and 7000 feet), is uniform olive grey above, whitish below, with three blackish cross bands on the neck, on the upper side of which only a few blackish marks are indicated; scales in 23 rows, posterior frontals markedly smaller than the anterior, which form only a very narrow suture, eighth upper labials, the second and third small, situated below the posterior nasal shield, the fourth and fifth enter the orbit, the eight labial is the longest of all, but only as high as the second and third; the first lower labials form a long suture; the preanal is entire but deeply grooved in the middle, the groove beginning at the previous shield; the second and third subcaudals are entire.

I have often observed uniformly olive coloured full grown specimens on the hills between Simla and Missúri and the plains, but whether they offer similar variations in the head shields, as the young form I have just noted, I am unfortunately not in a position to ascertain just at present.

This wide spread species also occurs on the Andaman islands, but does not seem to be common. One specimen, 22 inches long, lately sent to me by Mr. Homfray is, above, markedly blackish brown with very numerous, narrow, transverse, slightly angular pale bands, the angles being directed forward; a single large pale spot with a blackish centre on the middle of the neck; below, the chin and anterior part of the throat are yellowish, followed by two indistinct, broad, dark cross bands; the rest of the lower part is greenish ashy, the subcaudal scales are divided by a zigzag blackish line. A full grown snake from the Andamans does not exhibit any difference from the continental form. The species is as yet unknown at the Nicobars.

71. *Callophis intestinalis*, Laur. (Günther. l. cit. p. 348).

I received a specimen of this interesting species from Upper Burma. It is brown with the pale dorsal streak one scale broad; the black borders on either side are not very conspicuous; the lateral stripe is pure white, slightly narrower than the dorsal, and is situated between the last and before last series of scales. Ventrals 267.

The poison glands are of exactly the same shape as described in this species by Mr. Mayer in a paper lately (1869) published in the Monathsberichte of the Berlin Akademy. They are somewhat more than one-third of the length of the body, running along the ventral side and accompanying laterally the alimentary and respiratory canal &c. Their anterior half is extremely thin, after which they gradually thicken, terminating in front of the heart with club-shaped ends, being here partially surrounded by the parenchyma of the internal organs. There is a perceptible thickening of the muscles to be observed here, and when seen externally the body is slightly thicker where the poison glands terminate. This most remarkable physiological phenomenon, consisting in the prolongation of the poison glands has, to all appearance, its reason in the slenderness of the snake, its head being so small, that there does not seem to be sufficient room for the development of the poison gland and of the muscles required to produce upon it the pressure necessary for the ejection of the poison.

I was told that this little snake is more dreaded by the natives of Burma and of Java on account of its bite, than the comparatively gigantic *Ophiophagus elaps*, Schleg.

Fam. Hydrophidæ.

72. *Enhydrina Valakadyen*, Boie, sp., 1827.

Syn. *Enhydrina Bengalensis*, Gray, (Günther, l. cit. p. 381).

73. *Enhydrina schistosa*, Daud. (Günther, l. cit.).

Russell (Ind. Serpents part II, pls. x and xi) very properly pointed out the distinction of his *Valakadyen* and *Hoogli pattee*, according to native accounts. There can be little doubt that he had two distinct species before him, but the latter does not appear to be nearly as common as the former, at least I can find in the Asiatic Society's collections no specimen of it among many of *Valakadyen ;* neither does a specimen of it appear to exist in the British Museum collection.

I have lately obtained from Dr. Day two specimens of *E. Valakadyen* from Orissa, and one specimen from Gopalpore, the latter being to all appearance identical with *Hoogli pattee* of Russell, or *Enh. sehistosa*, Daud.

The principal characters of *E. Valakadyen* are a subcylindrical body, covered with hexagonal or suboval scales, carinated in the centre, the scales being, as Russell remarks, rather contiguous than imbricated. The head is stout, rather wide at the base, with a moderate gape of the mouth, the shields of the upper head are in all specimens, I saw, more or less granular; the scales are on the neck (about 2 inches behind the head) in from 38-44 series, they are ovately elongated, and very slightly imbricated; further on the scales are distinctly hexagonal and round the middle of the body in 48-50 longitudinal series. The tail is broad, its length being little more than one-seventh of the body; one specimen measures 33½ inches, of which the tail is 4½.

The Gopalpore specimen represents an altogether more slender form, and the tail measures a little more than one-tenth of that of the body, being proportionately rather narrow or less high than that of *Valakadyen.* As compared with this last named species, *E. schistosa* has the head more ovately prolonged, and the gape wider, consequently all the shields of the head are also a little more elongated, and all are perfectly smooth; the postocular is in this particular specimen united to the fourth upper labial; the scales on the neck are from 58-60 longitudinal series, they are very much elongated, pointed and imbricated. The body is more compressed than in *Valakadyen*, the scales on it are along the back much elongated, imbricated, and carinated, on the sides more oval or hexagonal and less distinctly keeled; round the middle they vary in from 66-70 longitudinal series.

In coloration, both species appear to be very much alike, and this was probably the principal reason, that they had been considered as one and the same species, though Gray, I think, very correctly remarks (Viperine snakes, p. 49) when speaking of *Enh. Valakadyen* (which is Boie's *Hydrus Valakadyen,** and the same as *E. Bengalensis*), "Schlegel states that *Hoogli pattee*, Russell, ... is a half grown specimen of this species; but this is inconsistent with Russell's description and figure of the head shields."

74. *Pelamis platurus*, Linn.

P. bicolor, Schneid., (Günth. l. cit. p. 382).

A large specimen from the Orissa coast has each scale impressed in the middle. A small specimen caught by Captain G. E. Fryer

* Or *Valakadyn*, which is evidently only an incorrect copy of Russell's name.

to the south of Ceylon is uniformly black above, yellow at the sides and below, with remarkably elongated long blackish brown spots at the sides; tail reticulated with yellow and black; the scales are almost smooth.

The species was taken also near the Andamans and the Nicobars; it seems to be common all through the eastern seas.

Fam. CROTALIDÆ.

Trimeresurus, L a c e p.

The difficulty in discriminating various species of this genus is well known. There is hardly a single character which could be confidently relied upon as constant, but the average number of rows of the scales and their form, as well as the shape of the head appear to be more useful in the determination of species than any other character, this of course applying to specimens of about equal size. The number of small shields behind the rostral is very variable, and the second upper labial is sometimes divided in two parts on one side, while it remains single on the other in one and the same specimen! The size of the supraciliaries is, however, tolerably constant.

The effect of the bite of a *Trimeresurus* does not as a rule appear to be nearly so fatal, as is for instance that of *Daboia Russellii*. This is often due to the difficulty accompanying the ready use of the long and rather strongly bent fangs, but mainly, I think, to the smaller size of the poison gland. The last is situated in *Trimeresurus* along the lower posterior edge of the maxillary, covered above by the masseter and post-temporal muscles, and laterally only by the skin; its form is simple, not provided with any appendages, as in the Cobra. The small size of this gland in some species, as for instance in *T. Cantoris* from the Nicobars, is very remarkable, for in some specimens between 3 and 4 feet in length it is not much longer than half an inch, and about a quarter of an inch high, with a canal in front, of about half an inch, leading to the fang. Dr. R i n k says that, during his stay at the Nicobars, he was informed of the existence of great many vipers in the jungles, but he never heard of a fatal case resulting from their bite. Occasionally, he says, a native was seen with a swollen foot, but it always soon passed away. I made inquiries on this point when visiting the Nicobars, and was told the same account. Subsequently, my collector heard the same from the natives who procured for him nearly all the *Trimeresuri* which he brought back. I believe that the species chiefly live here on insects. It really seems that the size of the poison gland, and consequently the quantity of secreted poison, varies according to the necessity which arises for its use. In some specimens of *Cantoris* the gland is, for instance, considerably smaller than in specimens of half the size of the allied *viridis* at Moulmein, or *carinatus* from the Himalayas.

I have lately examined about 70 or 80 specimens of *Trimeresurus*, belonging to several species; all these snakes are eminently arboreal and generally found on high grass or on bushes.

Theobald, in his Cat. of Rept. Asiatic Society's Museum, pp. 75-76, described two apparently Indian species as *T. Andersoni* and *obscurus*. The latter has entirely the type of the coloration of the former, and is no doubt specifically identical with it. Both have 25 rows of strongly keeled scales, the former specimen has 182 ventrals and 56 subcaudals; the latter also 182 ventrals and 71 subcaudals, the third and fourth shields being entire.

75. *T. gramineus*, Shaw, (Günth. l. cit. p. 388).

Body grass green; head moderately elongated and high; form 19-21 rows of large elongated strongly carinated, pointed scales. The species appears common in the Khasi hills and in Assam. I have never observed it in the interior of the N. W. Hymalayas, though I often procured *T. carinatus*, but Dr. Günther mentions it even from "Ladak." It would be interesting to know which part of the country is alluded to, for Ladak proper has scarcely any arboreal vegetation, except a few poplars and willows in the Indus valley. I passed three times through Ladak (I mean the upper Indus valley about Lei and the elevated country on both sides of it), but I never saw yet a single snake, and the existence of a *Trimeresurus* is of all the most improbable in a country situated above 10,000 feet, and subject to the most rigidly cold climate, so that hardly any arboreal vegetation can thrive.

T. Cantoris of Blyth is, as Dr. Günther rightly supposes, quite a distinct species, and will be noticed further on.

76. *Trimeresurus erythrurus*, Cantor, (Günther, l. cit. p. 386).

The head in this species is elongately oval, more depressed than in either *T. gramineus* and *T. carinatus;* the usual number of rows of scales is 23 in adult specimens, 21 in young ones; the scales are elongated, pointed and strongly carinated. There are mostly 11-12 upper labials, and usually only one row of scales between the labials and the infraoculars. The supranasals form a broad suture behind the rostral, but sometimes a small azygous shield is present. All the specimens, I have seen, had the lips and chin white, the lateral line was also always distinctly white, bordered with greenish or purple below; general color uniform green above, tail ruddy.

I found this species common on the limestone hills near Moulmein; and also obtained specimens from Upper Burma, from Penang and the Wellesley province; it is always more slender than *T. carinatus.* One specimen from Moulmein measures 25 inches of which the tail is 5, 23 rows of scales, ventrals 157, subcaudals 63; another young specimen is 10½, of which the tail is 2½, scales in 21 rows only, ventrals 167, subcaudals 63, the second, fifth and sixth are entire, the other bifid.

A specimen from Java measures 21½ inches, it has 170 ventrals and 75 subcaudals, the colour of this and of other Penang and Javanese specimens always appears to be darker green with a bluish tinge, while Moulmein specimens are bright green, but there is no difference in structure between both.

77. *Trimeresurus carinatus*, Gray, (Günth., l. cit. p. 386).

This species has 23-25 rows of scales, exceptionally only 22 or 21. The scales are elongated, larger than in either of the two last named species, sharply carinated; the head is short and high, there being mostly two rows of shields between the infraoculars and the labials, the latter are generally ten in number; there are usually one or two azygous shields present, very rarely there is no azygous shield, but in such a case the supranasals just touch each other, not forming a broad suture, as in *erythrurus;* the supraciliaries are very large. The general color is usually green, sometimes there are large blackish spots at the sides; the lateral line is either well developed, white, margined with coral red below, or it is absent; tail pale ruddy above, usually equal to one-sixth of the total length.

One specimen from Moulmein measures 27¼ inches, of which the tail is 4½, scales in 23 rows, ventrals 155, subcaudals 51, one azygous shield. A young specimen from the hills, N. E. of Simla (about 6000 feet) is 11¾ inches, of which the tail is 2½, ventrals 163, subcaudals 74, the fifth and ninth being entire. An other adult specimen from the same locality has no azygous shield, it measures 35½ inches, of which the tail is 5½; ventrals 173, subcaudals 62; on the neck there are 22, round the middle of the body only 21 series of scales, the reverse being often the case in other specimens.

Three specimens, in the Asiatic Society's collection, from Bengal, each has 25 rows of scales, they are uniform green. It is very difficult to distinguish some specimens of this species from *gramineus*, especially when the number of rows of scales is as low as 21; such specimens could be referred to either of the species, the only criterion in favor of *carinatus* being the short and rather broad, stout head, and the large size of the supraciliaries.

I have not seen any typical specimens of *carinatus* from the Andamans, those which have been referred to it appear to be really distinct and belong to the next species.

78. *Trimeresurus porphyraceus*, Blyth, Pl. XII, Fig. 2.

Blyth, Journal Asiatic Society, Bengal, 1860, vol XXIX, p. 111.

Theobald, in Journal Linn. Society London, vol. X, Zool. (Extract, p. 64).

Body rather slender with a large elongately triangular head; scales usually in 25 series, narrow, elongated, sharply pointed and carinated; supranasals small with one large azygous shield between them; supraciliaries narrow, as in *gramineus*; upper labials 12-14, the posterior nine or ten markedly small, the second forms the front of the facial pit; scales on the head keeled, all of moderate subequal size, those on the front part flattened.

A half grown specimen measures 25¾ inches of which the tail is 3¾; the first labial is united with the nasal; ventrals 180; anal narrowly projecting, semilunar, entire; subcaudals 55.

General color above dull green with a fine porphyraceous lustre throughout, sides of the posterior one-third of the body and tail with some indistinct large porphyraceous spots, upper lip and below whitish with a greenish tinge; lateral line sometimes indicated, but usually not marked at all.

Mr. Blyth first pointed out the peculiar colouring of this species as distinct from that of *gramineus*, to which he afterwards referred it on account of the similar form in the shields of the head. In consequence of the greater number of rows of scales, and their similar form, the species has been considered by Günther as identical with *carinatus*; but, setting aside coloration, the scales of *porphyraceus* are much narrower and more slender, and the ventrals are conspicuously narrower and in a greater number present, the supraciliaries narrow, the labials more numerous and the head a little less high than in *carinatus*. The peculiar porphyraceous tint of the dull green colour is very marked, and well preserved specimens can be readily distinguished by it from either *gramineus* or *carinatus*. The species seems tolerably common on the Andamans about Port Blair. The specimens marked *b* and *c* of *T. carinatus* in Theobald's Cat. of Rept. Asiatic Soc., Museum, p. 74, belong to *porphyraceus*, and probably also those marked *f*, but they are not well preserved, one has only 23 rows of scales.

79. **Trimeresurus mutabilis**, n. sp. Pl. XII, Fig. 5.

Body slender; head elongated, rather depressed, with the snout moderately narrowed and rounded, equal to about one-twentieth of the total length; tail strongly prehensile and short, being one-sixth or one-seventh (or even less than that) of the total length.

Scales in 21 series, subquadrangular, slightly keeled, posteriorly obtusely pointed; ventrals from 156-167; anal entire; subcaudals 48-62; last scale large conical; head covered with small, subequal flattened smooth scales, one azygous shield between a pair of supranasals, supraciliaries narrow and long; sometimes divided in two parts; a single long infraocular extending posteriorly, leaving room only for two or three small postoculars; upper labials 9-10, the first is in all the specimens examined united to the nasal, the separation being only indicated by a groove; the second is narrow, usually single, and generally forms the front of the facial pit, but sometimes it is divided into two shields; in the figured specimen it is normal on the left, divided on the right side, the shield, forming the front of the facial pit, being separated from the labial; in another specimen it is normal on the right, and divided on the left side, the labial proper being again separated into two shields. These alterations in the form of the second upper labial are principally to be observed in the banded variety, which will be immediately referred to. The third labial is as usually the largest and the size of the following gradually decreases; there is mostly only one series of scales between the infra-ocular and the labials, sometimes one or two additional minute shields are interposed.

The coloration is subject to great variation. Some specimens which appear to be males are more slender than others, and with a proportionately longer tail; they are dark blackish brown on the head, olive brown above, on the body either uniform or with some of the scales lighter, and with numerous greenish white and dark margined cross-bands, these being either regular, or broken up in halves, these again partially alternating with each other; there is an indistinct narrow pale longitudinal streak on the neck, and an oblique streak runs from the eye down each temporal region; a very conspicuous white streak originates at the base of the rostral, ascends to the orbit, passing along the infra-ocular, and then again descends to the angle of the mouth, meeting the temporal streak on the neck and continuing along the bases of the ventrals as a series of white spots, having dark brown spots below them. The sides of the body are marked by two longitudinal greenish white bands, separated by a brown band which is sometimes broken up into streaks and spots. In some specimens, the dorsal cross bands become indistinct, and in others—which are rather stout, with short tails and some of which certainly are females,—the color is above uniform reddish brown, darker on the head, paler at the sides, and sprinkled all over with coral red. Sometimes a narrow yellowish and reddish band is conspicuous along the two outer series of scales on either side. The upper labials are more or less whitish ashy; a rather indistinct whitish streak margined with black above, and sometimes also below, runs from the eye towards the angle of the mouth. Below, the color is pale yellowish or greyish, densely and finely marbled and freckled with dark and red, especially on the throat and fore-part of the belly; the bases of the ventrals are usually conspicuously darker than their centres. The tail is above always coral red, or reddish brown, below darker, being marbled and spotted with dark brown.

This species recalls the variability of coloration noticed in *T. Wagleri*, Schleg., (Günth., loc. cit. p. 388), and I was at first much inclined to refer it to that species, but as the Nicobar form always has only 21 rows* of very slightly keeled and rather large scales, both must be kept distinct. Whether any of the numerous species, which Gray describes in his Catalogue of Viperine snakes, (p. 9-11) and which Günther considers as varieties of *T. Wagleri*, are identical with the Nicobar form, it is impossible to decide from Gray's descriptions. I have never noticed in *T. mutabilis* that the squarish dark bands or spots extend on to the sides, much less on the belly; they are strictly dorsal, and each separated from the next by a narrow pale greenish band which is connected with with the lateral longitudinal band of the same pale color. The unicolored variety strongly resembles *T. purpureus*, Gray, (Günth. l. cit. p. 387), but the more slender habit, prehensile tail, smoothish scales in 21 rows, readily distinguish both.

As compared with *T. porphyraceous*, the distinctions just noticed are equally valid; the number of ventrals is in the present species conspicuously smaller than in the former. With *T. gramineus*, the number of series of scales agrees, but their form and slight carination as well as the shape of the head, and other characters do not admit a specific identification. Steindachner (Reptiles of the Novara, p. 86) mentions three rather much injured specimens of *T. purpureus* from the Nicobars; he does not record the number of rows of scales, but as these specimens were previously referred by Fitzinger to *T. viridis*, Daud. (*gramineus*, Shaw), I suspect that they belong to the unicoloured variety of the present species.

I have examined one specimen from the Andamans, 19½ inches long, of which the tail is 2¾, ventrals 163, subcaudals 52, (3rd and 7th entire); color uniform above, paler and conspicuously reddish at the sides, with an indistinct darker longitudinal band in the middle;

* Cantor says that in his *puniceus* (= *purpureus*) he counted once as many as 31 rows of scales.

sides of head blackish, hinder upper labials pale ; below greenish sprinkled with reddish and dark brown. From Camorta, one of the Nicobar islands, I obtained about 12 specimens. The measurements of the four principal varieties are as follows :—

a. Total length $18\frac{3}{8}$ inch. ; tail $2\frac{3}{8}$ inch. ; ventrals 167 ; subcad. 50, belly conspicuously yellowish, nearly uniform greenish brown above.

b. tot. length 16 inch. ; tail $2\frac{1}{4}$ inch ; vent. 156; subc. 48; uniform.

c. „ „ $18\frac{1}{2}$ „ „ $2\frac{1}{2}$ „ „ 160 ; „ 50 ; „

d. „ „ $18\frac{3}{8}$ „ „ $3\frac{1}{8}$ „ „ 164 ; „ 62 ; banded.

80. *Trimeresurus Cantoris*, Blyth, Pl. XII, Figs. 3-4.

Trigonocephalus Cantori, Blyth, Journal Asiatic Society, Bengal, 1846, XV, p. 377.

Trimeresurus viridis, var. *Cantori*, Blyth, ibid. 1860, vol. XIX, p. 110.

Body moderately slender, with a large triangular, rather high head, (being about one-twentieth of the total length), and a proportionately short tail, varrying in length from one-seventh to one-ninth of the total length of the body.

Scales narrow, elongated, distinctly keeled in 27-31 series, the most usual number being 29. Scales on the top of the head very small, almost tubercular, equal ; one (rarely two) small azygous shield between the supranasals which are of moderate size ; supraciliaries narrow, elongated, sometimes divided in two shields ; upper labials 11-12, first united with the nasal, second forms the front of the facial pit, third, as usually, the largest ; one long, linear infra-ocular extending posteriorly, usually two small post-oculars ; two rows of shields between the infra-ocular and the labials. Ventrals* 174-184 ; anal entire, narrowly semicircular and freely projecting ; subcaudals 55-76.

The general color is light, or more usually dull green, with several series of dark alternately placed spots ; a white lateral streak on the head beginning at the rostral ascending to the eye and then continuing to the angle of the mouth is often present, it is margined above and below with darker green, but it becomes obsolete with age ; a narrow white lateral band begining at the posterior neck, occupying half the width of the outermost row of scales on either side, edged with dark below and extending up to the end of the tail, is always present. Below, whitish or greenish with the bases

* Blyth's type of *Cantoris* has 182 ventrals and 76 subcaudals.

of the ventrals dark ashy, or blackish in more fully grown specimens; tail strongly prehensile, laterally compressed, and always provided with largish dark spots, its ground color being a light or whitish grey.

The following are the principal variations of coloring &c., which I have observed in specimens of various sizes; with one exception the specimens are all from the Nicobars :—

a. and *b.* Total length 12 inches, of which the tail is 2 inches, 27 rows of scales, ventrals 174, subcaudals 75, the last very large, cylindrical: dull green with five alternating series of small dark spots on the body, a white streak on the head and on the side of the body; below, greyish white; length of head $\frac{12}{16}$ inches, width at the base $\frac{9}{16}$ inches. Another young specimen, perfectly similar in coloration, measures about 14 inches, but the lateral streak on the head is absent.

As regards the very small size of the scales on the body and on the head, as well as regards the coloration &c., these two specimens so very much agree with the description given by Steindachner of *Trim. labialis*, Fitz. ('Novara exped., Reptilia, p. 86, pl. 3, fig. 1,) that I am very much inclined to believe the latter to be only a variety of *T. Cantoris*. Steindachner mentions, however, only 23 rows of scales, while in 14 specimens which I have examined, of all ages, the number of rows was never less than 27 and usually 28 or 29. Could perhaps 23 be a misprint for 28? Further in *T. labialis*, the supranasals are contiguous, but this character is of little value, as in some of our specimens the single azygous shield is almost obsolete, though always present. Fitzinger's species cannot be referred to *T. mutabilis* which never has more than 21 rows of very much larger scales, particularly those of the head; its coloration also does not agree with that of the last mentioned species.

c. Total length 19¾ inches, tail 2¼; 29 series of scales, ventrals 184, subcaudals 62; bright green above with some indistinct dark spots, eye streak indistinct, lateral band distinct; pale green below; tail ashy, spotted with brown, (From Port Blair).

d. Total length 22½, tail 4½ inches; 28-29 series of scales, ventrals 174, subcaudals 73, the 11th and 14th are entire; dull green above, paler at the sides, greenish white below, lateral streak on the head and body distinct.

e. Total length 23¾″, tail 3″; 29 series of scales, ventrals 175, subcaudals 57; length of head 1¼″, its width at the base 1 inch; dull green above with some dark spots on the head and body, whitish below with the base of ventrals dark, lateral band distinct; sides of head pale, but no trace of a distinct streak.

f. Total length 33½ inches, tail 4⅛″, length of head 1¾′, width 1⅛″; 29 rows of scales, ventrals 182, subcaudals 60; dark brown above with many scales partially or wholly of a greenish lighter color, and with large brownish pale spots on the top of head; below whitish, all over sprinkled with dark, bases of ventrals blackish, tail below mostly black.

g. Total length 44 inches, tail 5⅜″; length of head 2⅛′ its width at base 1½″, 31 series of scales; ventrals 176, subcaudals 62; light brown with numerous pale scales, the lateral white band partially yellow, top of head with indistinct dark and pale spots.

h. Total length 48½″, tail 6¾″, head 2⅛″, its width at base 1½″; ventrals 178, subcaudals 63; general color greenish brown with pale spots, each scale of the lateral white band has a distinct yellow spot. This is the largest specimen observed.

From what I have already noticed there can be no doubt that the present species is quite distinct from either, *T. viridis* or *gramineus*, of which Blyth considered it at one time to be only a variety. The great number of small, carinated scales which are almost granular on the head is especially characteristic for *T. Cantoris*. In Blyth's original description the number of subcaudals should be 76 instead of 214, which is a misprint, the number of ventrals is about 180 in the type specimen, which is, however, considerably injured and shrunk. The species is very common on the Nicobars and also occurs on the Andamans.

81. **Trimeresurus convictus**, n. sp. Pl. XII, Fig. 1.

Body stout and short; scales rhombic, moderately keeled in 21 series; ventrals 132, anal entire, subcaudals 29; head broadly eliptical, covered with largish, smooth scales; rostral very high, obtusely truncate above with a small shield adjoining, behind which a pair of largish suprarostral shields forms a suture, two other shields on either edge between them, and then follow the supraciliaries which are very large and broadly rounded posteriorly; the second upper labial forms the front of the facial pit; numerous small shields between the lower edge of the orbit and the upper labials, which are eight in number.

Color, above, pale brown, with minute dark specks; head uniform dark brown, with a small yellowish spot in the middle of the tympanoid region, a U-mark on the neck, and a series of large quadrangular more or less confluent or alternating brown spots along the back, sides marbled with brown and pale yellow, one series of brown spots above the bases of the ventrals being rather more conspicuous than others; below, greenish or yellowish white, all over minutely freckled with brown; chin yellowish brown with rather large light spots; a broad pale band runs from the rostral through the eye to the tympanoid region, a narrow white somewhat undulating streak from behind and below the eye to beyond the angle of the mouth and continuing for some distance on the sides of the throat. Total length 14¼ inches, of which the tail measures 1⅞ inches.

I long hesitated to separate this species from the Hymalayan *T. monticola*, Günth., (l. cit. p. 388), there being hardly any difference in coloration between the two, but the robust form of the body, eliptical rather high head, covered above with largish shields, short tail, and rhombic markedly broad scales, arranged in 21 rows, seem to be sufficient characters to recognise the Penang form as a separate species; in *T. monticola* the scales of the body are much more elongated, the number of small shields above the rostral varies between 1 and $\frac{1}{1}$ or $\frac{1+1}{1}$ or $\frac{1+1}{1+1}$; these azygous shields appear to be more numerous in the young than in the old snakes.

The only specimen I obtained, near the top of the so called Western hill on Penang, at an elevation of about 2400 feet. It was lying, (on an early morning and after a rainy night), near a dead branch in the middle of the path, when an old convict coolie who accompanied me was just too late for my calling out to him, and unfortunately stepped on the snake, which turned round and struck him on the left foot a little in front of the ankle. The man was shivering dreadfully with fright. I was only a few yards off, secured the snake, which made hardly an attempt to move off, made the man sit down and suck the wound for about ten minutes, both the punctures having drawn blood; but it was evident that the fangs could not have penetrated deep, for the snake was unable to close his jaws sufficiently well at the place where it struck. I had the snake in my hand and explained to the man that it is only a very small specimen, and not one of the very poisonous kind; this seemed to relieve a little his mind, though the poor fellow (who had been for the last 20 years a convict in Penang and employed in clearing jungle), was well acquainted with the danger he run into. After sucking the wound for the first ten minutes, I gave the man free use of my brandy flask, which he certainly appreciated. He then continued sucking for about five or six minutes longer, took a mouthful of tobacco, rubbed some of the juice on the wound, and declared himself ready to prosecute the stroll. I thought a long walk might do the man good. It was about 8 A. M., when he was bitten, and we returned home about 4 in the afternoon; the man accompanied me for three successive days afterwards, and did not complain of any symptoms whatever, not even of a swelling of the wounded part, which is so common after the bite of the Nicobar *Trimeresuri*.

82. *Halys hymalayanus*, Günth., (l. cit. p. 393).

idem, Steindachner, Reptiles of the Novara exped. p. 87.

The rostral is as broad as, or broader at its base than, high, but only of half the width at the top, where it touches the anterior frontals. The upper ground colour of this snake varies from brownish green to almost brownish black, but generally with some lighter spots, bands or marblings, and that of the lower parts is a greenish yellow with purple tinge, the purplish color sometimes predominating, especially on the subcaudals; the whole of the lower side is more or less strongly marbled with greenish black, rarely is the underside nearly all black, but the chin is always yellowish. The upper labials are yellowish white, and in continuation of this color there is, in younger specimens, a very conspicuous whitish lateral band, occupying the base of the ventrals and the adjoining row of scales. In old specimens, this lateral band is only indicated on the throat, becoming obsolete on the body.

The largest specimen, obtained by me in the Kulu valley, measured 34 inches. All specimens which I examined had only 21 series of scales. One nearly full grown, from the neighbourhood of Kotegurh (N. E. of Simla) measures 25½, of which the tail is 3½, terminating with a very small single, subconical scale; ventrals 160, subcaudals 42.

The species is very common all over the N. W. Himalayas, especially between 5 and 8000 feet, but on the Hatú mountain near Kotegurh and about Serahan I observed it even as high as 10·000 feet. It principally feeds on mice.

Fam. VIPERIDÆ.

83. *Daboia Russellii*, Shaw, (Günth., l. cit. p. 396).

This species is in the southern portion of the Kulu valley almost quite as common as the last, but it does not seem to grow to as large a size, as in Bengal or the plains of India; the largest Himalayan specimen I measured was only 32 inches. The coloration and other characters are, however, very constant, there are dark brown oval spots encircled with black and then with white; the tail in young specimens is brown above, yellow below.

I observed the species up to 5000 feet in Kulu, and up to 6000 feet in Kashmir, but its usual habitat is between 2 and 4,000 feet. It is generally found in sunny places near the foot-paths, while *Halys himalayanus* is met with on the path itself, generally after rain, and in shady places between overhanging forest trees.

CHELONIA.

Of this class I have obtained, along the Burmese and Malayan coast, only very few species, and those do not, with a single exception, call for any special remark.

84. *Emys crassicollis*, Bell, (Günth., l. cit. p. 28).

I found this species common in the small fresh water streams of Penang.

The coloration during life is blackish brown with a slight greenish tinge on the carpace and on the feet, sometimes the lower side is irregularly marbled with a paler color. The head has in young specimens a small interrupted pale orange or whitish spot somewhat in front above each eye, a pale large spot on each side of the neck, two spots behind the angle of the mouth and the greater posterior portion of the lower jaws are also whitish. In full grown specimens, the pale spots become indistinct and more or less confluent. It does not appear to be generally known that in the adult (8 inches long) turtle the *costal ridges** which are very distinct in young specimens often perfectly disappear, and the vertebral ridge also becomes indistinct, as observed by Dr. Cantor (Journal Asiatic Society, Bengal, 1847, XVI, p. 609). The last vertebral plate is in younger

* Dr. J. E. Gray quite lately (Proc. Zool. Soc., Lond. 1869, p. 197) proposed for *Emys crassicollis* (apparently as the type) a new generic name *Bellia*. In the generic characteristic the author states "back three-keeled." It is perhaps fortunate that Dr. Gray had not the carpace of an adult *crassicollis* with a detached skull for examination; he would certainly have made of it a new species, and under favorable circumstances perhaps a new genus! In the old turtle as compared with the young, the snout is more obtuse, the webbing of the feet a little less distinct, and the plates on the upper side of the feet more subdivided into single shields.

specimens sometimes as broad as the caudals, sometimes the caudals reach only on one or the other side beyond its angle.

Explanation of Plates.

Pl. X.

Fig. 1. *Cyrtodactylus affinis*, n. sp., p. 167; 1 upper view; 1 a, side view, and 1 b, lower view of the head; 1 c, femoral region with a portion of the tail; all figures in natural size; from Penang hill, 2,400 feet.

Fig. 2. *Riopa lineolata*, n. sp., p. 175; side view of the entire specimen in natural size, 2 a, b, c, top and lower views of the head and inner femoral region, enlarged; Martaban, near Moulmein.

Fig. 3. *Tiliqua rugifera*, n. sp., p. 170; corresponding figures as in the last species, natural size; Nicobars.

Fig. 4. *Mabouya Jerdoniana*, n. sp., p. 172; same views as of the last species, all in natural size; Pulo-Tickus, near Penang.

Pl. XI. (All figures in natural size).

Fig. 1. *Ablabes Nicobariensis*, n. sp., p. 184; upper, lower and side views of the anterior part of the body; Nicobars.

Fig. 2. *Compsosoma semifasciatum*, Blyth, p. 188; same views as of the last; Subthoo, N. W. Himalaya.

Fig. 3. *Tetragonosoma effrene*, Cantor, p. 203; upper and side views; Banka island.

Fig. 4. *Dipsas hexagonotus*, Blyth, p. 198; upper, lower and side views; from the Andaman Islands.

Fig. 5. *Cantoria Dayana*, n. sp., p. 208; same views as of the last; Amherst, Tenasserim Province.

Fig. 6. *Dipsas multifasciata*, Blyth, p. 199; upper and side views; from near Simla, N. W. Himalaya.

Fig. 7. *Ophiophagus elaps*, Schleg., p. 210; upper view of a young specimen; from near Moulmein.

Pl. XII. (All figures in natural size).

Fig. 1. *Trimeresurus convictus*, n. sp., p. 224; side and upper views of the head and neck, 1 b, side view of the middle portion of the body; Penang.

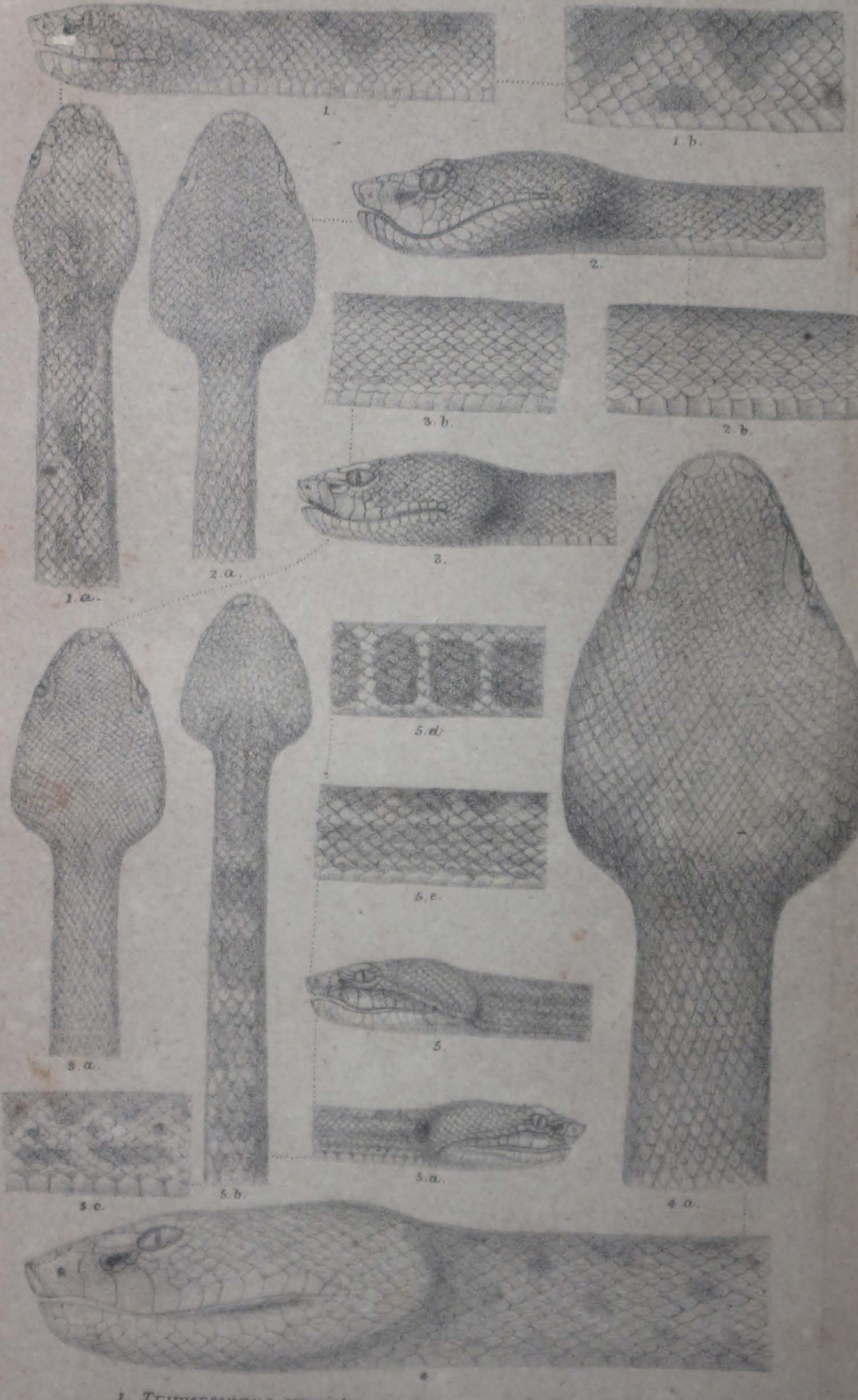
Fig. 2. *T——— porphyraceus*, Blyth, p. 218; similar views as of the last; Andaman islands.

Fig. 3. *T——— Cantoris*, Blyth, p. 222; same views as of the last, uniform green variety from the Nicobars.

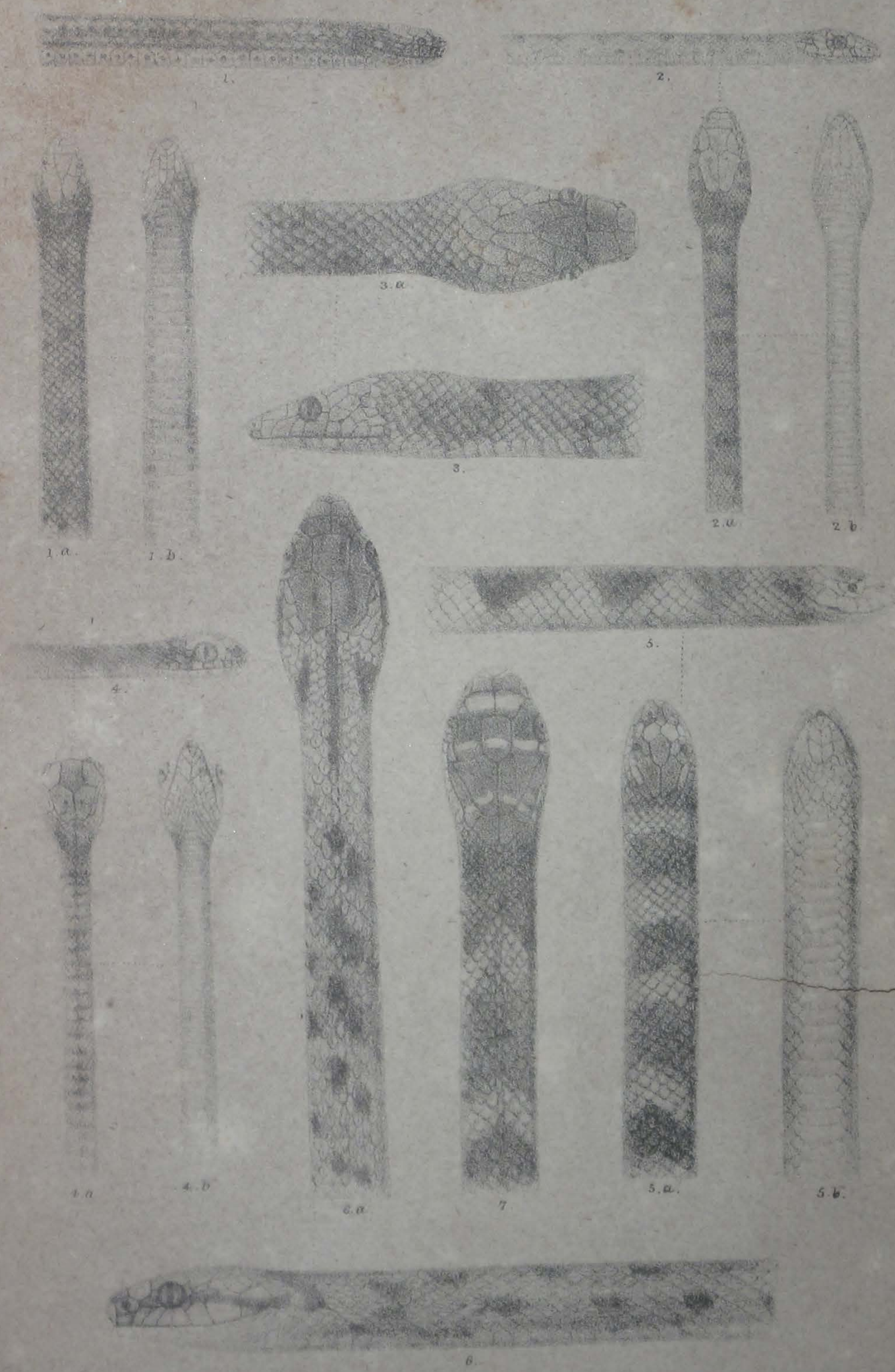
Fig. 4. *T——— Cantoris*, Blyth, p. 222; side and upper views of one of the largest specimens; Nicobars.

Fig. 5. *T——— mutabilis*, n. sp., p. 219; 5 and 5 a, the two sides of head and neck of the same specimen, shewing the second labial divided in one and united in the other; 5 b upper view of the fore part of the body, 5 c side view of the middle part of the body, 5 d upper view of the same, 5 e, side view of the middle part of the body of another specimen, shewing a slight difference in coloration; Nicobars.

Jaeschkea gentianoides, Kurz.



1. *Trimeresurus convictus, n. sp.* 3-4. *Trim. Cantoris, Blyth.*
2. " *porphyraceus, Blyth.* 5. " *mutabilis, n. sp.*



1. *Ablabes Nicobariensis*, n. sp.
2. *Compsosoma semifasciatum*, Blyth.
3. *Tetragonosoma effrene*, Cant.
4. *Dipsas hexagonotus* Blyth.
5. *Cantoria Dayana*, n. sp.
6. *Dipsas multifasciata*, Blyth.
7. *Ophiophagus elaps*, Schlegel.

1. *Cyrtodactylus affinis*, n. sp. 3. *Tiliqua rugifera* n. sp.
2. *Riopa lineolata*, n. sp. 4. *Mabouya Jerdoniana*, n. sp.

Gentiana Jæschkei *re-established as a new genus of* Gentianaceæ, by S. Kurz, Esq.

(with pl. xiii.)

[Received 5th April, 1870; read 7th May, 1870.]

A few years ago I communicated to Dr. B. Seemann, Editor of the Journal of Botany, together with a few other novelties, also the description and some fragments of a Gentianaceous plant, which I had called *Jæschkea gentianoides.* At the same time I requested him to give an opinion on the validity of the new proposed genus. Dr. Seemann referred the plant to Prof. Grisebach, who declared it to be "apparently an undescribed species of the *Amarella*-section of *Gentiana,* where, — on account of the hair-crown being wanting, — it will have to range near *G. Moorcroftiana,* Wall., from which it differs by its smaller flowers, its acute lobes of corolla, and its calyx, characters which make it allied to *G. Germanica,*" (comp. Journal of Botany, 1867, p. 241, in a note), and consequently, either Prof. Grisebach, or Dr. Seemann, changed my proposed name into *Gentiana* (*Amarella*) *Jæschkei,* Kurz, (by an accident spelled *Tæschke*).

I had no sufficient leisure to re-examine the plant under question, until very lately, when I came to the same conclusion, at which I arrived some years ago, *viz*, that it is a new genus of Gentianaceæ, and nearer allied to *Ophelia*, than to *Gentiana.* I suppose, that Prof. Grisebach was misled by the general appearance of the plant, and based thereupon his opinion, without examining the position of the stamens; for I do not believe, that, had he really observed the peculiar insertion of the stamens, he would have placed the plant in the *Amarella* section of *Gentiana.* Moreover, he has, in his elaborate monograph of Gentianaceæ in DeCandolle's Prodromus admitted genera, based upon less important characters than those which the present species possesses. Had the filaments been simply adnate to the corolla, I would have considered that circumstance of very little importance, but they are actually terminal between the corolla-lobes, as is shewn by the fact, that the epidermis of the corolla overlies the vascular bundles leading to the filaments. The calyx is exactly that of *Lomatogonium* or *Ophelia*, the bell-shaped corolla more that of a *Gentiana*.

As regards the name, which I gave to this new genus, I believe, I have done nothing more but paid due justice to the Rev. H. Jæschke, of the Moravian Mission, who, with untired zeal and for a great part of the year secluded from all the civilized world, prosecuted his Botanical researches in Lahúl, adding many a new or rare plant to the scanty Flora of British Tibet.

JÆSCHKEA, Kurz.

Calyx 5-fidus, subæqualis. Corolla campanulata, 5-loba, fauce nuda foveisque epipetalis destituta. Stamina 5, terminalia, in sinubus loborum corollae sita; filamenta brevissima; antheræ incumbentes. Ovarium utrinque attenuatum, uniloculare, ovulis 8 juxta suturas seriatis; stylus longiusculus, bipartitus. Capsula subsessilis, bivalvis, septicida, unilocularis. Semina oblonga, lævia, placentis membranaceis adnata.—Herba annua, glabra, caule recto foliisque oppositis, floribus racemosis v. sub-paniculatis.

1. **J. gentianoides,** (*Gentiana Jæschkei*, Kurz, in Seem. Journ. Bot. 1867, 241).—Caulis strictus, 1-2 pedalis, raro pumilus vix 4-pollicaris; folia glabra, ima spatulato-linearia, remota, v. (in specim. pumilis) sub-rosulata, superiora lineari-lanceolata, acuminata, sessilia; flores fere semipollicares, violacei; calycis segmenta linearia, corollæ tubo campanulato paulo breviora; corollæ lobi oblongi, acuti; capsula elliptica stylo longiusculo coronata; semina sinapiformia, majuscula.

Hab. Western Tibet, Lahúl, 9—15000 feet, on meadows, frequent, (R. Jaeschke); Rotang-pass between Lahúl and Kúlu, 10·000 feet, (Dr. Brandis); fl. Jul.—Sept.; fr. Aug.

Plate XIII, Fig. 1. Plant, in natur. size, cut in three parts, fig. 2, corolla laid open, magnified, (as are also the following figures); fig. 3, a small piece of corolla, particularly shewing the insertion of stamens; fig. 4 ovary.

Notes on the Geology of the Vicinity of Port Blair, Andaman Islands,—*by* V. Ball, B. A., *Geological Survey of India.*

[Received 3rd March, 1870; read 1st June, 1870.]

My examination of the geology of the Andamans did not extend beyond the immediate neighbourhood of Port Blair. An attack of fever prevented me from availing myself of the opportunities which Col. Man, Superintendent of the Andamans and Nicobars, had kindly promised to afford me for visiting more distant localities, as also from examining the excavations, which required to be drained, where coal had been worked for.

It is with some hesitation that I offer for publication these notes which for the reason above stated, refer to what is but a small portion of the islands, though it embraces the whole of the area in which the convict settlements are situated. I do so, however, in consideration of the facts that the few geological notices of these islands which have been published are of a general character, and that there has hitherto been no attempt to describe any stratigraphical details.

It has been shewn by Mr. Kurz* that the principal rocks about Port Blair are sandstones (tertiary). Mr. Kurz's specimens enabled Mr. W. T. Blanford to identify these rocks with those forming a considerable portion of Arracan.

The Port Blair sandstones are reported to be fossiliferous† and are certainly so to the extent of containing coal. No collection of fossils has been made, consequently the true position and affinities of this formation to those of other countries remain as yet undetermined.‡

It is probable, however, that, as I have pointed out,§ these sandstones will prove to be of identical age with those of the southern Nicobars. Dr. Hochstetter suspects the younger miocene of Java to be represented by the tertiary deposits of the Nicobars, and thus we arrive at the probable age of the Andaman rocks. For the

* Report on the Vegetation of the Andaman Islands.

† I observed in the sandstone at the N. E. end of Ross island several specimens of a *Pecten*, a small *Cytherea*-like shell and fragments of Oysters, which fossils prove that the deposits are marine, and the aspect of these fossils is undoubtedly a tertiary one. [F. Stoliczka.]

‡ J. A. S. B. XXXIX, 1870, p. 27.

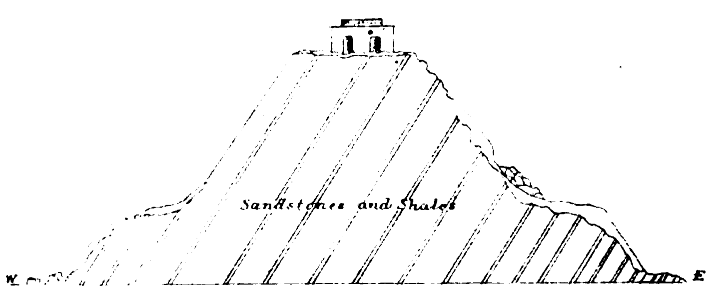
§ See Records of Geological Survey of India, 1869, Part 3, p. 67.

full discussion of this question, reference must be made to Dr. Hochstetter's paper and Dr. Stoliczka's note* on the age of the Andaman sandstone rocks.

For convenience of reference, I have arranged my field observations and deductions from them under the headings of a few of the principal localities commencing with—

Ross Island.—The geology of Ross Island, the head quarters of the Port Blair settlement, is particularly simple. The rocks are fine bluish grey sandstones with interbedded layers of argillaceous shales (mud-stones). The strike of the beds is almost uniform throughout the island being from N. 15° E. to S. 15° W.; in no case does it vary more than 5° on either side of that bearing. The dip is high, in some places being 60°; but 55° to W. 15° N. which is the amount of the inclination of the face of bare rock exposed on the west of the island underneath the barrack buildings may be taken as the fair average amount. On the east and south-east, I observed dips as low as 36°, 28°, 25°, but these are evidently due to local subsidence. At the south end of the island, where the beds are seen distinctly striking across the channel to South point and Corbyne's Cove, the dip is 55°, and in one bed 60°.

The above stratigraphical conditions which are roughly represented in the accompanying sketch section of the island are such, it will be observed, as are eminently conducive to landslips; not



Section across "Ross Island" at the North end.
Scale 1 Inch = 50 Yards.

* Verhandlungen der geol. Reichs-Anstalt, Wien, No. 9, 1868.

merely landslips of the superficial humus which must occur to a great extent wherever on steep or elevated ground primeval jungle has been cut down and the surface exposed to direct atmospheric influences, but to landslips of the rock itself.

Water passing through the permeable sandstones, and being arrested on the surface of the impermeable shales, produces a slide down which the superincumbent mass, resting at an inclination of from 55° to 60°, must tend to slip, the rapidity with which such destruction takes place being in a direct ratio to that of the removal of the lower portions of the beds by the sea or other agencies. Such being the condition of the rocks on Ross Island, it was with surprise that I saw that it had been the practice and was still so at the time of my visit, not only to remove and use for building purposes the stones on the beach which serve to break the force of the waves, but even to quarry out large masses from the face of the beds, thus endangering the stability of the island.

On the eastern or seaward side, the destruction is progressing in a different way. The escarpment shews a steady tendency in the edges of the beds to break up; and confused heaps of fallen rock and clay abound. Sections of the road too, constantly slide down and so bring more and more of the rocks and their natural covering within the range of the wash of the waves.

The highest point of Ross is 195 feet and the area about one-third of a square mile. As the principal buildings of the settlement are upon this small island, it should be an object of no trifling importance to preserve its integrity to the utmost. With this in view, it is perfectly obvious that the practice of removing stones from the beach and of quarrying them out of the side of the island should be discontinued. Some protective measures to retain the soil and shelter the rocks from the direct action of the atmosphere might be undertaken with advantage.

Under this head the planting of trees especially of those species known to have roots which bind the soil (thus to a certain extent reviving the conditions which existed before the jungle was cut down,) would be perhaps the most efficacious.

Southern Coast line of Port Blair.—An examination of the rocks exposed along the coast line from Aberdeen round by Haddo to Navy point, discloses the existence of a succession of rolls which tend to keep the same beds near the surface. At Navy point, the dip is to N. W., while on the opposite shore of Viper, it is to S. W., or nearly so, thus indicating the probable existence of an anticlinal in the channel between. These facts render it possible if not probable that the coal of Ross, Navy point and Viper may be from the same bed of sandstone, or at least that it is confined to a narrow zone in the formation, and is not widely scattered throughout the whole thickness, as it at first sight appears to be.

Near Haddo, on the crest of a roll, the beds shew little sign of disturbance, being nearly horizontal. Some of the sandstones there contain veins of calcspar, and a peculiar *grit* makes its appearance. A loose block of limestone lies on the beach south of the Western point of Chatham Island; I did not succeed in finding its source.

Mount Harriet.—The principal rock is a coarse yellowish green or grey sandstone apparently very absorbent of water. Close to the top of the hill which is 1155 feet above the sea level the sandstone appears in vertical beds; on the ascent the rocks are much obscured by humus.

Viper Island.—There is a good deal of irregularity in the bedding of the sandstones which form this island; towards the west-end they are also much cut up by joints which form an angle of 75° with the prevailing strike there. The highest point of this island is about 220 feet, its area less than half a square mile. The comparatively small inclinations of the beds renders the danger from landslips much less here than on Ross.

On the north side of the island a sinking for a well through sandstones and blue mud-stones disclosed some indications of coal in nests which, however, were speedily exhausted, and the excavation allowed to revert to its original purpose as a well. At the time of my visit, the well was full of water, and I could detect no trace of coal in the exposed section on the side of the hill.

Homfray's Ghat to Port Mouat.—The road between these two places is about two miles long. It is carried for the most part along the line of junction between hilly ground covered with lofty jungle and a mangrove swamp, in some places it runs across the swamp on a bund.

The rocks seen in the vicinity of the road are the same sandstones and shales as at Ross, &c. There are also some conglomerates which may be of more recent age. Not far from Homfray's ghat the road crosses what appears to be a *dyke* of intrusive serpentine; it is, however, not well exposed, the junction with the sandstones being hidden by soil. I shall speak of this rock, portions of which are very beautiful, again further on.

The abrupt termination of the rocks at the edge of a mangrove swamp, as above described, seems to point to the former existence of a strait which joined Ports Blair and Mouat and consequently divided the island into two. Such a strait now separates the north and middle Andamans. This would either involve the fact of a general rising of the land having taken place, or be simply the result of silting up of the channel. Mr. Kurz has given evidence of a general sinking; the question may still be regarded as an open one to be decided on the collection of further data.

Islands North East of Port Blair.—North-east of Port Blair there is a group of islands of various sizes. The smallest, known by the name of the *buttons*, being rocky pinnacles covered with close and dense jungle. As seen from a passing vessel, some of the rocks appear excessively white, and it occurred to me as possible, that they may be similar to the clay-stones of Kamorta and Nancowry, and therefore distinct from the Port Blair sandstones. I had no opportunity of landing to ascertain the point.

Narkondam Island. E. Long. 94° 17′ 22″, N. Lat. 13° 28′.

Both when going to and returning from Port Blair I passed within a few miles of the remarkable island of Narkondam. From its shape no reasonable doubt can exist as to its being a volcano. Unlike its neighbour on Barren Island,* it has never been seen in action. The central cone which rises to the height of 2150 feet appears to be surrounded, as Mr. Kurz has pointed out, by the remains of an old crater. The cone is furrowed by deep ravines. At one place, I noticed what appeared to be a slip or subsidence of a portion of the crater. I was most anxious to land, and Captain Barrow the

* Barren Island has frequently been described. See Lieut. Colebrooke, Asiatic Researches, Vol. IV, p. 397; Dr. Playfair, Records, Government of India; Dr. Liebig, J. A. S. B. 1860, and Report by a Commission to enquire into the amount of Cattle fodder obtainable on the island. Proc. A. S. B. 1866.

commander of the Arracan, would have afforded me an opportunity, had he not, on approaching, considered that owing to the surf which was breaking on the steep cliffs, an attempt to do so would have been attended with danger.

The useful products contained in the rocks of the Andaman Islands.

So far as is at present known, the useful products occurring in the rocks in the vicinity of Port Blair are chiefly confined to three, *viz.* Coal, Serpentine and Sandstones suitable for building purposes :—

Coal.—As has been mentioned above, traces of coal have been found on Ross, at Navy point and at Viper. From all that I could ascertain, the coal at each of these localities occurred in small nests in the sandstones, which were speedily exhausted, and it was found impossible to discover any definite seam which might be followed up.

Instances of coal occurring in a similar manner are not wanting in India as well as elsewhere. The principal localities are Cachar, Chittagong, Cheduba Island, Sandoway, and some of the Southern islands of the Nicobar group. The coal of these places has been described as occurring in "nests of simply fossilized wood which may be supposed to have drifted into the sandstones."*

Regarding the quality of the coal which has been found,—two specimens B and C, free from sandstone, have on analysis,† given the following good results—

	Unpicked.	Picked.	
	A.	B.	C.
Carbon, ...	50·8	52·3	62
Volatile, ...	26·	41·4	34
Ash, ...	23·2	6·3	4

It is therefore a coal which would, undoubtedly, be of very great value if found in large quantities for making gas; possibly from its lightness and consequent tendency to dissipate before complete combustion had taken place, it might not prove of sufficient heating power for steam engines.

* Coal resources of India by T. Oldham, Esq., LL. D., 1867, p. 18.
† By Mr. Tween.

So far as they have been examined, the Nicobars and Andamans do not contain any trace of the group of coal bearing rocks (Eocene) to which, according to Dr. Hochstetter, the workable coal seams of Java, Borneo and Sumatra belong.

Serpentine.—The Serpentine near Homfray's ghat, the existence of which was first pointed out by Mr. Kurz* is, I think, deserving of special mention in an account of the useful products.

This Serpentine marble is an exceedingly handsome variegated green and black rock, which might be worked up into many useful and ornamental articles. The portion exposed near the surface is of very variable quality, and is much broken up. Lower down, however, where the rock has been protected from the injurious effects of the atmosphere, it might be found to be of a more uniform character.

If on quarrying it should be ascertained that large blocks of homogeneous texture can be obtained, there can be no question that the working up of such a stone would furnish an occupation singularly well suited for those amongst the convicts whose constitutions unfit them for laborious out-door work; while it is conceivable that under judicious management, it might be made a very profitable undertaking.

Manufactures of more or less elaborate character in soft sectile stones, such as soap stone and marble supply, as is well known, occupation and the means of living to large numbers of people in parts of the North West Provinces, in Chota Nagpúr, and other parts of India and in Burma.

It is not improbable that amongst the convicts some might be found already skilled in such work. In any case were the operations at first simply confined to sawing the rock into slabs, such would, I believe, find a ready sale, and be applicable to many of the purposes for which Italian marble is largely imported into Calcutta.

Building Stones.—Sandstones are found on all the small islands and on the so-called mainland in the vicinity of Port Blair. The variation in texture is not excessive. The sandstones of Ross have been used extensively in the buildings on that island, and have I believe been found when carefully selected, very strong and

* Report on the Vegetation of the Andamans.

durable. The results of local experience on this point are desirable. It is not impossible that the time may come when it will be found both practicable and profitable to export some of these as well as the ornamental Serpentines to Calcutta.

LIME.—An unlimited amount of lime of the best quality might be obtained from the coral reefs. In Calcutta, and Bengal generally, where lime is expensive and often much adulterated, the introduction of lime from the Andamans would be most desirable. I am not at this moment in possession of statistics to shew how far this might be expected to prove a profitable undertaking; but it seems probable that the coral worked by convict labour in the Andamans, would bear the cost of transmission to Calcutta, and leave a considerable margin for profit. It would be of course a matter of no small difficulty to cut the coral on the surf-washed reefs.

IRON.—Mr. Kurz speaks of some very ferruginous serpentine which he thinks might be worth smelting, but he adds that there is no limestone at hand. As to the quality and quantity of this ore I cannot speak from personal experience, but the absence of limestone is scarcely a valid objection in a place where any amount of lime might be manufactured from coral or sea shells.

Before concluding, I would allude to several notices as to the occurrence of quicksilver in the Andamans which I have met with in my examination of the numerous accounts of these islands.

1. The Mahomedan travellers of the ninth century having described an island inhabited by a race with the characteristics of the Andamanese of the present day proceed to say. "Beyond this is a "mountainous yet uninhabited island where, it is said there are "mines of silver; but as it does not lie in the usual track of ship-"ping, many have sought for it in vain, though it is remarkable "for a mountain called Kashenal. It once so happened that a "ship sailing in this latitude had sight of the mountain and shap-"ed her course for it, and falling in with the land sent a boat on "shore with hands to cut wood. The men kindled a fire and saw "silver* run from it which plainly indicated there was a mine of

* This may possibly allude to the quicksilver mentioned in the following notices.

"this metal in that place; they shipped, therefore, as much of the "earth or ore as they thought fit, but as they were proceeding on "their voyage, they met with such a storm that to lighten their ship, "they were under the necessity of throwing all their ore overboard.

"Since that time the mountain has been carefully sought for, but "has never again been seen."*

2. In Hamilton's East Indies, quoted by Dr. Mouat, we learn that an Andamanese was captured in one of the forays which his countrymen were in the habit of making on their more peaceful neighbours in the Nicobars, he was retained in slavery there. Afterwards he was purchased by some Mussulmans of Acheen (Sumatra). His master having died, he was manumitted, and allowed to set out on a trip to visit his country, this he effected alone in a canoe. Having remained for some time with his friends on the little Andaman, he returned again to the Nicobars, bringing with him a quantity of quicksilver, which he reported to be abundant. Subsequently he made several voyages to and fro, and was seen by the narrator in 1694.

3. In a list of the useful metals found in India, attached to a letter† on the formation of the Museum of Economic Geology for India by Captain Tremenhere to H. Torrens, Esq., Secretary to the Asiatic Society, mention is made of quicksilver as occurring in the Andaman Islands, but the authority for the statement is not quoted.

I have given the above in the hope that those, who may have the opportunity, may endeavour to test the truth of the report.

* Harris's Collection of Voyages and Travels.

† Dated 27th January, 1841.

Notes on Birds observed in the neighbourhood of Port Blair, Andaman Islands, during the month of August, 1869,—by V. Ball, B. A., *Geological Survey of India.*

(Received 2nd March, 1870; read 1st June, 1870.)

The following are brief notes upon some of the birds which I observed in the vicinity of Port Blair, while staying there for a few days in August last. I have not attempted to draw up any complete list of the birds occurring in the Andamans, as that has already been done by the late Capt. Beavan, in a paper in the Ibis for 1869, N. S., III, p. 314 et seq. When no special reference is given, the names of the species quoted correspond to those recorded in Dr. Jerdon's "Birds of India."

1. Hæmatornis Cheela, Daud., *H. undulatus, Vigors.*

Two specimens which I obtained, one in young and the other in adult plumage, appear to belong to this species, and not to *H. Elgini* which, according to Col. Tytler, is the more common species at the Andamans. In the types of *H. Elgini* the length of the wings does not exceed 14 inches,* whereas in both my specimens it is 15. I was told that these birds are very mischievous about Port Mouat, constantly carrying off live fowl.

2. Ninox sp.? I received from Mr. Homfray an old skin of a species of Ninox, which had been shot by him at Port Mouat. The measurements of it are so much greater than those of *N. affinis* given by the late Captain Beavan,† from a skin in Col. Tytler's collection, that I am doubtful about referring it to that species.

	Length.	Wing.	Tail.	Bill at front.	Tarsus.
N. affinis,	9·5-10	6·75	4·36-4·5	·75	·75
N. sp.?	12	8·5	4·75	·75	1

The colour corresponds to that given for *N. affinis*, and the measurements very nearly with those of *N. scutellatus*. I hope to receive other specimens of this bird.

3. Halcyon fuscus, Bodd.
4. H. atricapillus, Gmel.
5. Todiramphus collaris, Scopoli?

* Ibis, N. S., III, p. 314. † Ibidem, p. 316.

6. PALÆORNIS NICOBARICUS, Gould. Birds of Asia, 1857, Part IX; P. Z. S. 1866, p. 555; *P. erythrogenys*, Blyth, J. A. S. B. 1846, XV, p. 23 and 1858, XXVII p. 81; Ibis, N. S., Vol. III, 1867, p. 319.

Large flocks used to fly over Viper to and fro daily for the purpose of visiting their feeding grounds north of the Port.

7. MUELLERIPICUS HODGII, Blyth, J. A. S. B. 1860, XXIX, p. 105; Ibis, N. S. III, p. 320.

This peculiarly plumaged woodpecker seemed rather abundant on Mount Harriet. Its vigorous taps on the dead trees resound through the forest, and may be heard for a considerable distance.

The specimen I procured, had a peculiarly rank and offensive smell; it measures—wing $7\frac{1}{4}''$, tail $6''$, bill at front $1\frac{1}{16}''$, tarsus $1\frac{1}{8}''$.

8. CENTROPUS ANDAMANENSIS, Tytler, Ibis, N. S., III, p. 321.

I frequently heard the call of this bird in the dense jungle on Mount Harriet. It resembles, but is not so deep or sonorous as, that of *C. rufipennis*.

9. NECTARINIA PECTORALIS, Horsf. Pl. Col. 138.

Common on Mount Harriet.

10. EDOLIUS, sp., I obtained a specimen of what I believe to be a young *Edolius*, which answers to the meagre description of *Dicrurus Andamanensis*, Tytler, (Ibis, N. S., III, p. 323,) in having hair-like feathers springing from the nostrils and white lunules under the wings. The tail is unfortunately only partly developed, the 4th pair of feathers being only half grown, and the 5th not yet sprouted. The beak and general aspect is that of an *Edolius* rather than of a *Dicrurus*. Making every allowance for age it is still a much smaller species than that which has hitherto been found in the Andamans, and which according to Blyth is the largest race of *E. Malayensis*. The presence of the hair-like feathers from the nostril and the forehead, serve to distinguish it from the latter species. The description and measurements of my specimen are as follows: Plumage black with a metallic green gloss, primaries brownish; wing $5\frac{3}{16}''$, tail $4\frac{1}{4}''$, bill at front $1\frac{1}{8}''$, tarsus $\frac{7}{8}''$.

11. ARTAMUS LEUCOPYGIALIS, Gould, P. Z. S. Lond. 1842, p. 17; ibid. 1866, p. 555. *A. leucogaster*, Valenc. apud Beav., Ibis, N. S., III, p. 324.

Abundant at Port Mouat, where they may be seen perched on posts, at intervals soaring forward in pursuit of insects, and again returning to their perches.

12. OTOCOMPSA JOCOSA, Linn.

Common on Mount Harriet. I shot several specimens, but could not find them in the heavy undergrowth which is perfectly impenetrable in the Andaman jungles.

13. IRENA PUELLA, Lath. ?

14. PRATINCOLA INDICA, Blyth, Ibis, N. S.. III, p. 328.

I saw a single specimen of this bird. According to Col. Tytler, it is "not uncommon."

15. CORVUS ANDAMANENSIS, Tytler, Ibis, 1866, p. 420, and 1867, p. 34, note; *C. culminatus* apud Blyth.

Under the impression that this bird which I saw almost every day while at Port Blair was the common *C. culminatus*, I did not shoot a specimen; but Col. Tytler I find, makes them distinct.

The introduction and attempt at acclimatisation of *C. splendens* by Col. Tytler, seems to have failed, as I did not see a single specimen near Port Blair.

16. DENDROCITTA BAYLEYI, Tytler, J. A. S. B., 1863, p. 88. Ibis 1863, p. 119.

I shot a specimen of this interesting little pie which was perched on a high tree of Mount Harriet. Wing 2¾″, tail 7¾″, bill at front 1″, tarsus 1″.

17. EULABES ANDAMANENSIS, Tytler, Ibis, N. S., III, p. 331.

I obtained specimens of this bird both in the Nicobars and Andamans. I could detect no difference between them.*

18. TEMENUCHUS ANDAMANENSIS, Tytler, Ibis, N. S., III, p. 329 ? *Sturnia erythropygia*, Blyth, J. A. S. B. 1859, p. 74.

Flocks of this pretty white Maynah used to feed on the slopes of Viper every day.

19. MUNIA LEUCONOTA Tem.? Mouat's Adventures and Researches, App. p. 359. *M. striata*, Linn. apud Tytler et Beav.

The birds which I shot were certainly distinct from *M. striata*, Linn., they had scarcely a trace of central striæ. They were feeding in flocks on the roads on Mount Harriet.

* Compare J. A S. B., XXXIX, Part II, 1870, p. 31.

20. CARPOPHAGA SYLVATICA, Tickell.

Abundant on Mount Harriet. Two specimens, male and female, which I obtained, are exactly identical with birds which I have shot in Manbhúm and the Rájmahál hills, also with specimens in the Indian Museum from Cachar, but they are quite distinct, as has been already shewn,* from the Nicobar pigeon.

21. DEMIGRETTA CONCOLOR, Blyth? *Herodias Andamanensis*, Tytler. I only saw some young birds in confinement. The species is said to be common.

22. ONYCHOPRION MELANUCHEN, Tem., P. Z. S., 1866, p. 556. Common. Breeds on all the small detached rocky islands.

[*Note*—on page 33, line 17 of this volume for (Tarsus) 3″ read 2½″.]

On the Normal Rainfall of Bengal,†—*by* Henry F. Blanford, F. G. S., *Meteorological Reporter to the Government of Bengal.*

[Received 27th May, 1870—read 6th July, 1870.]

The records of rainfall summarized in the following tables relate, with a few exceptions, to the years 1848—1852 and 1860—1869. The former series have been extracted from the records of the Board of Revenue, and were kept by the Collectors under orders of Government at the sudder stations of their respective districts. In 1852, the charge of the rainfall registers was made over to the District Medical officers, but the series from 1852 to 1859 are not available, having been placed in the hands of Mr. H. von Schlagintweit for the preparation of a summary of their results. The later series have been principally taken from the records of the Medical Department, and have been supplemented and completed as far as possible from the returns received in theMeteorological office since its establishment in 1867. Some additional data have been taken from miscellaneous sources, such as Dr. Lamb's table in Vol. XXI of the Journal of the Asiatic Society, Dr. Hooker's Himalayan Journals, &c., but these are comparatively few.

* Vide antea, p. 32.

† For discussion upon this paper, see Proc. Asiat. Soc. for July 1870, p. 223-226.

It must be premised that very few of the registers can pretend to accuracy, and as will be seen from the figures indicating the number of years from which each monthly average has been computed, very few are complete for the entire series of years. It is clear from the character of the original records, that the value of the register in each case has been determined very much by the amount of interest taken in it, or the supervision that could be exercised over it by the local officer, and in some cases it would appear to have been treated in a very perfunctory manner. In some cases, the register has been discontinued for several years consecutively, in others for three or four months only, *e. g.*, while the rain-gauge was sent to Calcutta for repair, and some sudder stations appear never to have been furnished with rain-gauges. I have omitted many stations, the data of which are generally doubtful, or insufficient to furnish a fair average result, especially those in which the earlier series shows a marked discrepancy with the later. On the other hand, I have admitted one or two registers presenting points of special interest, and which I have reason to believe trustworthy, although extending over but a short period. What kind of gauge may have been used in the earlier years I am unable to say; of late years, the form commonly in use is that which consists of a deep narrow receiver, in which moves a float carrying a graduated brass rod. The rise of the float is read off on the rod at its intersection with a bar which crosses the mouth and the funnel and through a hole in which the rod slides.* Gauges of this kind in unpractised or careless hands are subject to error in many ways; the general tendency of which is, that the quantities indicated are less than the actual rainfall. This I am disposed to believe is very generally the case with the registers here summarized, to the extent perhaps of 2 or 3 per cent. of the total rainfall, but any such estimate must necessarily be very vague.

I have classified the stations in groups according to the chief physical divisions of the country, and their exposure to the vapour-bearing winds. Mr. D o v e in his well known treatise on the Rainfall of the torrid zone† has classified the Bengal stations in two

* This form is figured as No. II in the Second Report of the Rainfall Committee of the British Association. Brit. Assoc. Rep., 1867, Plate IV.

† Klimatologische Beiträge, Vol. I. Ueber die Vertheilung des Regens auf der Oberfläche der Erde. Erster, Theil. Die Regen der Heissen Zone.

groups, which he terms respectively the Dacca Group and that of the Ganges plain and the Himalaya. This division is in so far natural, that the stations of the former group, lying to the east of the Bay and the Gangetic delta, receive their rain from the SW winds, which, passing over the Bay of Bengal, reach them without much alteration of direction, and at an earlier period of the year, while the temperature of the Peninsular and the Ganges valley is rapidly rising under the rays of a vertical sun. The westerly stations of the latter group are visited by heavy rainfall, only when, in consequence of the high temperature of May and the early part of June, and consequent fall of the Barometer, a large body of the saturated air from the Bay is drawn round from its primitive direction towards the plains of Upper India, which it reaches at a SE or ESE wind. The rainfall, therefore, commences and reaches its maximum at a later period at these stations.

Mr. Dove's tables give the rainfall of 12 stations only. The larger number of the stations for which I now have registers, permits of a more detailed grouping, and I am enabled to classify them with regard both to their exposure and elevation, as well as to the comparative siccity or moisture of the rain-bearing currents, that reach them. This is determined chiefly by the nature of the country traversed by these winds in their passage from the Bay of Bengal. The arrangement adopted is the following—

Eastern.	1. Assam Group.	Seebsaugor, Tezpore, Nowgong, Gowhatty, Goalpara.
	2. Khasi Hills.	Shillong, Cherrapunji.
	3. Silhet Group.	Silhet, Cachar.
	4. Tipperah and Arakan Group.	Tipperah, Noacally, Chittagong, Akyab, Sandoway.
Central.	5. Delta Group.	Jessore, Calcutta, Kishnagur, Moorshedabad, (Berhampore), Burdwan.
	6. Northern Group.	Dacca, Mymensing, Bogra, Rungpore, Dinajpore, Maldah, Rampore Beauliah.
	7. Himalaya.	Darjiling, Rungbee.
Western.	8. Behar Group.	Monghyr, Gyah, Patna, Tirhoot, Chuprah, Arrah, Chumparun.
	9. Western Bengal.	Bhagulpore, Soory, Ranigunj, Bancoorah, Midnapore, Manbhoom, Hazareebaugh, Ranchee.
	10. Orissa Group.	Balasore, Cuttack, Pooree, Sumbulpore.

Assam Group.—These are all situated in the valley of Assam, on the narrow alluvial plain of the Brahmaputra, the elevation of which at Goalpara is about 140 feet above sea level, and at Seebsaugor, 260 miles higher,* does not much exceed 500 feet. The elevated plateau to the south known as the Garrow, Khasi, Jyntiah and Naga Hills, averages from 4000 to 6000 feet, and intercepts a large portion of the vapour which is brought by the SW winds, direct from the Bay, and is discharged upon these hills, and the plains to leeward and windward, from the first setting in of these winds in March or April, up to the termination of the SW monsoon in the beginning of October. The heaviest rainfall is at Goalpara, near the lower end of the valley and at Seebsaugor, and Dibroogurh at its upper extremity, where it exceeds 90 inches. In Central Assam, it appears to average between 70 and 80, but it is probably higher along the foot of the Himalaya, all the stations enumerated lying either on the main stream or to the south of the Brahmaputra. The heaviest rainfall is in June and July.

Khasi Hills.—The station of Cherrapunji is situated near the summit of the southern escarpment, at an elevation of 4100 feet, and immediately overlooking the plains of Silhet. The SW winds, passing unimpeded over these plains and the Gangetic delta beyond, are here suddenly arrested by an almost mural escarpment up which they are driven, and consequently discharge their vapour in a torrent of rain, unequalled by that hitherto recorded at any other station in the world. In a single month, [July, 1861,] the almost incredible amount of 366 inches is recorded in the register, and the average fall of this month is not less than 157 inches. This enormous fall is as might be expected quite local. Shillong is but 30 miles to the north and a little higher, (4800 feet), but between the two stations intervene three higher ridges, averaging about 6000 feet, and at Shillong, the annual rainfall, as deduced from four years observations, does not exceed 96 inches, about the same as that of Goalparah. Records from other parts of the plateau are wanting, but it is probable that Cherra-

* As measured in a direct line on the map.

punjí represents the heaviest rainfall, and that on the more easterly parts of the hills, the rain is considerably less than on the westerly portion, since the wind currents that reach it, must first have traversed the hill tract of Tipperah.

Silhet Group.—The two stations forming this group represent the rainfall on the alluvial plain of the Barak and its branches, to windward of the Khasi Hills. The elevation of Cachar, the higher of the two stations, is 72 feet only. Silhet probably does not much exceed 50. The former station is under the lea of a portion of the Tipperah hills, and hence probably the difference (26 inches) in their mean annual fall.

Tipperah and Arrakan Group.—Next to the Khasi Hill Group this group of stations exhibits the highest mean rainfall; Tipperah, the most northerly, receiving 95 inches, and Sandoway, the most southerly, 236 inches. The stations are all at or near sea level; but they lie (with one exception) on the sea coast, and to windward of a continuous range of forest-clad mountains that runs obliquely across the path of the SW monsoon. The very great difference between the annual falls of Sandoway, or Akyab and Chittagong, is probably due, partly to differences in the direction of the monsoon wind in the lower and upper parts of the Arakan Coast, and partly to the greater proximity of the hills to the coast line at Akyab and Sandoway, as well as their greater elevation. Owing partly, it may be, to the obstacle presented by the Arakan Mountains to the SW winds, but, in a greater degree, to the lower barometric pressure of the plains of Bengal, the wind-direction at Chittagong, during the greater part of the SW monsoon, is SSE, or about parallel to the coast and the hill ranges. At Akyab and Sandoway, it is from SW or SSW or light and variable, in the earlier months, becoming S in the later months of the monsoon. The rains begin earlier at the northern than at the more southerly stations, since at the latter but little rain falls in April; and that of May is light, as compared with the rainfall of the subsequent months.

Delta Group.—In this group, I include only those stations lying between the Megna, Pudda, (or lower Ganges) and the western margin of the Delta. In their case, as in that of the two next mentioned groups, the annual fall is considerably greater on the stations lying to the eastward than on those to the west, and of the latter those lying to the south near the coast receive more than those to the north. I have omitted the two stations, Burrisal and Furreedpore for the reasons given at a previous page, but it is well known, as indeed their registers show, that they [the former especially] receive more rain than any of the stations here enumerated, and their rains begin earlier. The mean rainfall of the Delta would appear to be about 70 inches.

Northern Group.—With the exception of Malda and Rampore Beauleah in the SW, and Dacca in the SE corner of the area, these stations have a higher rainfall than those of the Delta proper. This is doubtless owing to the influence of the hills on the north and north-east, especially the latter, which obstruct the free passage of the vapour-bearing winds, and increase the precipitation of their vapour. This influence is felt to at least 80 miles from their foot. Other things being equal, the easterly stations receive more than the westerly, and the rains begin earlier at the former, as in the case of the Delta stations. The average fall of the area is about 80 inches.

Himalayan Group.—I have returns of the rainfall of only two stations in the Himalaya, and of one of these only a four years' register. One of them, Rungbee, is situated at an elevation of 5000 feet on a spur directly facing the plains to the SE, the other (Darjiling) at 6,950, shut out from the plains by a ridge which averages 1000 feet above the station. It cannot, therefore, be ascertained how far the difference of their rainfall, which amounts to about 24 per cent. of that of the wetter station, is attributable to difference of elevation. But it is important to note the very great difference of the rainfall of Rungbee and Cherrapunjí, both at nearly the same elevation, and both fully exposed to the moist wind of the region; since in Sikkim, the course of the vapour-bearing monsoon has turned so as to proceed from the SE.

Behar Group.—I include in this group, all stations to westward of the hilly and upland region that lies to the south of the Ganges and between its Delta and the Sone valley, and those north of the Ganges in the province of Behar. Their elevation varies from 150 to 450 feet. The vapour-bearing monsoon reaches these as a SE or ESE wind, and having already traversed the high ground above noticed, and its flanking hill ranges, has been deprived of a portion of its moisture. Consequently their mean rainfall does not exceed 40 inches, and their climate is similar to that of the N. W. P. Moreover the rains commence as a rule about a fortnight later than in the Delta, and they reach their maximum in July or August.

Western Bengal.—Under this name, I group the stations lying between the Delta and Behar groups. Those on the eastern and northern edge are from 100 to 200 feet only above the sea. Those in the interior are more elevated, the highest, Hazareebaugh, being 2010 feet. Their rainfall varies between an amount equal to that of the western Delta stations, to one not greater than that of the Behar group. Generally there is a gradual diminution from east to west, but the amount is much influenced by elevation and exposure. Thus, Hazareebaugh, at 2010 feet, has a mean rainfall 10 inches higher than Manbhoom, 70 miles to the eastward, but situated on a plain probably less than 500 feet above the sea. On the east face of the Kurruckpore hills, 30 miles west of Bhagulpore, in a country covered with dense forest, and directly facing the SE wind, the rainfall is stated by Mr. Stevens in a report on a proposed scheme for irrigation, to be as high as 72 inches, which does not seem improbable. But at Bhagulpore to the eastward, close to the Ganges, the average fall is only 51 inches, and at Monghyr at the north-western foot, and somewhat to leeward of the range, it does not amount to 40 inches.

Orissa Group.—This group includes three stations situated on the alluvial plain which borders the north-west corner of the Bay and averages 50 miles in width, and one, Sumbulpore, in the interior of the hill country lying to the westward. Balasore, the most northerly of the former stations, has a rainfall equal to that of Calcutta, but the quantity diminishes to the south and towards the interior. The wettest months appear to be July and August, but the registers shew some anomalies, which are probably due to their imperfection. It may be noticed, that while the June rainfall is somewhat less than that of the Delta, the October fall is somewhat larger.

Seasons and causes of the Rainfall.—It has been noticed above, that there is a certain amount of variation in the season of maximum rainfall in eastern and western Bengal, the rains of the former beginning and reaching their maximum earlier than those of the latter; but there are some other features of their periodicity that may be noticed in connection with what is known of the general causes that determine them.

A glance at the tables will shew that the rainfall of Bengal is far from being restricted to that period which is emphatically termed 'the rains'; in which respect, Bengal offers a marked contrast to Bombay, and the western part of the Peninsular generally. December is in general the driest month, but from that time forward the monthly rainfall gradually increases, more rapidly however in eastern than western Bengal, and there is no long period of great siccity preceding heavy rainfall such as characterises western India.

Of the cause of the rain that falls in the winter months, I have seen no satisfactory account, and our records are at present too imperfect to permit of my suggesting its probable explanation. The winter rains, it must be observed, are more regular and frequent in Upper India than in Bengal. Generally, however, a few days of rain in January and February are experienced at Calcutta. As far as I have observed, this rain is preceded by a calm state of the atmosphere, or sometimes by a light wind from the south, and the Calcutta registers shew that it is most frequent with north and east winds. The sky becomes covered with cirro-stratus which gradually thickens, and at length resolves itself into a steady rain, less heavy than the summer rains, and somewhat like the winter rains of Europe. It is always followed by a considerable fall of temperature, and generally by a cool breeze from the NW.

As the sun advances northwards in March and April, the temperature of the Peninsular rises rapidly, the focus of heat being, according to the Messrs. von Schlagintweit's chart, about Nagpore. With the rise of temperature, the tendency of the winds becomes centripetal, the direction being between S and SE along the Coromandel Coast, and W or WNW on the Coast of Bombay. Herein we have the probable cause of the spring rains, which as I have above remarked, are not felt in Bombay, or indeed any where to the west of Nagpore. This will be understood, if we consider what will be the source of the winds that impinge upon the opposite coasts of the Peninsular in accordance with Buys Ballot's law, and as verified by observation. On the east coast, the air comes from the south, less saturated indeed, than that which brings the monsoon rains, since at this period, it is not drawn in a steady current over so great an expanse of ocean; but containing a considerable quantity of vapour, which it precipitates chiefly in the brief, but frequently violent storms of which the Bengal 'North-Westers' are examples. On the West,* the air comes originally from the NW, that is, from the arid region of Arabia, and the countries around the Persian Gulf, and the expanse of sea traversed between these countries and the Indian Peninsular is insufficient to charge it highly with vapour.

The above explanation applies of course only to the Peninsular of India, properly so called. In Eastern Bengal and Assam, heavy rains begin in April, or shortly after the equinox. SW winds now predominate, and precipitate their moisture abundantly on the cool hilly but not very elevated region on which they immediately impinge. Since the winds preserve their SW direction, they would appear to flow towards the region of low barometric pressure which, as Mr. Buchan's charts shew, prevails at this season over Tibet and Western China, the Himalayan range terminating at the 94th parallel of longitude, and ceasing, therefore, to present so great an obstacle to the transfer of the air, as it does everywhere to the westward. It may be observed that in April, the heavy rains are restricted to latitudes north of the head of the Bay. At Akyab and Sandoway there is little rain in this month, and heavy rains begin with the strengthening of the monsoon, only a week or two earlier than in Lower Bengal.

The monsoon rains usually set in in Calcutta about the second or third week in June. At Darjiling, they are somewhat earlier, and in Western Bengal, and the N. W. Provinces, a fortnight or three

* See Board of Trade Wind Chart, No. IX for the north parts of the Indian Ocean, and for Bombay the Magnetic and Meteorological observations of the Bombay University.

weeks later. The focus of heat, as Col. Strachey long since observed, and as is shewn in the Messrs. Schlagintweit's charts, is now transferred to the Punjaub, and the air from the Bay of Bengal is drawn across the hilly region of Western Bengal and Orissa, and up the Gangetic plain as a SE, ESE or easterly wind. The mean annual fall decreases gradually *ceteris paribus* with the increasing distance from the Bay of Bengal. At Benares, the mean fall is 34.34, at Agra 25.17 inches &c. As I have pointed out in a previous paper, the immediate cause of the deficient rainfall of the N. W. Provinces in 1868 and 1869, was the existence of a circumscribed area of low pressure, immediately in the path of their winds, and their consequent detraction from their usual path. The monsoon of Hindustan is, therefore, a local phenomenon, independent of that of Central Asia or nearly so, while the SW monsoon of Eastern Bengal is probably a part of the greater movement which has its centre in the latter region. The focus towards which the monsoon of Hindustan flows, is the heated and dry region of the Punjab, which is the limit of the rains, and where they are comparatively light, not exceeding five inches in the five months, from June to October, at Mooltan.*

The monsoon of Bengal usually lasts to the first or second week in October, but northerly winds frequently begin to be felt somewhat earlier; the plains of Northern India being now cooled down by evaporation, while the sun is retreating in Southern declination.

Meanwhile the Southern part of the Coromandel Coast and its adjacent plains have received little or no rain, since, as is well known, the SW monsoon is nearly exhausted of its moisture by the Ghats and Table land of Mysore, and the still loftier hill-masses to the South that lie along the west coast, and form an interrupted prolongation of the Ghats. When, therefore, the air is no longer drawn from the south towards Northern India, the plains of Madras still retain a high temperature and as

* The mean of the five years, 1862-66 at Mooltan is given by Dr. Neil, the Meteorological Reporter for the Punjab, as follows :—

June,	0·40
July,	1·76
August,	1·74
September,	0·50
October,	0·50

Prof. Dove long ago pointed out, the southerly winds come round and blow towards them from the ESE or ENE, bringing the autumn rains. This is more especially the season of Cyclones in the Bay of Bengal, their frequency being about twice as great as at the beginning of the SW monsoon. The retroversion of the monsoon is felt slightly in Orissa, as is shewn by the excess of the October mean over that of the Delta already noticed.

INFLUENCE OF ELEVATION ON THE RAINFALL.—On this subject systematic observations are wanting in Bengal, and although the list of stations here given, comprises a considerable variety of elevations, the stations present such differences of exposure that their registers are not comparable for the purpose of determining the effects of mere elevation on the quantity of the annual precipitation. It will, however, be of interest to notice such differences as they present, with due regard in each case to those other circumstances which affect the result; and in so doing, I shall draw attention to the effect of the proximity of hills in increasing the rainfall of stations lying to the windward, and the distance to which this influence appears to extend, a subject to which I have already adverted in a cursory manner in the foregoing pages. In this discussion, I shall have occasion to adduce some data, which I have omitted from the general table on account of the short period over which the observations extend. To eliminate, as far as possible, the effects of varying distance from the sea, and those due to the difference and force of the prevailing vapour-bearing winds, I shall consider separately the stations of Eastern, Northern and Western Bengal.

The enormous rainfall of Cherra-punjí at an elevation of about 4000 feet, has already been noticed. This is a little below the elevation of maximum precipitation determined by Col. Sykes, for Southern India,* but whether the same elevation holds good for the Khasi Hills cannot be determined; the only station with which a direct comparison of elevation can be made is Silhet, at 23 miles from the foot of the hills and less than 100 feet above the sea. Here the mean rainfall is, in round figures, 150 inches, that of Cherra

* Phil. Trans. 1850, p.

being 560 ins. Teria Ghat, immediately at the foot of the escarpment, at an elevation of 130 feet, would doubtless shew an amount intermediate between the two. I have already noticed the influence of the hills in increasing the rainfall on the plains to windward, and it is easy to see that such an effect must be produced wherever (as in this case) a steep escarpment directly faces the prevalent vapour-bearing wind.

This effect is two-fold, direct and indirect; direct since, as a physical obstacle, it must cause a piling up so to speak of the lower and more saturated strata of the atmosphere, and force them to an elevation at which their temperature falls below the dew point, causing precipitation; and indirect, since the vast quantities of water discharged from the hills and spreading themselves over the plain, present an extensive evaporating surface which may extend far beyond the region of the former influence. Such is the case in Silhet. In the rains, the whole region traversed by the SW winds in their passage from the Bay of Bengal, is covered with broad flooded rivers, innumerable creeks and extensive jheels which occupy the whole intervening space, with the exception of the river, banks and the small elevations on which are built the villages. At this season, the whole country may be not inaptly described as an expanse of water. The atmosphere is, therefore, kept in a state constantly bordering on saturation, and to this fact, and not solely to the direct or (so to speak) mechanical effect of the hills, must be attributed the high rainfall of Eastern Bengal. The following list of stations, all on the plains, and within 70 feet of sea level, with their distance from the hills, and their annual rainfall will shew the combined effects of the two causes above noticed.

	Distance from the hills.	Annual Rain-fall.
Dacca, ...	100 miles.	75·23 inches.
Bogra, ...	60 „	91·07 „
Mymensingh, ...	30 „	108·03 „
Silhet, ...	20 „	149·76 „ .

I now turn to the corresponding facts presented by the Himalayan and Sub-Himalayan stations.

Here again a direct comparison of the effects of elevation is impracticable, but the stations for which I have registers are more numerous. Three of them viz. Darjiling, Rungbee and Rishap are situated within a few miles of each other at elevations respectively of 6950, 5000 and 2000 feet approximately; the positions of the two former stations have been described above; the last is situated below Rungbee. The following is a comparison of the rainfall of each, the mean of the two years, 1868 and 1869.

	Elevation.	Mean Rainfall of 2 years.
Darjiling, ...	6950 feet.	117·93 inches.
Rungbee, ...	5000 ,,	167·07 ,,
Rishap, ...	2000 ,,	104·95 ,,

The two stations last mentioned lie on the exposed face of the hills, but they are, to some extent, shut off in a measure from the plains by a spur that reaches to 7000 feet, or 2000 feet above the higher of the stations. The effect of this is, however, as I am assured by Mr. Clarke, less than might be anticipated, since the open valley of the Teesta and that of its lateral feeder, the Rungbee, afford a free passage to the SE wind, which pours up them, and from the head of the latter valley is driven up the Sinchul ridge. The difference of these stations, at 2000 and 5000 feet, amounts to 60 per cent. of the rainfall at the lower. I am now making arrangements, with Mr. Clarke's assistance, to establish a guage at a greater elevation, where Mr. Clarke opines, the rainfall will be found to be heavier than at Rungbee. Darjiling being to leeward of the Sinchul ridge has doubtless a lower rainfall, than a station at the same elevation immediately above Rungbee would be found to have.

Buxa in the Bhotan doars is stated to be about 2,490 feet above the sea.* In 1869, for which year alone I have its register, no less than 252 inches were measured at this station. It presents the freest possible exposure, standing forward on the ridge of a spur that projects directly into the plains, but its excessive rainfall, as compared with the Sikhim stations, is no doubt in part due to its more easterly position, and I have considerable reason to believe that the rain-

* The mean of two boiling-point determinations by Major Godwin-Austen.

fall was exceptionally heavy, as compared with that of Bengal generally, over an area which included Buxa. Julpigooree, the nearest station, 20 miles from the foot of the hills, and about equidistant from Darjiling and Buxa, had in 1869 a fall of 164 inches, or equal to that of Rungbee, and Rungpore, 70 miles south of Buxa, had nearly 100 inches or 15 inches above the annual mean, while at Darjiling the fall in 1869 was 29 inches below the average. It is clear, therefore, that any conclusions drawn from the registers of a single season may be extremely fallacious even for neighbouring stations.

I have not any returns for stations near the foot of the Himalaya, extending over a sufficient period to yield an approximate average, but the following shew a certain decrease of precipitation with increasing distance.

	Distance.	Annual fall.
Rungpore, ...	70 feet.	85·22 inches.
Dinagepore, ...	80 ,,	85·84 ,,
Malda, ...	130 ,,	51·81 ,,
Rampore Beauliah, ...	160 ,,	63·32 ,,

This table exhibits irregularities, such as do not appear in that of the stations lying between Dacca and the Khasi Hills, but the circumstances are not so uniform, and the stations do not range so nearly in the line of the prevailing moist wind.

The stations of the group that I have termed Western Bengal, do not present any regular increase of elevation with uniform exposure. I have already adverted to the increase of rainfall on the SE face of the Kurruckpore hills, over that of Bhagulpore on the plains near their foot. The elevation at which the mean rainfall is estimated to be 72 inches, is stated to be between 300 and 1200 feet above the river valley, the mean elevation of which is not stated. The data, therefore, are too indefinite to admit of other than a general conclusion as to the effects of elevation. The data for Hazareebaugh at 2010 feet are more exact, but there is no station with which it can be directly compared.

As a general conclusion, it may be stated that so far as our data go, stations at 4000 to 5000 feet present a higher rainfall than those at lower elevations in similar circumstances of exposure, but the evidence is insufficient to shew whether this is the elevation of maximum precipitation, and there are other circumstances of position, apart from the character of the prevalent rain-bearing wind, at least equally influential in determining the amount of precipitation.

To sum up the principal facts educed in this discussion.

The rainfall of Eastern Bengal commences at an earlier period and is on the whole heavier than in Western Bengal at stations equally distant from the sea, and at equal elevations.

The SW monsoon of Eastern Bengal is probably due to the low pressure in Central Tibet, towards which the saturated air from the Bay flows as a SW wind, traversing the hill plateau between Assam and Cachar in its course towards upper Assam, where the barrier of the Himalaya ceases and allows it a passage to the north. The corresponding monsoon of Western Bengal tends on the contrary towards the heated plains of the Punjaub, access to Central Asia being barred by the Himalaya range.

Besides the regular rains of the SW monsoon, Western Bengal receives a small precipitation in the cold weather months, similar to the water rains of Central and Upper India, but less in quantity and regularity. It also receives spring rains, irregular in quantity and period of occurrence, which are probably due to an inflow of moist air from the Bay towards Central India, the temperature of which is then normally higher than that of any other part of the Peninsular. The autumn rains of Madras are felt in Orissa as a slight prolongation of the regular rains.

MEAN RAINFALL TABLES.

1.—Assam.

	Seebsaugor.		Tezpore.		Nowgong.		Gowhatty.		Goalpara.	
	Inches.	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.
January, ………	1.18	12	.68	9	1.40	9	.70	8	.42	6
February, ………	2.43	12	.99	10	1.45	9	1.43	10	.76	6
March, …………	3.77	11	1.91	9	3.05	10	1.48	8	1.84	6
April, …………	10.15	11	6.84	10	5.87	10	7.27	9	4.85	6
May, ……………	11.04	10	9.51	10	11.01	9	10.92	9	11.72	5
June, ……………	15.56	11	13.83	10	11.92	10	13.29	9	23.72	5
July, ……………	14 87	11	16.51	10	15.08	8	13.08	9	21.33	5
August, …………	13.88	11	13.06	10	13.20	10	11.98	8	12.67	5
September, ……	11.13	11	7.91	10	11.17	9	6.82	9	10.93	5
October, ………	4.46	11	3.10	9	4.33	10	3.20	9	5.61	5
November, ……	1.29	11	.82	8	.65	10	.47	8	.39	6
December, ……	.69	11	.92	9	.37	10	.12	9	.20	6
Year, ……	90.45	...	76.08	...	79.50	...	70.76	...	94.44	...

2.—Khasi Hills.

	Shillong.		Cherra.	
	Inches.	Years.	Inches.	Years.
January, ………	.23	3	.52	7
February, ………	.87	3	3.64	8
March, …………	2.13	3	3.89	7
April, …………	3.76	3	36.71	7
May, ……………	8.18	4	76.73	8
June, ……………	20.06	4	118.90	10
July, ……………	13.44	4	157.35	11
August, …………	9.77	4	80.05	10
September, ……	18.42	4	60.47	11
October, ………	6.97	4	17.66	8
November, ……	1.82	4	3.10	4
December, ……	.23	4	...	4
Year, ……	95.88	...	559.02	...

3.—Silhet and Cachar.

	Silhet.		Cachar.	
	Inches.	Years.	Inches.	Years.
January, ………	.23	13	.50	10
February, ………	1.59	14	3.53	11
March, …………	4.89	13	6.09	11
April, …………	14.40	13	12.69	10
May, ……………	25.04	11	16.12	9
June, ……………	30.87	11	19.55	9
July, ……………	25.94	11	24.58	9
August, …………	23.61	11	16.84	9
September, ……	13.49	10	13.90	9
October, ………	8.71	11	7.77	9
November, ……	.82	10	1.03	10
December, ……	.17	10	.79	10
Year, ……	149.76	...	123.39	...

4.—Tipperah and Aracan.

	Tipperah.		Noacally.		Chittagong.		Akyab.		Sandoway.	
	Inches.	Years.	Inches.	Years.	Inches	Years.	Inches.	Years.	Inches.	Years.
January.	.77	10	.42	12	.37	11	.43	11	0.14	5
February, ...	1.07	10	.83	12	1.62	11	.37	10	...	5
March, ...	2.28	9	1.62	11	1.31	10	.49	11	0.24	5
April, ...	9.28	10	4.31	13	5.46	11	1 38	10	1.35	4
May, ...	11.51	10	9 07	13	9.42	12	8.00	10	14.01	5
June, ...	20.38	10	21.27	13	22.92	12	65.16	10	55.32	5
July, ...	17.11	10	16.59	13	22 54	12	55.75	10	64.50	5
August, ...	13.76	10	19.55	13	23.04	12	41.73	11	51.36	4
September, ...	10.44	10	14.94	13	13.01	12	24.97	10	30.91	4
October, ...	7.04	10	· 7.90	13	5.93	12	14 67	11	17.09	5
November, ...	2.16	9	1.79	11	2.30	10	6.29	9	1.15	3
December, ...	.06	9	.04	11	.55	10	.21	11	...	4
Year, ...	95.86	...	98.33	...	108.47	...	219.45	...	236.07	...

5.—Gangetic Delta.

	Jessore.		Calcutta.		Krishnagur.		Moorshedabad.	
	Inches.	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.
January, ...	.27	12	0.53	32	.61	10	.38	13.
February, ...	.46	11	0.72	32	.99	9	.93	14
March, ...	1.65	9	1.22	32	.77	9	1.20	14
April, ...	3.95	8	2.25	32	4.91	9	2.41	13
May, ...	7.33	9	5.43	32	8.33	7	4.17	14
June, ...	12.61	10	11.80	32	11.81	6	9.23	14
July, ...	10.95	11	13.33	32	9.13	7	10.23	14
August, ...	10.33	10	14.18	32	9.70	9	9.57	14
September, ...	9.85	9	10.36	32	7.94	8	8.53	14
October, ...	6.47	10	5.31	32	5 16	8	6.11	14
November, ...	1.03	10	0.67	32	.44	7	.25	12
December, ...	.01	11	0.24	32	.22	9	.12	13
Year, ...	64.91	...	66 04	32	60.04	...	53.13	...

6.—Northern Group.

	Dacca.		Mymensingh.		Bograh.		Rungpore.		Dinagepore.		Maldah.		Rampore.	
	Inches.	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.
January,	.37	10	.37	5	.43	6	.16	10	.14	10	.92	14	.16	10
February,	.91	10	1.56	6	1 13	7	.34	10	.58	10	1 01	14	1.39	9
March,	1.29	9	1.54	6	1.10	8	.97	10	.56	9	1.01	14	1.61	9
April,	7.52	10	10.26	6	5.32	9	3.30	8	3.07	8	1.96	13	2.70	8
May,	9.81	9	15.32	6	9.93	9	9.96	9	9.75	8	3.57	14	6.21	9
June,	13.90	10	24.34	6	17.26	9	23.40	9	18.95	8	8.56	12	12.01	9
July,	13.39	10	22.06	6	21.07	9	16.53	9	17.51	10	9.58	13	12.87	10
August,	12.33	10	14.88	6	12.13	9	14.05	9	14.36	10	9.86	13	8.85	10
September,	8.24	10	12.46	6	14.82	9	11.44	10	14.81	10	10.07	13	10.69	10
October,	6.32	10	5.06	6	5.90	9	4.47	10	5.83	10	4.40	13	6.34	9
November,	1.08	9	.18	6	1.87	8	.44	9	.26	8	28	12	.42	8
December,	.07	9	...	6	.11	8	.16	10	.02	9	.59	13	.07	9
Year,	75.23	...	108.03	...	91.07	...	85.22	...	85.84	...	51.81	...	63.32	...

7.—Behar.

	Monghyr.		Gyah.		Patna.		Tirhoot.		Chuprah.		Arrah.		Chumparun.	
	Inches.	Years.	Inches	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.
January,	.41	14	1.05	7	.61	8	.71	10	.78	14	1.01	14	.31	7
February,	.69	14	.62	7	1.01	7	.55	10	.57	14	.62	14	.37	7
March,	.41	14	.77	6	.30	7	.60	9	.54	14	.69	14	.95	6
April,	.36	14	.34	7	.41	8	.40	10	.51	14	.91	14	.45	7
May,	1.71	14	.90	6	.74	7	1.71	10	1.26	11	1.24	13	1.11	7
June,	6.02	14	7.49	8	6.51	7	6.07	11	6.26	13	7.73	11	8.16	6
July,	10.39	14	12.19	8	10.43	7	8.64	11	8.63	12	14.41	13	9.81	6
August,	7.85	14	9.47	8	7.19	7	9.66	10	7.72	13	8.96	13	10.53	6
September,	7.30	14	8.00	7	6.02	7	5.72	11	5.96	13	10.61	13	5.16	6
October,	3.66	13	3.43	7	2.26	7	3.07	11	2.59	13	2.66	13	3.03	7
November,	.06	14	.07	7	.12	8	...	10	.03	13	.28	14	...	8
December,	.13	14	...	7	.06	8	...	10	...	13	.04	13	.14	8
Year,	39.19	...	44.33	...	35.66	...	37.13	...	34.85	...	49.16	..	40.02	...

8.—Western Group.

	Bhagulpore.		Soory.		Ranigunge.		Burdwan.		Bancoorah.		Midnapore.		Manbhoom.		Hazareebaugh.		Ranchee.	
	Inches.	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.
January,	.54	14	.61	7	.32	3	.64	13	.44	13	1.06	5	.26	5	.42	4	1.02	12
February,	.83	14	.67	7	.62	3	1.17	13	.96	13	.52	5	.75	5	.52	4	.98	12
March,	.48	14	.71	7	1.15	3	1.50	13	1.46	13	1.51	5	.58	5	.75	4	1.71	12
April,	1.03	14	.65	7	.54	3	1.88	12	1.95	13	1.85	6	.69	6	.42	4	.58	12
May,	2.83	14	2.10	7	2.59	3	4.45	12	2.75	13	6.03	5	.58	6	1.37	4	1.40	13
June,	8.58	13	7.89	7	11.88	3	11.17	11	10.35	13	14.02	5	9.51	7	10.99	4	6.59	14
July,	11.57	14	12.36	7	13.71	3	13.31	12	12.47	13	11.28	4	6.61	6	14.63	4	10.12	13
August,	11.18	14	10.81	7	11.24	3	11.56	11	9.94	13	11.29	5	9.39	7	11.44	4	9.04	14
September,	8.42	14	8.56	7	11.45	3	8.87	12	8.24	13	10.10	5	6.75	7	6.26	4	5.83	12
October,	5.34	14	4.21	7	3 36	3	5.67	11	4.50	13	6.65	6	5.51	7	3.51	4	3.50	13
November,	.04	13	.17	7	.23	3	.61	10	.17	13	.54	5	.04	8	.19	5	.14	12
December,	.09	13	.24	7	...	3	.58	11	.08	12	..	6	.29	7	.02	5	.11	12
Year,	50.93	...	48.98	..	57.09	...	61.41	...	53.31	...	64.85	...	40.96	.	50.52	.	41.02	...

9.—Orissa.

	Balasore.		Cuttack.		Pooree.		Sumbulpore.	
	Inches.	Years.	Inches.	Years.	Inches.	Years.	Inches.	Years.
January, ...	1.18	10	.48	12	.11	13	.19	6
February, ...	1.82	10	.51	12	1.46	13	.68	7
March,............	2.15	10	1.16	12	.66	13	.46	5
April, ...	2.34	9	1.39	10	1.40	12	.25	6
May, ...	4.96	10	1.59	10	2.62	12	1.31	6
June, ...	12.82	10	9.60	10	7.95	12	9.99	7
July, ...	8.94	10	11.04	10	9.04	13	13.22	7
August, ...	12.62	10	11.22	9	12.45	13	10.27	6
September,...........	13.86	10	8.99	10	9.59	13	6.33	7
October, ...	7.42	10	5.63	10	7.43	13	4.79	8
November, ...	.84	8	.90	11	1.21	12	...	6
December, ...	...	9	.76	10	.91	13	.16	7
Year, ...	68.45	...	53.27	...	54.83	..	47.65	...

6a.—Himalaya.

	Darjiling.		Rungbee 5,000 ft.	
	Inches.	Years.	Inches.	Years.
January,............	0.76	8	1.41	4
February, ...	1.60	8	1.66	4
March, ...	1.65	8	1.82	4
April, ...	3.62	8	6.22	4
May, ...	7.01	7	8.35	4
June, ...	27.50	7	33.94	4
July, ...	29.40	10	46.31	4
August, ...	29.09	8	36.70	4
September,.....................	18.06	9	25.55	4
October, ...	6.56	9	8.15	4
November, ...	.20	8	0.16	4
December, ...	.14	9	.18	4
Year,...	129.59	...	170.45	...

Second List of Birds obtained in the Khasi and North Cachar Hill ranges, including the Garo Hills and Country at their base in the Mymensing and Sylhet Districts,—*by* Major H. H. Godwin-Austen, F. R. G. S., *Deputy Superintendent Topographical Survey of India.*

[Received 23rd June, 1870; read 6th July, 1870.]

During the past field season (1869-70) I have been able to make another collection of birds from the above hills. It includes some 148 species, and forms an addition to the list, lately published in this Journal (see p. 91). The greater number of the birds were collected upon the southern base of the Khasi and Garo Hills, and in the Garo Hills themselves; it contains, therefore, fewer novelties, and the species are for the most part well known; especially is this the case with the *Grallatores*, nearly all from the beels of Sylhet and Mymensing. We find here the same species as are to be got to the west of the Brahmaputra; nevertheless I have recorded every bird, whether common or not, shot by my assistants, the collector, or myself, and *only* these have been brought into the list, thus many very common birds do not appear in it at all. Those enumerated have been identified in "Jerdon's Birds of India," or compared with the collection in the Indian Museum, Calcutta, with Blyth's descriptions in the Journal of the Asiatic Society of Bengal, &c.

For a few birds, obtained on the north Cachar side, I am indebted to Mr. W. Robert, Assistant Surveyor, who, I am glad to say, has commenced to form a collection of his own, and who will I trust add many more and new birds to the present list. A Surveyor has fine opportunities afforded him of forming a collection in any section of Natural History, and if he only carry on this work for several years, must make this a very valuable and complete one, for he visits every kind of ground at successive elevations. Thus Mr. N. A. Belletty has added many birds that I did not obtain or see myself, and in the same way, Mrs. Belletty, remaining at the Head Quarter Camp, added a number brought in by a collector, and identified the same as well as a great number sent in by myself and those working in the hills. I have every hope that the desire, expressed in my first paper on the birds of these hills, will be fulfilled, and that the list now commenced, will be greatly added to through the agency of the members of the Survey party, provided the Survey should continue to exist in these days of reduction.

Besides the birds recorded in the list, there are others in my collection of whose identification I am still doubtful, and two or three may prove new; I was unable to find them among those in the Indian Museum. I, therefore, refrain from any remarks or descriptions, until I shall have an opportunity of comparing them with collections in England, the British Museum, &c. Among the species not yet identified, I may mention a *Drymoipus*, *Suya*, *Siphia*, *Pellorneum*, *Stachyris*, *Phylloscopus* and *Tribura*, this last may be *T. luteoventris*, Hodgs.

Jerdon's No.

No. 2. OTOGYPS CALVUS, Scopoli.

Some six or eight were together at Chatak.

20*a*. HIERAX MELANOLEUCOS, Blyth.

Length 6½″, wing 4·2″, tail 3·2″, tarsus 1·0″, bill at front 0·42″; obtained for me by Mr. W. Robert, Assistant Surveyor, near Lukhipur, Cachar.

24. ACCIPITER NISUS, Linn.

From Mymensing. Length 14″, ex. 26½″, wing 9″, tail 7¼″, tarsus 2¼″.

30. AQUILA HASTATA, Less.

On the plateau near Nongkulong (1,500 feet), West Khasi. The feet and cere are dull yellow. L. 26½″, ex. 60″, w. 20″, t. 10″, tr. 5″, bill at front 2¼,″ spread of foot with claws 5·2″.

40. PANDION HALIÆTUS, Linn.

L. 21″, ex. 58½″, w. 16¾″, t. 9″. — Teria Ghat.

41. POLIOÆTUS ICHTHYÆTUS, Horsf.

42. HALIÆTUS FULVIVENTER, Vieil.

Both this and the previous species were breeding in Mymensing in December and January.

51. CIRCUS SWAINSONII, A. Smith.

Irides bright yellow, legs and cere yellow. Length 19¾″, ex. 40″, w. 13½″, t. 9½″, tr. 2¾″, bill at f. ½″, mid toe and claw == 1½ inch, spread of foot ¾″. — From Mymensing.

53. CIRCUS MELANOLEUCUS, Gmelin.

L. 17½″, ex. 42″, w. 14″, t. 9¼″, tr. 3.0″, mid toe and claw 2¾″, cere dark yellow; from Bolagunj, Sylhet.

72. KETUPA CEYLONENSIS, Gmel.

81. NINOX SCUTELLATUS, Raffl.

85. HIRUNDO DAURICA, Linn.

Specimens of the three last named species were obtained at Mymensing.

89. COTYLE SINENSIS, Gray.

Breeding in January at Shirshang in banks of the Lumessary River. L. 12½″, w. 8¼″, t. 6½″, tr. 0.7″, bill at f. 0.5″.

109. CAPRIMULGUS ALBONOTATUS, Tickell.

The first primary has a white spot on the inner web only, and is also faintly mottled at tip.

119. MEROPS QUINTICOLOR, Vieill.

Ear coverts dark brown, tail exceeds end of wings by 1½ inches. L. 8¾″, w. 4.2″, t. 3.4″, tr. 1.4″, bill at f. 1.3″. Several specimens obtained in the topes of trees at Agarkote, W. Shushang, Mymensing district.

129. HALCYON FUSCUS, Bodd.

L. 11″, ex. 16.7″, w. 4.7″, t. 3.5″, tr. 0.7″, bill at f. 2.25″; foot of hills near Sylhet and Mymensing.

141. HYDROCISSA CORONATA, Bodd.

♂.—L. 36½″, ex. 41″, w. 14.5″, t. 13·5″, tr. 2″, bill at f. 5½″, casque depth at base 3⅜″, its length over top 7″, bill from gape 6¾″.

♀.—L. 36″, ex. 42·5″, w. 14″, t. 13″, tr. 2·0″, casque depth at base 3⅜″, casque over top 6¼″, bill from gape 6½″.

Orbital skin waxy white, bill waxy pale ochre with a black longitudinal mark in front. Jerdon remarks that the black patch does not extend to the upper mandible; in my specimens it does so markedly. I was at first inclined to think that the species was *H. albirostris*, but its much larger size distinguishes it from that species.

I shot both sexes in the west Khasi Hills, West of Pundengru in the dense forest, on the same tree which was frequented by these birds for the fruit then ripe.

148. PALÆORNIS TORQUATUS, Bodd. — Chatak.

172. Gecinus occipitatis, Vigors.

♀.—L. 11¼″, w. 5⅜″, t. 4½″, tr. 1⅛″, bill at f. 1·28″.

As the description of a female has not been given by Jerdon, I give it here. Head grey with feathers centred dark grey, rufous and grey at chin, brest dull green; primaries and secondaries spotted on inner web with white; tail black, tinged green on outer edge of web and faintly barred; back yellow green, strong on upper tail coverts; legs plumbeous.

178. Micropternus phaioceps, Blyth.

From Lukhipur, Cachar.

180. Brachypternus aurantius, Linn. — Mymensing.

188. Yunx torquila, Linn.

W. 3.3″, t. 3.1″, tr. 0.75″, bill at f. 0.58″.

197. Xantholæma Indica, Lath. — Chatak.

199. Cuculus canorus, Linn.

Shot in Mymensing District in a fine tope of trees on the bank of the Ubda Káli river in April. The call was not so low and soft as that of the European bird, or the Cuckoo heard in the Himalayas and Khasi Hills; it was quite harsh compared to it.

203. Cuculus micropterus, Gould. — Chatak, in April.

One specimen measures: L. 13″, ex. 21½″, w. 7¾″, t. 6.5″, tr. 0.9″, bill at f. 0.95″; another specimen: ex. 22″, w. 8″, t. 6.25″, bill at front 0.98″.

The note of this bird is a repetition of the sound, *ta-koo, ta-koo*, with an intervening pause, quite different from the familiar note of the Cuckoo, *C. Canorus*.—One specimen was much larger than the other. The first was of a fine rich brown grey with a purple gloss, the other dull and grey; the rufous tinge on side of upper breast and neck was also absent in this last. I am inclined to think that *C. micropterus* and *striatus* are not to be separated, one being only a finer larger bird than the other.

217. Centropus rufipennis, Blyth. — Teria Ghat.

224. Arachnothera pusilla, Blyth.

Wg. 2·7″, t. 1·8″, tr. 0·68″, bill at f. 1·42″. Hemeo Peak, N. Cachar Hills.

232. Leptocoma Zeylonica, Linn.

Length 4″, w. 2″, t. 1·3″, tr. 0·52″, bill at f. 0·7″.

234. Arachnechthra Asiatica, Lath. ♀ — Teria Ghat.

238. Dicæum minimum, Tickell.

Length 3·1″, w. 1·75″, t. 0·75″, tr. 0·42″, bill at f. 0·34″. Bill grey, pale at base. Garo Hills.

257. Lanius erythronotus, Vigors.

Length 9½″, ex. 11¼″, w. 3¾″, t. 4¼″, tr. 1⅛″. Mymensing.

259. Lanius nigriceps, Franklin.

261. Lanius cristatus, Linn.

L. 7¾″, ex. 10½″, w. 3¾″, t. 3½″, tr. 0·85″, bill at f. 0·6″.

276. Pericrocotus peregrinus, Linn.

L. 5¾″, ex. 8½″, w. 2·7″, t. 3″, tr. 0·6″, bill at f. 0·37″. — Mymensing.

283. Bhringa remifer, Temm. — Garo Hills.

307. Cyornis ruficauda, Swainson.

L. 5¼″, w. 2·8″, t. 2·4″, tr. 0·68″, bill at f. 0·4″. North Cachar.

Above olivaceous, with tinge of rufous on lower back; tail rusty with pale brown edges; chin and throat dull white; breast rusty brown, oily white on abdomen and sullied with green.

324. Erythrosterna pusilla, Blyth.

L. 4¼″, w. 2·3″, t. 1·6″, tr. 0·68″, bill at f. 0·3″; legs reddish fleshy; procured at the base of the Garo Hills.

350*a*. Zoothera marginata, Blyth.

L. 8½″, ex. 14½″, w. 4¾″, t. 3″, tr. 1·0″, bill at f. 1·0″, legs fleshy grey, bill black; from the base of West Khasi Hills.

352. Orocetes erythrogastra, Vigors.

W. 4·8″, bill at f. 0·8″, tr. 1·1″. — North Cachar.

355. Geocichla citrina, Latham.

Obtained at Asalú and in the Garo Hills. Length 8½″, w. 4·5″, t. 3·0″, tr. 1·3″, bill at f. 0·7″.

363. Merula castanea, Gould.

Length 10″, ex. 14″, w. 5½″, t. 4½″, tr. 1⅜″, bill at f. 0·8″, legs dull yellow, irides dark brown. Tura range, Garo Hills.

371. Oreocincla dauma, Lath.

Length 10½″, w. 5⅝″, t. 4″, tr. 1·4″.

373. Paradoxornis flavirostris, Gould.

Length 9″, ex. 9¾″, w. 3½″, t. 4″, tr. 1¼″, bill from gape ½″.

Obtained in the high grass of the jheels near Bolagunj in December. Several were then seen. On passing through the same ground in April, I found it quite common, and it evidently breeds there.

384. Gamsorhynchus rufulus, Blyth. — Garo Hills.

387. Trichastoma Abbotii, Blyth.

Irides red brown, legs pale fleshy. Length 6¼″, w. 3″, t. 2·1″, tr. 0·95″, bill at f. 0 65″. Foot of South Garo Hills.

390*a*. Turdinus brevicaudatus, Blyth.

From South base of Khasi and Garo Hills. The under tail coverts are very rufous, feathers of the head and neck very large and scale-like, centred paler and edged darker brown. Secondaries and larger coverts tipped with pale rufous; above umber brown, grey on the chin and upper throat. The type specimen in the Asiatic Society's Museum is much faded.

403. Pomatorhinus leucogaster, Gould.

From West Khasi Hills. Irides red buff, bill yellow.

Length 9″, ex. 9¾″, w. 4·15″, t. 4·3″, tr. 1·4″, bill at f. 1·15″, bill from gape 1·3″, hind toe 0·62″ and claw ·48″ = 1·1″, spread of foot 2·15″.

405. Pomatorhinus erythrogenys, Gould.

West Khasi Hills, December. Irides dark red brown, legs and bill pale grey, one specimen had greenish grey legs. One specimen measures: Length 10·5″, ex. 12″, w. 3·9″, t. 3·9″, tr. 1·6″, bill at f. 1·6″; another specimen: Length 10·5″, ex. 12·5″, w. 4·2″, t. 4·3″, tarsus and bill the same as in the last, bill from gape 1·9″ in both.

409*a*. Garulax gularis, Mc Lelland.

This rare bird was procured at Lukbipur near Cachar; it appears that only two specimens have been obtained in Assam, one by Mc Lelland, and another by Dr. Jerdon who sent it to Mr. Gould; it is figured and described in the "Birds of Asia."

Length 9¼″, w. 3·8″, t. 4¼″, tr. 1·52″, bill at f. 1·02″.

410. Garrulax ruficollis, Jard. and Selby.

Length 10″, ex. 11½″, w. 3·7″, t. 4·2″, tr. 1·45″, bill at f. 0·7″; the tail is distinctly barred. From base of Garo Hills.

439. Chatarrhœa Earlei, Blyth.

Hind toe and claw 0·8″, spread of foot 1·8″. Mymensing and Sylhet, very common in the grassy parts of those districts.

440. Megalurus palustris, Horsf.

The tail is distinctly barred, and the breast and flanks are *streaked* with brown rather than *spotted*.

441. CHÆTORNIS STRIATUS, Jerdon.

Length 7¾″, w. 3⅛″, t. 3·6″, tr. 1·15″, bill at f. ·52″; rather smaller than the dimensions given by Jerdon. Irides pale umber.

447*a*. IOLE VIRESCENS, Blyth.

Wing 3·2″, t. 2·9″, tr. 0·62″, bill from gape 0·82″. Lukhipur near Cachar.

463*a*. PHYLLORNIS COCHINCHINENSIS, Lath.

From Kylas Peak or Chickmung, Garo Hills.

484. PRATINCOLA LEUCURA, Blyth.

Length 5⅝″, ex. 8″, w. 2⅝″, t. 2″. In reeds and grass bordering rivers in North Mymensing district.

486. PRATINCOLA FERREA, Hodg. — Cachar.

487. RHODOPHILA MELANOLEUCA, Jerdon.

♂ Sp. Length 6″, ex. 8¼″, w. 2·6″, t. 2·7″, tr. 0·8″, bill at f. 0·42″.
♀ Sp. „ 5¾″, „ 7¾″, „ 2·45″, „ 2·55″, „ 0·8″, „ „ „ 0·5″.
Obtained at Chatak and to the North of Mymensing.

503. RUTICILLA FRONTALIS, Vigors.

Wing 3·6″, t. 3″, tr. 0·9″, bill at f. 0·42″. N. Cachar.

512. CALLIOPE KAMTSCHATKENSIS, Gmel.

Length 6″, ex. 8½″, w. 3,″ t. 2·3″, tr. 1·15″, bill at f. 0·45.″ Bill grey, legs pale grey, irides dark brown. Mymensing.

513. CALLIOPE PECTORALIS, Gould.

Length 6½″, ex. 9″, w. 2¾″, t. 2¾″, tr. 1⅛″. Mymensing.

514. CYANECULA SUECICA, Linn.

♀ Sp. Length 6″, ex. 8⅝″, w. 3″, t. 2¼″, tr. 1·1″. This female bird was dark ashy above with a tinge of brown. Mymensing.

515. ACROCEPHALUS BRUNNESCENS, Jerdon.

Length 8″, ex. 10″, w. 3⅝″, t. 3½″. — N. Mymensing.

516. A. DUMETORUM, Blyth.

Length 5″, ex. 7″, w. 2·35″, t. 2·3″, tr. 0·9″, bill from gape 0·7″. — Chatak.

517. A. AGRICOLUS, Jerdon.

Length 5⅝″, ex. 6¼″, w. 2·2″, t. 2·4″, tr. 0·95.″ Irides pale ochre yellow. Bill grey above, pale below, legs pale fleshy. — Chatak.

518. ARUNDINAX OLIVACEUS, Blyth.

Length 7·5″, ex. 9·75″, w. 3·15″, t. 3·5″, tr. 1·2″, bill at f. 0·6″; legs pale grey, bill fleshy below, tail distinctly barred. — Chatak.

520. LOCUSTELLA CERTHIOLA, Pallas. — Cherra Poonjee.

Wing 2·4″, tr. 0·9″, bill at f. 0·5″.

530. Orthotomus longicauda, Gmel.—N. Mymensing.

532. Prinia flaviventris, Dellessert.

Wing 1·85″, tr. 0·75″, bill at f. 0·45″; in high reedy grass near the rivers. North Mymensing.

555. Phylloscopus fuscatus, Blyth.

1 specim: Length 5″, ex. 7·5″, w. 2·4″, t. 2″, tr. 0·9″, bill at f. 0·35″.

2 specim: Length 5″, ex. 6″, w. 2·5″, t. 2·25″, tr. 0·9″, bill at f. 0·4″. Tail very indistinctly barred; 1st quill is 0·7″ shorter than the 2nd, the 2nd—0·4″ than the 3rd, 4th quill the longest, 5th and 6th sub-equal. Among high reeds in beels between Bolagunj and Chatak, Sylhet District.

558. Phyl. lugubris, Blyth.

Length 5″, w. 2·3″, tr. 0·8″, bill at f. 0·37″; 1st primary 0·19″, 2nd 0·65″ longer; legs greenish grey; bill at base below pale yellow.

560. Phylloscopus viridanus, Blyth.

From high grass in beels near Chatak.

577. Abrornis albogularis, Hodg.

Length 3½″, ex. 5·0″, w. 1·8″, t. 1·8″, tr. 0·62″, bill at f. 0.16″. This rather rare bird was seen several times in the forest on the slopes of Kylas or Chikmung Peak, Garo Hills, generally low among the boughs, not confining itself to the tops of the trees, as many allied species do.

593. Budytes viridis, Gmel. Mymensing, &c.

645. Parus cinereus, Vieil.

Jerdon in his description does not allude to the tail feathers of this bird. In my specimen, from the base of the Garo Hills, the centre tail feathers are dark slaty, the rest edged cinereous; the outermost are white, penultimate white on inner web for half an inch and tipped with the same color; the antepenultimate with a very small white spot on the inner web. Length 5½″, ex. 8¼″, w. 2⅝″, t. 2¼″, tr. 0·65″, bill at f. 0·4″.

686. Acridotheres fuscus, Wagler.—Shuthang, Mymensing.

696. Ploceus Bengalensis, Linn.—Hylakandy, Cachar.

702. Munia acuticauda, Hodg.

Length 5¼″, ex. 6¼″, w. 2·1″, t. 1·6″, tr. 0·6″, bill at f. 0·4″; irides dark red brown, legs grey. West Khasi Hills.

706. PASSER INDICUS, Jard. and Selby.

717. EMBERIZA SPODOCEPHALA, Pallas.

This bird was common in the marshes between Chatak and Bolagunj in April. Length 6″, w. 3″, t. 2·7″, tr. 0·75″, bill at f. 0·45″.

720. EMBERIZA PUSILLA, Pallas.—Foot of Garo Hills.

A very large specimen measured: Length 5⅝″, ex. 8½″, w. 3″, t. 2½″, tr. 0·7″, bill at f. 0·37″. A smaller spec. has w. 2·5″, t. 2⅜″.

723. EUSPIZA AUREOLA, Pallas.

Length about 6″, w. 3·05″, t. 2 4″, tr. 0·85″, bill at f. 0·5″. Bill and legs pale fleshy, the former paler above; the dark brown collar mentioned by Jerdon was conspicuous in the specimen I obtained in December at Sonaingunj, Sylhet district.

754. MIRAFRA ASSAMICA, McLelland.

Length 6″, ex. 10½″, w. 3·2″, t. 1·9″, tr. 0·9″, bill at f. 0·6″, hind toe and claw 0·8″. Mymensing.

772. CROCOPUS PHŒNICOPTERUS, Latham.—Mymensing.

774. OSMOTRERON BICINCTA, Jerdon.—From Chatak, Sylhet.

Length 10·5″, ex. 18″, w. 5¾″, t. 3·5″, tr. 0·7″, bill at f. 0·65″. Under tail coverts pale, slightly streaked with dusky.

780. CARPHOPHAGA SYLVATICA, Tickell.—Garo Hills.

788. COLUMBA INTERMEDIA, Strickland.—Mymensing

793. TURTUR MEENA, Sykes.—Khasi hills.

Length 14″, ex. 20″, w. 7″, t. 5″, tr. 0·9″, bill at f. 0·7″.

796. TURTUR RISORIA, Linn.

803. PAVO CRISTATUS, Linn.

Commom in Mymensing at the base of the Garos, and very numerous about the villages in the higher part of the Shunshang or Sumesang river, quite in the heart of the hills. East of the Moish Kulla and even of the Mahadeo river this bird is not seen; I have never heard them at the base of the Khasi Hills near Teria, and if there are any there they are very scarce indeed. The South base of the Garos may be said to mark the extreme Eastern range of the Indian Bird.

803*a*. POLYPLECTRON TIBITANUM, Linn.

811. GALLOPHASIS HORSFIELDII, Gray.

812. GALLUS FERRUGINEUS, Gmel.

Occurs up to 4000 feet in the Burrail ranges.

823. ORTYGORNIS GULARIS, Temminck.

I have seen a specimen shot by Lt. R. Beavan on the Cherra Punjí plateau; a pair brought up a brood in the garden at Emmaville in the same place last summer, 1869. It is curious to find this bird, with a habitat in the swampy grass jungle at the base of the hills, ranging so high as 4000 ft.

831. EXCALFACTORIA CHINENSIS, Linn.

This handsome little game bird comes in at Cherra about August.

825. ARBORICOLA RUFOGULARIS, Blyth.—North Cachar.

Length 9½″, w. 5¼″, t. 2¼″, tr. 1·5″, bill at f. 0·7″.

825*a*. ARBORICOLA ATROGULARIS, Blyth.

Tura Range, Garo Hills. Length 9¼″, ex. 16½″, w. 5⅛″, t. 2½″, tr. 1·6″, bill at f. 0·65″,

843. GLAREOLA LACTEA, Temm.

845. CHARADRIUS LONGIPES, Temm.

846. ÆGIALITIS LESCHENAULTII, Lesson.

849. Æ. PHILLIPENSIS, Scopoli.

854. CHETTUSIA INORNATA, T. and Schleg.

855. LOBIVANELLUS GOENSIS, Gmelin.

857. HOPLOPTERUS VENTRALIS, Cuvier.

870. GALLINAGO STENURA, Temm.

Length 4¼″, w. 4¾″, t. 2·3″, tr. 1·18″, bill at f. 2·3″. I first observed this bird on the 5th April solitary on the edge of a stream flowing through the marches between Chatak and Bolagunj ; several were flushed and I bagged a couple, one of which I observed running along the muddy edge of the water like an *Actitis*, which I at first took it to be; they were by no means wild, flying a short distance and setting by the water up stream. Proceeding and shooting along the same river 12 days after I did not see one, they had evidently all passed to the north.

871. GALINAGO SCOLOPACINUS, Bonn.

872. GALINAGO GALLINULA, Linn.

884. TRINGA SUBMINUTA, Leisler.

885. TRINGA TEMMINCKII, Leis.

891. ACTITIS GLAREOLA, Gmel.

892. ACTITIS OCHROPUS, Linn.

893. AC. HYPOLEUCOS, Linn.

A large white spot on the inner webs of all the primaries except the *first;* the secondaries barred white, three last with a dusky spot, the last has a white spot on inner web.

894. Totanus glottis, Linn.

898. Himantopus candidus, Bonaterre.

900. Metopidius indicus, Latham.

901. Hydrophasianus chirurgus, Scop.

902. Porphyrio poliocephalus, Latham.

905. Gallinula chloropus, Linn.

907. Gallinula phœnicura, Pennant.

Length 13½″, w. 6·2″, t. 3″, tr. 2·6″, bill at f. 1¾″, mid toe and claw 2·9″, hind toe and claw 1·2″. In the specimen I got in Mymensing there is a marked black line down the side of the neck, in immediate contact with the white of the front part.

923. Ardea cinerea, Linn.

924. Ardea purpurea, Linn.

926. Herodias egrettoides, Temm.

929. Buphus coromandus, Bod.

930. Ardeola leucoptera, Bod.

931. Butorides Javanica, Horsf.

932. Ardetta flavicollis, Latham.

Length 21″, ex. 29″, w. 8″, t. 2″, tr. 2·65″, bill at f. 3·3″, hind toe 2·3 + claw ·55 = 2·85″. Bill and cere madder brown, irides red brown with a narrow ring of pale yellow; legs dusky red brown. The mid toe and claw is somewhat longer than the measurement given by Jerdon, exceeding it by 0·35″.

933. Ardetta cinamomea, Gmel.

934. Ardetta Sinensis, Gmel.

938. Tantalus leucocephalus, Gmel.

In the specimen obtained in January, I noticed that the primaries and secondaries were not all of the same shade of color, the contrast being very marked. The first five primaries were glossy purple *black*, the next five glossy *green*. The first two secondaries purple *black*, three next glossy *green*, then three of purple *black*, the next five glossy *green*, and remainder of the secondaries of a *black* tinge. This probably marks the succession of growth of these large feathers during the period of moulting and the difference of tint is due to the difference in age; one set falling out in this regular order and coming to maturity before the next are ready to fall out. Jerdon does not notice this difference of shade, and it may have been peculiar only to this one bird, as I only obtained one specimen.

940. ANASTOMUS OSCITANS, Bod.

942. GERONTICUS PAPILLOSUS, Temm.

The whole back has a metallic tinge; the lower parts are *pale* blackish brown, the under tail coverts glossed with blue green; legs *dull* pale lake. Shot in December in Mymensing district.

943. FALCINELLUS IGNEUS, Gmelin.

951. NETTAPUS COROMANDELIANUS, Gmelin. — Sylhet.

952. DENDROCYGNA AWSUREE, Sykes.

954. CASARCA RUTILA, Pallas. — Mymensing.

957. SPATULA CLYPEATA, Linn.

959. ANAS PŒCILORHYNCHA, Pennant.

961. CHAULELASMUS STREPERUS, Linn. — Mymensing.

964. QUERQUEDULA CRECCA, Linn.*

965. QUERQUEDULA CIRCIA, Linn.

972. MERGUS CASTOR, Linn.

In December this bird is generally to be seen on the deep reaches of water on the larger rivers above their debouchment into the plains.

♂ Length 26″, ex. 38½″, w. 11½″, t. 6″, tr. 2⅛″, bill at f. 2″. Irides dark brown; in the female the bill is pale purple, legs dull orange.

980. XEMA BRUNNICEPHALA, Jerdon.

984. HYDROCHELIDON INDICA, Stephens.

985. SEENA AURANTIA, Gray.

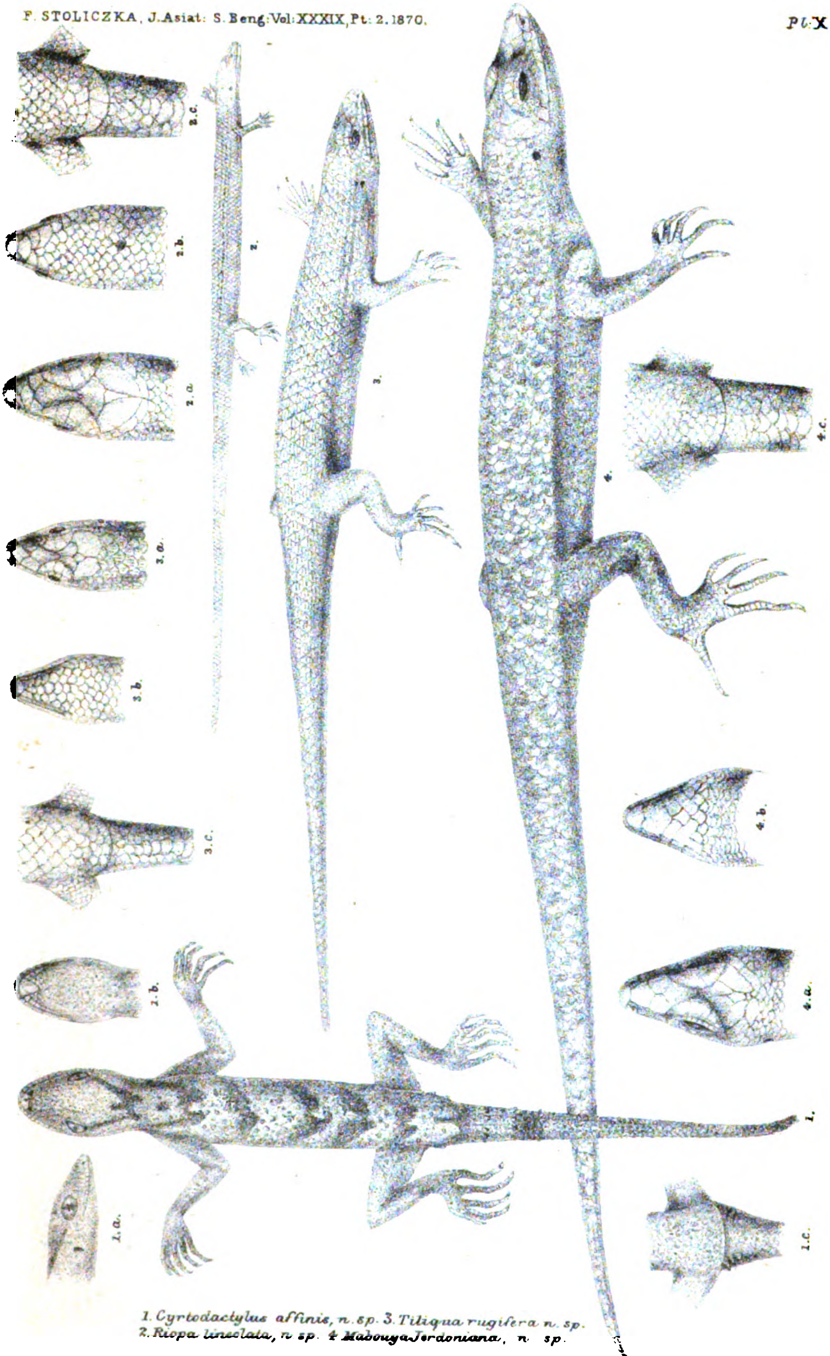
1005. GRACULUS CARBO, Linn.

Very numerous in the deep pools on the Sumessary River near Rywick, Garo Hills.

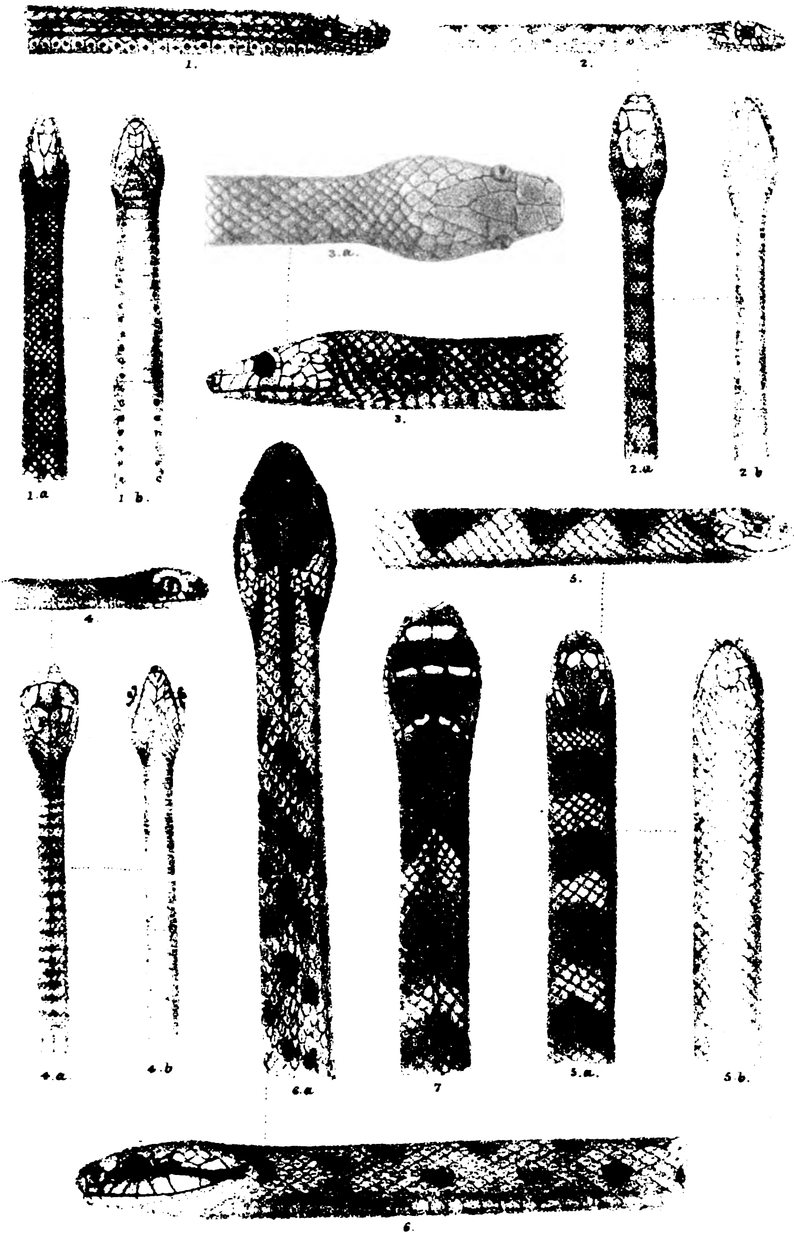
1007. GRACULUS JAVANICUS, Horsf.

1008. PLOTUS MELANOGASTER, Gmelin.

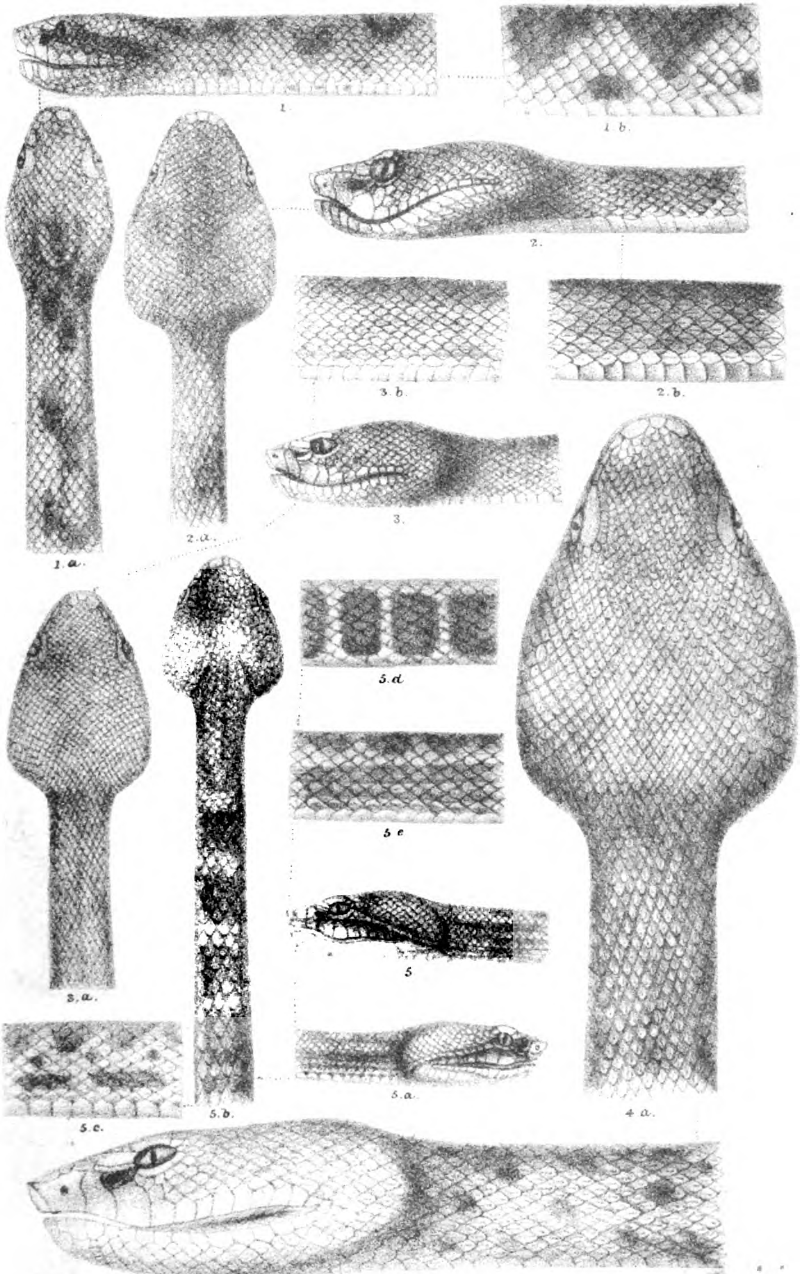
* Jerdon does not make reference to the large patch of glossy green on the side of the head; the fine white line running from eye and bounding this patch below, while another curves upward from the base of bill over the same green patch.



1. *Cyrtodactylus affinis*, n. sp. 3. *Tiliqua rugifera* n. sp.
2. *Riopa lineolata*, n. sp. 4 *Mabouya Jerdoniana*, n. sp.



1. *Ablabes Nicobariensis*, n. sp.
2. *Compsosoma semifaciatum*, Blyth.
3. *Tetragonosoma effrene*, Cant
4. *Dipsas hexagonotus* Blyth.
5. *Cantoria Dayana*. n. sp.
6. *Dipsas multifasciata*, Blyth.
7. *Ophiophagus elaps*, Schlegel



1. *Trimeresurus convictus* n. sp. 3 4 *Trim. Cantoris, Blyth.*
2 „ *porphyraceus, Blyth.* 5 „ *mutabilis, n. sp.*

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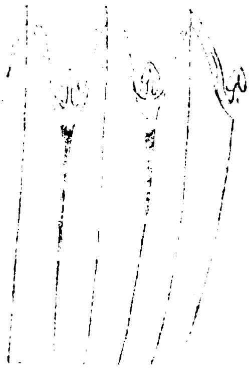
Pl. XIII.



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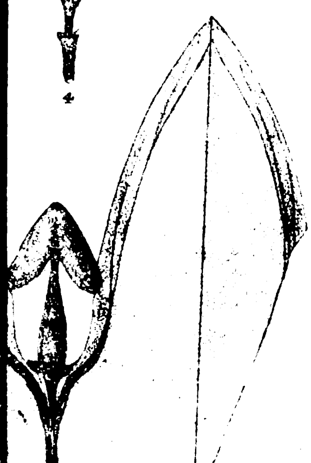

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JOURNAL

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Part II.—PHYSICAL SCIENCE.

No. IV.—1870.

A Contribution to Malayan Ornithology,—*by* Dr. F. Stoliczka, *Palæontologist, Geological Survey of India; Honorary Secretary, Asiatic Society of Bengal.*

[Received and read, 6th July, 1870.]

A short visit to the Malay Peninsula, during the latter part of 1869, gave me an opportunity of observing a portion of the fauna of that country. While staying at Penang, and on a short trip into the Wellesley Province, I noticed among others a large number of birds, which seemed to me to possess great affinities to Indian forms, but at the same time to exhibit some peculiarities. Knowing that this part of the Malayan country was as yet very little explored, but not being able to prolong my stay in that locality for even a few days, I engaged a collector for about a month, and sent him into the interior of the Province, instructing him to direct his attention especially,—as far as birds were concerned,—to the smaller kinds. After my return from Malacca and Singapore, I found that the trial was not quite without success, and I met my collector with more than 300 specimens of bird skins. These proved to belong to nearly one hundred species, and the following notes are offered on such as appear to possess a more general interest. Others are only referred to by name, as being nteresting in a point of geographical distribution, for with the exception of a number of species quoted by Blyth, Horsfield and Moore, and others, from Penang, very few birds appear to have been received from the Wellesley Province, which is geographically situated between Tenasserim and the well known Malayan country about Malacca.

The avifauna of the Burmese and Tenasserim Provinces has been ably worked by Blyth, with the assistance of Col. Tickell, Sir A. Phayre and many others. To the Malayan fauna about Malacca Mr. Blyth's labours have equally contributed very largely; his "Catalogue of the Birds in the Asiatic Society's Museum" is a valuable mine of information, and it is indeed not easy to hit upon a species which this most zealous naturalist had not already placed on record as occurring in those regions. Almost every one of the earlier volumes of our Journal bears testimony to this.

Through several Dutch collectors, large numbers of Malacca birds had gone to Europe many years before they reached Calcutta, and in fact Malacca birds (generally stated to be from Singapore, because shipped from that port), are among the most common in European Museums. Many new species and interesting new genera have been described by Mr. Eyton, (P. Z. S., Lond., 1839 and Ann. and Mag. 1845, vol. xvi), by Strickland, (Ann. and M. N. H., 1844, vol. xiii and 1847, vol. xix,) Hartlaub, (Rev. Zool., 1842 and 1844), Lord Hay (Madras Jour. vol. xiii,) and by a few others.

The Malaccan fauna was known to be most closely allied to that of Java and Sumatra, which has been so successfully worked out by Horsfield and Sir Raffles, and afterwards by Temminck in his Pl. Col. It is comparatively only within a recent period that ornithologists are attempting to increase the number of species by the discovery of minutious characters between the insular and continental Malayan forms, but I do not think that this attempt will be followed by very great success, as far as the creation of new species is concerned, though the fact of these differences really existing is, no doubt, of very great interest. It cannot be questioned for one moment, that the most intimate relation exists between the avifauna of Sumatra, Java, the greatest part of Borneo and the Malayan peninsula from Singapore to

Malacca, and, I can add, extending as far north as the Wellesley Province and including the island of Penang. More than one-half of the species are absolutely the same, and many others have very marked affinities. Several of the species which characterize this part of the fauna, like many peculiar CAPITONIDÆ, PICIDÆ, and COLUMBIDÆ (TRERONINÆ) etc., do not extend further north, but others do so, and again some of the species and genera are replaced by closely allied types. Several of the birds noted from the Wellesley province represent intermediate types between the northern Indo-Burmese and the southern Malayan forms, and are on that account particularly interesting, as will be seen from a comparison of the details given further on.

Indeed these intermediate local forms are the most important in the study of a fauna, for they are the only reliable records upon which the explanation of the origin of local faunas must be based, and their connection with the faunas of the neighbouring countries. And still more: they are to a great extent the basis of a good classification, for upon the correct determination of these local variations and their constancy actually rests the limitation of the term species. Bearing this in view, I have added exact measurements of all the birds I noted, and more detailed descriptions of some others which appear either to represent peculiar varieties, or seem otherwise to be interesting in a comparison with Indian birds.

It is an established fact that British India* is peopled by two markedly distinct faunas. The fauna of nearly the whole of the provinces to the east of the Ganges and Húgli, stretching N. W. somewhat along the base of the Himalayas, is Malayan, the Malayan character gradually dimininishing, or altering, the more the fauna proceeds towards west or north-west. I may say that about one-fourth of the birds in this great Malayan province are identical as to species. Some which appear to be rather inclined to an insular habitat seem to decrease in size when they proceed northwards; but as a rule, the same species, when it enters India, seems again to develop to a large form. This fact should not be unduly appreciated, for taking the fauna of each small province independently of that of the other,

* Excluding the Western Punjab country which has strong European affinities.

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it is not difficult to consider the local races as specifically distinct. In this way a bird in India is sometimes made the type of one species, the same slightly varying in Burma the type of another, a third one in the Malay Peninsula, and a fourth one often in Java and the other islands. Such artificial specific distinctions may look very well in a Catalogue of birds, or on the labels in a museum, where perhaps one or two specimens from distant localities are considered to indicate an unusual richness of the collection, but they are far from sufficient to illustrate the fauna of a province, and those so-called species often have no existence in nature. I shall relate some instances of this kind, and indicate others, though, naturally, my present materials are very limited, but I believe that in many cases the gradual change from one form to the other will be satisfactorily proved, as soon as we become properly acquainted with the fauna of the intervening districts. In any case the one general fact that the original and prevalent character of the fauna of Eastern and South-Eastern British India is very closely allied to that of the southern Malay countries, wherefrom the fauna appears to have migrated to north and north-west, should not be lost sight of by any one desiring to multiply the existing number of known species from those regions.

Considerably different is the fauna of Southern and South-Western India, which is known to possess in part a strong African admixture. The only exception to this partially forms the fauna of some of the elevated districts of Southern India and of the Malabar coast. This latter again shews affinities to the eastern Malay fauna, and the question how that isolated Malay fauna came into existence, becomes of equally high interest as the one is with regard to the admixture of African element into the rest of the Indian fauna. Was the fauna of the whole of India at one time Malayan? Was it partially destroyed, or was its development otherwise arrested through some past geological catastrophe, such as that appears to be which must have affected India during the so-called trappean deposits, extending over the greater part of Central and Southern India? Certainly these enormous volcanic operations must have had great effect upon the fauna, as well as the flora. After, or in relation with these catastrophes, the presumed connection of India with Africa may have taken place, to which Professor Huxley in his recent (1870) address to the Geological Society made allusion. At that time, the African fauna began to immigrate, partially mixed with, and in the plain country partially also suppressed the remaining elements of the original Malay fauna which could not have been sufficiently quickly nourished from the east, as the waters of the Bay of Bengal have probably at that time washed the bases of the yet little elevated Himalaya mountains, and thus maintained a separation of the two faunas. By all these operations the fauna of the more elevated Southern Indian districts appears to have been little affected.—These are of course mere speculations, but they have a high degree of probability, supported by the differences in the fauna, which were pointed out several years ago by Mr. W. T. Blanford.

Fam. FALCONIDÆ.

1. Hierax fringillarius, Drap.

Wing very nearly $3\frac{1}{2}''$, tail $2\frac{1}{8}''$, tarsus $\frac{11}{16}.''$

A Malacca specimen exactly corresponds with Drapiez's figure on pl. 21 of Dictionaire Class. d'hist. naturelle. The Javanese *Hierax*, called *H. cærulescens*, Linn., as figured by Horsfield in his "Researches in Java," and generally identified with the above species, would appear to be a different bird. It is considerably larger, the loreal region in front of the eye is white, the last tertiaries white spotted, and the white bars on the inner webs of the other wing feathers more numerous, while *fringillarius* has the loreal region black, the white supraciliary ridge above the eye interrupted, and the last tertiaries almost wholly black. In other respects both are (except size) almost identical, the tibial feathers being black externally and rufous brown internally, (see also Hume, in "Scrap Book," Calcutta, 1869, p. 111).

Should the larger Java bird be the female of *fringillarius?* It is difficult to arrive at any very satisfactory conclusion on this point. Temminck's figure in the Pl. Col. represents a bird, the wing of which is about $3\frac{5}{8}''$; one specimen has the white supraciliary band nearly interrupted above the eye, the other has it distinctly continuous. A specimen, in the Society's collection, from

Malacca has the wing 4″, and one from Java 4⅛″, both have the supraciliary stripe interrupted, and the loreal region black, therefore, agree with typical *fringillarius*, except that they are larger. Possibly, the black of the loreal region and above the eye, suppressing the development of the white supraciliary stripe, is only an occasional face of plumage, or it indicates a distinction of the sexes, or a local variation; it seems, however, pretty certain that the Javanese bird is somewhat larger than the Malayan. Whatever the case may be, whether there be one or two distinct species, or only varieties, of the *black-legged Hierax*, I do not understand how it came, that Linné's name *cœrulescens* has been almost universally adopted for the Malayan birds. The name appears to have been introduced through Horsfield's and Temminck's illustrations, though Horsfield (Res. Java) very properly pointed out the distinctions between his and Linné's *cœrulescens*. Judging from the 13th edition (by Gmelin) of the Syst. nat., Linné's name has been based upon Edwards' figure (Nat. Hist. Birds, pl. 108), which was taken from a Bengal specimen and clearly represents the *red-legged Hierax* (*H. eutolmus* of Hodgson) and, therefore, it should be reserved for the Indian species, but not applied to the Malayan (and Java) form with *black* tibial feathers, which is *fringillarius* of Drapiez, a name originally adopted by Blyth, but afterwards replaced by that of *cœrulescens*.

Fam. PSITTACIDÆ.

2. Loriculus gulgulus, Linn.

This is a somewhat smaller bird than *L. vernalis*, Sparrm., but very like it, and young birds can hardly be separated; wing 2¼″-2⅜″; tail 1⅜″; usually with some bluish tinge in front and on the top of the head, and on the middle throat, a golden tinge on the posterior neck, as well as on the upper vent in front of the scarlet patch. The blue patch on top of head appears characteristic of the bird in full plumage. The species is very common in the Wellesley Province, and is often caged by the Malays of the country. An albino specimen shot there has the whole plumage very much mixed with yellowish white, the longer wing coverts deep green, the quills mostly white and edged with greenish and yellow on the outer webs; on the top of head are many feathers partially scarlet, almost forming a round patch of red, as in *L. vernalis.*

Fam. CAPRIMULGIDÆ.

3. CAPRIMULGUS MACROURUS, Horsf.

Jerdon, B. Ind., I, p. 168.

Wing $7\frac{1}{2}''$, tail $5\frac{3}{4}''$; bill at front $\frac{3}{8}''$, from gape $1\frac{1}{4}''$, tarsus $\frac{9}{16}$. Wellesley Province and Penang.

Fam. TROGONIDÆ.

4. HARPACTES DIARDI, Temm.

Gould, B. Asia., pt. XVII.

This is one of the most common species in the forests east of Malacca. The carmine colour on the vent is in the female greatly mixed with white, and the sides of the vent with ashy brown, the external and terminal lower tail coverts are almost wholly ashy brown; the white tips to the outer tail feathers are considerably less freckled with black in the ♀ than they are in the ♂. One ♀ has one of the central tail feathers wholly brown, another has them tipped black, almost quite as much as in the male.

5. HARPACTES KASUMBA, Raffl. ?

Gould, B. Asia, pt. VIII.

A female specimen shot by my collector in the Wellesley Province is intermediate between the figures of the females of *Kasumba* and *fasciatus*, as given by Gould. The head is darkish brown, occiput behind, neck and back dark rufescent brown, very indistinctly and minutely barred across with dark, purely rufescent brown or rather yellowish brown on the vent and on the upper tail coverts. Wings black, all the superior coverts and tertiaries with light brown cross bars, as in typical *Kasumba*, but the bars are decidedly broader, (while they are almost minute in *fasciatus*); primaries (except the first) very distinctly edged with pure white; two central tail feathers wholly brown (as in *fasciatus*,) next black, but brown along the quills, on the extreme outer edge and near the tip; the third is black with a brown quill and outer tip; the other outer tail feathers are black, broadly tipped with white which increases externally, the outer web of the outermost feather being almost wholly white;

chin and breast greyish-, or rather dull olivaceous brown, like in *Kasumba*, but with barely any white gorget bordering it, as in *fasciatus ;* the rest of the lower parts is uniform fulvous brown, very much like in the last named species ; wing very nearly $5\frac{3}{4}''$; tail $6\frac{3}{4}''$; bill at front $\frac{9}{16}$, from gape $1\frac{1}{8}''$; tarsus $\frac{1}{2}''$.

Though in coloration this specimen resembles almost quite as much the Ceylon *fasciatus*, as it does agree with the Malayan *Kasumba*, it seems much more probable that it belongs to the latter species, with which the form of the bars on the wing coverts and the measurements of the bird better agree. At the same time it does not appear, from the account given, improbable, that a new form is here indicated, of which the male is not yet known. Unfortunately all the specimens of the allied species in our Museum are so insufficient, that they do not admit of a very close comparison. None of the female specimens exactly agree with our bird, but that of *Kasumba* comes nearest to it.

Fam. EURYLAIMIDÆ.

6. CALYPTOMENA VIRIDIS, Raffl.

Horsfield, Research. in Java, fig. of ♂.

Male — bright shining green, somewhat deeper on the back and considerably paler on the vent and lower tail coverts, a small yellow spot in front and above the eye, a larger black spot on the sides of the neck behind the base of the mandible, the wing coverts with large cross subterminal black spots forming three oblique bands, the black not extending on the few first or marginal coverts ; shoulder edge of wing blackish green. The first three or four primaries are dusky brown, edged with green on the outer web, the other wing feathers are deep brownish black and the green gradually increases, until the last tertiaries become almost wholly green on the terminal half ; tail green above, bluish below. The lateral front feathers of the head are obliquely erect towards each other, forming a crest above the bill and entirely concealing the nostrils, only the curved tip of the bill remaining visible ; these erect green feathers are pure black for the lower half, and the other green feathers gradually become paler at their bases as they proceed posteriorly ; the internal side of the green is always bluish.

Raffles says the female does not differ in appearance from the male. I first obtained this species from Malacca, where it did not seem to be common, and from the forests of the Wellesley Province my collector brought seven specimens, one of which is a male in full plumage, the others were pointed out by him to be females. They equal in size the ♂, and all very closely resemble it in colouring, except that the green is duller throughout, the yellow spot in front of the eye very small, most of the feathers forming the orbit pale yellowish green, and the black spots on the neck and wing coverts are almost entirely absent; the crest at the base of the bill is also smaller. Four of the six specimens appear by the development of the bill and toes to be old birds, and can, I think, be safely considered as the ♀s, but two appear to be young ♂s, changing their plumage to a brighter green, while the black spots on the neck and on the coverts also begin to make their appearance. All specimens have 12 subequal tail feathers, not 10, as noted by Raffles; the former being the usual one in other EURYLAIMIDÆ also.

Wing 4″, tail $1\frac{3}{4}$″-2″, bill from gape 1″, width of gape $\frac{3}{4}$″ to $\frac{7}{8}$″.

This species is one of the most marked birds indicating the affinities of the Malayan continental fauna to that of the adjacent islands. Its general character certainly agrees best with the Malayan EURYLAIMIDÆ, though the external appearance of the bird is like that of a Parocett.

7. CORYDON SUMATRANUS, Raffl.

Gould, B. Asia, pt. V.

Apparently not common in the Wellesley Province; perfectly identical with Sumatran specimens.

8. CYMBIRHYNCHUS MACRORHYNCHUS, Gmel.

Gould, B. Asia, pt. V.

Common near Malacca and in the Wellesley Province and Penang. One specimen has all the wing-coverts tipped white; this is probably a sign of immaturity, as the samé specimen has not the white scapulars developed to their full length. The crimson colour below is on the chest and especially on the lower belly often mixed with a yellowish tinge; wing $3\frac{3}{4}$ inch, tail about the same.

9. EURYLAIMUS OCHROMALUS, Raffl.

Gould, Birds of Asia, pt. V.

The pale collar is generally vinaceous pink below, quite white above, and in most specimens which I saw, from Malacca and the Wellesley Province, almost interrupted in the middle of the neck above. The white subterminal spots extend over both webs on the outermost tail feathers, and are, as likewise the small spot at the base of the primaries, often of a pale sulphur yellow. Some specimens have a few white feathers below and somewhat posterior to the eye. The upper bill is laterally partially yellow, this color extending up to near the tip. Both upper and lower mandibles are emarginated near the tip; length of wing 3-3⅛ inch., tail 2-2⅛″.

Fam. CUCULIDÆ.

10. PHŒNICOPHAUS CURVIROSTRIS, Shaw.

Blyth, Cat. p. 75, and Journ. Asiat. Soc., Beng., XI, p. 927.

Very common about Malacca and in the Wellesley Province. Total length between 17 and 18 inches; wing 6½′-6⅝″; tail 10″-10¾″, the two central feathers being either wholly metallic green, or terminally for about ⅜th their length tipped with brown; bill very strong, curved, about 1½″ at front, 2¾″ from gape; tarsus 1½″. The extreme edgings of the feathers round the red naked space of the eye are always white in full plumaged birds. The chin is white in some, grey in other specimens.

11. PHŒNICOPHAUS [ZANCLOSTOMUS] DIARDI, Less.

Blyth, Cat. p. 76.

Common about Malacca and in the Wellesley Province, but apparently, like the last species, not extending farther north. It is very closely allied to Raffles' *Ph. Sumatranus*, but a little smaller and with no rufous colour below. The edgings round the red naked space of the eye are white, more distinct above than below, but not developed in the young bird. Wing 5″-5⅛″; tail 9″; bill at front 1″-1⅛″, from gape $1\frac{5}{16}$″; tarsus $1\frac{3}{16}$.

12. RHINORTA CHLOROPHÆA, Raffl.

Blyth, J. Asiat. Soc. Beng. XI, 923-924, and Cat. p. 76.

It is remarkable that, though I observed these birds repeatedly in the brushwoods near the coast of the Wellesley Province and at Malacca, I hardly ever saw the two sexes (♂, *Phænicoph. viridirostris*, Eyton, or *Bubutus Isidorei*, Less., and ♀, *Ph. chlorophæa*, Raffl.) together; neither have I seen any of the birds with intermediate plumage.

The species is very common in the Wellesley Province, and of 8 specimens from that locality (3 ♂ and 5 ♀) none has the wing more than $4\frac{3}{8}''$, mostly only $4\frac{1}{4}''$; tail $6\frac{1}{2}''$-$7''$; bill at front $1''$, from gape $1\frac{5}{16}''$; tarsus $1''$.

13. Eudynamys orientalis, Linn.

Jerdon, B. Ind., vol. I, p. 342.

Does not appear to be common; a male has the tarsus $1\frac{1}{4}''$, wing very nearly and the tail fully 8 inches, which is slightly in excess of the measurement noted by Jerdon, but it agrees with that given of the female.

Fam. CAPITONIDÆ.

14. Cyanops chrysopogon, Temm.

Planches Col. 285.

Specimens from the Wellesley Province, where the species appears common, measure: wing $4\frac{7}{8}''$—$5''$; tail $2\frac{1}{2}''$—$2\frac{5}{8}''$; bill at front very nearly $1\frac{3}{4}''$, from gape $2\frac{1}{4}''$; greatest length of narine bristles $1\frac{1}{4}''$; tarsus $1\frac{1}{4}$—$1\frac{5}{16}''$.

Front of head yellowish silvery white, lores interrupted across the culmen crimson, posterior crown and occiput spotted crimson, each feather being black, then blue and terminally crimson, rest of upper plumage deep green, below paler, on neck with a golden glossy tinge, quills terminally and all wing feathers internally blackish, fulvous at their bases and internally, superciliary stripes, cheek and ear-coverts dark silvery brown, occiput margined blue, broad mustachial streak bright yellow, chin extending somewhat posteriorly silvery grey, bordered posteriorly with blue; tail internally blue.

15. Cyanops versicolor, Raffl.

Trans. Linn. Soc XIII, pt. II, p. 284.

Common on the islands Sumatra, Borneo, Java, about Singapore and Malacca, but I have not obtained it from farther North. Malacca specimens measure : wing $4\frac{5}{8}''$; tail $2\frac{1}{16}''$; bill at front $1\frac{3}{8}''$, from gape very nearly $2''$, tarsus very nearly $1\frac{1}{8}''$, the longest bristles reach beyond the tip of the bill.

16. CYANOPS MYSTICOPHANES, T e m m.

Bucco quadricolor, E y t o n, Proc. Zool. Soc., Lond., 1839, p. 105.

E y t o n 's description applies to the bird in full plumage. The forehead and a short mustachial streak are golden yellow, lores, top of head and occiput, chin and front of throat and a spot on each side of the front breast deep crimson, supraciliaries, cheeks and throat azure blue ; streak through the eye blackish ; general colour above deep green, paler grass green below, all the feathers on the neck and front breast with a golden lustre, quills slightly margined with fulvous on the outer web, all wing feathers blackish brown on the inner webs and margined fulvous, this being especially conspicuous on the inner side of the wings ; tail below bluish green. T e m m i n c k 's figure does not shew the coloration of the head clear enough.

In other (? female) specimens with the green plumage perfectly developed, the front part of the head is partially greenish, partially yellow, sometimes intermixed with blue ; chin and front throat are yellow, intermixed with red, the mustachial streak is like the cheek blue, the crimson on the occiput is of smaller extent.

This species is common at Malacca, Penang, and in the Wellesley Province. Wing $3\frac{3}{4}''$-$3\frac{7}{8}''$; tail $2\frac{2}{16}''$—$2\frac{3}{16}''$; bill at front $1\frac{1}{4}''$, from gape $1\frac{3}{4}''$; tarsus $1''$; the longest bristles slightly reach beyond the tip of the bill.

H a r t l a u b 's description of his *Bucco Malaccensis* seems to indicate a distinct and smaller species.

17. XANTHOLÆMA DUVAUCELII, L e s s.

B. frontalis, T e m m., Planches Col. 536, fig. 1.

Head including lores and occiput blue, somewhat dusky in front, a short stripe behind the supraciliary edge, cheek in front and mustachial stripe crimson, behind the eye and ear-coverts greenish, tinged blue, chin and throat in front purely greenish blue, with a very small dark gorget ; rest of plumage above deep green, below yellowish green, especially on the breast; wing $2\frac{7}{8}''$; tail $1\frac{1}{2}''$; bill at front $\frac{3}{4}''$, from gape $1\frac{1}{8}''$, tarsus nearly $\frac{3}{4}''$; rictal bristles nearly double the length of the bill.

Another specimen of equal size (? a ♀ or immature) is green above with a scarcely traceable tinge of blue on top of head, chin cinereous blue with a black gorget on the throat; breast yellowish green, the rest dusky green; size about the same as of the last.

18. Xantholæma indica, L a t h.

J e r d o n, B. Ind., vol. I, p. 315.

This species does not appear to be so common in the Malay peninsula, as the various *Cyanops*. Specimens from the Well. Province, Penang and Malacca quite agree with the Indian bird.

19. Megalorhynchus Hayii, G r a y.

Meg. spinosus, E y t o n, Proc. Zool. S., Lond., 1839, p. 106.

I have not seen this species from farther North than Malacca; wing $3\frac{1}{4}''$; tail $1\frac{7}{8}''$; bill at front $\frac{7}{8}''$, from gape $1\frac{3}{16}$; tarsus $\frac{7}{8}''$.

It is most probably the *Bucco Lathami*, (G m e l.) of R a f f l e s, who states that it is also found in the interior of Sumatra.

Fam. PICIDÆ.

20. Tiga "rufa,"* R a f f l.

Tiga tridactyla, K a u p (1836), B l y t h. J. Asiat. Soc. XIV, p. 193, *Chrisopicoides tiga* apud M a l h e r b e, Mon. Picidæ.

* Genus *Tiga*, K a u p, 1836, *Chrysonotus*, S w a i n s o n, 1837, *Chrisopicoides*, M a l h., 1849 —What does R a f f l e s mean (Trans. L. Soc. XIII, 1822, p. 290) by the quotation "Picus Tiga" (H o r s f i e l d) "Tukhi besar, or *T. rufa*," and immediately after that he refers to the generic peculiarity of *Tiga* as distinct from *Picoides* (*P. tridactylus*, L i n n.). Does that last reference mean *Tiga rufa*, or what? I do not think that it could justly be presumed that R a f f l e s refers to *Picus rufus*, G m e l. At the same time it would be impossible to say possitively what R a f f l e s meant by the generic name "T.," whether "*Tiga* or *Tukhi*," unless his originally labelled specimens could be found. But what other than a specific appellation could be assigned to the second name "*rufa*?" Whatever the case may be, this last name would be more acceptable than "*tridactyla*," because all other *Tiga* also have only three toes. The only objection to the name "*rufa*" may be made on the ground that R a f f l e s had a specimen of *T. intermedia*, B l y t h, before him, as the measurements of the bird he gives are rather those of the form designated by B l y t h with the last name, and which, B l y t h says, occurs in Java. However, it seems very difficult to discriminate between *tridactyla* and *intermedia*, when large series are compared, and I am not certain whether it is correct to separate them specifically.

Blyth says (Ibis, 1866, II, 356) that his *T. intermedia*, (see Jerdon, B. Ind. I, 299) also occurs in Java and extends to Penang, but is replaced at Malacca,—which is geographically intermediate between the two countries—by *T. tridactyla!* The latter species appears to be very common in the Wellesley Province and on Penang island where I obtained it. The colouring is typical, except that the back is in some specimens bright crimson, in others (often slightly larger), scarcely so, being almost pure golden yellow. This last character has been assigned as characteristic of Blyth's *intermedia*, but none of our specimens attain the size recorded of that species. The white spots on the head of the females (the larger race) are very elongated, pointed above, somewhat obtuse below, but very distinct on the whole head. The measurements vary in seven different specimens as follows: wing $4\frac{7}{8}''$—$5\frac{1}{4}''$; tail $3\frac{3}{4}''$—$4''$; bill at front $\frac{7}{8}''$—$1\frac{1}{16}''$; tarsus $\frac{12}{16}''$—$\frac{13}{16}''$. The bill and tarsus appear to be sometimes shorter in the ♀ than in ♂. Thus the length of wing varies in *tridactyla* between $4\frac{7}{8}$ and $5\frac{1}{4}$ inches and that of *intermedia* is stated to be $5\frac{1}{2}''$. Some of the specimens in the Museum, labelled as *intermedia*, have it barely $5\frac{1}{2}''$.

21. Tiga Rafflesi,* Vig.

Strickland in Ann. and Mag. N. H., XIX, 1847, p. 133, and Blyth, Jour. As. Soc. XV, p. 16.

Apparently not common in the Wellesley Province and on Penang. A ♀ measures: wing $5\frac{1}{2}''$; tail about $4\frac{3}{4}''$; bill at front $1\frac{3}{16}''$ from gape $1\frac{1}{2}''$, at base $\frac{3}{8}''$ high and equally broad; tarsus $\frac{7}{8}''$. The colouring exactly agrees with Blyth's description.

22. Hemilophus Javensis, Horsf.

Trans. Linn. Soc. XIII, p. 175; *Muelleripicus*, Bonap., apud Jerdon. *Megapicus leucogaster*, Reinw.—Malherbe Mon. *Picidæ*, p. 47.

A specimen from the Wellesley Province in full plumage has the lower parts, including the sides, fulvous white, lower tail coverts black, and the feathers in front of them as well as those on the tibia spotted black; it measures—wing $9''$, tail along the central fea-

* *Chloropicoides Rafflesi* apud Malherbe.

thers $7\frac{1}{4}''$; bill at front $2\frac{1}{8}''$; from gape $2\frac{3}{8}''$, at base $\frac{9}{16}''$ high and $\frac{10}{16}''$ broad; tarsus $1\frac{3}{8}''$.

A Malacca specimen, probably an undeveloped male, has the head above only partially crimson, occiput distinctly crimson and the feathers elongated; stripe at the base of the lower mandible black, vent very slightly fulvous, almost pure white, tips of the primaries dusky; wing $8\frac{1}{4}''$; tail $6''$; bill at front $1\frac{7}{8}''$, from gape $2\frac{1}{8}''$, at base $\frac{1}{2}''$ high and a little more than $\frac{10}{16}''$ broad; tarsus $1\frac{5}{16}''$.

In both, but especially in the first specimen, the lower fulvous white reaches laterally high up, leaving only a narrow black stripe along the middle of the rump, which is wholly white in the South Indian *H. Hodgsoni*, Jerd., and the Burmese *H. Feddeni*,* Blyth, the latter differing solely from the Indian form by having a little more white on the internal wing feathers.

Malherbe questions the correctness of Blyth's reference "Tenasserim" concerning *H. Javensis*, but does not give his reason for it. Evidently he entertains the idea that the true Malayan fauna stops at Malacca, and that the Burmese and Tenasserim fauna is what is generally called Indian.

23. Hemilophus [Reinvardtipicus] validus, Reinw.

Pl. Col. 378 and 402; Blyth, Cat. 54, No. 240; Malherbe, Mon. Pic. I, p. 28.

Common in the Wellesley Province; Blyth says "Western Malasia." Sclater (Proc. Z. Soc. Lond. 1863, p. 211) gives it from Borneo.

♂. Wing $6\frac{3}{8}''$; tail $3\frac{1}{2}$—$3\frac{3}{4}''$; bill at front $1\frac{9}{16}''$, from gape $1\frac{7}{8}''$; tarsus $1\frac{1}{16}''$; outer hind-toe including claw $1\frac{1}{2}''$. The ♀ is often slightly smaller, the corresponding measurements are $6''$ to $6\frac{3}{8}''$; $3\frac{1}{2}$; $1\frac{1}{2}$; $1\frac{3}{16}$; $1\frac{1}{16}$; $1\frac{5}{8}$.

The lateral ridges on the front part of the bill are double, and continue up to the tip which is high and laterally compressed. As regards the shape of the bill, there is no difference between that of the present species, and that of typical *Hemilophus*, but while in this one the versatile toe is shorter than the middle one, it is longer in *Reinwardtipicus*, which is exactly intermediate between *Chrysocolaptes* and *Hemilophus*, where Jerdon placed it.

* Journal A. S. B., 1863, vol. xxxii, p. 75.

Malherbe's figures could hardly have been taken from fresh or well preserved specimens, unless they represent unusual varieties. I never saw the female so pale coloured, as shewn by Malherbe.

♂. Crown of head extending down the occiput with a moderate crest crimson, back and rump bright orange yellow, wings with the scapulars and coverts dark brown with five brown bands, the basal very small; fore head, sides of head including a narrow supraciliary stripe, and below extending on the chin, golden yellow, most distinct on the mustachial streak, becoming brownish on the ear-coverts and posterior to them; median chin stripe and the whole plumage below more or less bright crimson; upper tail coverts and tail black; lower tail coverts mostly brown.

♀. Above, head, neck, wings blackish brown, the latter with five brown bands, the basal almost obsolete; whole back and rump white; upper tail coverts and tail black; sides of head and chin ashy white, median chin striped and the whole of the lower plumage ashy brown.

24. CHRYSOPHLEGMA MENTALIS, Temm.

Pl. Col. 384, and Malherbe Mon. *Picidæ*.

Temminck in his figure gives the throat almost wholly black. The Malayan specimens from the Wellesley Province have it always only black striped, as shewn in Malherbe's drawing; but I have not seen the brown color at the sides of the throat and of the front breast extending above the eye; it extends up to the eye but not on the supraciliary edge itself. The forehead is in ♂♂ somewhat brownish and the crown dingy green.

Specimens from the Wellesley Province vary in size:—wing $5\frac{1}{4}''$—$5\frac{1}{2}''$; tail along the central feathers $3\frac{3}{4}''$ to $4''$; bill at front $1\frac{1}{8}''$—$1\frac{2}{8}''$; from gape $1\frac{1}{2}''$—$1\frac{9}{16}''$; tarsus $1\frac{1}{16}''$; inner toe barely $\frac{1}{2}''$; versatile toe slightly shorter than the median one.

25. CHRYSOPHLEGMA MALACCENSIS, Lath.

Venilia malaccensis, Sclater, Proc. Zool. Soc. Lond., 1863, p. 211, from Borneo.

For description see Blyth in Journ. Asiat. Soc. XIV, p. 192.

I got this species only from Malacca, it does not appear to extend farther North.

.26. VENILIA PORPHYROMELAS, Boie.

Celeopicus porphyromelas, Malherbe, Mon. Pic. II, p. 39; *Picus rubiginosus*, Eyton, Ann. and Mag. N. H., XVI, Octb. 1845, p. 229; *Picus melanogaster*, A. Hay, Madras Journal, 1845, XIII, pt. II, p. 153.

The species does not appear to be common. Specimens from Malacca and the Wellesley Province quite agree with Lord Hay's description and measurements. Old males have some of the mustachial feathers posteriorly crimson, which Malherbe denies, but they certainly are present in ♂ with full plumage. Judging from Malherbe's figure, he could not have had a full grown ♂, for in this the upper plumage, especially on the scapulars and the outer webs of the wing feathers, is very distinctly deep crimson. The first quill is $1\frac{1}{2}''$, the second $1\frac{1}{4}''$ longer, the third again $\frac{11}{16}''$ longer, the fourth again $\frac{3}{8}''$ longer, and the fifth again $\frac{1}{8}''$ longer and subequal to the sixth; the four central feathers are pointed and subequal, the next outer somewhat shorter and obtuse, the following rounded. Bill yellowish white, dark greenish at the base, strongly compressed at tip; feet brownish black.

27. MICROPTERNUS BADIUS, Raffles.
Linn. Trans. XIII, pt. II, p. 289.

27a. MICROPTERNUS BRACHYURUS, Vieill.
Malherbe, Mon. PICIDÆ, II, p. 5.

It does not appear very improbable that these two species are really distinct. A Malacca specimen agrees perfectly with the short account which Raffles gives of his *badius*; the head above and below is somewhat pale, the rest of plumage rufous brown, the cheek below the eye is spotted with crimson; the feathers on the chin are broadly margined with very pale rufous; the breast is unspotted, the vent with tolerably distinct cross bars; wing $4\frac{5}{16}$; tail $2\frac{1}{4}''$; bill at front $\frac{13}{16}''$, from gape nearly $1\frac{1}{8}''$; tarsus $\frac{3}{4}''$.

Another specimen from the Wellesley Province has the plumage throughout of a deeper hue, the head above is rather dark brown; the throat is also darker, each feather being rufous brown in the middle, then blackish, to which follows a narrow pale margin, (while in the former specimen (*badius*) the feathers are blackish in the middle and broadly margined pale); the breast is unspotted and the vent distintly barred with dark brown. The cheek including the lores, superciliaries and a stripe somewhat extending behind the eye on the neck are spotted with crimson; the bill is slightly more attenuated than in the other specimen, but the size of the two birds is almost exactly the same; wing $4\frac{3}{8}''$; tail $2\frac{1}{8}''$; bill at front nearly $\frac{7}{8}''$; from gape $1\frac{1}{4}''$; tarsus $\frac{3}{4}''$. This second specimen perfectly agrees in the red colouring at the sides of the head with *brachyurus*, Vieill., and the only difference of Malherbe's figure consists in the uniform brown vent.

It is possible that, as I said, these two forms belong to distinct species; but large series must first be available for comparison. In general character of colouring and size they are so closely allied that it seems difficult to believe in a specific distinction of the two birds in spite of the few differences pointed out.

28. Meiglyptes tristis, Horsfield.

Blyth, Cat. p. 60; *Phaiopicus tristis* apud Malherbe, Mon. Pic. II, p. 10.

A common species about Malacca, on Penang and in the Wellesley Province. A male specimen from the last named locality has the breast uniform blackish brown, which does not appear to be usually the case in this species; a female from the same locality has the pectoral streaks also less distinct than usually, but in other respects it is identical with typical specimens from the Southern islands. Raffles says that the transverse striæ on the head are in the female finer and more numerous, or almost obsolete. In all the Malayan specimens I saw, there is no perceptible difference to be noticed in the coloration of the two sexes, except that the ♀ wants the red mustachial streak of the male.

Total length about 6 inches; wing $1\frac{5}{8}''$—$1\frac{6}{8}''$; tail $1\frac{3}{4}''$—$2''$; bill at front $\frac{13}{16}''$—$\frac{12}{16}''$, from gape $\frac{5}{8}''$ to nearly $1''$; tarsus $\frac{11}{16}''$. The bill often appears to be less strong in the ♀ than it is in the ♂.

29. Meiglyptes marginatus, Reinw. (1821).

M. pectoralis, Latham, in Blyth' Cat. p. 60, N. 274.

Hemicircus brunneus, Eyton, Proc. Z. S. Lond., 1839, p. 106.

I only procured this species at Malacca where it appears to be common, and was described by Eyton from that locality. Sclater (Proc. Zool. Soc. 1863, p. 210) quotes it from Borneo.

Male and female do not differ in colouring, except that the latter has no mustachial streaks. Total length about $7\frac{1}{2}''$; wing $4\frac{1}{8}''$; tail $2\frac{7}{8}''$; bill at front $\frac{6}{8}''$ to nearly $\frac{7}{8}''$, from gape $1''$—$1\frac{1}{16}''$; tarsus $\frac{11}{16}''$. All the tail feathers are pointed, while in the preceding species the outer tail feathers are obtuse and the last ones rounded.

Blyth identified Eyton's species with *P. pectoralis*, Latham. I do not know whether Blyth refers to any other of Latham's species than the one noticed in Suppl. Indicis Ornith., 1801, p. xxxii, App. to vol. VIII of Synops., and Add. p. 372, which is certainly quite a different bird, stated to inhabit Queen Charlotte's Sound. Latham says: "About 9 inches, head, neck and upper parts, deep cinnamon or chesnut — across the breast a large black crescent — tail black" &c. &c. Malherbe (Mon. Picidæ, II, p. 8) from whom we should have expected an explanation of the difficulty, does not solve it. He describes the Malayan species as *Phaiopicus pectoralis*, (Licht.), and gives as the first synonym *P. pectoralis*, Lath., but without further reference. Whether Latham described the present species as *P. pectoralis* prior to 1801, I have not been able to ascertain; I believe there is no other species of his under the same name; and presuming that Malherbe's identification of Reinwardt's *marginatus* is correct, I adopt the next oldest name for the Malayan species.

Fam. ALCEDINIDÆ.

30. Ceyx tridactyla, Pall.

Jerdon, B. India, I, p. 229.

I have obtained only one specimen from the Wellesley Province, and the bird was pointed out by my collector as rare. I have myself barely seen a single specimen along the Malayan coast, though it may be common in some other districts of the Malayan Peninsula. Sharpe calls it the "Penang king-fisher." One would have, I believe, some difficulty in procuring a specimen in Penang. In addition to Jerdon's description, it should be stated that a patch in front of the eye, and the greater part of the eye-brows are also black,* the sides of the chest are bright rufous. The measurements perfectly agree with those given by Jerdon.

31. Halcyon Coromandelicus, Scop.

Jerdon B. India, I, p. 227.

Blyth (Ibis, 1866, II, p. 348) says that this species extends from India to Japan, " but the Japanese race is said to be rather smaller and more deeply coloured." My collector shot one specimen in the Wellesley Province, and this is remarkably smaller than the Indian bird, even allowing something for immaturity. The lilac gloss above is very slight, the band on the upper back and rump is very narrow, pale bright blue, some of the lateral and terminal feathers partially or wholly bright violet blue ; chin whitish rufescent, the rest below rufous, deepest on the chest, and all the feathers tipped dark brown, this color gradually disappearing towards the vent ; front edge of wings fulvous ; wing only 4 inches ; tail barely $2\frac{5}{8}''$; bill at front $2''$, from gape $2\frac{1}{2}''$; tarsus $\frac{9}{16}''$.

The bird is evidently a smaller Malayan race, like so many others, but it is not on that account specifically distinct from the Indian.

32. Halcyon atricapillus, Gmel.

Jerdon, B. Ind. I, p. 226 ; Gould, B. Asia, pt. XII.

This species does not appear to be common in the Malay Peninsula. One specimen has the feathers on the sides of the breast dark shafted, and those on the lower breast checkered with dark. The rusty color on the sides and on the vent is very pale ; wing only $5\frac{1}{8}$ inches ; tail $3\frac{1}{2}''$; bill at front $2\frac{1}{4}''$, from gape $2\frac{3}{4}''$.

33. Halcyon fuscus, Bodd.

Jerdon, B. Ind. I, p. 224 ; Gould, B. Asia, pt. XIII.

One specimen, shot at Malacca, has only the chin pure white, most of the other white feathers down the throat and the breast are tipped with bluish and some also with brown ; the albescent coloring is confined to the middle of the breast, and is not so largely developed as usually seen in Bengal and other speci-

* Sharpe, (Proc.) Z. S. L. 1868, p 594, says " Spot in front of the eye &c. pale orange." This must occasionally become obsolete, for it does not exist in several Malayan specimens.

mens. This would seem to indicate a passage to the Manilla form, *H. gularis*, Kuhl, but the specimen has not the distinctive character of that species; the blue color above is beautifully developed, which seems to shew that the Malacca specimen is not a young bird: wing $4\frac{1}{2}$ inches; tail barely 3″; bill at front only $1\frac{3}{16}$″, from gape $2\frac{5}{16}$″, its height at base $\frac{5}{8}$″.

34. ALCEDO BENGALENSIS, Gmel.

Jerdon, B. Ind. I, p. 230; Gould, B. Asia pt. XIV.

A large specimen shot in the Wellesley Province has the pale blue tips to the feathers on the front head slightly, and on the scapulars scarcely at all developed, the chesnut below is pale; wing $2\frac{13}{16}$ inch, bill at front $1\frac{1}{2}$″, from gape a little more than $1\frac{3}{4}$″. Other specimens from the same locality, and from Malacca and Penang, are typical in coloration, some larger, others smaller.

35. DACELO PULCHELLA, Horsf.

Resear. in Java, with fig. of ♂.

This appears to be a rare species in Malacca; one specimen obtained somewhat differs from the Javanese bird described by Horsfield.

Forehead and sides of head and neck, extending from the base of the lower mandible backwards, rich chesnut, this color partially tinging a few of the upper feathers on the posterior neck, but not joining to a complete collar, though the chesnut is laterally very distinct; crown and occiput extending posteriorly covered with a large beautifully azure blue patch, this reaching well to the sides of the neck; it is produced by the blue tips of the feathers, the basal two-thirds of their length being black on the front crown, the next posterior feathers have one white bar, and the last which gradually increase in length 2 to 3 white cross bars. The feathers on the back and scapulars extending down to the upper tail coverts are all broadly tipped with greenish blue, the rest of the upper plumage being black with white cross bars. Wings black, shoulder edge of wing and the external edge of the first primary pale rusty, primaries and the first secondaries with their coverts black, the former white at the base of the inner webs, the last secondaries with white spots on the outer web; the tertiaries on both webs, their coverts being also spotted, and partially tipped with blue. Tail long, black, the inner webs of the feathers with transverse white spots, the outer ones with blue spots, this color diminishing on the outer tail feathers and becoming mixed with white, but on the outermost tail feathers it is replaced by rusty. Chin and throat pure white, breast and vent with their sides and including the lower wing coverts and the lower tail-coverts pale rusty. The fourth quill is the longest, and the first about half the length of the fourth; bill coral red, conical, almost uniformly and rather flatly arched above, upper mandible laterally somewhat projecting at the base, slightly curved at the tip; outer toe slightly shorter than the middle one, and the inner only $\frac{2}{3}$ of the length of the latter; wing $3\frac{1}{4}$ inches; tail $2\frac{1}{2}''$; bill at front $1\frac{5}{8}''$, from gape very nearly $2''$.

Mr. Blyth (Cat. Asiat. Soc. Museum, p. 46, No. 198) already records this species from Malacca; it also occurs in the Wellesley Province and extends into Tenasserim. In one ♂ from the last locality the brown collar nearly joins posteriorly, as in the Java bird, in two others from Tenasserim the brown is almost entirely separated above; but in no specimen have I seen it so strongly developed on the upper neck, as shewn in Horsfield's figure.

The female does not apparently differ in size; it is dark or blackish brown above, barred across throughout with rufous brown; below white with blackish cross bars on the lower breast, these bars being mostly developed at the sides of it and gradually disappearing towards the vent; lower tail coverts white.

Horsfield placed this species in the genus *Dacelo*, principally on account of the peculiar coloration of the bird; the bill is shorter and more regularly depressly conical, but barely more hooked at the tip than in most typical species of *Halcyon*, from which it can hardly be generically separated.

Fam. NECTARINIDÆ.

36. ÆTHOPYGA LATHAMI, Jardine.

1842, Nat. library, XIII, pp. 233 and 268, (an *Æ. siparaja*, Raff. seu *Æ. mysticalis*, Temm.)

Forehead extending posteriorly to the region crossed by a line between the middle of the eyes metallic purplish blue; occiput, sides of head, neck and its sides, back, scapulars, deep crimson, wings with their coverts dull greenish brown, the feathers with the exception of the two first primaries edged with green on the outer web, shorter coverts broadly tipped with red, longer coverts of the primaries and secondaries edged green and tinged with red; coverts of primaries uniform brown, edged green, shoulder edge of wing red; rump bright yellow; margined by elongated olive coloured feathers at the sides; upper tail coverts, the two central tail feathers wholly, and the next on the outer webs purplish steel-blue, this color decreasing towards the outermost tail feathers which gradually pass into shining black and are very indistinctly barred with dull black.

Loreal region dull black; a short streak from the base of the lower mandible bright red, bounded below, or internally, by a long streak of purplish steel blue, followed by dull black, both stripes extending to the middle of the neck. Chin, throat and breast bright scarlet, slightly darker on the breast, all the feathers white at their bases and with yellow shafts about the middle; lower part of breast, vent and lower tail coverts dusky greenish or ashy black; wings internally dark ashy with a silvery lustre, tail below black.

I have obtained (in Sept.) three male specimens in the forests of the Wellesley Province opposite Penang; all perfectly similar in coloration; wing 2″, tail $1\frac{3}{4}''$—$1\frac{7}{8}''$, the central feathers being only about $\frac{3}{16}''$ longer than the next; bill black above, light brown below, at front $\frac{6}{16}''$, from gape very nearly $\frac{11}{16}''$; feet brown, tarsus nearly $\frac{1}{2}''$; middle toe (including claw) $\frac{7}{16}$.

The coloration of this species agrees almost in every particular with Jardine's description, and so do also the measurements. I don't think there can be the least doubt as to the identity of the two. Jardine's original specimen was believed to have come from India, but its proper locality was unknown. Visc. Walden (Ibis, Jan. 1870, p. 34) places Jardine's bird as doubtfully identical with Raffles's *siparaja* and Temminck's *mysticalis*. My impression is, that they are quite distinct birds. Raffles says of *siparaja* that the two central tail feathers are brown, which does not even apply to *mysticalis*, though it seems very probable that the two species are identical. T e m m i n c k 's original figure of *mysticalis* in the Pl. Col. is not good. M ü l l e r and S c h l e g e l (Verhand. Nat. Gesch. Nederl. Ind., *Nectariniæ*, p. 55) re-describe the ♂ of *mysticalis*, and from their account it is clear that this species and *Lathami* are closely allied. The authors describe the vent as ashy grey with greenish tinge, while T e m m i n c k 's figure shews it almost white. The inner webs of the outer tail feathers are said to be reddish black, but in *Lathami* there is no red tinge on them. In a note the authors state that the rump is yellow, not blue as shewn in T e m m i n c k 's figure, but I suspect the yellow must be of very small extent, as its presence escaped not only T e m m i n c k 's, but apparently also R a f f l e s' notice. Turning at last to the measurements given by M ü l l e r and S c h l e g e l, T e m m i n c k 's *mysticalis* is undoubtedly a much larger bird, its total length being 5 inches, while that of *Lathami* does not exceed 4¼". The tail of *mysticalis* is 17 mm. longer than the wing which is about 2 inches; while in *Lathami*, the tail is shorter than the wing, and the central feathers much less elongated, all the tail feathers being regularly graduated. The central tail feathers in *Lathami* are only about 3 mm. longer than the next, and these again from 10-15 mm. longer than the shortest feathers; in *mysticalis* M ü l l e r and S c h l e g e l give the corresponding proportions as 28 mm. and 11 mm. The black internal margin of the mustachial streak also appears characteristic of *Lathami*, and is not mentioned in *mysticalis*. I have little doubt that C a b a n i s' *Æ. eupogon* from Malacca is the same bird as *Lathami*, but original specimens must be compared in order to settle this question satisfactorily.

37. NECTAROPHILA BRASILIANA, G m.

W a l d e n in Proc. Z. S. L., 1866, p. 543 and Ibis, 1870, VI, p. 41.—*Nectarinia Hasseltii*, T e m m. B l y t h Cat. p. 226.

Wing 1⅞", rarely 2"; tail 1 $\frac{3}{16}$", rarely 1¼"; bill at front ½" or very little longer; tarsus very nearly or quite ⅛".

B l y t h (l. cit.) quotes his *N. Phayrei*, (J. A. Soc. XII, non XI, p. 1008), as a synonym of this species. J e r d o n says (B. Ind. I, p. 361), *A. Phayrei*, B l., from Pegu, very close to *Arachn. magna*. What does this last quotation refer to?

My collector obtained in the Wellesley Province and on Penang 4 males, but strangely not a single ♀ which appears to be rare, or difficult to procure, and was unknown to T e m m i n c k. M ü l l e r and S c h l e g e l in their Bijdragen der Honigvogels v. d. ind. Archip. p. 59, pl. 10, fig. 5 (Verh. over Nat. Gesch. &c., door C. J. T e m m i n c k, Zoolog. 1839-1844) figure and describe the ♀ of this species as being above brownish black, sides of neck and head and of the breast, front and top of head, posterior rump and upper tail coverts, chin and throat mostly red, lower breast and vent whitish. The same authors state that the young bird resembles the ♀ during the first year.

38. ARACHNECHTHRA FLAMMAXILLARIS, B l y t h.

J. Asiat. Soc. Beng. XIV, p. 557; Cat. p. 226; W a l d e n in Proc. Z. S. L. 1866, p. 541 and Ibis 1870, VI, p. 24.

I obtained only one ♂ specimen from the Wellesley Province. The feathers on chin and throat have a purple metallic lustre, at the sides slightly, but in front of the reddish brown pectoral semicircle, distinctly greenish metallic. Laterally the feathers are also somewhat mixed with dingy green. In other respects, the specimen is identical with the Arracan and Burmese form; wing 2″; tail $1\frac{3}{8}$″; bill at front $\frac{11}{16}$″; tarsus $\frac{9}{16}$.

Visc. W a l d e n 's remarks (l. cit. p. 542) respecting the possible identity of this species with *A. jugularis* of L i n n é will, I believe, soon call for a revision of the nomenclature. Both species certainly are very closely allied, if not identical.

39. NECTAROPHILA [ANTHREPTES] MALACCENSIS, S c o p.

W a l d e n, Ibis, 1870, VI, p. 47, cum synon.—*Nectarinia lepida*, L a t h. (Synop. I, 298) et auctorum.—*N. malaccensis* apud B l y t h Cat. p. 225.

This species appears to be common in the Wellesley Province; ♂ wing $2\frac{1}{2}$″—$2\frac{9}{16}$″; tail $1\frac{3}{4}$″; bill at front $\frac{5}{8}$″, from gape $\frac{6}{8}$″, or a little more; tarsus $\frac{5}{8}$″;—♀, wing $2\frac{7}{16}$″; tail $1\frac{5}{8}$″; bill at front $\frac{9}{16}$″, from gape very nearly $\frac{3}{4}$″; tarsus $\frac{5}{8}$″.

H o r s f i e l d 's *N. javanica* (Linn. Trans. XIII, p. 167) is usually considered to be the same bird, and as the identification of the Javanese bird has, I think, first been suggested by Müller and Schlegel, it is probably correct, though Horsfield's description does not speak in favour of it. He calls the chin and throat ferruginous, while Latham's expression "*rubro-fusca*" is the more correct. Horsfield's "lower coverts of the wings are rufous" is doubtful, for in the Malayan bird, the longer scapulars and the shortest coverts are terminally rufous brown, the longer coverts of the secondaries and tertiaries are edged on the outer webs partially brown, partially greenish. Further on, Horsfield says "tail is black with a greenish lustre above, fulliginous and paler underneath." In *Malaccensis* we have the tail above black, the two central tail feathers edged with purplish green on both webs, the following only on the outer web and the last feathers uniform dull black, all ashy black below. The sides of the head and neck are dingy green in the Malayan bird. However all these variations do not appear to be of great importance, for they would hardly indicate more than local races of the same species.

The female is above dingy green, wings and tail dusky brown, more or less edged with green, below yellow, brightest and purest on the middle breast, somewhat tinged with green on the throat, the two mustachial streaks are indicated by pure yellow, eyelid especially the lower one, distinctly yellow.

Fam. ARACHNOTHERIDÆ.

40. Arachnothera modesta, Eyton.

Anthreptes modesta, Eyton, Proc. Z. S. Lond., 1839, p. 105.—*Arach. modesta* et *latirostris*, Blyth, Jour. A. S. B., vol. XII, p. 981-982.

Above uniform yellowish green, duller on the wings and tail, the feathers on the forehead centered dark; the first two quills almost wholly brownish black, the others only on the inner webs, the last tertiaries wholly green; shoulder edge of wing yellow; tail feathers with a brownish black, almost terminal band, and the outer feathers mostly of the same color on the inner webs, the three outer feathers on each side with a subterminal large white spot on the inner webs. Below, greenish ashy, the feathers on the chin, throat and breast very distinctly centred dark; lower tail coverts yellowish green with yellowish white tips; lateral feathers of the vent greatly lengthened. Wing $2\frac{7}{8}''$; tail $1\frac{3}{4}''$; bill at front $1\frac{3}{16}''$; from gape $1\frac{3}{8}''$; tarsus $\frac{5}{8}''$.

This species is readily distinguished from the last by its stout and short bill; it is rare about Malacca and in the Wellesley Province, and I only once saw it at Penang.

Fam. DICÆIDÆ.

42. DICÆUM TRIGONOSTIGMA, Scop.

Blyth, Cat. p. 226; Latham, In. Ornith., I, p. 299.

♂. Dark, sometimes greyish, blue above and on the sides of the head and neck, as well as on the scapulars and wing coverts of which the anterior are edged with green; wings black, the feathers edged with greenish blue on the outer webs, shoulder edge of wing white; back bright golden orange, rump greenish yellow, longer upper tail coverts green, tail black, like the wings, with a faint greenish lustre; chin and throat cinerous white, breast and vent bright orange yellow, becoming pure yellow on the lower tail coverts; wing $1\frac{7}{8}''$; tail $\frac{7}{8}''$; bill at front $\frac{3}{8}''$; from gape $\frac{1}{2}''$; tarsus $\frac{1}{2}''$.

♀. Above dark greenish, wings and tail blackish, rump and upper tail coverts yellow, chin and throat greenish grey, rest of lower parts orange yellow; size same as that of the male.

Apparently not common in the Wellesley Province and about Malacca.

43. DICÆUM CHRYSORHÆUM, Temm.

Pl. Col. 478; Jerdon, B. Ind. I, p. 374.

Specimens from the Wellesley Province are all a little larger than the measurements given by Jerdon from Indian specimens, and there is no distinct yellow tinge on the rump and upper tail coverts; wing $2\frac{3}{8}''$; tail $1\frac{3}{16}''$; bill at front $\frac{3}{8}$; from gape $\frac{1}{2}''$; tarsus $\frac{1}{2}''$. The Malay specimens agree best with Temminck's figure of a Javanese bird, which has the throat whitish and the rest of the plumage below with a very slight greenish tinge.

44. DICÆUM CRUENTATUM, Linn.

D. coccineum, Scop., Gould, B. Asia, pt. VI; Jerdon, B. Ind. I, p. 373.

The Malayan bird, though identical in coloration with the Indian one, seems to be smaller, at least of four specimens shot in the Wellesley Province, opposite Penang, three have the wing scarcely longer than $1\frac{3}{4}$ inch, and only one has it $1\frac{7}{8}$, but none reaches 2 inches, the tail is nearly one inch, and the bill at front is $\frac{3}{8}''$; the wing coverts and scapulars have a rather bluish green lustre, and the scarlet above is either very bright and almost pure or with a slight yellowish tinge. Visc. Walden (Proc. Zool. Soc. Lond., 1866, p. 544) draws attention to these differences, but I hardly think that they are sufficient to warrant a specific distinction. Should this, however, be the case the name *coccineum*, Scop., would stand for the Eastern, Malayan and Chinese form, for the type of this is said to have been obtained from China, and the Indian race had to be called *cruentatum*. I believe, however, that smaller races, similar to the Malayan ones, also occur locally in India and Burma, and that there is no sufficient ground for a specific separation.

Fam. MEROPIDÆ.

45. Merops Philippinus, Linn.

Gould, B. Asia, pt. VII; Jerdon B. India, I, p. 207.

Specimens from the Wellesley Province are perfectly identical in size and coloration with those from India. The last tertiaries are almost wholly dull greenish blue, not only on the outer edge, as shewn in Gould's figure.

Fam. MOTACILLIDÆ.

46. Henicurus Chinensis, Gould.

Birds of Asia, pt. XVIII.

I obtained only one specimen from the Wellesley Province; it quite agrees with the figures and measurements recorded of the species.

47. Henicurus ruficapillus, Temm.

Planches Col. 534.

A specimen from the Wellesley Province almost perfectly agrees with Temminck's figure, except that there is a little less black on the top of head separating the frontal white from the rufous brown of the crown and of the neck. The lateral black stripes become obsolete on the posterior vent. Wing $3\frac{3}{8}''$; tail about $3\frac{1}{2}''$; bill at front $\frac{3}{4}''$, strongly hooked at the tip, from gape $1\frac{15}{16}''$; tarsus $1\frac{1}{8}''$; bill black, feet white.

The species is recorded from Java and Sumatra, and seems to be very rare in the Malay Peninsula; it is not known to extend farther northwards.

48. EUPETES MACROCERCUS, Temm.

Blyth, Cat. p. 158.

Wing $4''$; tail $5''$; bill at front nearly $1''$, from gape $1\frac{7}{16}''$; tarsus $1\frac{3}{4}''$;—not common in the Wellesley Province.

Strickland (Ann. and Mag. N. H., XIX, 1847, p. 132) suggests to class this remarkable bird in the TIMALIINÆ, but considering the general structure of this and allied species, they undoubtely exhibit a greater relation to *Hydrobata* and *Henicurus*, then to any *Timalia;* unfortunately I could not obtain any information about the habits of the present species; the coloration exactly agrees with Temminck's figure.

Fam. PITTIDÆ.

49. PITTA GRANATINA, Temm.

Planches Col. 506.—*P. coccinea,* Eyton, Proc. Zool. Soc. Lond., 1839, p. 104,

An apparently young bird from the Wellesley Province has the front sides of head sooty brown, head above and occiput crimson, posterior neck blackish brown, rest of upper plumage uniform deep blue, quills with their coverts and the inner webs of the other wing feathers brownish black, chin and throat of the same colour, breast and vent brown, on the former most of the feathers are blue and tipped with reddish, the red increasing towards the vent but not predominating, except at the sides; under tail coverts red; wing $3\frac{1}{2}''$; tail $1\frac{1}{4}''$; bill at front $\frac{10}{16}''$; from gape $1''$; tarsus $1\frac{1}{2}''$. The specimen wants the bright lilac color at the sides of the head and on the wings, which is to all appearance a sign of maturity. Malacca specimens in full plumage appear perfectly to agree with Temminck's *granatina* with which Blyth (Cat. p. 157) first identified them, but subsequently he stated (p. 326) that the name *granatina* has been restricted to the Borneo bird, and that the

Malayan one is identical with *venusta*, Müll. This last, as figured by Temminck (Pl. Col. 590) and re-described by Müller and Schlegel (Oversigt. Ind. Arch. *Pitta*, p. 15) seems to me, however, to be quite a different bird.

Fam. TURDIDÆ.

50. GEOCICHLA MODESTA, Eyton.

Turdus modestus, Eyton, Proc. Z. S. London, 1839, p. 103.

♂. Olivaceous brown above, a little darker on the head, lores and ear-coverts dusky, a narrow streak below the lower mandible, widening posteriorly, and the whole of the posterior throat cinereous; superciliary stripe, lower eyelid, mustachial stripe, chin and anterior throat pure white; front of breast including the sides and extending down to the vent pale ferruginous; median portion of lower breast, vent, and lower tail coverts pure white; wing 5″; tail $3\frac{1}{2}$″; bill at front $\frac{5}{8}$″, from gape $1\frac{1}{16}$″; tarsus $1\frac{3}{16}$″.

The female differs by having the cinereous color less pure and much less developed on the posterior throat, the ferruginous of the breast is also more mixed with ashy; the size is the same as that of the male.

Specimens from the Wellesley Province perfectly agree with those from Malacca as well as with those from Arracan. The species has been by different authors identified with Horsfield's *T. javanicus*, but on comparing the description of this, as well as that of Drapiez *rufulus*, the Javanese bird appears to me to be distinct, though I have no authentic specimens to compare. I do not know Temminck's *T. concolor*, but until the uncertainty about the correct definition of the allied insular species has been satisfactorily settled, Eyton's name should be reserved for the Malayan bird.

G. modesta also occurs at the Andamans and along the Arracan coast, and may probably extend into Cachar and farther north into Assam.

Fam. TIMALIIDÆ.

51. TURDINUS MACRODACTYLUS, Strickl.

Vide Strickland in Ann. and Mag. N. H., 1847, XIX, p. 133, and Blyth in J. A. S. B., XIII, p. 382.

B l y t h separated this species as the type of *Turdinus* from E y t o n 's *Malacopteron.* The bill as well as the gradation of the wing feathers, and in fact the entire habitus of the bird are quite distinct from the type of the last named genus. B l y t h ' s description and measurements apply to the Malaccan bird, but a smaller form occurs farther north in the Wellesley Province. The plumage is in every respect the same, the back in one of the specimens slightly more rufous brown, and the chin in both pure white, extending a little more on the sides of the head, than it does in Malaccan specimens, but apparently not so much low down, barely reaching beyond the middle of the throat. The bill also appears to be a little higher, gradually tapering, and less notched at the tip, than in a specimen from Malacca, but such slight variations no doubt are individual, or differ according to age.

I append the comparative measurements of the two races.

	Spec. from Malacca.	2 Specimens for Wellesley Province.
Wing,	$3\frac{5}{8}''$,	$3\frac{3}{16}''$—$3\frac{1}{4}''$.
Tail,	$2\frac{1}{2}''$,	$2\frac{3}{8}''$.
Bill at front,	$\frac{3}{4}''$,	$\frac{3}{4}''$.
,, from gape,	$1\frac{1}{16}$,	$1''$.
Height of bill at front,	$\frac{1}{4}''$,	$\frac{9}{32}''$.
Tarsus,	$1\frac{1}{4}''$,	$1\frac{3}{16}''$.

B l y t h described (Jour. Asiat. Soc. 1855, XXII,) three other species of *Turdinus* from the Tenasserim Provinces; they all somewhat differ in plumage from the Southern Malayan form; lately (Ibis, April, 1870), the same author also notes several species of that genus from Java, having inspected some specimens in the Leyden Museum, &c.

52. Turdirostris superciliaris, H a y.

Madras Jour. 1845, XIII, pt. II, p. 163.

From Malacca and the Wellesley Province.

The male has the whole of the dark plumage tinged with bluish ashy; the female is dull brownish black with a plain ashy tinge. A full grown male measures wing $4''$; tail $3\frac{7}{8}''$; bill at front $\frac{13}{16}''$; from gape $1\frac{1}{8}''$; tarsus $1\frac{1}{16}''$. As compared with *Turdinus*, the bill of *Turdirostris* is stronger, more concave at the sides and broader at the base, provided with strong bristles and stiff feathers, those of the loreal region almost entirely covering the nostrils, while the same are uncovered, or nearly so, in *Turdinus*. The wings and tail are comparatively longer, the primaries being narrower and longer, but the tertiaries shorter, than in *Turdinus*. On the whole this last named genus appears to possess more of a Turdine while *Turdirostris* has more of a Timaline aspect.

53. MIXORNIS NIGRICOLLIS, Temm.

Planches Col. pl. 594, fig. 2; *T. erythronotus*, Blyth, J. A. S. B., XI, p. 793; *Brachypterix nigrogularis*, Eyton, Ann. and Mag. N. H., 1845, XVI, p. 228.

If the generic distinction between *Mixornis* and *Timalia* is to be retained the present species, should be placed in the former genus, on account of its comparatively very strong bill and the very short rictal bristles, the reverse being the case in *Timalia*, which besides has the 5th and 7th primaries equal, while *Mixornis* has the 7th sensibly shorter than the two preceding.

Blyth's description of the bird is excellent; ♂ and ♀ are quite similar. Wing $2\frac{3}{4}''$; tail $2\frac{1}{4}''$; bill at front $\frac{5}{8}''$; from gape $\frac{13}{16}''$; tarsus $\frac{15}{16}''$. The species is very common in Penang and the Wellesley Province.

54. DRYMOCATAPHUS NIGROCAPITATUS, Eyton.

Brachypteryx nigrocapitata, Eyton, Proc. Zool. S. Lond. 1839, p. 103.

Blyth in Catalogue, p. 178, quoted this species first as a doubtful *Brachypteryx*, and then, in Appendix 3, as *Drymocataphus*, which genus he proposed for the species in Vol. XVIII, Journ. Asiat. S., 1849, p. 815. Its distinction from *Brachypteryx* is indeed very marked, not only the bill being different, but the tail much longer, and the primaries shew totally different proportions. The habitus of the bird is that of a *Pomatorhinus* and of *Pelorneum*, differing from the former by the hooked and notched bill, and from both by the proportions of the primaries. In 1849 (l. cit.) when proposing the genus, Mr. Blyth simply quotes Eyton's species as the type, and describes another species, *D. fuscocapillus* from Ceylon, which he says is allied to the former. Since then (Ibis

1867, III, p. 301) B l y t h referred the Ceylon species to *Pellorneum*, but does not say anything about the genus *Drymocataphus*, of which the Malayan species is the type. As the species is not common, a brief description of the genus and of the type species may be acceptable to Indian Ornithologists.

Drymocataphus, B l y t h, 1849. Bill lengthened, gradually becoming thinner laterally, and on the upper terminal half slightly arched, moderately curved and hooked at tip; nostrils elongated, free; a few short rictal bristles; wings very short, first quill smallest, second about half as long again, 3—7th graduated, the 7th being longest, the eighth and ninth very little shorter and equal; secondaries elongated, tertiaries conspicuously shorter; tail long, rounded, the middle feathers being the longest; feet strong with a long tarsus, inner and outer toe subequal, the middle one lengthened, hind toe shorter, but stronger, and with a very long curved claw, being double the length of that of the middle toe.

D. nigrocapitatus, E y t o n. Head above and occiput black, rest of upper plumage rufous brown, lores and supraciliary stripe and lower eyelids whitish ashy, the feathers having pure white quills; ear coverts rufescent ashy; a moderate blackish brown mustachial streak from lower mandible bordering laterally the white chin and anterior throat; lower throat and breast bright rufescent, changing to deeper brown on the vent and the lower coverts. Bill black above, yellowish white below; legs brown. Wing $2\frac{3}{4}''$; tail $2\frac{3}{8}''$; bill at front $\frac{5}{8}''$, from gape $\frac{7}{8}''$, tarsus $1\frac{1}{4}''$, middle toe including claw $\frac{7}{8}''$; hind toe, including claw $\frac{11}{16}''$, claw alone $\frac{5}{16}''$. I did not observe the species farther North than Malacca.

Fam. MELLIPHAGIDÆ.

55. IORA LAFRESNAYEI, H a r t l a u b.

Rev. Zool. 1844, p. 401.

I obtained a single full grown male of this species from the Wellesley Province. The one originally described by H a r t l a u b was from Malacca, and appears to be a female. Mr. B l y t h described another specimen from Arracan, also a female, under the name of *I. innotata*, (vide J. A. S. B., XVI, p. 472). The species seems to be very rare.

♂. General plumage above black with a greenish glossy tinge, forehead yellow, passing to black on top of head between the eyes, neck and back tinged with yellowish green, feathers of the rump very soft, much lengthened, whitish at their bases, olivaceous towards the middle and with yellow tips ; upper tail-coverts short, metallic black, tail and wings shining black, the latter internally near the shoulder edge yellow, then white, all the wing feathers having the bases with their coverts and the edges of the inner webs white ; the 5-9th quills are on the basal half of the outer webs also slightly edged with yellow ; lores and eyelids yellow, ear-coverts black ; below uniform bright yellow throughout, slightly olivaceous at the side of the breast below the wings ; wing $2\frac{3}{4}''$; tail $2\frac{5}{16}''$; bill at front $\frac{13}{16}''$, from gape $\frac{15}{16}''$; tarsus $\frac{13}{16}''$.

Blyth gives the measurements of the female as : wing $2\frac{3}{4}''$, tail $2\frac{1}{4}''$, bill from gape $1''$, tarsus $\frac{3}{4}''$; it is uniform green above, yellow below with no white on the wings except a slight edge to the primaries.

Although the beak of this species is comparatively of a very large size, its form is exactly that of other typical *Ioræ*, and the same applies to the peculiar yellow and black, or yellow and greenish coloration of the sexes. When viewed externally, the black tinge of *Lafresnayei* strongly recalls the coloration of *Zeylonica*.

56. Iora typhia, Linn.

Jerdon, Birds of India, II, p. 103.

Blyth (J. A. S. B., XIII, p. 380), I think, first suggested the identity of *I. typhia*, L. and *I. Zeylonica*, Gmel., and Mr. Hume, lately (J. A. S. B., XXXIX, Part II, p. 117) says that there can be hardly a doubt as to the identity of the two. I do not think that the difference of size, relied upon by Dr. Jerdon, holds good ; he must have had taken the measurements of an unusually large specimen of *typhia* with the wing $2\frac{5}{8}''$, for several which I measured, have the wing only $2\frac{1}{2}''$, and some barely as long, but the bill of *typhia* always appears to be a trifle longer than that of *Zeylonica*. It certainly appears very probable that the two forms only represent different phases of plumage, or races of one and the same species, but it is at the same time remarkable to find that ♂ *typhia*, in fully developed plumage, never has the whole head black, at least I never saw, nor heard of, such specimens ; but of course if the two extreme, as well as intermediate, forms do occur in one and the same locality and interbreed, there is every reason to believe that they only form one species. However, I do not think that even in this case it could be disputed that the two phases of plumage,—pointed out as characteristic of *typhia* and *Zeylonica*,—do not occur constant in mature birds. *Zeylonica* is the strictly Indian form, *typhia* is the Malayan, and birds with the whole upper black plumage of *Zeylonica* are never met with in Burma and the Malayan country. A couple of female specimens of *Zeylonica* which I compared had the green upper, and yellow lower, plumage slightly paler than specimens of *typhia*, and the tail feathers were less truncate, more obtusely rounded with yellowish subterminal cross bands and the general plumage of the tail feathers was a little brownish, but I cannot say whether these characters are in any way constant among a large series of birds ; I do not expect they are. The female of *typhia* is almost exactly like that of *scapularis*.

Visc. Walden (Proc. Z. S. London, 1866, p. 550) questions Blyth's statements as to the occurrence of both *typhia* and *scapularis* in the Malayan Peninsula, and observes that he possesses a female specimen of an *Iora* from Malacca with the bill longer and slenderer than that of a Tenasserim specimen, but the wing much shorter. Walden suspects it to be *scapularis*, which identification may be correct, considering that the usual size of ♂ *I. typhia* is at the wing 2½″, and the ♀ is often a little smaller than the ♂, consequently the measurements between the two species are not so contrasting, as they were believed to be. It is, however, also possible that the ♀ specimen in question belongs to a small variety of *typhia*, of which I obtained a pair in full plumage from the Wellesley Province.

The coloration of a ♂ specimen from the same locality, indicates one of the intermediate forms between *Zeylonica* and *typhia*, and is almost exactly like that of *Lafresnayi*. It is green above, on the occiput and neck strongly tinged with black ; wings and tail black, the former with the usual large white tips to the shorter, and the narrower greenish white tips to the longer coverts ; sides of head including eyebrows, lores, and the whole of the lower plumage bright yellow, brightest, almost saffron yellow, on the throat and paling towards the vent. The bill is exactly as large and slender as in Burmese or Calcutta specimens, but the wing shorter, being $2\frac{3}{8}''$, tail $1\frac{7}{8}''$, bill at front $\frac{9}{16}''$, from gape nearly $\frac{3}{4}$; tarsus, $\frac{3}{4}''$ (the same as in *typhia* and *Zeylonica*).

♀. Olivaceous green above, blackish brown on the wings, yellow below, the tips to the shorter wing coverts white, those of the larger coverts mostly green, and the shoulder edge greenish yellow, tail feathers green, the outer ones partially dusky brown on the inner webs and with greenish yellow edges, all conspicuously cross-barred with dusky brown; wing $2\frac{5}{16}''$; tail $2''$, the other measurements the same as in ♂. In spite of its slightly smaller size, I am confident that the Malayan bird is the same which occurs in Tenasserim and in Bengal, and probably similar variations of size, as those just noted, will be sooner or later recorded also from Indian localities.

As regards the alleged identity of *typhia* and *Zeylonica*, we must now await the result of Mr. Hume's comparison of the numerous specimens of both forms which he states that he has at his disposal from almost all parts of India.

57. Iora scapularis, Horsf.

♂. Uniform dark green, paling to yellowish on the rump, and passing to bright yellow on the vent and lower tail coverts; eye-brow above and a spot below the eye bright yellow, posterior and anterior angle of the eye, including the lores, dull black; wings with the scapulars, upper tail coverts and tail shining black; shoulder edge of wing yellow, or greenish yellow; shorter and longer coverts broadly tipped with white, wing feathers edged green externally, tail feathers sometimes very slightly tipped greenish; and in immature specimens the outer feathers are mostly green; tibial feathers yellow; tail very indistinctly cross-barred; bill leaden brown with pale whitish edges, legs leaden grey. Wing $2\frac{9}{16}''$, tail $2''$, bill at front $\frac{9}{16}''$, from gape very nearly $\frac{3}{4}''$; tarsus $\frac{3}{4}''$.

The female does not appear to differ from that of *I. typhia*, except that the tail seems less dusky on the inner webs and very narrowly edged with greenish, above there are scarcely any cross bars perceptible ; wing 2 $\frac{7}{16}''$; tail $2\frac{1}{8}''$. The bill of *scapularis* appears in some specimens to be more straight than that of *typhia*, but there is no difference in its length. It seems pretty constant that the tail of the female *Ioræ* is proportionally longer and the wing shorter, than those of the males.

This species is not uncommon in Penang, the Wellesley Province, and farther south about Malacca. The female was described and figured by Horsfield in his "Researches" from Java.

58. PHYLLORNIS JAVENSIS, Horsf.

Gould, Birds of Asia, pt. XIII.

This is a very common species about Malacca and in the Wellesley Province. All the males, that I have obtained, had the hinder angle of the eye yellowish, indicating the yellow eye-ring of the female. The old ♀ has the mustachial streak slightly blue and the shoulder tuft mostly green with only a slight trace of blue, sometimes with scarcely any ; the young ♂ has the mustachial streak originally green, but it gradually changes to blue, and at the same time also some of the yellow feathers on the throat begin to turn black. Wing in ♂ $3\frac{7}{8}$ 4 inch ; tail $2\frac{3}{4}''$—$3''$; wing in ♀ usually $3\frac{3}{4}''$; tail $2\frac{3}{4}''$; bill in both about $\frac{11}{16}''$, being a little more strongly curved at tip in the ♂, than in the ♀.

59. PHYLLORNIS CYANOPOGON, Temm.

Gould, Birds of Asia, pt. XIII.

Five males were obtained in September by my collector in the Wellesley Province. All have the forehead and a gorget on the front breast bordering the black much more conspicuously yellow than shewn in Gould's figure ; wing 3-$3\frac{1}{8}$ inch ; tail about $2\frac{5}{8}''$; bill at front $\frac{1}{2}''$.

Blyth (Ibis, 1867, III, p. 9,) suggests that for this and the preceding species, characterized by a small shoulder tuft and a bill of the shape of *Iora*, the name *Phyllornis* should be restricted, as distinct from J. and Selby's *Chloropsis* under which he would include the other chiefly smaller species with a very conspicuous blue shoulder tuft. This distinction does not seem to be very important, and it would be very difficult to define genera upon such subordinate characters. In coloration the two last noted species of *Phyllornis* so thoroughly agree with their Indian allies, that it strikes one as very unnatural to separate them generically. The bill is in all species of *Phyllornis* which I saw more compressed and higher towards the tip, than in *Iora*, in which it is more uniformly attenuated towards the tip; and this difference is equally well apparent in a comparison of these two species, as of other typical forms, with *Iora*.

60. PHYLLORNIS COCHINCHINENSIS, Lath.

Ph. icterocephalus, Temm., Pl. Col. 112; Blyth, Ibis, 1867, III, p. 8.

Common in Malacca and the Wellesley Province and Penang, though not equally so as *Ph. Javensis*.

Mr. Blyth (l. cit.) suspects that in *Phyllornis* both sexes are similar, or very nearly so, in coloration. So they are, but I think the differences usually pointed out between ♂♂ and ♀♀ are mostly correct, though like in all similar birds there is great difficulty in distinguishing between ♀ and young birds. As an example I give a short description of a pair of the present species shot together on the coast just opposite Penang, and examined by myself.

♂. Head yellow, changing to golden yellow on top of head and neck; above deep grass green, all external wing coverts and outer webs of primaries, and secondaries bright blue, the latter tipped with greenish, which color extends on the edges of the outer webs, and gradually increases, till the last tertiaries become wholly green; inner webs of all feathers dark brown, gradually decreasing on to the last tertiaries; a large shoulder tuft verditer blue, scapulars and all upper coverts green; two central tail feathers mostly green, the others prevalent blue. Chin and throat black, laterally extending from the base of the bill to half the length of the eye, with a very small deep blue spot at the base of the lower mandible; the black is bordered below by yellow, to which follows a narrow gorget of bluish green, and the rest including lower tail-coverts is of a soft yellowish green. Bill black, legs leaden brown; wing $3\frac{1}{8}''$, tail $2\frac{3}{8}''$; bill at front $\frac{9}{16}''$, from gape $\frac{14}{16}''$; tarsus $\frac{5}{8}.''$

♀. Above, grass green with a slight golden yellow tinge on the head, especially on the top and at the sides of the middle neck, wings and tail equally bright and exactly similarly colored as in ♂, and the same is also the case with the breast, vent and under tail coverts; chin and throat uniform bluish green, with a blue elongated spot at the base of the lower mandible; bill and legs brown; the measurements are the same, as in the ♂, but the bill a little smaller and less stout.

Another pair shot near Malacca exactly agrees in colouring with the above.

Fam. BRACHYPODIDÆ.

61. Criniger gularis, Horsf.

Ixos phæocephalus, Hartlaub and *Pycnon. rufocaudatus*, Eyton, vide Strickland in Ann. and Mag. N. H., 1847, XIX, p. 130.

Although several descriptions have been published of this bird, they are hardly sufficient to recognize the species. Head above blackish ashy, each feather being narrowly margined paler, rest of upper plumage olivaceous green, yellowish green on the rump, dusky brown on the inner webs of the wing feathers, rufescent greenish brown on the upper tail coverts and tail; lores whitish, sides of head ashy; chin and throat pure white; breast, vent and lower tail coverts bright yellow, sides of breast and vent olive green; lower wing coverts yellow; inner webs of wing feathers, especially near their bases, silky white; bill well curved, slightly hooked at tip, above dark leaden brown with white edges, below a little more whitish; 6 very strong black rictal bristles on each side, the most anterior the smallest, the two median ones almost reach to the tip of the bill when laid forward; narine bristles thin and small; wing $3\frac{1}{2}''$; tail $3\frac{1}{2}''$; bill at front $\frac{5}{8}''$, from gape $\frac{7}{8}''$; tarsus very nearly $\frac{3}{4}''$; middle toe $\frac{5}{8}''$; hind toe $\frac{1}{2}''$, the claw of the latter is very little stronger than that of the middle toe; the two outer toes are equal, and each as long as the hind toe. The bill is rather broad at the base, the rictal bristles comparatively very strong, the feet rather weak, shewing that the whole habitus of the bird is that of a *Criniger*, as pointed out by Strickland. With the exception of the characteristic shortness of the tarsi, the species shews considerable affinities to *Turdirostris*, especially in the form of the bill and the length of the rictal bristles.

Rare at Malacca and in the Wellesley Province.

62. MICROTARSUS MELANOLEUCOS, Eyton.

Proc. Zool. Soc. London, 1839, p. 102. *Brachypodius tristis*, Blyth, J. A. S. B., XIV, p. 576.

Apparently rather rare in Penang and in the Wellesley Province, occurring in dense forest; wing $1\frac{1}{4}''$; tail $2\frac{1}{2}$; bill at front $\frac{11}{16}$, from gape $\frac{3}{4}''$; tarsus $\frac{9}{16}''$.

63. BRACHYPODIUS MELANOCEPHALUS, Gmel.

Temminck, Pl. Col. 147. *Ixos metallicus*, Eyton, Ann. and Mag. Nat. Hist., 1845, XVI, p. 228.

Eyton's name evidently refers to the greenish or purplish metallic tinge of the whole head; the total length stated to be 8″ must be a misprint, as Strickland suggested, for Eyton's two other measurements agree exactly with those of this species. Wing $3''$—$3\frac{1}{8}''$; tail $2\frac{1}{2}''$—$2\frac{5}{8}''$; bill at front about $\frac{1}{2}''$, from gape $\frac{3}{4}''$; tarsus $\frac{1}{2}''$. Common in the Wellesley Province and on Penang. I have seen it darting after insects almost like a fly-catcher.

64. IXIDIA CYANIVENTRIS, Blyth.

Pycnonotus ? cyaniventris, Blyth, J. A. S. B., XI, p. 792; *idem* Cat., 211, cum syn.

The original measurements given by Blyth must have been taken from a rather large bird, for the specimens in the Asiatic Society's Museum are somewhat smaller. The species is common with the previous about Malacca, on Penang and in the Wellesley Province. Wing $2\frac{3}{4}''$—$2\frac{7}{8}''$; tail $2\frac{1}{2}''$; bill at front very nearly $\frac{1}{2}''$, from gape nearly $\frac{3}{4}''$; tarsus $\frac{9}{16}''$.

These three last named species are so closely allied as regards their short stoutish form of the body, the subconical arched bill (being slightly hooked at the tip), the presence of few rictal and narine bristles, feeble feet with short tarsi, coloration, &c., that it would at the first sight appear unnatural to apply to them three distinct generic names. It is perhaps so, and a smaller sub-division would suffice; we may call them either genera or sub-genera, but there certainly are noticeable distinctions between each of the three species.

MICROTARSUS has the first primary very narrow and short, the 2nd of considerable length, the 4th largest and the two following subequal to it; the tail is rounded, the middle feathers the longest and the rest slightly gradated; the feathers on the rump are very full and the lower tail coverts short; the feet and toes are rather strong.

BRACHYPODIUS has the 1st primary very short, the 2nd again of considerable length, the following gradated up to the fifth, which is longest, and the others rapidly decrease in length; the tail is rounded, the central feathers longest, the others gradually decreasing in length, and the outermost are considerably shorter; tail coverts long, feet and toes feeble.

IXIDIA has the 4th primary the longest, the 5th and 6th very little shorter and equal, the tail squarish, the middle feathers being shortest, and the outermost a trifle longer; lower tail coverts short, much in form resembling *Pycnonotus*, feet and toes feeble.

Fam. ORIOLIDÆ.

65. ORIOLUS XANTHONOTUS, Horsfield.

Res. Java with fig.; Blyth in Cat., p. 215; Pl. Col. 214.

Horsfield's figure of the male is evidently taken from a specimen not in fully developed plumage, for in this state of plumage the black is quite pure and the yellow above much more bright, the edgings of the primaries are very distinct and pure white, while the secondaries and tertiaries are very faintly edged with pure yellow.

What Horsfield describes as the female is no doubt a young bird, and probably a male; it corresponds with Blyth's *O. castanopterus** which is based upon a young bird from Malacca, as recorded by Mr. Blyth himself.

The female in full plumage is almost uniformly dingy green above, yellowish in front of the head and round the eye, top of head somewhat darker; quills brown with pale edgings, secondaries brown on the inner, greenish on the outer webs, the latter color

* Journ. Asiat. Soc. Bengal, Vol. XI, p. 795.

gradually increasing till the last tertiaries become wholly green, most of the secondaries and tertiaries are sometimes narrowly tipped with yellowish brown, a few of the median wing coverts are externally distinctly edged with chestnut; tail green above, the two median feathers wholly so, the others blackish on the terminal half of the inner webs and terminating with a yellow tip, both the black and yellow increasing towards the outermost tail feathers. Below, chin and throat whitish with a very slight greenish tinge, breast and vent with elongated dark brown blotches as in the ♂, lower tail coverts pure yellow, tail feathers below greenish. The young have the back and wing coverts more or less brown and the other colors of the ♀ less pure.

This species seems common about Malacca, and is very common in the Wellesley Province, being constantly seen flying about immediately one passes through the cocoanut forest in the interior. Its habits and call are entirely that of other Oriols and so is also its coloration. ♂, wing $4\frac{1}{8}$-$4\frac{1}{4}$ inches; tail about $2\frac{1}{2}''$; bill at front $\frac{11}{16}''$-$\frac{12}{16}''$; from gape $\frac{15}{16}$-$1''$; tarsus $\frac{12}{16}''$; the ♀ is of the same size as the ♂, or slightly smaller.

As compared with other allied species the size is somewhat small and the bill distinctly hooked at the tip, but these are, I believe, not sufficient characters, upon which subgenera could be based, and, therefore, Bonaparte's name *Xanthonotus* appears to me to have no claim to be accepted as a distinct appellation.

Fam. IRENIDÆ.

66. Irena puella, Lath. (var. *cyanea* Begbie).

I. Malayensis, Moore, vide Walden in Ann. and Mag. Nat. Hist. V, 1870, p. 417.

It was, I think, Blyth who first pointed out, years ago, the constant smaller size of the Malayan as compared with the Indian bird, but on account of the identity in coloration, he considered the two races as belonging to one and the same species, *I. puella* of Latham, (Jerdon, B. India, II, p. 105). There are probably few ornithologists who, after having seen large series of this species, would not follow Blyth in his determination, and though the question of India, Malaya and Java, each being inhabited by a distinct species, lately appears to have been finally settled by one of our most able ornithologists (Visc. W a l d e n, loc. cit.), I still think that these so-called species (*puella, cyanea* and *turcosa*) should only be considered as local races of one and the same bird. Of course the question entirely rests in the name, but as long as there are no other distinctions developed, than those pointed out between these local races, it would be preferable not to rank them as species, for such instances are exactly those which leave the definition of a species quite optional to every naturalist without an attempt of making the idea of a specific character a generally applicable one. It is true that the Indian bird is generally larger, but there certainly are exceptions to this, and specimens from Assam, Arracan and Burma are sometimes quite as large as the Malabar bird, while others from the same localities are smaller. A ♀ from the Wellesley Province has the wing $4\frac{3}{4}''$, tail $3\frac{3}{4}''$, upper tail coverts $1''$ shorter than the tail, lower tail coverts a little shorter than the upper; bill at front $\frac{15}{16}''$, from gape $1\frac{3}{16}''$; tarsus $\frac{11}{16}''$. Of two Malacca specimens one has the wing $4\frac{5}{8}''$, the other $4\frac{1}{2}''$; tail in both $3\frac{1}{2}''$, and the upper tail coverts are $1\frac{1}{8}$ inch shorter in one, and only 1 inch shorter in the other specimen, bill at front $\frac{7}{8}''$, from gape $1\frac{1}{8}''$, tarsus barely $\frac{11}{16}''$. I can see no striking difference in the lazuline or blue coloration of ♂ and ♀ specimens from South India and those from Burma, and again between these and others from Malacca, but the latter are the smallest. It appears that the size of the bird becomes, through some cause or other, smaller the more southward we proceed in the narrow strip of land of the Malayan Peninsula, but when we arrive at the larger islands, like Java and Sumatra, the birds again appear to increase in size, equalling those of Burma. One point is certainly clear, namely, that the greater length of the tail coverts in the Malayan bird as compared with the Indian is *not constant.* Lord W a l d e n admits that there is no difference in the color of the Java and Malayan ♀ birds; I have not seen ♂ Java specimens.

Fam. LANIIDÆ.

67. Lanius Lucionensis, L i n n.

W a l d e n, Ibis, 1867, p. 215.

The more ashy (than rufous)* variety, which has been noted from the Andamans, also occurs in the Wellesley Province. The color and size ($7\frac{1}{2}''$) quite agree with the brief notice of the species in Latham's Ind. Ornith.; wing $3\frac{1}{2}''$; tail $3\frac{3}{8}''$; bill at front $\frac{9}{16}''$, from gape $\frac{13}{16}''$; tarsus $\frac{15}{16}''$.

68. Lanius magnirostris, Less.

Walden, Ibis, 1867, p. 220, pl. vi, cum syn.

A specimen from the Wellesley Province exactly agrees with Eyton's description of Malacca specimens, (*L. strigatus*), it may be perhaps a trifle smaller. The short bristle-like feathers covering the nasals, and the anterior lower angles of the eyes are black, the lores above partially whitish; chin pure white; head pale rufous ashy, some of the feathers on top white shafted and subterminally slightly black; wing $3\frac{1}{8}''$; tail $2\frac{3}{4}''$; bill at front $\frac{9}{16}''$, from gape $\frac{7}{8}''$; tarsus $\frac{7}{8}''$; hind toe $\frac{9}{16}''$. This specimen appears to be a young male, which accounts for its dimensions being less than those of any of the three specimens noted by Lord Walden.

Another specimen, slightly larger, from the same locality, quite agrees in coloring with the above, and this is rather remarkable, but I suppose it is also a young bird; both were obtained at the beginning of September.

69. Tephrodornis sordida, Wallace.†

Teph. gularis, auctorum (from Malacca), nec Raffles.

This Malayan species, which extends northwards into the Wellesley Province and occurs on Penang, is exactly intermediate between the Indian *T. pelvica*, Hodgs., and the Sumatra *gularis*, Raffles, (*T. virgatus* apud Temm., Pl. Col.). It has a coloration very similar to the former, and the size (total length 7″) is that of the latter.

Above pale ashy brown, a little less ashy on the wings and tail, darker on the inner webs of the wing feathers, rump with a small white patch; forehead and a narrow superciliary stripe slightly paler ashy than the rest of the head, streak extending from the

* Very slightly on the head and more distinct on the upper tail coverts.

† I believe Wallace proposed this name for the Malacca bird, but I cannot just now give the exact reference.

lores through the eye brownish black, shoulder edge of wing white, lower wing coverts ashy brown; mustachial streak extending from the base of the lower mandible posteriorly white; below, cinereous white, paler on the chin, very slightly rufescent at the sides of the breast and passing to white on the vent and lower tail coverts; wing 4″; tail $2\frac{7}{8}$″; bill at front very nearly $\frac{3}{4}$″, from gape slightly more than 1″; tarsus $\frac{5}{8}$″.

The bill of this section of *Tephrodornis*, including the present species, *pelvica* and *gularis*, is very much like that of *Turdirostris*, but the feet are very feeble, and the tarsus as short as in *Hemipus*. The Malayan form is especially distinguished by its unusually feeble feet, as compared with the size of the bird. I do not think, however, that there is sufficient ground for a generic separation of these species from *Tephrodornis*, but if a special section should be thought convenient, Hodgson's name *Tenthaca* would have priority before *Tephrolanius*.

70. Volvocivora culminata, Hay.

Ceblepyris culminatus, A. Hay, Madras Journ., 1845, XIII, pt. II, p. 157.

I have not seen this species except from Malacca, wherefrom the type specimen was described, and even here the bird does not seem to be common. A female specimen is bluish ashy above, darker on the wings and tail, slightly rufescent at the base of the beak, the wing coverts are margined paler, and the outer tail feathers are strongly blackish; sides of head and below dull white, with narrow transverse blackish stripes; the three outer pairs of tail feathers are tipped white; wing $3\frac{5}{8}$″; tail $2\frac{7}{8}$″, bill at front $\frac{1}{2}$″, from gape $\frac{7}{8}$″, tarsus $\frac{3}{4}$″. The Malacca species is smaller than *V. saturata*, lately described by Swinhoe, (Ibis, April, 1870).

Blyth and Jerdon suggest that this species is probably identical with Temminck's *fimbriata*. Comparing Temminck's figure of the female specimen (Pl. Col. 250) with the one noted above, the Malacca bird appears to be a little smaller, while Temminck's species wants the rufescent color on the upper base of the bill, it also has the chin much purer white and contrasting with the greyish white tint of tho rest of the lower parts, all tail feathers and the longer coverts of the wing are tipped white. Until more sufficient proof of the probable identity of both has been given, it will be preferable to retain H a y ' s name.

71. BUCHANGA INTERMEDIA, B l y t h.

Dicrurus intermedius, B l y t h, J. A. S. B., XV, p. 298. See also W a l d e n in Proc. Zool. Soc. Lond., 1866, p. 545.

Whole plumage black, glossed with bluish green on the head, neck, back, scapulars and breast, slightly less on the upper tail coverts and the outer webs of the tail feathers; below blackish, some of the feathers on the middle of lower breast and vent tipped white, lower vent and sides dark cinereous; lower tail and wing coverts black with white tips; wing $5\frac{1}{2}''$; middle tail feathers $4\frac{1}{2}''$, outer $5\frac{1}{8}''$; bill from the front of the nostrils to tip $\frac{3}{4}''$, the nude portion only $\frac{9}{16}''$, from gape very nearly $1\frac{1}{4}''$; tarsus $\frac{3}{4}''$. This (apparently young) specimen shot near Malacca, only differs from B l y t h ' s type (in the Museum) by having the wing and the bill slightly longer, and by the few whitish spots on the belly and the lower tail coverts, which are more uniform dark ashy in the type (the wing and outer tail feathers of which are about $5\frac{3}{16}''$ each). Both are undoubtedly identical and the same as Burmese specimens, but distinct from the Javanese *cineraceus*.

72. DISSEMURUS MALAYENSIS, H a y apud B l y t h.

Edolius paradiseus, L i n n., var. auctorum, J. A. S. B., XV, p. 294.

This appears to be in part the Tenasserim form which B l y t h (J. A. S. B., XI, p. 800, fig. 8-9) formerly referred to *D. Rangoonensis*, but which is smaller than this species; it occurs in the Wellesley Province and on Penang. J e r d o n says that T e m m i n c k ' s name *setifer* is applicable to this species. The upper black plumage has a steel blue lustre on the head, and on neck and back, greenish posteriorly and on the wings, frontal crest about $\frac{5}{8}''$ long and $\frac{1}{2}''$ high; lores and ear coverts dull black; chin almost dull, throat purplish blue, passing into a greenish lustre on the breast and gradually disappearing on vent, lower tail coverts tipped white. Younger specimens have the lower plumage mixed with white; wing $5\frac{1}{2}''$; middle tail feathers nearly $5''$, outer nearly $12''$; bill from the nostril $\frac{3}{4}''$; from gape $1\frac{5}{16}''$; tarsus $\frac{15}{16}''$; the terminal portion of the outer web of the outermost tail feathers very narrow, that of the inner larger and very much broader. Specimens from the Wellesley Province exactly agree with the type specimen in the Society's collections.

This is a decidedly smaller race than *D. affinis*, Tytler, (Ibis, 1867, p. 323) from the Andamans, which appears to be very doubtfully distinct from *Rangoonensis*. Burmese specimens almost perfectly agree with Gould's original description of the last-named species.

73. Pericrocotus flammeus, Forst. ?

Jerdon, B. Ind. I, p. 420; an *Per. elegans*, McClelland, Proc. Zool. Soc. Lond. 1839, p. 156!

One ♀ specimen, from the Wellesley Province, is intermediate in size between *speciosus* and *flammeus;* the general coloring and especially the wing spots agree with the latter, except that the terminal yellow spots on the last tertiaries are very small. The top of head is somewhat blackish ashy, yellowish in front and the yellow tinge extends to half the length of the crown; Temminck's figure shews it perfectly yellow. The lores are black. The head above is peculiarly flattened, which McClelland says is characteristic of his *P. elegans* from Assam, and as this is said to differ from *speciosus* (=*princeps*) by its smaller size, I do not think it improbable that McClelland's species will be shewn to be distinct from *flammeus*. Wing 3½″; tail about 3¼,″ bill at front and tarsus ½″ each.

Godwin-Austen quotes *P. flammeus* from Assam, but without further notice of any peculiarities (Jour. Asiatic Soc. B., XXXIX, p. 99).

The Malayan specimen is not the female of *P. igneus*, Blyth, (Jour. Asiat. Soc. XV, p. 309), described from a Malacca specimen, which is a much smaller bird, but it may be the same as Tytler's *Per. Andamanensis* (Ibis, 1867, p. 322), being apparently only a trifle larger.

Fam. MUSCICAPIDÆ.

74. Philentoma velata, Temm.

Drymophila velata, Tem. Pl. Col. 334.—Eyton in Ann. and Mag.

N. H., 1845, XVI, p. 229.—*Muscicapa pectoralis*, A. H a y, Madras Journal, XIII, pt. II, 1845, p. 161.

♂. Above and lower breast, vent and under tail coverts light cinerous blue, forehead, lores, a very narrow superciliary stripe, cheeks, ear-coverts and chin, inner webs of wing feathers, the same of the tail feathers,—with the exception of the two central ones,—black; throat and front of breast extending somewhat to the sides deep castany brown; wing $3\frac{3}{4}''$; tail $3\frac{1}{2}''$; bill at front $\frac{9}{16}''$, from gape $\frac{7}{8}''$; tarsus $\frac{11}{16}''$; rictal bristles nearly $\frac{5}{8}''$.

♀. Uniform ashy blue, slightly deeper than the male, forehead, chin and throat somewhat blackish; wing $3\frac{5}{8}''$; the other measurements the same as in ♂.

T e m m i n c k described the species from Timor and Java. It is common about Malacca, and in the Wellesley Province.

75. Myiagra azurea, B o d d.

J e r d o n, B. Ind., I, p. 450.

Specimens from the Wellesley Province exactly correspond in size with the Indian bird. The rictal and narine bristles and the short feathers in front on the upper and lower mandibles are pure black in the ♂, most of the wing feathers and the outer webs of the tail feathers are indistinctly barred across with a duller color than that of the general plumage.

Fam. SYLVIIDÆ.

76. Copsychus mindanensis, G m e l.

G o u l d, Birds of Asia, pt. XV.

This is so closely allied to the Indian *C. saularis*, that the propriety of a separate appellation seems doubtful. I shot a pair near the coast of Wellesley Province, just opposite Penang. The male is somewhat larger than the female, in the former the wing is $3\frac{3}{4}''$ and the tail $3\frac{1}{2}''$, in the latter wing $3\frac{1}{2}''$ and tail $3\frac{1}{4}''$; both these measurements are somewhat less than those given by J e r d o n of *C. saularis;* but the length of the bill is in both the same. The ♂ has the front edge of the wing partially white and the ♀ spotted with grey; the back in the ♀ is a little darker than usually seen in Bengal *saularis*, but the throat and breast are equally ashy and the sides of the vent quite similarly buffy grey in both. It would be interesting to make a close comparison of a good series of Burmese specimens, for these are usually referred to our common Indian form.

77. CITTACINCLA MACRURA, Gmel.

Jerdon, B. India, II, p. 116.

Jerdon calls the breast first black and then chestnut, the colors refer to the anterior and posterior part of the breast respectively. Two specimens from the Wellesley Province and one from Malacca, each has the wing $3\frac{5}{8}''$, and the bill at front $\frac{9}{16}''$, being, like in *Copsychus mindanensis*, slightly less than the usual measurements of Indian specimens. The Malacca specimen has the two last secondaries slightly tipped with white. All three specimens are males and the upper plumage is in all glossy purplish black.

Fam. AMPELIDÆ.

78. LOPHOCITTA GALERICULATA, Cuv.

Leveillant, Ois. de Par. and Roll. pl. 42.

Common at Penang and in the Wellesley Province. The ♂ has the black almost quite pure on the head, and the ♀ is more olivaceous brown on the back, but I did not see such brown specimens as described by Raffles; all feathers composing the crest are indistinctly cross barred with dull black and the longest attain 4 inches. There is always a small white spot on the posterior part of the eyelid, above and below. When seen alive in the dense forests, which these birds usually inhabit, they look like gigantic *Lophophanes*. Total length 10-11 inches; wing $5\frac{1}{2}''$-$5\frac{5}{8}''$; tail $4\frac{1}{2}''$-$5''$; bill at front $1\frac{1}{8}''$, from gape $1\frac{1}{4}''$; tarsus $1\frac{1}{4}''$.

79. MELANOCHLORA SULTANEA, Hodgs.

Jerdon, B. Ind. II, p. 282; Gould, B. Asia, pt. XX.

I obtained numerous specimens from Malacca and the Wellesley Province; they are mostly somewhat smaller than Indian specimens, the wing being only $3\frac{3}{4}''$. The lower of the longer wing coverts are generally tipped pale yellowish white and the front-edge of the wing is also yellowish; only in one ♀ specimen the pale tips of the wing coverts are entirely absent, they appear to

have been worn off, but instead of this the primaries are externally edged pale. The yellow crest appears to be very often somewhat shorter in Malayan, than it is in Indian specimens.

Fam. STURNIDÆ.

80. CALORNIS CANTOR,* G m e l.

This species is found in Penang and in the Wellesley Province, but does not appear to be common; wing $3\frac{5}{8}''$—$3\frac{3}{4}''$; tail $2\frac{1}{8}''$; bill at front $\frac{5}{8}''$; from gape about 1″; tarsus $\frac{13}{16}''$.

A specimen which may possibly be a young bird of this species, is greyish brown above, blackish on the wings and tail, with a very slight greenish gloss throughout, most distinct on the outer webs of the wing and tail feathers; below ashy white on chin and throat, purer white on breast and vent, marked throughout with dark brown streaks, each feather being thus colored along the centre; wing $3\frac{1}{2}''$; tail $1\frac{3}{4}''$; bill at front $\frac{1}{2}''$, from gape $\frac{7}{8}''$; tarsus $\frac{13}{16}''$. None of the feathers on the head and throat are elongated and cuspidate, the bill is brown and apparently that of a young bird, being very short. The general character of the specimen is that of *C. cantor*, but the difference in size is very striking. Unless the different phases of plumage of this last species have been properly studied, it would be of no advantage to look upon the present single specimen as belonging to a new species.

80. *Eulabes Javanensis*, O s b e c k.

There seems to have been, as in the case of *Irena puella*, L a t h., a little too much stress laid upon local variations of apparently the same species of bird. I will first record a short description of a specimen from Malacca and one from the Wellesley Province.

The coloration of the two birds is exactly the same. The lateral stripes of velvet feathers, narrowest (and in one specimen almost interrupted†) above the front angle of the eye, the lores, below the anterior front of the eye, and the oblique streak through the nude

* H o r s f i e l d (Cat. Ind. H. Museum, p. 543) retains his name *chalybeus* for the species and doubts its identity with G m e l i n ' s *cantor*.

† I have seen specimens of *E. intermedia*, certainly brought from Oude, in which the velvet bands were *not* interrupted above the eyes, though very narrow at that place. I do not think that this character is reliable in distinguishing the various races.

skin below the eye have in certain lights a greenish metallic lustre, front and middle portion of the head, neck, the upper part of the back and of the scapulars, chin, throat, and breast are glossed purplish, lower back, rump, vent and both tail coverts are glossed greenish. The nude patch of the skin begins at the lower half of the eye, is broadest here, and becomes narrower posteriorly, where the flaps are semi-circularly prolonged; in both they are narrowly connected at the base. There can be, I believe, not the least doubt that the two birds belong to one and the same species. Both the specimens have the bill not larger than most *E. intermedia;* in fact I have seen Indian specimens of the latter which had the bill longer. J e r d o n says that the height of the bill in *Javanensis* is $\frac{11}{16}''$, this appears to have been taken from a specimen in the Asiat. Soc. Coll., and seems very unusual, if not abnormal. The size of the wing of the Malacca specimen approaches that of the Javanese one, but the tail is as short as in *intermedia;* the wing of the Wellesley specimen is equal to that of a large *intermedia*, but the tail is quite as long as in the largest specimens from Java on record. This clearly shews that the birds vary in some or other point almost from every other locality. J e r d o n (B. Ind. II, p. 339) observes that *intermedia* certainly extends from India into Burma as far south as Tenasserim, and specimens from the last locality are perfectly equal in size to those from Assam.

The reference to the size of birds from a particular province must be always considered as that of the usual average to be observed. Lord W a l d e n (Mad. Journ. XIII, pt. II, p. 156) considered the Malacca bird to be the same as the Javanese, but distinct from the Indian *intermedia.* Lately (Ibis, III, 1867, p. 331) the same author appears to be inclined to add a third species to the number, called by T y t l e r *Andamanensis*, and another, (or the same form) was described as *Graucula dubia* by S c h l e g e l in Nederl. Tijdsche. voor de Dierkunde, 1863, p. 7. I cannot unfortunately just now refer to the description of this last bird, nor have I any true Javanese specimens to compare, but I shall briefly record the measurements and general characters of a number of specimens in the Asiatic Society's Museum, together with those above described from Malacca and the Wellesley Province. From all the existing records, it seems certain that the Javanese and Southern Malayan birds are perfectly identical in size.

Measurements in inches.

	Nepal (Terai).	Arracan*	Andaman.	Nicobar.		Wellesley Province.	Malacca.	
	1	2	3	4	5	6	7	8
Wing, ...	$6\frac{1}{4}$	$6\frac{1}{2}$-$6\frac{5}{8}$	$6\frac{1}{2}$	$6\frac{1}{2}$	$7\frac{3}{16}$	$6\frac{1}{2}$	$6\frac{7}{8}$	7
Tail,...	3	3-$3\frac{1}{8}$	3	$3\frac{9}{16}$	$3\frac{1}{2}$	$3\frac{5}{16}$	3	$3\frac{1}{8}$
Bill at front,	$\frac{15}{16}$	$\frac{13}{16}$-1	$\frac{15}{16}$	1	$1\frac{1}{8}$	1	1	1
Bill from gape,	$1\frac{6}{16}$	$1\frac{1}{2}$-$1\frac{6}{16}$	$1\frac{9}{16}$	$1\frac{9}{16}$	$1\frac{5}{8}$	$1\frac{10}{16}$	$1\frac{11}{16}$	$1\frac{11}{16}$
Height of bill,..	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{10}{16}$	$\frac{9}{16}$	$\frac{9}{16}$	$\frac{9}{16}$
Tarsus, ...	$1\frac{5}{16}$	$1\frac{1}{2}$	$1\frac{6}{16}$	$1\frac{3}{8}$	$1\frac{5}{8}$	$1\frac{3}{8}$	$1\frac{1}{2}$	$1\frac{1}{2}$

1, 2, 3, 5, 8, are from Asiat. Soc. Coll.; 4 from Mr. V. Ball; 6 and 7 were procured in the localities cited.

The coloration of all the birds is exactly the same, and the form of the nude skin at the side of the head below the eye agrees in all. The size of the posterior occipital flaps increases with the size of the bird, and their length varies according to the sex and apparently also according to the season. I saw in Penang two male birds in a cage, and one of them had the occipital flaps almost an inch long.

On comparing the Nepal with the Nicobar or Malacca bird, nothing would appear more averse than saying that those two were identical, though every one will admit that the only difference is the size. But in putting a series together geographically arranged, and observing the gradually diminishing size from the Nicobar and Malacca bird to that from the Wellesley and Tenasserim Provinces, and the Andamans, and from this again to that from Arracan and the Khasi hills, we arrive at the comparatively pigmy bird of the Nepal Terai, and the ornithologist will find it extremely difficult to characterize all these forms as distinct species. My belief is, that

* Specimens from the Khasi and Garro hills in the Indian Mus. Coll. are exactly the same, as those from Arracan.

we have in these birds nothing more than local or geographical races of the same species, and the present example appears to me particularly illustrative of the gradual change in the size of typical Malayan forms, when they extend northwards. Whether such geographical races are for the advantage of science favoured with separate distinct names, seems to me very doubtful.

Fam. FRINGILLIDÆ.

81. MUNIA RUBRONIGRA, Hodgs.

Jerdon, B. India, II, p. 353.

A single specimen was obtained in the Wellesley Province. In size it resembles *M. sinensis*, (? Gm. apud Latham, not = *maya*) which, according to Jerdon, has no dark abdominal streak, while this specimen has it distinct, though not black, but dark brown, as are likewise the lower tail coverts. Other details of coloration agree exactly with the Indian form, except size, the Malayan form being smaller, wing $1\frac{15}{16}''$; tail $1\frac{1}{4}''$; bill at front not quite $\frac{1}{2}''$; tarsus $\frac{9}{16}''$.

Latham (Ind. Ornith. I, p. 386) quotes the true *L. Malacca* from "China, Java, Malacca," and of the present species he says "habitat cum priore," but it does not appear certain that this last extends southwards into the Philippine islands, wherefrom Wallace and others mostly only quote *M. Malacca.*

82. MUNIA MAYA, Linn.

Latham, Syn. III, 151; Blyth, Cat. 116, No. 620 and ? 621.

In style of coloration, this speeies very much resembles *M. Malacca,* but the head and anterior part of neck are white, gradually paling, the throat posteriorly albescent brown, the general color dull brown, but the bright glistening color of the upper tail coverts is the same as in *Malacca,* middle of breast, of the abdomen, tibial and under tail-coverts deep brownish black; wing $2''$, tail $1\frac{3}{8}''$, bill at front nearly $\frac{7}{16}''$; tarsus $\frac{9}{16}''$. Apparently not common in the Wellesley Province; Latham gives it from Malacca, and it is no doubt identical with *leucocephala,* Raffles, from Sumatra, as recorded by Blyth.

A Batavian specimen of this species is entered by Blyth in his Catalogue as "*M. ferruginosa,*" "Syn. *Loxia ferruginosa,* Latham." I do not know where Latham published that name, he has a *L. ferruginea* (Ind. Ornith. I, p. 389), but that is not the same bird.

83. MUNIA ACUTICAUDA, Hodgs.

Jerdon, B. India, II, p. 356.

Wing $1\frac{7}{8}''$, tail $1\frac{1}{16}''$; bill very little more than $\frac{3}{8}''$; tarsus $\frac{7}{16}$, the central tail feather $\frac{1}{2}''$ longer than the outermost. Specimens from the Wellesley Province, exactly agree in colouring with the Indian bird, but they are slightly smaller as compared with the measurements given by Jerdon. Visc. Walden (Proc. Z. S. L. 1866, p. 552), says that a Moulmein specimen is larger than a Darjeeling specimen in his collection, but that Formosan specimens agree better with the Himalayan race. Thus slight variations seem to occur locally, but they did apparently not yet attain to such prominent distinctions, that they could form the basis of new species!

Fam. COLUMBIDÆ.

84. TRERON [OSMOTRERON] VERNANS, Linn., 1771.

? *C. viridis*, Scop., 1777, non *viridis*, Linn.

Wing $5\frac{6}{8}''$; tail $3\frac{1}{2}''$; bill at front little more than $\frac{1}{2}''$, from gape $\frac{13}{16}''$; tarsus $\frac{5}{8}''$. This species does not appear to extend farther north than the Wellesley Province and Penang, and is already rare in these localities, but it is common on all the southern islands, Sumatra, Java, Borneo, &c.

85. TRERON [OSMOTRERON] OLAX, Temm.

Wing $4\frac{3}{4}''$; tail very nearly $3''$; bill at front $\frac{1}{2}''$, sometimes very thickened on the terminal half; tarsus $\frac{3}{4}''$. Not uncommon about Malacca, Penang and the Wellesley Province, the latter being apparently the northern limit of the geographical extent of the species.

86. PHILINOPUS (RAMPHICULUS) JAMBU, Gmel.

Raffles (Trans. Linn. Soc. XIII, pt. II, p. 316) gives this species from Sumatra and Sclater (Proc. Z. S. L., 1863, p. 221) from Borneo. It extends northwards into the Wellesley Province, but does not appear to be equally common as at Malacca. Young ♂♂ are at first quite of the colouring of the ♀♀; those I obtained in September were already changing their plumage, which, however, does not become fully developed until the next year.

A specimen from the Wellesley Province has the wing only $5\frac{1}{4}''$, (Malacca specimens have it $5\frac{1}{2}''$); tail $3\frac{1}{2}''$; bill at front $\frac{5}{8}''$; tarsus $\frac{5}{8}''$.

87. Chalcophaps indicus, L i n n.

J e r d o n, B. Ind., III, p. 484.

The two dark bars on the rump are in Assam and Cachar specimens, as well as in the Malayan bird, always very conspicuously greenish golden in both sexes, the feathers being grey at the base and of a deep greenish brown at the tips, the bars between them are light grey. In specimens from the Wellesley Province, the wing is in the old ♂ $5\frac{9}{16}''$; tail $3\frac{1}{2}''$; bill at front very nearly $\frac{3}{4}''$; tarsus $\frac{15}{16}''$; the corresponding measurements in an old ♀ are: $5\frac{1}{4}''$; $3\frac{1}{4}''$; $\frac{5}{8}''$ and $\frac{15}{16}''$. In the male the occiput and anterior neck above is ashy, this color being almost interrupted in the middle of the neck by the vinaceous brown color at the sides, but it becomes again very conspicuous at the posterior neck, spreading out on the shoulders. This is thought characteristic of *javensis*, and R a f f l e s mentions this state of coloration in the Sumatrean bird, which cannot differ from *indica*. The ashy on the posterior neck and between the scapulars is usually not so well developed in Indian specimens, as in the Malayan, but it is always indicated, especially in specimens from Assam and Burma.

If no other distinction exists between *javensis* and *indica*, than the one alluded to, I should certainly consider both as identical. There would seem to be no constant difference between them; the size is certainly not one of the differences recorded.

88. Macropygia ruficeps, T e m m.

B l y t h (in Catalogue, p. 234, No. 1423) appears to refer to this species under the name of *Amboinensis*, L i n n., which seems to be a considerably larger bird. L a t h a m gives the total length of this 14 inches, while that of the Malayan bird is barely 11″. A specimen from the Wellesley Province measures: wing $5\frac{1}{4}''$; tail $5\frac{5}{8}''$; bill at front $\frac{1}{2}''$; from gape nearly $\frac{3}{4}''$; tarsus $\frac{5}{8}''$.

H o r s f i e l d (Trans. Linn. Soc. XIII, pt. I, p. 184) mentions that the Javanese bird has the upper part of the neck covered with a purple gloss. T e m m i n c k ' s figure represents it strongly metallic green, and the breast not spotted; this must apply to the plumage of old males. In the specimen from the Wellesley Province, which is apparently a female, the posterior neck and back are blackish brown, with a very slight green metallic tinge on some of the feathers, but all are minutely freckled with rufous brown, somewhat less conspicuous on the middle back; but the red is again much more prevalent on the rump and upper tail coverts; the whole head above is rufous brown, chin whitish rufescent; throat posteriorly and front of breast irregularly spotted with black. The specimen agrees in other respects with the Javanese bird. *Amboinensis* is often quoted by Wallace from the various islands of the Philippine Archipelego, but *ruficeps* does not appear to occur there.

89. Turtur tigrinus, Temm. (? ?).

? *T. Suratensis*, Gmel., Jerdon, B. Ind. III, p. 79.

Wing and tail $5\frac{1}{2}''$ each; bill at front $\frac{11}{16}''$; from gape $\frac{14}{16}''$; tarsus very nearly $1''$; a narrow black loreal stripe appears constant in male specimens; the white and posteriorly brownish tips of the collar are squarish, not rounded.

The Malayan form is very like the Indian *T. Suratensis*, Gm., only a little smaller and having the back, like *Chinensis*, Scop., almost unspotted, the feathers being only narrowly tipped with pale brown, but all the wing coverts are blackish along their shafts, except the most anterior which are ashy white. I doubt that *tigrinus* is specifically distinct from *Suratensis*. Blyth, (Ibis, 1867, III, p. 150) says that he has not seen intermediate specimens. I saw specimens from Burma which had the two lateral spots on each of the feathers of the back distinct, while others had them nearly quite obsolete, or only indicated by pale terminal edgings, as in the Malayan *tigrinus*. Such minor differences should not be considered as specific distinctions, for they are not definable in nature.

This and other allied species of *Columbidæ* do not appear to be so common in the Wellesley Province, nor at Penang and in the neighbourhood of Malacca, as are species of the *Treron* group.

90. Geophelia striata, Linn.

A single specimen was obtained in the Wellesley Province; the measurements are:—wing $3\frac{7}{8}''$; tail $4\frac{1}{8}''$; bill at front $\frac{9}{16}$, from gape

$\frac{13}{16}''$; tarsus $\frac{5}{8}''$; round the eye and loreal space naked. The species does not apparently extend into Burma. Blyth quotes *C. sinica*, Linn. and *malaccensis*, Gmel., as synonyms, but the characteristics, (especially of the latter), as given by Latham, are not applicable to the Malayan bird, which exactly agrees with specimens from the Mauritius.

Fam. PHASIANIDÆ.

91. Polyplectron bicalcaratum, Linn.

Gould, B. Asia, pt. XXII.

In the figure recently published by Gould the crest of the male is coloured uniform greenish. This would appear to be very unusual, at least as far as summer plumage is concerned. I had seen about 20 specimens with the dealers at Malacca and, as far as I remember, all had the frontal feathers barred across with dusky white, but the feathers on the crest of the female are generally uniform brown, with rather indistinct edgings of dark brown.

This species also occurs in the interior of Wellesley Province, but seems to be already here very rare.

92. Gallus ferrugineus, Gmel.

The more red and deeper coloured Malayan variety,* lately noticed by Blyth (in the Ibis), occurs in the Wellesley Province; wing of cock $9\frac{1}{2}''$; outer tail feathers barely 12.″

93. Rollulus cristatus, Gmel.

Blyth, Cat. 253.

More common about Malacca than in the Wellesley Province and in Tenasserim. All the birds are perfectly identical.

Fam. TINAMIIDÆ.

95. *Turnix pugnax*,† Temm.

Blyth (Ibis, 1867, III, p. 161) says that *T. occellata*, Scop. apud Jerdon (B. Ind. II, p. 597) should stand as *T. pugnax* of Temminck, *occellata*, Scop. (= *luzoniensis*, Gm.) being quite a distinct species, and that both *pugnax* and *taigoor* are

* Only the posterior neck is golden yellow.

† *Tetrao Luzoniensis* of Raffles from Sumatra is, to all appearance, the same bird. Temminck's figure represents an unusually dark specimen.

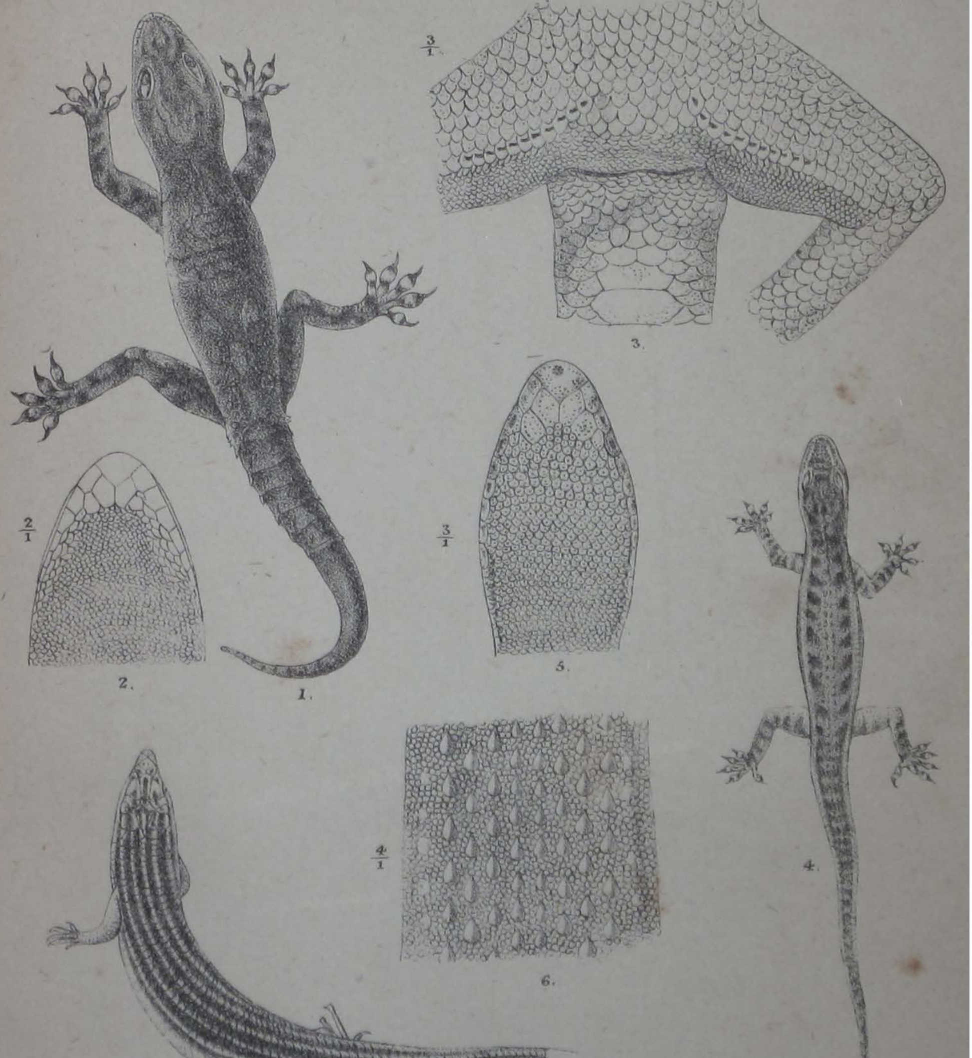
insufficiently distinguishable, and, therefore could be brought together under the name *pugnax*, Temm., "subject to a certain amount of local variation." This appears to be a very fair view of the question, for comparing large series of these birds from different parts of India, from the Malayan countries and Java, it certainly appears extremely difficult to find any permanent distinctions strictly peculiar to each form, but to a certain extent the local varieties, or sub-species, generally possess some slight distinctive characters.

Typical Java and Malayan *pugnax* generally are the smallest of all. The head is dark, the pale brown edgings to the feathers being very narrow, the median occipital streak is dark and usually indistinct, the feathers of the back are scarcely margined laterally with pale, and those of the lower back and scapulars very little, generally only on the outer web. The longer scapulars and wing-coverts have pale yellowish, transverse, largely oval spots. Specimens from Malacca and the Wellesley Province, belonging to this race, have the wing only $3\frac{1}{8}''$-$3\frac{1}{4}''$; tail 1-$1\frac{1}{8}''$ (rather long); bill at front $\frac{1}{2}''$, from gape $\frac{3}{4}''$; tarsus $\frac{3}{4}''$.

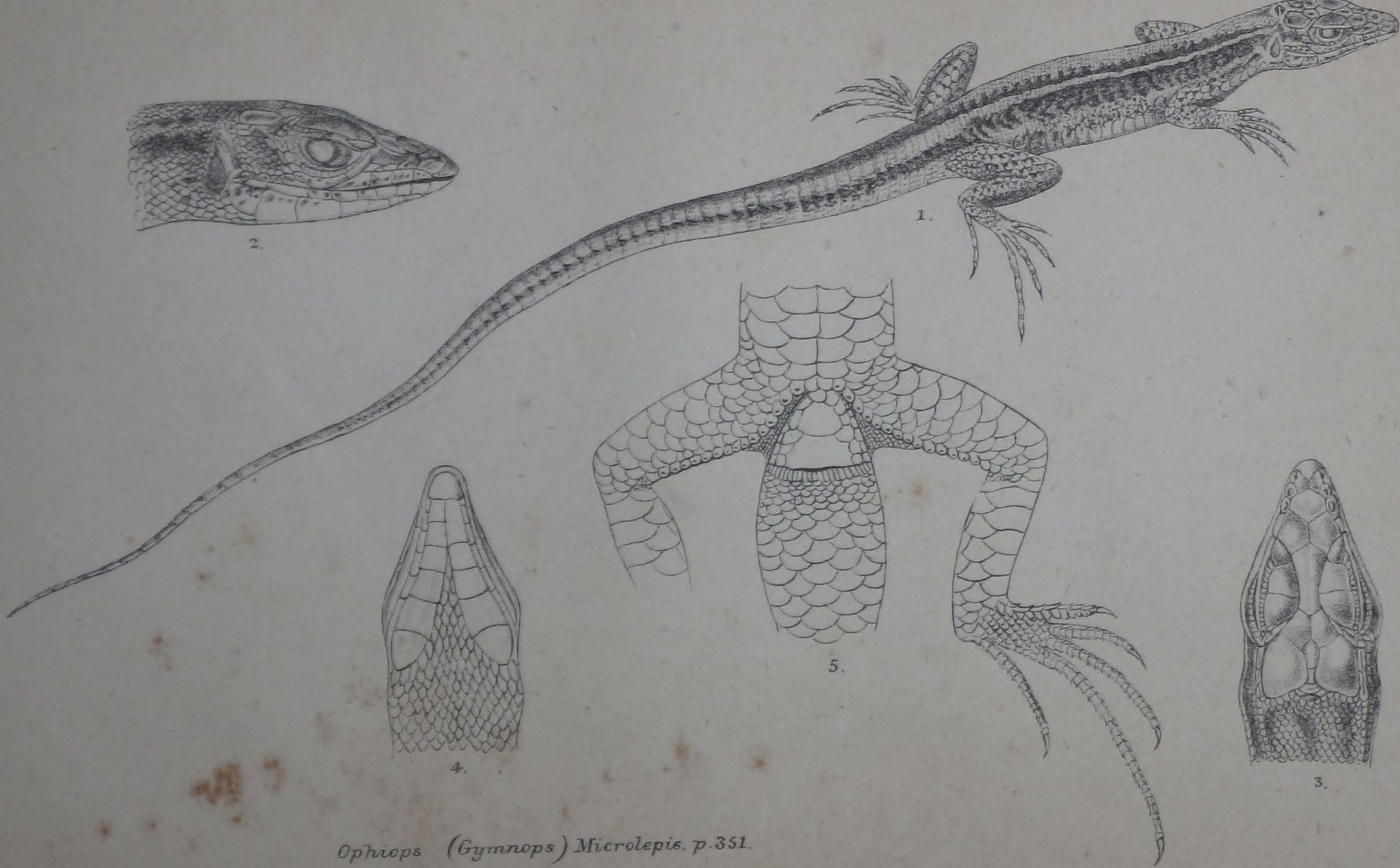
The Himalayan race (*plumbipes*, Hodgs.), is very similar in its dark coloration to Malayan specimens, but the median streak on the head appears to be always more distinct, the chin and throat is less pure white in the male (?), and the blackish spots on the terminal outer webs of the tertiaries are more distinct. As to size, the North Indian and Himalayan specimens are the largest. Jerdon gives wing $3\frac{6}{10}''$, tail $1''$, bill at front $\frac{9}{10}''$, tarsus $1''$, and Himalayan specimens in the Asiatic Society's collection quite come up to these measurements. I have measured specimens with the wing $3\frac{3}{4}''$.

The third form is *taigoor*, Sykes, (apud Jerdon), being intermediate in size between the two, and very similar to the latter in coloration, except that the feathers on the back generally are very distinctly margined laterally with pale or yellowish rufescent.

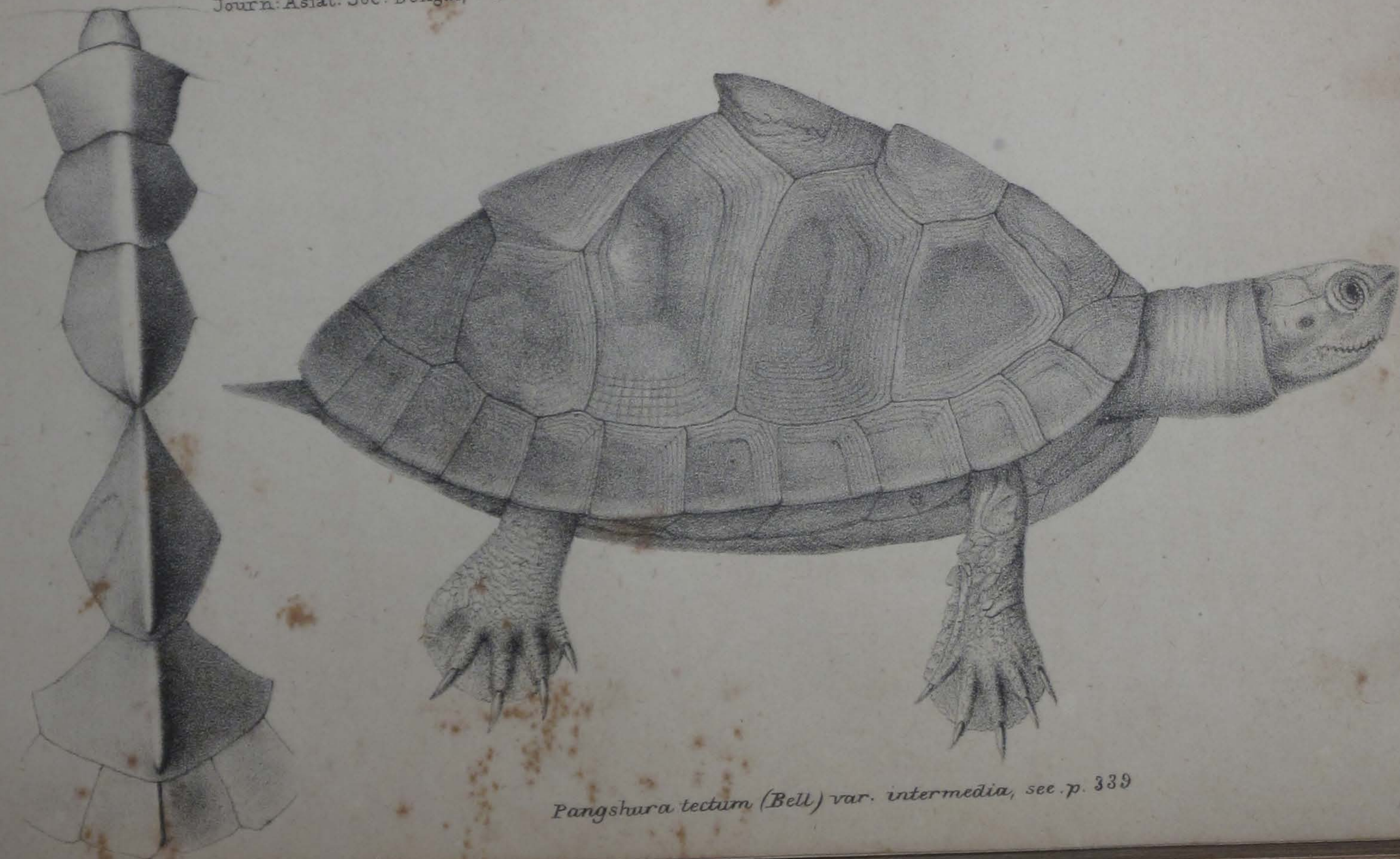
Looking at these variations, one cannot help to recall to mind the perfectly similar and corresponding variations in the plumage of *Turtur Suratensis*, *tigrinus* and *Chinensis*, and the variations in size are also something similar in the two series of races, at least as regards the Malayan and Indian birds.



1-3. *Hemidactylus marmoratus*, p. 363.
4-6. " *gracilis*, p. 362.
7. 8. *Euprepes septemlineatus*, p. 360.
9. " *innotatus*, p. 354.



Ophiops (Gymnops) Microlepis, p. 351.



Pangshura tectum (Bell) var. intermedia, see p. 339

Notes on some Reptilia and Amphibia from Central India,—*by* William T. Blanford, F. G. S., C. M. Z. S., &c.

(With plates XIV—XVI.)

[Received 2nd August, read 3rd September, 1870.]

A collection, chiefly of Reptilia, made by me during the cold and hot seasons of 1869-70 in a part of India hitherto but little explored by herpetologists, contains several interesting forms, and a few lizards which appear to have been previously undescribed. My principal object in collecting has been to obtain somewhat more exact information as to the range of different species, a subject in which, as was pointed out by Günther in his Reptiles of British India, very much remains to be done. I was at first struck by the herpetological provinces into which Dr. Günther has divided Peninsular India, and which differ greatly from those which appeared to me, from a study of the landshells, birds and mammals, to be the great natural zoological divisions of the country, and I wished, before publishing any observations on the subject, to ascertain, to some extent at least, whether the distribution of the Reptilia differs in any way from that of the other groups upon which I had founded my conclusions.

I soon became satisfied that it does not, and that Dr. Günther was misled by the very imperfect information available in Europe, and especially by the confused ideas which have hitherto prevailed as to the affinities of the Indian fauna. It is naturally very difficult for any one unacquainted with a country to form a correct opinion of its physical geography, and of the distribution of its fauna as affected by physical characters. Another very great difficulty is correctly to appreciate the comparative value of the evidence before the compiler. In such matters local knowledge is essential. It should also be borne in mind that, until recently, the importance of accuracy in determining the exact localities of specimens, brought from distant parts of the world, was not appreciated by European naturalists, indeed it is to be feared that many scarcely appreciate it even now, and that the labels in European Museums are but too often misleading. A naturalist in Europe must depend entirely upon the information supplied to him by others, whilst a local observer can largely supplement and correct the observations of other men.

I think that it adds greatly to the probability of my own views to find that the localities of certain Reptilia which were quoted by Günther in his Reptiles of British India, and which appeared opposed in a very marked manner to the conclusions at which I had arrived, have lately been shewn by Dr. Jerdon* to be erroneous. Amongst the most anomalous of these were the supposed occurrence of an *Acanthodactylus* at Coonoor on the Nilgiris and some of the localities given by Dr. Günther on the authority of the Messrs. Schlagintweit, such for instance as the occurrence of *Eryx Johnii* at a height of 9800 feet in Sikkim! † This last assertion I had noted in my copy of Günther's Reptiles as incredible before I saw Dr. Jerdon's remarks, a circumstance I think worth mentioning as it shews that, probably from a different line of argument, both Dr. Jerdon and I had arrived at the same conclusion.

It is impossible for me here to enter at full length into the subject of the geographical distribution of the Indian fauna, but the following short sketch will serve to shew its outlines.‡

I divide Peninsular India with Ceylon, from Biluchistan to a line drawn to the north from the head of the Bay of Bengal, and including all south of the Himalayas, but excluding the mountains themselves, into the following principal divisions. The boundaries of all require more exact determination.

1. The Punjáb province, including, besides the Punjáb itself, Sind, the desert country east of the Indus, Cutch and probably western Rájpootana. The fauna, with a few exceptions, is of the desert types.

2. The Indian province proper. This includes all India§ east of Delhi and Katthiawar as far as the Rájmahál hills, and the whole

* Proc. As. Soc. Bengal, 1870, pp. 77 and 79.

† Günther Rept. Brit. India, p. 335.

‡ I mentioned a few of the principal distinctions in a paper, read before the British Association at Exeter in 1869. Vide Rept. Brit. Assn. 1869, p. 107.

§ I employ the word India as meaning solely the country of the Hindus, from whom it derives its name. All the countries to the East of the Bay of Bengal differ to a most important extent in climate, zoology, botany, and eth-

Peninsula south of the Ganges with the exception of the western coast, and probably a few scattered hills in Southern India. It also includes Northern Ceylon. It is thus subdivided roughly.

a. Gangetic sub-province or Hindustán ;*—extending south as far as the Nerbudda; in its eastern portion comprising only the valley of the Son and the Ganges valley as far east as Benares.

b. Deccan sub-province ;—from the Nerbudda to the Krishna (Kistna), bounded on the west by a line drawn parallel to the west coast a little east of the main range of the Western Ghats, and on the east by a line drawn nearly north and south a little east of Nágpúr. I comprise in this for the present Katthiawar, Gujerat and Khandeish.

c. Bengal sub-province ;—bounded by the last on the east and extending to the south at least as far as the Godavery, perhaps to the Krishna. I believe that the Gangetic valley east of Benares should be included, but on this point, as on many others, I have no certain information. This sub-province contains a few well marked Malayan forms not met with in the other two.

d. Madras sub-province ;—all the peninsula south of the Krishna and east of the Nilgiris and other hill ranges forming the Western Ghats. The tops of such hill ranges as the Shevroys, Kolamullays, &c. appear, however, rather to belong to the Malabar province. This Madras sub-province also comprises Northern Ceylon.

3. The Eastern Bengal Province. This perhaps should be classed with the Indo-Chinese countries. Malay forms prevail.

nology. European naturalists I know object to this definition of the term, and prefer using the name in its old vague sense, and Dr. Günther appeals to the practice of centuries, (Zool. Rec. for 1868, p. 118). But I am sure that when the fauna of India is better known, all naturalists will see the necessity of using one word for the country, and of avoiding all risk of confounding it with the very different Indo-chinese and Malay province, and Dr. Günther's argument is open to a very obvious reply, viz. that Zoology is not the only branch of human knowledge which has improved since mediæval times and in which the necessity for accuracy in definition has become apparent, and that geographers will be scarcely satisfied with the argument that some centuries ago all Eastern Asia was known as India, and therefore the old nomenclature should be retained. Besides if we must go back three or four centuries for our geographical nomenclature, we shall be obliged to include America as part of the "Indies," and Brazil as part of the "East Indies."

* The word Hindustán is commonly employed by Europeans as signifying the whole of India. By natives of India it is used to designate the upper Gangetic plain only.

Calcutta is just on the edge of it, and may be rather placed inside it than outside; Assam and Cachar beyond our limits belong to it.

4. The Malabar province with Southern Ceylon. This, although far from throughly explored, has the richest and most interesting fauna of all. It comprises the Western Coast about as far north as Bombay, and the range of hills which runs parallel to that coast from Cape Comorin probably as far as the river Taptee. Its fauna is in part peculiar, but its affinities are distinctly Malayan, and this is the more interesting, because it is divided from the Eastern Himalayas and Eastern Bengal, the nearest countries in which Malay types are prevalent, by the whole breadth of the Indian province with its semi-African fauna.

I can only mention a few of the more marked Reptilia and Amphibia of each province. Some species range throughout, but they are very few. The lists are very imperfect for want of accurate information.

Punjáb province. *Pangshura Smithii*, *Psammosaurus scincus*, *Acanthodactylus Cantoris*, *Sphenocephalus tridactylus*, *Eublepharis macularius*, *E. fasciatus*, *Uromastix*, *Trapelus sp.*, *Agama agilis*, *Chamæleo ceylonicus*, *Zamenis diadema*, *Echis carinata.*

Indian province. *Testudo elegans*, *Pangshura tectum*, *Cabrita* (the genus), *Pseudophiops Jerdoni*, *Euprepis trilineatus*, *E. Beddomei*, *E. trivittatus*, *Eumeces Hardwickii*, *Sitana*, *Charasia*, *Chamæleo ceylonicus*, *Zamenis brachyurus*, *Eryx Johnii*, *Daboia Russellii*, *Echis carinata*, *Pyxicephalus breviceps*, *Cacopus.*

Eastern Bengal province. *Emys Hamiltonii*, *Pangshura sylhetensis*, *Simotes bicatenatus*, *Tragops prasinus.* I am unable to say how far to the westward several Indo-Chinese forms such as *Tachydromus* and *Pseudopus gracilis* extend, but I believe they may fairly be considered as part of the fauna of this province. If the base of the Himalayas be included, the number of Malay forms will be greatly increased.

Malabar province. *Ateuchosaurus travancoricus*, *Gymnodactylus*, several species, *Draco Dussumieri*, *Otocryptis*, *Lyriocephalus*, *Ceratophora*, *Cophotis*,* *Calotes nemoricola*, *C. Rouxii*, *C. nigrilabris*,

* These four genera are hitherto peculiar to Ceylon, but like many other Ceylon forms may very possibly be hereafter found in the hills of Malabar, which have as yet been only very imperfectly explored, many parts of them being singularly difficult of access.

C. Elliotti, *Salea*, *Liolepis guttatus* (in India); the family of *Uropeltidæ;* the family of *Calamaridæ* except *Falconeria*, Theob., (found also in Assam and the Malay countries but with the exception quoted, not out of this province in India); *Oligodon*, *Simotes venustus* and some other species; *Ablabes olivaceus*, *A. Humberti*, *Cynophis*, *Tropidococcyx*, *Tragops dispar ?* *Dipsas Forsteni*, *Cercaspis*, *Calophis nigrescens*, *Trimeresurus anamulliensis*, *T. strigatus*, *T. trigonocephalus*, *Peltopelor*, *Hypnale*, *Hylorana malabarica* and two or three other species, *Ixalus*, several species, *Rhacophorus malabaricus ;* *Epicrium* and *Cæcilia* (in India proper).

It is quite possible that some of the species mentioned may extend into other districts; a few certainly do, but I think not to a sufficient extent to prevent their being fairly characteristic species. Thus *Daboia Russellii* occurs in Pegu, but this is quite in accordance with some other peculiarities in the fauna of the Irawady valley, especially in upper Pegu and Ava, where many Indian animals are found which are unknown in the intervening country of Arakan.

The main object of the following notes is to give accurate localities for all the species named, and thus to contribute slightly to a knowledge of the distribution of particular species. As the collection was made in the dry season, and in great measure during rapid marches, the snakes and amphibia, which are chiefly seen in the rains, are very poorly represented. My reason for mentioning some very common and widely spread forms is, that I have found that such have frequently well marked limits within India itself, and it is very desirable to ascertain such boundaries, which can only be done by each collector giving the precise district in which he found specimens.

REPTILIA.

Chelonia.

1. Emys [Pangshura] tectum, Bell., *var.* **intermedia.** Pl. XIV.

This form is nearly or quite as high in the dorsal ridge as *P. tectum* from Bengal. The ridge appears merely as a blunt keel on the two first vertebral shields, but rises into a strong nodose prominence on the third. The feet are much flatter, and the toes longer and more broadly webbed than in *P. tectum*, and the form of the vertebral plates differs from the type. In coloration and in many other characters, it closely approaches G ü n t h e r' s description of *P. tentoria*, but it is more tumid and the vertebral plates have a different form.

Plates. Nuchal plate short, trapezohedral, broader behind than in front. First vertebral subquadrangular, very little broader in front than it is behind, the anterior margin convex, posterior slightly concave, lateral margins sinuate. Second vertebral almost hexagonal, the breadth exceeding the length slightly, the posterior margin straight, thus differing from both typical *tectum* and *tentoria* in which it is convex. Third vertebral longer than broad, pentagonal, pointed behind, the anterior margin nearly straight and equal in length to either of the front lateral margins, or slightly exceeding them. Fourth diamond shape, rather attenuate in front and rounded or subtruncate behind; fifth twice as broad as the anterior margins of the two caudals. Caudals rather broader behind than in front, in breadth at their posterior margin about equal to their length, they are very little smaller than the nearest marginals, and are separated from each other by a very slight notch. Posterior margin of upper shell very slightly serrated. Sternum flat, slightly bent upwards in front, keeled at the sides; width between the inguinal incisions less than half the length. Suture between the gular plates shorter than that between the postgulars. Pectorals longer than the postgulars and not much shorter than the abdominals and præanals. Suture between the anals longer than their posterior margins, which meet at an obtuse angle. Jaws finely denticulated, the upper not emarginate in front. Tail short, shorter than the head. Feet broadly webbed, very flat, front of fore leg down to the base of the first toe, and hinder part of hind leg nearly covered by broad horny scales, hind margin of fore foot also covered with large scales; claws of moderate size.

Coloration. Carapace above brown, anterior and lateral margins of plates a little paler. Sternal plates black, anterior and lateral margins, but not the posterior ones, yellow. Limbs and head dull olive, paler below, the first unspotted, in this differing conspicuously from

Bengal specimens of *P. tectum*, in which they are spotted with yellow. There is a ferruginous spot behind each eye, and three others, less well marked, in a convex line on the occiput.

I obtained three specimens of this form, the following are the measurements of their carapaces in inches.

	Length.	Breadth.	Height.
1,	4	3.2	2.
2,	3.5	2.7	1.75
3,	3.6	2.7	1.8

Loc. All the specimens were procured at Chappa and Korba in Biláspúr, on the Hasdo river, a tributary of the upper Mahanaddi which it joins above Sambhalpúr. I had named the *Pangshura* above described, and intended publishing it as a separate species, when some specimens from the Jumna river near Agra sent by Mr. Carlleyle to the Indian Museum were shewn to me by Dr. Anderson. These agreed remarkably with my specimens in the coloration of the head and limbs, whilst the vertebral plates shewed an intermediate form between the Biláspúr and Bengal tortoises. This induced me to re-examine the fine series of specimens of *P. tectum* in the Indian Museum, and I found that although none have vertebral plates of the same form as the Biláspúr specimens, there is considerable variation, and the changes due to age are much greater than I had at first supposed, or than previous describers seem to have been aware of, and that a certain amount of change takes place in the sternal plates also. Under these circumstances, I doubt if the coloration of the head and limbs alone can be considered sufficiently important characters to justify specific distinction. In *P. tectum* from Bengal the head appears always to be black in the centre above and red or yellow at the sides, and the limbs to be spotted with yellow.

In young animals from Bengal and frequently in larger specimens up to about 4 inches in length, the first vertebral is pentagonal with straight sides, and much narrower behind than in front. But in old shells I find that the sides become curved as in the Agra and Biláspúr examples, and that the difference between the breadth in front and behind diminishes. The second vertebral increases in breadth with age, and although it has never in Calcutta carapaces so broad a straight hinder margin as in the specimens from central India, the extent to which it is truncated behind in young animals varies. In the third vertebral a great change also takes place with age, while the fourth in old shells loses its diamond shape and assumes the outline of a flask. In the sternum, the pectoral shields become shorter in older specimens, in proportion to the postgulars and abdominals, and the angular ridge on each side of the sternum is blunter, while the extent of black on the sternal plates is rather greater.

It is very clear that these variations tend in a great measure to obliterate the distinction between *P. tectum* and *P. tentoria*; the only remaining difference being the more tumid form of the first named species. But I doubt if this be a more valid character than the form of the plates. In two Calcutta specimens in the Indian Museum, I find the measurements to be in inches.

	1.	2.
Length, ...	3.3	3.7
Breadth, ...	2.7	2.5
Height, ...	1.3	1.8

Indeed, judging from Günther's figures and description, I should rather have suspected my specimens from the Hasdo to be a variety of *P. tentoria* than of *P. tectum*. It is never quite safe to conclude that a species is not distinct without comparison of specimens, but I cannot help thinking it highly probable that *P. tentoria* must be considered a variety of *P. tectum*. *P. flaviventer* has better grounds to distinction, and *P. Smithii* is clearly a well marked species.

I may here remark that if the assignment by Gray* and Günther† of figs. 3, 4 and 5 on the plate of *Emys tectum* in Hardwicke's Illustrations of Indian Zoology to *P. tentoria* be correct, the species must fall at once, for those figures are most unmistakeably taken from old specimens of *P. tectum*, and the differences of coloration pointed out by Gray are of no importance. They may be in part seasonal, at any rate the brightly coloured small specimens with an orange stripe down the centre of the ante-

* Cat. Shield Reptiles, p. 37.

† Reptiles of British India, p. 34.

rior vertebrals, are of the same species as those in which the stripe is wanting. But the species *P. tentoria* was originally founded by Gray on a specimen brought by Col. Sykes from Western India, and there may possibly be a difference, though I cannot tell what it is.

2. Emyda vittata? Peters.

A single specimen of *Emyda*, obtained in a tributary of the Máhánaddi, differs from *E. granosa* in several minor characters. The outline of the vertebral plates is far more indistinct, even after the specimen has been in spirits for some months, and their surface has no trace of the fine granulation seen in *E. granosa*. The carapace appears also to be lower, and much longer in proportion to the breadth, and the coloration is different, there being a total absence of yellow spots on the back and head. The following description of the colours was taken from the animal when alive.

Back of the shell dark olive with a few indistinct dusky marks, only conspicuous when the surface was wet: beneath pale salmon colour. Head and neck olive above, with a slight rufous tinge, a dark line running backwards and a little downwards from the hinder corner of the eye, a second above and a third below, also commencing from the orbit, all somewhat waved, some black irregular spots on the back of the neck between the innermost lines. Lips bright pink, lower part of head bright salmon colour. The length of the carapace is 4·7 in., breadth 3·9″, height 1·5″. In spirit the dimensions have decreased.

Unfortunately the volume of the Monathsberichte Berlin Akad., containing Peters's description of *Emyda vittata*, does not exist in either of the Calcutta libraries, the Society's and that of the Geological Survey. Günther's description in Rept. Brit. Ind. is scarcely sufficient for identification. He merely says "This species has been characterized by the black streaks and spots on the head and neck, and is said to have been brought from Goa."

The specimen of *Emyda* obtained was found under the sand in a melon plantation in the dry part of a river bed. I found the tracks upon the sand, and followed them till they disappeared, and at that spot the tortoise was concealed two or three inches below the surface. Running water of some depth was within few feet, but the animal had not entered it, and had, during the night, come for at least a quarter of a mile along the sand from another hiding place beneath some grass, without once entering the water. The people of the country are quite aware of this habit, and when I pointed out the tracks to a fisherman, he said at once that the tortoise would be found in the sand by following them. It is evident, therefore, that G ü n t h e r 's statement, that *Emyda* is thoroughly aquatic, requires modification. I have often seen tracks on the sand of streams before, but always supposed them to be made by *Emys* or its allies. The time of year was the middle of March at the commencement of the hot season.

Loc. Seo river, a tributary of the Máhánaddi in Raipúr.

3. Trionyx Gangeticus, C u v. var.

I obtained three specimens in Biláspúr, all of small or moderate size: they differ from Calcutta specimens in coloration, but not to any important extent in form: the carapace is perhaps a little broader, in proportion to the length, but the difference is very trifling; both have the swelling on the anterior dorsal portion of the carapace, and precisely similar ornamentation. In the younger specimens, the anterior dorsal bone is separated by an unossified space from the first costals, but in an older specimen they are perfectly united.

The largest specimen exceeded a foot in length when alive, the carapace now measures 8·5 inches in length by 8 in breadth. The second measured 7 inches by 6 when living, the carapace in the dried specimen being 4 inches by 3·25. The small specimen preserved in spirits measures 3·9 by 3·5.

All were rather pale olive in colour above, on the shell as well as on the head and limbs. In the smallest specimen there were 2 pairs of very indistinct ocelli on the carapace. The back of the head and neck shewed black veinings. Neither head nor limbs were spotted nor presented any pale markings, the lower parts were flesh coloured, lips yellow. There were in the smallest specimen about 15 very irregular rows of granules on each side of the shell, and some scattered isolated granular tubercles on the hinder portion. On the intermediate specimen, the granules were fewer in number and on the largest they were obsolete.

Loc. With *Pangshura tectum* var. *intermedia* in the Hasdo river, a tributary of the Máhánaddi.

Sauria.

4. Cabrita Leschenaultii (M. Ed.)

Dum. et. Bib. Erp. Gen. V, p. 262, *nec* Gray, *nec* Günther.

There has evidently been some confusion about this species. I have not access to the original description by Milne Edwards, but the excellent detailed account of the characters in Dumeril and Bibron is taken from authenticated specimens of Milne Edwards' species and I believe from the type. Dr. Günther had no specimen to examine, and appears to have accepted Gray's opinion of the identity of his *Cabrita brunnea* with Dumeril and Bibron's *Calosaura Leschenaultii.*

All writers appear to have overlooked the fact, that *Cabrita brunnea* is a different lizard from *Lacerta Leschenaultii*, as will be seen by the following comparison of the characters taken from Gray's description in one case, and Dumeril and Bibron's in the other.

Cabrita brunnea, Gray, Ann. and Mag. Nat. Hist. 1838, Ser. 1, Vol. I, p. 282.	*Calosaura Leschenaultii*, Dum. and Bib., 1839, loc. cit.
Nostrils in a horizontal suture between two small nasal shields having a smaller one behind them. (In Cat. Liz. Brit. Mus. p. 43. Nostrils on the muzzle ridge between a superior and inferior nasal plate with a small hinder nasal. Günther gives the same description with only trifling verbal alterations.)	La narine. . est situeé positivement à l'extrémité du *canthus rostralis* entre deux plaques qui s'articulent avec la rostrale. Les deux plaques naso-rostrales...ont derrière elles une paire de petites plaques qui sont les analogues des naso-frénales des Lézards.

Cabrita brunnea was described by Gray from a specimen *of unknown locality* in the collection of Mr. Thomas Bell. *Lacerta Leschenaultii* was founded on lizards sent from the Coast of Coromandel by M. Leschenault.

There are, I may add, one or two minor discrepancies in the descriptions of the French and English authors which, although unimportant by themselves, tend to support the view here taken of their having had different species before them. Dum. et Bib. describe the 6 rows of ventral plates thus; "aux deux series medianes et aux deux marginales elles présentent moins de largeur qu' aux deux autres." In the original description of *Cabrita brunnea,* Gray says "Ventral shields 6-rowed, central ones narrowed on each side" and in Cat. Liz. Brit. Mus. "Ventral shields 6-rowed, the middle row on each side largest." Both Dumeril and Bibron had examined Mr. Bell's collection, but I can find no reference in their work to *Cabrita brunnea.*

In these points of difference, the specimens procured by me in Central India, coincide with the description of *Calosaura Leschenaultii,* and differ from Gray's species. The only differences which I can observe between my specimens and the description by Dumeril and Bibron are, that in the latter one large præanal shield is stated to be surrounded by small scales, whereas in Central Indian specimens, there are two enlarged præanal plates one before the other, the posterior being the largest, and whereas in the type in Paris the temporal regions are said to have three small quadrilateral plates against the upper border, in my specimens there is one long plate above the small scales covering the temples. The latter character is certainly of no consequence, and the amount to which the anterior præanal plate is enlarged varies in different individuals. I unhesitatingly refer the lizards collected by myself to *Calosaura Leschenaultii.*

The question then arises, what is the locality of *Cabrita brunnea,* and is it congeneric with *Calosaura Leschenaultii?* Gray in the Catalogue of Lizards in the British Museum, 1845, p. 43, certainly gives India as the locality for the specimens in Bell's collection, but unfortunately British Museum Catalogues are fallible on the score of localities, and in 1838 it was not known whence Mr. Bell's specimens were obtained.

Mr. Blyth in his notes to Dr. Jerdon's Catalogue, J. A. S. B. xxii, p. 476, stated that the Museum of the Asiatic Society had at that time, 1853, examples of what he took to be *Calosaura*

Leschenaultii from Pind Dadun Khan in the Punjáb Salt Range, and formerly possessed the same from Afghanistan. None of these specimens could be found, when Mr. Theobald made a Catalogue of the Society's Reptiles in 1865 (J. A. S. B., 1869, Pt. II). They may very possibly have been in bad condition from inadequate preservation in the first instance, and have fallen to pieces. If so, it may have been difficult to identify them, and as Dr. Jerdon has recently described a very similar lizard, *Pseudophiops Theobaldi*,* from the Punjáb, and as the distinction between *Ophiops* or *Pseudophiops* and *Cabrita* would be very difficult to determine in specimens in bad condition, it is not impossible that the Pind Dadun Khan specimens may have been a *Pseudophiops* or some other lizard.

In his Catalogue of the Reptiles inhabiting the Peninsula of India, l. c., Dr. Jerdon describes *Calosaura Leschenaultii* from specimens obtained in the Salem and Coimbatoor districts, but he does not mention the form of the nasal plates. Major Beddome has, however, since procured the same lizard in the same localities, and, on my writing to inquire, he has kindly examined his specimens, and he informs me that the nostril is between two swollen plates followed by a small post-nasal. I think there can be but little doubt, therefore, that this is Gray's *Cabrita brunnea.*

It will be seen from my remarks on the next species, that the characters of the nasal plates are eminently variable amongst these lizards, which appear to be otherwise closely allied, and I therefore see no reason for considering *Calosaura* and *Cabrita* distinct genera. The generic character will, however, require modification, but to this I will recur after my notes on *C. Jerdoni.*

The few individuals of *Cabrita Leschenaultii* which I obtained were found in thin forest. It is a quick active lizard, but less so than *Acanthodactylus*, and its habitat accounts both for its being less agile, since it can more easily elude its enemies by hiding, and for its very different coloration. The length is 6 inches, of which the tail is nearly 4.

The following description of the coloration is taken from a fresh specimen. Head above dusky, centre of the back brown, bordered

* Proc. As. Soc. Beng. March, 1870, p. 71.

with black against a white line which runs from behind the eye-brows to the tail, below this on the sides is a band of brown, finely mottled with black, then another white line less distinct than the first, running from the upper labials through the tympanum and just above the shoulder to the thigh. Below this from the thigh to the shoulder is an apple green band broken by black mottling, especially above in front. Some black spots and occasionally mottling occur on both upper and lower labials. Lower parts pure white. Limbs above brown finely mottled with black.

A female killed in April contains 6 eggs, each about $\frac{3}{10}$ inch long. The femoral pores vary in number from 13 to 15, and the transverse rows of ventral shields from 24 to 27 in the specimens before me. On such slender evidence, nothing certain can be stated as to the connection between the number of the latter and sex, but in 2 females the ventral shields are in 27 transverse rows, whilst a male has 24.

Loc. S. E. Berár and Chánda, not common. A single specimen was also obtained in Udipúr between Chhatisgarh and Chota-Nágpúr.

5. Cabrita Jerdoni, Beddome.

Madras Monthly Journal of Medical Science, January, 1870, p. 34.

Major Beddome obtained only a single specimen of this interesting form. I have been more fortunate, having found a small lizard abundant in several localities, which I have no doubt is that described, but which has the nasal shields different from those in *C. Leschenaultii.* In my specimens the nostril is between three shields, one præ- and two post-nasals, the prænasal large, articulating with the rostral, the opposite nasal and the præfrontal, one shield behind and below the nostril which joins the first labial and the anterior loreal, and one behind on the *canthus rostralis* which touches the anterior loreal and the præfrontal. In every other detail, my specimens agree with Major Beddome's description.*

* Since writing the above, I have heard from Major Beddome, to whom I sent a specimen, that it agrees exactly with his type. Major Beddome also informs me that he proposes to make this species the type of a new genus *Cabritopsis* on account of the differences in the nasal plates. I prefer keeping *C. Jerdoni* in *Cabrita,* as the distinctions scarcely appear sufficient to require

The characters of the nasal plates are the same or very nearly the same as in the genus *Eremias.* But in that form there is a distinct collar of large scales beneath the throat, and this only represented by a small fold before each shoulder in *Cabrita.*

In some individuals of *C. Jerdoni,* the sutures between the post-occipital plates appear to be obsolete as in Major Beddome's specimen. In others, however, perhaps of less mature age, the sutures can be distinctly traced between the two pairs of raised lines. In some specimens the suture between the occipital plates is obsolete. The central post-occipital is much broader than in *Calosaura Leschenaultii,* being very little narrower than the lateral plates beside it. Femoral pores 11 to 14, ventral shields in about 20 to 24 transverse rows. Specimens from the eastward, from Chhatisgarh and the states west of Chota-Nágpúr, are darker and less rufous, with more black spots along the sides of the back, on the flanks, and on the chin than those from the neighbourhood of Chánda, and the former are rather larger in size. The average length differs not more than half an inch, being about 4½ to 5 inches, of which the tail is 3½, measured from the anus.

Loc. Abundant on a range of rocky hills in S. E. Berár, just west of the Warda river near Chánda. Found more sparingly in parts of Chánda, Bhandára and Raipúr ; common in the sál forests of eastern Biláspúr, Udipúr and Jáshpúr and probably in Chota-Nágpúr.

The following is the character of the genus *Cabrita* as amended to comprise the additional species, and the synonomy of the forms included.

CABRITA, Gray.

Ann. and Mag. Nat. Hist. 1838, Ser. I, Vol. I, p. 282.

Syn. *Calosaura* Dum. et Bib., Erp. Gen. V, p. 261.

Nasal shields swollen, variable in number and distribution. No collar, a fold before each shoulder. Eyelids present, lower eyelid with a large transparent disk. Dorsal scales similar to lateral, all sharply keeled and arranged in oblique rows. Ventral scales 4-sided, smooth, longitudinally arranged. Femoral pores. Toes 5-5, keeled beneath. Coloration brown, not grey.

generic separation, and the three species *C. Leschenaultii, C. brunnea* and *C. Jerdoni* together form a well marked and natural genus.

1. *Cabrita brunnea*, Gray, A. and M. N. H., I, p. 282.

C. Leschenaultii, Gray, Cat. Rept. Brit. Mus. 1845, p. 43.—Günther, Rept. Brit. Ind. p. 71.

Calosaura Leschenaultii, Jerdon, J. A. S. B. XXII, p. 476,—Proc. As. Soc. 1870, p. 72.

Loc. Cavery valley in the Coimbatoor and Salem districts, (Jerdon, Beddome).

2. *C. Leschenaultii*, (M. Ed.)

Lacerta Leschenaultii, M. Ed., Ann. Sci. Nat. XVI, pp. 80, 86, pl. VI. fig. 9.
Calosaura Leschenaultii, Dum. et Bib., Erp. Gen. V, p. 261.

Loc. Coromandel, (Leschenault), S. E. Berár, Chánda and country between Biláspúr and Chota-Nágpúr, (W. T. B.).

3. *C. Jerdoni*, Bedd.

Mad. Monthly Jour. Med. Sci., January, 1870, p. 34.

Loc. Cavery valley (Beddome.) S. E. Berár, Chánda and throughout the southern Central Provinces; Chota-Nágpúr, (W. T. B.).

The next lizard is a very interesting novelty, being an additional form of the naked-eyed lizards (*Ophiops*) of which one species was described by Mr. Blyth in the Journal of the Society for 1853, Vol. xxii, p. 653, and two others have been recently named by Dr. Jerdon (Proc. As. Soc. Beng., March, 1870, p. 71).* These Indian forms have been separated by Dr. Jerdon from true *Ophiops* as a new genus *Pseudophiops*, on account of differences in the characters of the nasal and post-nasal shields. In *Ophiops* proper, the nasal is between an upper and a lower nasal shield, with 2 post-nasals (Dum. et Bib.) or 3, according to Gray and Günther. In *Pseudophiops*, the nostril is in the hinder part of a nasal shield, which is followed by two post-nasals. In the new form, the nostril is on the ridge of the snout between an upper and lower plate as in *Ophiops*, but with one small post-nasal which lies between the posterior margins of the two nasal shields,

* Dr. Jerdon l. c. mentions having obtained near Saugor another species of this group. Can it be that now described?

and is only just separated from the nostril. In other specimens or in allied species, the nostril may very possibly be found to be at the point of junction of the three plates.

After the details already given in the case of *Cabrita*, I doubt much if these characters of the nasal shields are of generic importance. They appear to me to be at the most sectional or sub-generic characters. They are easily recognised, however, and are therefore convenient for classification. I am myself inclined to consider *Pseudophiops* as a sub-genus of *Ophiops*, and the present form as an additional sub-genus. If, however, *Pseudophiops* have generic rank, the present may also be considered a distinct genus.

GYMNOPS subg. nov. *Ophiopis.*

Naris inter dua scuta inflata, uno superiori, altero inferiori, posita, scuto tertio posteriori ad narem fere attingente. Palpebræ nullæ.

6. **Ophiops [Gymnops] Microlepis,** sp. nov. Pl. xv, Figs. 1-5.

O. scutis cerebralibus subplanis, haud rugatis, præfrontali unico, postfrontalibus suturâ solâ disjunctis, scuto nullo interveniente, occipitalibus parvis, quartam partem postoccipitalium subæquantibus, submentalibus utrinque 6 *vel* 7; *squamis dorsalibus minutis, carinatis; præanali uno magno, altero vix minori ante eum; caudâ elongatâ, antice subquadratâ, postice rotundatâ, attenuatâ, corporem longitudine magis quam duplo excedente; dorso medio griseo, ventre albido, lateribus maculatis, lineâ albidâ utrinque ab superciliis ad lumbum decurrente, maculis fuscis supra et infra marginata, aliâ inferiori infra oculum oriente, vix post humerum distinguenda, fasciatis.*

Head of moderate length, muzzle depressed, rounded. Rostral shield large, running back below the nostril so that the lower nasal shield rests partly on the rostral, partly on the first labial. All the three nasal shields swollen, the two upper nasals meeting with a short suture behind the rostral. Post nasal small, on the *canthus rostralis*, semi elliptic, the rounded margin directed forwards and only just separated from the nostril; this shield is separated from the upper labials by the lower nasal, and abuts behind partly against the præfrontal, partly against the anterior loreal. Præfrontal hexagonal, single, concave in the centre. Postfrontals each about equal in size to the præfrontal meeting in a rather long suture, without any intermediate shield. Vertical elongate with a longitudinal groove in the middle for the anterior half of its length, sides concave, posterior margin forming a salient angle. The two large supra-orbitals have a row of granules on their exterior margins, a small shield in front and one or two behind them. Occipitals small, each little more than a quarter the size of a postoccipital. Postoccipitals irregularly pentagonal with small shields between them, hinder edges straight, rather oblique.

Loreals two, the upper parts of both bent over to form the *canthus rostralis*, the anterior about half the size of the posterior, the latter in the specimen broken up below on each side into small shields. Temples covered with small inflated subcarinate scales with 3 or 4 small shields along the upper margin. Ear opening much higher than broad, one enlarged scale in front of the upper portion. Upper labials about 8, the 5th from the front much enlarged and below the orbit, lower labials 7 or 8. Mental shield large, chin shields in 6* (? 7) pairs the first two (3) pairs meeting.

The fore leg laid back extends to the thigh, laid forward it reaches to the end of the snout, the hind toe comes just beyond the ear. The first three toes on the fore foot are graduated, the 4th is very little longer than the 3rd, the 5th about equal in length to the 2nd. All the toes are keeled and denticulate beneath, but not at the sides. In the hind foot, the first four toes increase regularly in length, the 5th is about as long as the 3rd.

There is a well marked fold in front of each shoulder, not vertical, but inclined obliquely upwards and backwards, with very small scales behind it and in front of the shoulder. There is no collar beneath the throat. Scales of the belly rhomboidal, in six rows, the four centre rows about equal in size, the lateral ones rather smaller. Dorsal scales strongly keeled, very small, much smaller than in *Cabrita Leschenaultii*, and not oblique as in that species, arranged in transverse rows; there being about 50 in each row. Scales of the tail much larger than those of the back, all strongly keeled. Two large plates in front of the anus, one before the other, the hinder being the largest. Femoral pores 14 on each side.

* In the only specimen obtained there are six chin shields on one side, seven on the other.

Tail rather more than twice the length of the head and body, measured from the nose to the anus.

The dimensions of the specimen obtained are:

	in.
Whole length,	7.2
Length of head from end of nose to hinder margin of postoccipitals,	0.55
,, from end of nose to ear,	0.55
Breadth of head at superciliary ridge,	0.25
Length of head and body from nose to anus,	2.1
do. of tail from anus,	5.1
do. of fore leg and foot to point of finger,	0.9
do. of longest finger,	0.3
do. of hind leg and foot,	1.5
do. of longest toe,	0.55

In colour, the head above and the middle of the back are grey, marked towards the sides with dusky brown, especially on the margin of two narrow white lines, one running backwards from the hinder part of each superciliary ridge to the insertion of the tail, where it becomes lost in a broader pale reddish band. These bands a little way down the tail unite above and all the upper part of the tail becomes reddish. The sides of the head, body and tail are spotted with dusky, the spots on the head and body being fewer below, and another white line less well marked than the upper one runs from below the eye just above the shoulder, becoming much less distinct behind; below this, in life, there are on the sides a few green spots mixed with dusky specks which fade in spirit. Lower parts white.

Loc. But a solitary specimen of this curious Lizard was found at Korba in Biláspúr, the eastern part of the Chhatisgarh division, Central Provinces.

Ophiops microlepis may be distinguished from *O. Jerdoni* by the differences in the nasal plates, by the head shields being flat and not ribbed, by the post-frontals having no intermediate shield, by the smaller occipitals, and by the narrow shields between the post-occipitals, whereas in *O. Jerdoni*, the intermediate plate is half the breadth of a post-occipital.

Other differences are the much smaller scales, the more numerous chin shields, the proportionally longer limbs and much longer tail, and the more numerous femoral pores. In *O. Jerdoni*, the length from the nose to the anus is 1.65 inch, of the tail from the anus 2.4. In *O. microlepis*, as before, the head and body measure 2.1, tail 5.1 inches.

Of the two new species of *Pseudophiops*, described by Dr. Jerdon, only a few characters have been given, but these shew other differences from *O. microlepis*, besides those of the nasal plates, which are similar, it may be presumed, to those of *O. Jerdoni*. In *Pseudophiops Theobaldi* there is a shield intercalated between the posterior frontals, and the proportions of body to tail are 5 to 7. *P. Beddomei* has two anterior frontals, and the head still shorter and more triangular than in *Jerdoni*. The reverse of the latter is the case in the present species.

7. **Euprepes innotatus**, sp. nov. Pl. xvi, Fig. 9.

E. parvus, figurâ coloreque E. macularii *similis, dorso olivaceo, lateribus purpurascenti-brunneis, ventre flavo, (vel albo ?), linea albescenti utrinque superciliari postice et antice productâ, alia inferiori breviori ab aure ad humerum decurrente ; palpebrâ inferiori mediâ translucente, lineis impressis haud notatâ ; squamis in* 32 *seriebus longitudinalibus, dorsalibus quinque carinatis.*

I am indebted to Dr. Anderson for calling my attention to this species, which I had overlooked amongst several specimens of *E. macularius*, Blyth. I have unfortunately but a single example, it differs, however, so much from the two Indian *Euprepes*, with transparent lower eyelids, previously described, *viz.*, *E. trilineatus*, Gray and *E. Beddomei*, Jerdon, that I see no resource but to consider it new.

Desc. A pair of small supranasal shields ; the single præfrontal touches the rostral, but is just separated from the vertical by the post-frontals.* Opening of the ear not very small, with two or three minute denticles in front. Lower eyelid with a transparent disk. Scales in 32 longitudinal series and in 32 transverse rows between the axils : dorsal scales with 5 (here and there with 4 or even 3)

* This is not a character of much importance, and I find it varies much, in other species, in different individuals.

well marked equidistant keels. Præanal scales not enlarged, subcaudals broader behind but not near the anus.

Colour olivaceous above, sides purplish brown, under parts yellow when alive with a red band from the thigh to the shoulder; these colours disappear in spirits, and are doubtless only seasonal. A few black spots on the back and upper parts of the tail. A whitish line on each side from the nostril along the superciliary ridge and extending about half way down the back, another, very ill marked, from the tympanum to the shoulder, a few fine white spots are scattered over the sides of the neck.

In the only specimen procured the tail is imperfect. The body measures 2.25 inches from the nose to the anus, fore limb to end of toes 0.7, hind limb 0.9, 4th toe of hind foot 0.3, 3rd of do. 0.22 inch.

This species is distinguished from *E. trilineatus* by having five (sometimes four) instead of six or seven keels on the dorsal scales, and by the very different coloration without any trace of the central dorsal line. The same characters apparently separate it from *E. Beddomei*, Jerdon, Proc. A. S. B., 1870, p. 73, the scales of which, however, are not described, but the coloration is even more diverse than that of *E. trilineatus*. From all other Indian forms the present is well distinguished by its transparent lower eyelid.

Loc. Pem Ganga valley, S. E. Berár.

It is well worthy of note that the species of *Euprepes* with a transparent lower eyelid appear restricted in South-Eastern Asia to what I have called the Indian province proper. None are known from Malabar, Eastern Bengal or the Indo-Chinese countries (except one species of a very peculiar type from Borneo), nor even from the Bengal sub-division of the Indian province. One species, *E. Petersii*, Steind., has been found in Thibet. This is precisely what might have been expected, the form being principally African.

8. EUPREPES [TILIQUA] CARINATUS, (Schneider).

Euprepes rufescens, (Shaw). Günther Rept. Brit. India, p. 79. *E. Sebæ*, Dum. et Bibr. Erpét. Gén. V. p. 692. *Tiliqua rufescens*, Gray, Cat. Liz. Brit Mus. p. 109. *Euprepes carinatus*, (Schneid.), Peters, Monathsberichte Berl. Akad. 1864, p. 50.

All my specimens from Chánda, Raipúr and Chota-Nágpúr differ so much from Günther's description, that until I had an opportunity of comparing them, I supposed them to be either a variety of *Tiliqua trivittata*, Gray, or else a new species. The most marked peculiarity of all the specimens I have collected is the existence of five keels on the dorsal and lateral scales instead of three, the usual number in *E. carinatus*. Occasionally the two outer keels are more or less obsolete on part of the back and sides, but in most specimens there are five well marked keels throughout. Specimens from Bengal and the countries to the eastward have only three keels in general, but careful examination usually shows the presence of the two others more or less imperfectly developed on a few scales, usually on those of the loins.

Dumeril and Bibron notice this, but they are in error in supposing, p. 694, that the young has "sometimes seven but more frequently five keels," and they have evidently confounded *E. macularius*, Blyth or else *E. multicarinatus*, Kuhl, with the young of *E. carinatus*, as did also Cantor, (*vide* Theob. Cat. Rept. p. 24, J. A. S. B., Part II, 1868). I obtained several young specimens which I take to belong to the latter, of various sizes up to about 5 inches in length. All have three keels only.*

I cannot attach much importance to the form of the anterior head shields. In some specimens the præfrontal touches the vertical, in others it is widely separated.

In coloration, specimens of *Euprepes carinatus* from localities as distant from each other as S. E. Berár and Chota Nágpúr agree perfectly, but they differ somewhat from all described varieties, though approaching Günther's var. a and Dum. et Bibron's var. A. The following description is taken from a fresh specimen.

Back olive, the posterior edges of the scales darker in some specimens; superciliary stripe white, continued as a well marked white band down the sides of the back to the insertion of the tail and continued as a pale but not white band on the tail for about one-third of its length; beneath the narrow white band is a broad chesnut one

* If not the young of *E. carinatus*, these belong to an undescribed species, but all my specimens appear to be immature.

including the eye and the upper part of the ear, and extending backwards as far as the thigh: lower part of the sides of the head including the upper labials white, as are sometimes all the lower parts, but they are more frequently golden yellow, in some cases with a blotchy scarlet band, extending from the shoulder to the thigh, below the chesnut portion of the sides, a pale whitish line intervening between the two colours. These red patches I believe to be seasonal, and so is perhaps, to some extent, the golden yellow of the under surface, which varies also in extent. These red and yellow colours fade in spirit.

In the specimens which I suppose to be young, the back has a coppery tinge only seen in fresh specimens. Nearly all, both young and adult, have 32 rows of scales round the body, a few specimens having 30 or 31. The largest specimen obtained by me measures 10.5 inches, of which the tail is 6.5. This is decidedly smaller than specimens from Lower Bengal and the Burmese countries.

Whether the form inhabiting the Indian Peninsula deserves separation from the Bengal and Burmese species I am not certain, but I think the difference in the development of the keels on the scales, and in the coloration, eastern specimens being almost uniform, shew the two to be well marked races.

Loc. *Euprepes carinatus* I found, although not very common, throughout the country traversed, *viz.*, in S. E. Berar, Chánda, Bhandára, Raipúr and Biláspúr in the Central Provinces and in the country west of Chota-Nágpúr. I did not observe it in the sál forests of the latter region, it is usually seen in thin tree jungle with underwood, or amongst bushes.

E. trivittata, Dr. Jerdon informs me, occurs at Nágpúr. I did not meet with it to the southward or eastward. The specimen in the Museum at Calcutta differs not only, as pointed out by Theobald, in having five keels on the scales throughout, but also in those keels being stouter, more regular and more equally developed than in *carinatus*, in the very different coloration, three broad white bands with distinct edges down the back, and in the number of scales, there being 36 longitudinal rows round the body.

9. E. [TILIQUA] MACULARIUS, B l y t h, var.

E. macularius B l y t h, J. A. S. B., 1853, Vol. XXII, p. 652. *Tiliqua multicarinata*, J e r d o n, J. A. S. B., 1853, Vol. XXII, p. 479, note.—T h e o b a l d, Cat. Rept. Mus. As. Soc. Bengal, p. 24, in J. A. S. B. for 1868, appendix, *partim*.

I obtained a considerable number of specimens of a scink which I have very little hesitation in referring to the above species. It agrees admirably in every character except the number of keels on the scales, which appears to me somewhat variable in both instances. The coloration is identical. I shall proceed first to give a detailed description, and then to point out why I do not think this species can be identified with *Scincus multicarinatus* of K u h l, as has been proposed by Mr. T h e o b a l d.

Desc. General form less stout than in *E. carinatus*. Lower eyelid scaley. A pair of supranasal shields; the single præfrontal meets both the rostral and the vertical, and often forms a rather broad suture, with the first especially; post-occipitals generally rather short longitudinally, and often ribbed posteriorly; behind them, as in *E. carinatus*, are two plates of small longitudinal extent, but nearly equal in breadth to the post-occipitals, and with many keels, usually about nine, upon them. Opening of the ear rather small, slightly granulate in front and below. The fifth upper labial usually longer than the others, but this character is far from constant, and appears rarely so well marked as in *E. carinatus*. Scales in 28 longitudinal rows, rarely in 27, 29 or 30, and in 20 to 24, generally 22, transverse rows between the axils, those of the back with from five to seven keels each, the prevailing number being five. No enlarged præanal or subcaudal scales, except (in the latter only) when the tail has been renewed.

The coloration is nearly as described by B l y t h. Upper parts bronze, the hinder part of the back and the anterior portion of the tail usually but not always with a few irregular black spots varying much, both in number and character, in different individuals, and occasionally forming interrupted lines on the tail. Sides darker than the back, especially above, and more or less spotted with white, the sides of the tail near the base with alternating longitudinal broken lines of dusky and whitish; hinder parts whitish, or sometimes, in fresh specimens, yellow, with a red band along the lower part of the side. These red and yellow colours were only observed in spring. Length 4.5 to 5.5 inches. A large specimen measures 5.7 : in this the tail from the anus is 3.6, forelimb and toes 0.55, hind limb and toes 0.8, longest toe (4th) of hind foot 0.3, next longest (3rd) 0.23 inch.

Mr. Blyth's original specimen was supposed to be from Rangpúr. It is doubtless the same to which Dr. Jerdon had alluded in the same volume of the Society's Journal (Vol. XXII, p. 479, note). Of the four specimens mentioned under this name by Mr. Theobald in his Catalogue of the Reptiles in the Society's Museum, p. 24, three probably belong to a different species, the coloration not agreeing with Mr. Blyth's description. The 4th specimen which is in very poor condition is evidently Mr. Blyth's type.* It is rather stouter than my specimens from Central India, and the tail and limbs are a little shorter in proportion, whilst the dorsal scales are very generally seven-keeled throughout, a few scales only having but five or six keels. In the characters of the head scales, and in the coloration, I see no distinction, and the number of scales round the body is the same, *viz.* 28. The Indian Museum has recently received other specimens from Assam and Cachar, which closely resemble Mr. Blyth's type specimen. It is thus evident that there is a slight distinction between the Assam species and that inhabiting Eastern Central India, the difference being similar to that found in *E. carinatus.* It may be briefly expressed by saying that Assamese specimens have seven keels on the dorsal scales as a rule, five as an exception, whilst in specimens from Chhatisgarh and Udípúr five keels are the rule, seven the exception, and that the latter form is rather more slender with longer tail and limbs. I have unfortunately no specimens from Pegu for comparison ; so I cannot tell if Mr. Theobald's *Tiliqua multicarinata,* Jour. Linn. Soc. 1868, Vol. X, p. 26, be the same or not. Mr. Theobald has examined my specimens and is disposed to consider them distinct.

* I am indebted to Dr. John Anderson for pointing this out to me; the specimen was in such poor condition, that I did not myself remove it from the bottle, and having satisfied myself that the other three specimens could not have been the types, I rather hastily concluded that the original of Mr. Blyth's description had been lost.

Unfortunately Kuhl's Beitrage is not procurable in Calcutta, and I have not access, therefore, to the original description of *Scincus multicarinatus*. The characters of the British Museum specimens from the Phillippines, as given by Gray in the Catalogue of the specimens of Lizards, 1845, p. 109, shew totally different coloration from *E. macularius*, an important character where the ornamentation is so constant as it appears to be in the Indian species; the head shields are said to be rather rugose, the scales large, ovate, and transverse. These are not the characters of *E. macularius*, which has smooth head plates, and hexagonal scales about equally broad and long.

From *E. carinatus* this species may be distinguished by the more numerous keels and the coloration, by its much smaller size and narrower form.

Loc. Not rare in the Eastern part of Chánda and in Bhandára. Extremely abundant (far more so than *E. carinatus*) throughout the sál forests in Biláspúr, Udípúr and Jashpúr west of Chota-Nágpúr.

10. **E. (Tiliqua) septemlineatus,** *sp. nov.* Pl. xvi, Figs. 7-8.

E. parvus, similis E. carinato *sed multo minor, supra et ad latera nigrescente brunneus, albido longitudinaliter 7-lineatus, ventre albido, squamis tricarinatis in* 30 *seriebus longitudinalibus, palpebra inferiori striis impressis signata.*

Desc. Form moderately slender. A pair of supranasals. The single præfrontal is just separated from the rostral, and more broadly from the vertical; fifth upper labial elongate. Lower eyelid with faint lines on it throughout and with no transparent disk. Ear opening small, with two or three well marked denticles in front. Scales three keeled, in 30 longitudinal rows, and about 28 transverse between the axils, præanal and subcaudal scales not enlarged. Colour brownish black above with seven equidistant narrow white longitudinal stripes, three on the back and two on each side, the upper of the latter arising from the supercilia, the lower from the upper labials. These bands are only lost on the tail down which some of them extend. Plates on the top of the head dark in the centre with pale margins, limbs dark above, the hind legs with white spots: lower parts white.

Length nearly 4 inches,* tail from anus 2.1 ; fore limb to end of toe 0.43 ; hind limb to do. 0.65 ; third toe of hind foot ¾ the length of the fourth.

Loc. A single specimen only found on a stony ploughed field amongst thin jungle in the Pem Ganga valley, S. E. Berár.

11. RIOPA HARDWICKII, Gray.

Scarce in the southern part of the central provinces. I have not met with a *Riopa* in S. E. Berár or Chánda.

My largest specimen measures 4.2 inches, of which the tail from the anus is exactly 2. Scales in 26 longitudinal rows in two large female specimens, and in 25 in two smaller ones (males ?). One of the former contains four eggs.

Loc. Korba in Bíláspúr.

12. RIOPA ALBOPUNCTATA, Gray.

Only found in the same neigbourhood as the last, and scarce. The country where alone I obtained specimens was just where the range of the sál tree was entered from the westward.

In five specimens procured, three have 28 and two have 26 scales round the body ; transverse series between the axils of the fore and hind limbs 45 to 48. My largest specimen measures 4.4 in., of which the tail is 2.5.

Loc. Korba in Biláspúr ; Udipúr.

13. HEMIDACTYLUS MACULATUS ? Dum. and Bib.

The larger tubercles often vary greatly in the extent to which they are angulate in the same individual ; in parts of the body they are often sharply trihedral, in other places, especially on the hinder part of the head, the sides of the body and the upper parts of the limbs, hemispherical. In different specimens, I find the upper labials vary from eight to eleven, the former being the common number about Chánda. The lower labials are if anything even more variable. The rows of scales across the abdomen are in some specimens only 34 or 35, usually there are about 40.

* The specimen is imperfect, the tail having been broken when captured and since lost, but the measurement was taken at the time of capture.

I cannot help doubting whether the type of Dumeril and Bibron's species, 241 mm. (above 9½ inches) long, is really identical with the Indian Gecko. Jerdon has noted this distinction also in his Catalogue; J. A. S. B., XXII; p. 467. Out of a considerable number of specimens, I have none exceeding 4½ inches in length. But the synonymy and classification of the *Hemidactyli* of India and the neighbouring countries is still far from clear.

Loc. Found everywhere under stones and on trees. Very common about Chánda; I obtained specimens also in Raipúr and to the eastward. It is common in Calcutta houses, the tubercles being a trifle smaller and blunter than in Central Indian examples.

14. **Hemidactylus gracilis,** *sp. nov.* Pl. xvi, Figs. 4-6.

H. affinis H. reticulato, *Bedd., gracilis, corpore parum depresso; cauda rotundata, elongata, sine spinis vel tuberculis majoribus; dorso granulato, tuberculis majoribus subtrihedris elongatis ornato; poris femoralibus nullis, inguinalibus* 6; *griseus, maculis et lineis fuscis superne, utrinque, et sæpissime subtus fasciatus.*

Form slender, much less depressed than usual in the genus, back granular with many elongate subtrihedral tubercles, all of equal size and smaller than the ear opening, and arranged in distinct longitudinal rows, the two central rows being the best marked. Tail round, but slightly depressed at the base, and not at all farther back, tapering, without any enlarged or spinose tubercles whatever, this being clearly, I think, not due to reproduction, as it is constant in four specimens, three of which have perfectly well developed tails: subcaudal scales hexagonal, broad. The scales of the top and sides of the tail simply subimbricate, not in rings. Toes elongate, not webbed, the plates beneath them narrow and undivided at the base, broader and double towards the tips. Upper labials usually 9; lower 6 to 7, generally 7; the hinder 3 labials small. The rows of scales across the belly are about 24 in number, but they pass so gradually into the granular scales of the sides in most specimens, that it is very difficult to count them. Ear opening small, pupil of eye vertically oval, nearly as broad as high in some cases, edges deeply waved. No femoral pores, 6 præanal in a curved or angulate line with the convexity directed forward. Coloration dirty grey, whitish beneath, head and back elegantly marked with black spots, often subquadrangular, which form bands, especially down the sides of the back. A pale line runs from the nostril down each side of the back and along part of the tail, below this the sides are marked with longitudinal dark lines, broader above than below, and in some specimens there are narrow rather faint dusky lines along the belly ; tail more or less longitudinally striped throughout. Length 3 inches ; of which the tail is 1¾.

This species has a smooth tail like *Hemidactylus* (*Leiurus*) *Berdmorei*, Blyth, and two allied species, described by Theobald, but in those forms there are no enlarged tubercles on the back, and they are of the usual broad depressed shape, not slender like *H. gracilis*.

Loc. I only obtained four specimens of this new form, two from S. E. Berár and two from near Raipúr.

15. **Hemidactylus marmoratus**, sp. nov. Pl. xvi, Figs. 1-3.

H. robustus, dorso minute granulato, lateribus serie unicâ longitudinali tuberculorum distantium planulatorum ornatis, cauda depressa annulata, tuberculis elongatis squamæformibus utrinque duobus vel tribus ad latera annulorum singulorum armata, scutis subcaudalibus magnis, poris femoralibus utrinque circa 12, *intervallo præanali lato disjunctis, digitis omnibus unguibus præditis : superne griseus, fusco-marmoratus, subtus albescens. Long. circa* 3.3, *corporis* 1.85, *caudæ nuper renovatæ* 1.5 *unc.*

Habit stout as in *H. maculatus*. Back uniformly granular, sides with one sub-distant series of very small flat tubercles from thigh to shoulder, and a few others irregularly scattered about the loins, all very inconspicuous. Tail depressed, distinctly ringed, each ring with one large scale shaped tubercle behind at each side of the base, and one or two others, rather smaller, above, but none on the top. Subcaudal scales very broad. Femoral pores 12 on each side, separated by a broad space in front of the anus. Scales of the abdomen in about 38 rows. Upper labials 11-12, lower 7-8. Two pairs of enlarged chin shields, the first irregularly pentagonal and truncated behind, the hinder pair much smaller. Ear opening rather large. Pupil narrow, vertical edges deeply waved.

Fingers with broad divided plates below, and all provided with distinct well developed claws. Grey above, marbled with dusky, a dusky band running from behind the eye to the shoulder.

This is a fifth species found in India or Ceylon of the group to which *Hemidactylus Coctæi* belongs, characterized by the absence of enlarged tubercles on the back. They may be differentiated as follows :—

I. Enlarged chin shields present.

a. Claw on thumb minute or wanting.

* Femoral pores numerous in a continuous row.

1. *Hemidactylus sublævis*, Gray.

** Femoral pores 6 or 7 on each side, interrupted in front of the anus. Tail with scale like tubercles at the side.

2. *H. Coctæi*, D. and B.

b. Thumb claw well developed.

* Rows of scales across belly about 45.

3. *H. Kelaartii*, Theobald, Cat. Rept. J. A. S. B., 1868, Pt. II., p. 29.

** Rows of scales about 38.

4. *H. marmoratus*, sp. nov.

II. No enlarged chin shields.

5. *H. aurantiacus*, Bedd.

H. Kelaartii, Theobald, which is very near the present species, is also distinguished by its more numerous femoral pores, but this is not so good a character as that of the scales on the belly. It is a very much larger form, measuring 5·2 inches of which the tail is 2·5. From the shape of my specimen, I have no doubt of its being adult.*

Loc. Only a single specimen of *H. marmoratus* was obtained in S. E. Berár, near Chánda. It was found in my tent.

16. Calotes versicolor, Daud.

This lizard appears to me far less abundant in the portions of Central India which I have traversed than it is in Bengal or Madras. Although a tree lizard, it is by no means common in

* *H. Bellii*, Gray, Cat. Liz Brit. Mus. p. 155, of unknown locality, is closely allied, but appears to have a more spinose tail, and differently shaped chin shields from the present species.

forest, it appears to keep much to thin bush, and frequently to haunt rocky places.

The variety common about Chánda and S. E. Berár has a yellow band down each side of the back, which disappears in large specimens.

17. SITANA PONDICERIANA, Cuv.

S. minor, Günther, Rept. Brit. Ind. p. 135.—Steindachner, Reise der Novara, Zool. Theil., Reptilia, p. 26.

Although it is possible that there are two distinguishable forms of *Sitana* in India, one much larger than the other, I doubt greatly whether the proportions of the legs, which have been mainly depended upon by Günther, when pointing out the differences, are sufficiently constant to enable them to be used as specific characters. If they really be so, I should have to describe two new species, as I have obtained two forms, both of which differ somewhat in the proportions of their limbs from the two species discriminated in Günther's Reptiles of British India. If they are not, and I shall give some measurements which will shew a considerable amount of variation, then the only difficulty in identifying the smaller Southern form with *S. Pondiceriana*, Cuv., disappears. As the lizard abounds in Southern India, it is far more probable that Cuvier's specimens were obtained from the neighbourhood of Pondicherry than that they were captured in the Northern Deccan,* whilst Dumeril and Bibron had palpably, I think, specimens both from the North and the South, and their description is very probably taken from a Northern individual.†

Günther describes his *S. minor* as having the forelimb extending beyond the vent if laid backwards, the hind limb to or beyond the extremity of the snout, if laid forwards; the lower thigh, he adds, is considerably shorter than the foot, the length of which is more than the distance between the shoulder and hip joints. Now I have collected between 30 and 40 specimens

* I have not access to Cuvier's original description.

† The figure in Jacquemont, Voy. dans l' Inde, Atlas, pl. 10, is that of the Northern variety, and Dumeril and Bibron mention Jacquemont's specimens amongst those in the Paris Museum.

from S. E. Berár, Chánda and throughout the country extending thence to Chota-Nágpúr, and although all of them, I believe without exception, have the hind limb sufficiently long to extend to the end of the snout, or beyond it, the latter being more common, the fore limb very rarely extends to the vent; out of the whole number, I can find only one specimen in which the fore foot laid back extends beyond the vent. I have not a single specimen exceeding 7 inches in length, and the majority are under 6. Precisely in accordance too with Jerdon's account J. A. S. B., XXII, p. 473, I find the dewlap-like gular appendage comparatively slightly developed, never much exceeding half an inch in length,* and in only one specimen is it tricolored; in general, even in May, it was scarcely distinct in colour from the remainder of the throat; but the male had always, late in the season, an indigo stripe from the chin to the front end of the pouch. Specimens of the larger form which I have seen in previous years usually had the pouch fully coloured in April.

I find that specimens in the Indian Museum from Ceylon agree with those collected by myself in every character, they have the same leg proportions, and they also resemble mine in some peculiarities of the scales to which Günther does not refer in his description. About eight to ten rows of scales in the centre of the back are much larger than the scales of the sides, but a few large scales, the number varying greatly, are usually interspersed amongst the latter.† A few large, strongly keeled, almost spinous scales are also distributed over the occiput. Specimens occur, however, without these enlarged scales.

The following measurements of my own specimens and of two from Ceylon in the Museum will serve to shew the proportions of different parts of the hind legs and of the body. The three specimens from S. E. Berár were captured in the same spot. The dimensions are in inches.

* It perhaps becomes larger, later in the year, in the breeding season.

† The larger size of the dorsal scales appears to be shewn in Günther's figure.

	Loc.	Whole length.	Lower thigh.	Hind foot.	Thigh to shoulder.
1	S. E. Berar,..	6·7	0·6	0·75	0·8
2	ditto, ...	5·8	0·5	0·7	0·7
3	ditto, ...	5·0	0·5	0·7	0·55
4	Raipúr, ...	6·25	0·65	0·8	0·75
5	Ceylon, ...	7·5	0·75	0·95	1·95
6	ditto, ...	5·0	0·6	0·8	0·85

It will be seen that whereas the proportion between the lower thigh and the foot is nearly constant, that between the limbs and the body varies greatly.

Sitana Pondiceriana is found in open country, amongst bush jungle, and in forest, but is perhaps most commonly seen in thin tree jungle. I not unfrequently met with it even in the great sál (*Shorea robusta*) forests between Biláspúr and Chota-Nágpúr. It is purely a ground lizard, as has already been shewn by Jerdon. It is very abundant, being perhaps the most generally spread of all lizards inhabiting the Indian peninsula, and I have seen thousands, but I never yet observed one on a tree in the position depicted in Günther's Reptiles of British India, Pl. XIV, fig. A. It is quite as great a mistake to represent *Sitana* in this position, or indeed upon a tree at all, as it would be to draw a *Euprepes*, a plover or a hare in the same position, and Dr. Günther might have avoided this mistake by attending to Dr. Jerdon's description of the animal's habits.

Loc. As already mentioned *Sitana Pondiceriana* abounds in S. E. Berár, throughout the southern part of the Central provinces in the districts of Chánda, Bhandára, Raipúr and Biláspúr, and in the country west of Chota-Nágpúr.

18. Sitana Deccanensis, Jerdon.

S. Pondiceriana, Günther, Rept. Brit. Ind. p. 135; Dum. et Bibron, IV, p. 437, partim.

I did not obtain any specimens of this large form during the past season, but I find some amongst my former collections from Nágpúr and Chánda, and I believe one of these at least was from near Chánda, where it probably meets the range of the smaller race. These specimens shew precisely the same proportions of the limbs as I find usual in the smaller race, the hind foot laid forward extends just beyond the snout, while the fore limb laid back does not reach, or, at the most, just reaches the vent. The dorsal scales are enlarged, but there is an absence of enlarged scales on the sides, and although one or two occur on the occiput, they are much less distinct and less numerous. The gular pouch is well developed, being 1¼ inches long at its union with the throat and head, or nearly three times as long as in the smaller race, but as I have previously stated, I am not sure that I have a specimen of the latter with a fully developed pouch. The following are the dimensions of the three larger specimens.

	Whole length.	Lower thigh.	Hind foot.	Thigh to shoulder.
1	8·25	0·9	1·2	1·25
2	7·25	0·8	1·15	0·9
3	imperfect	0·9	1·22	1·1

The weight of the body must be far more than double that of the smaller specimens.

There is evidently very little difference between these forms of *Sitana* except size, as will be seen from the preceding details. I have obtained specimens of both races which, agreeing with each other, differ from both the forms described by Günther in the length of the legs. I shall endeavour to procure further specimens, and to decide if all these varieties pass into each other by insensible degrees, or whether there are really two races distinguished by the marked difference in size. The former appears to me the more probable at present.

19. Charasia dorsalis, Gray.

A fine rock lizard which I found abundantly in parts of Central India puzzled me greatly. I could not conceive it probable that so conspicuous a species had escaped notice, but nevertheless no generic description in Günther's Reptiles would apply to it. In all but one character it agreed with *Charasia dorsalis*, but that character, the arrangement of the scales on the tail, is mentioned by Dr. Günther as one of the principal distinctive marks, and

I find it also employed by Dr. Gray (Cat. Rept. Brit. Mus. p. 231) in characterizing the genus, the scales of the tail being said to be arranged in rings. In my specimens, on the contrary, the caudal scales are unmistakeably imbricate, as much so as in *Calotes versicolor*. In the very careful and detailed description in Dumeril and Bibron,* IV, p. 486, not a word is said of rings on the tail, nor is this character mentioned by Dr. Jerdon, Cat. Rept. J. A. S. B. XXII, p. 475, and in specimens from the Nilgiris, formerly presented to the Society's collection by Mr. Theobald, I find that although the caudal scales are partly in rings, the annulation is often ill-marked and irregular and never appears to resemble the very characteristic arrangement seen in *Stellio*. Major Beddome also, to whom I wrote on the subject, informs me that in specimens in his possession the scales on the tail are subimbricate. I conclude that this character is variable, and that the individual specimens in the British Museum described by Drs. Gray and Günther exhibit it in a more marked manner than usual.

The genus *Charasia* is in fact little more than a sub-genus of *Agama*, distinguished by the absence of præanal pores.† It is one of the forms with African affinities which are so common and widely spread in India proper, and which serve to distinguish its fauna from that of the countries lying east of the Bay of Bengal.

The coloration and habits of *Charasia dorsalis* have been well described by Dr. Jerdon l. c. I have repeatedly seen and secured specimens with the head a brilliant scarlet above and on the sides, a black streak from the nostril through the lower eyelid and over the tympanum passing into the black of the sides of the neck, chin red marbled with dusky, just as in *Stellio cyanogaster* blue and grey are intermingled, back dull rufous becoming ashy behind and slightly mottled with grey and dusky, sides, belly and limbs blackish excepting some orange spots along the sides.

These brilliant colours are seasonal and confined to the males as

* I am equally unable with Dr. Gray, Cat. Rept. Brit. Mus. p. 246, to find anything corresponding with the "6 à 10 écailles crypteuses de forme rhomboidale" said by M. M. Dumeril and Bibron to occur in male specimens on the edge of the anus, and to be arranged in oblique and crossed series.

† I recently described an *Agama* (*A. annectans*) from Abyssinia with the caudal scales in rings (Obs. Geol. & Zool. Abyss. p. 446.)

in *Calotes versicolor*, and I observed them at the same time of year, in May. At other times of the year the coloration in the living animal is brownish grey, with irregular blackish marks on the sides and back, those on the latter having sometimes an imperfect lozenge shape, and with dark cross bands on the upper part of the tail.

Charasia dorsalis is rarely seen except on high rocks, and is especially met with on hills of granitoid gneiss, which usually consists of enormous detached blocks piled upon each other. I did not find it on the sandstone hills of Biláspúr, although they have precipitous sides. I have found this lizard both in forest countries and in open places, but always with the same habitat. It not unfrequently, if pursued, takes refuge on a tree. I obtained specimens chiefly by shooting them, as the localities they inhabit are frequently rather difficult of access and abound in narrow clefts, into which these lizards escape. I once saw one with a large green beetle, a *Cetonia*, in its mouth.

The largest specimen obtained by me is 9¾ inches long, of which the tail measured from the anus is 6½. The nostril is a little farther back than in Nilgiri specimens, but the difference is trifling.

Loc. I have seen this lizard once, I believe, in S. E. Berár where it is certainly very rare, probably because no suitable habitat exists. I found it common on a rocky hill about 60 miles west of Raipúr, and abundant thence to the eastward, in suitable places, in Chhatisgarh, Udipúr and Jashpúr, and near Ránchi and Hazáribágh. I have also met with it, I believe, in former years, near the Godavery.

OPHIDIA.

20. TYPHLOPS BRAMINUS, Daud. var. PAMMECES.

T. tenuis Günth. Rept. Brit. Ind. p. 176, Pl. XVI, fig. C.
T. pammeces, id. app.

A single small specimen was found under a stone. It is nearly six inches long and about three millemetres or barely one-eighth of an inch thick, so that the thickness is little more than one-fiftieth of the length. The rostral shield is considerably narrower in front than behind, but the general form of the head shields is the same as in *T. braminus*, there is the same number of longitudinal rows, twenty, (I leave the counting of the transverse rows to any one who may find the occupation congenial), and the thickness of the body is evidently a very variable character. I do not think that the form should be distinguished from *T. braminus*.

Loc. S. E. Berár.

21. Tropidonotus quincunciatus, Schleg.

Var D. Günth. Cat. Col. Snakes Brit. Mus. p. 65.—? var. δ. Rept. Brit. Ind. p. 261.

T. piscator, Jerdon, Cat. Rept. J. A. S. B., XXII, p. 530.

I obtained two large specimens, a male and a female of this common snake, from beneath a large stone in a stream. They evidently lived in the place, and when dislodged shewed a great disinclination to quit the water. I found them to be provided with perfect nasal valvules; they were so large and so unlike ordinary specimens of *T. quincunciatus* in colouring that at first I mistook them for *Homolopsidæ*.

The largest was a female measuring 51 inches in length, of which the tail was 11·5. Her colour was olive marbled with black and an indistinct row of small pale yellowish spots on each side of the back from the head to the anus. Ventral scales 148, subcaudals 61. The smaller was a male, 38 inches in length, of which the tail was also 11·5 or the same length as that of the much larger female, with 143 ventral scales and 89 subcaudals. Its colour was olive without any dark marks, but with a row of well marked small buff spots down the sides. In both specimens the black lines from the eye to the upper labials were very ill-marked; the lower parts were white with a slight pinkish or orange tinge.

The stomach of the female was empty, that of the male contained small fish. In the oviducts of the former I counted 85 soft partly developed eggs.

A smaller specimen obtained afterwards at Korba, on the bank of the Hasdo river, had precisely similar coloration with the male specimen above described. It had 158 ventral and 81 subcaudal shields.

Loc. S. E. Berár and Bilaspúr.

22. Ptyas mucosus, (L.)

The common rat snake appears to me to be much less common in the Deccan proper, west of Nágpúr, than it is to the eastward. This snake attains a greater size than that given by Günther, I shot one this year 7 feet 7 inches long, of which the tail was 2 feet 1 inch. The ventral shields were 197, subcaudals 124.

On another occasion I saw a *Ptyas mucosus* seize and commence to swallow a large *Calotes versicolor*. When my attention was first attracted, the snake was fairly pursuing the lizard at full speed along a sandy path. Presently both stopped, the snake made a slight movement and in an instant had the head of the lizard well within his jaws and his body thrown over that of his victim.

Loc. Central Provinces, Chota-Nágpúr &c.

23. Zamenis (?) brachyurus, Günther.

Ann. and Mag. Nat. Hist. 1866, Ser. 3., Vol. XVIII, p. 27, pl. vi, figs. A. A.

A small snake, which I captured on the ground in thin tree jungle, proves to belong to this rare species, though it differs so much in appearance from other Indian forms of *Zamenis* that I was inclined to look upon it as a species of *Coronella*. The specimen measured when captured 21½ inches, of which the tail is 3 inches only. Ventrals 213, subcaudals 53. It agrees very well with Günther's description. In the fresh specimen the coloration was almost uniform, olivaceous above and whitish below, in spirits an indistinct marking becomes more apparent, the anterior portion of the scales in the front part of the trunk being paler than the remainder, and the ventral scales have a dark hinder border. The last maxillary tooth is very little if at all larger than the preceding, and although, on one side of the jaw, it is separated from the latter by an interspace, this is evidently due to loss, as, on the opposite side, the distances between all the teeth are regular. If perfect, there would probably be about 10 or 12 maxillary teeth on each side of the jaw.

The back is somewhat compressed and almost keeled towards the tail, the scales are perfectly smooth, in 23 rows, and the anal undivided, as in the British Museum specimen.

Loc. S. E. Berár, near Wún.

24. Dendrophis picta, (G m.)

A single specimen procured has 196 ventral and 135 subcaudal shields, the number of the former being considerably greater than usual. The coloration is also a little different from that given by Günther. The whole of the upper surface in brown, paler in the middle of the back. Ventral portion white with a slight dusky band along each side just about the edges of the ventral scales. Some black irregular spots on each side behind the head.

Loc. Jashpúr, W. of Chota Nágpúr.

25. Passerita mycterizans, (L.)

A specimen 44 inches long is a female containing 4 large eggs. Ventrals 194, subcaudals 148.

Loc. Korba, Biláspúr. This is I fancy nearly as far to the westward as it is found in Central India. I have never noticed it near Nágpúr, in Berár, or in the western portion of the Nerbudda valley. In Bengal and Orissa it is one of the commonest snakes. It is also found in the western ghats near Bombay,* P. Z. S. 1869, p. 502.

26. Lycodon aulicus, (L).

The only specimen obtained belongs to the var δ of Günther's Reptiles, ferruginous brown with yellowish white cross bands on the back. Ventrals 205, subcaudals 66.

Loc. Udipúr, west of Chota Nágpúr.

27. Naja tripudians, Merr.

All the specimens I have seen in the Chánda and Nágpúr country as well as those in Berár and throughout the Deccan have the

* I would here call attention to the evidence afforded by the list of reptilia *l. c.* collected by Dr. Leith of the occurrence of Malabar forms of Reptiles in the hills near Bombay. Amongst the species enumerated from Mahableshwar and Matheran are *Gymnodactylus deccanensis*, *Calotes Rouxii*, *Silybura macrolepis*, *Cynophis malabaricus*, *Trimeresurus gramineus* (an Indo-Chinese form) and *Hylorana malabarica*. With the exception of *Calotes*, I am not sure that any of the above genera even have been found in the Deccan proper, that is, the open country between the Western Ghats and Nágpúr. Sykes did not distinguish the two well marked faunas on the edge of which he collected. I have already shewn (J. A. S. B. 1869 Pt. II, pp. 178 and 184 &c.) that many Malabar birds range northward along the Western Ghats in the same manner as the reptiles are now proved to do, and as is the case with land-shells.

double ocellus or "spectacle mark" more or less well developed. I have not myself seen the common Lower Bengal and Burmese form with the single large ocellus on the neck in Central India.

28. Bungarus cæruleus, (Schneid.)

A female of this much dreaded snake was brought to me at Korba in Biláspúr. It contained 9 eggs, each above an inch long, enclosed in a cartilaginous skin. Length of the snake 35 inches, of the tail 3½.

29. Daboia Russellii, (Shaw.)

Although not abundant I have seen this snake in S. E. Berár, and also near Bétúl. It is a sluggish animal; a friend once told me he had carried one home under the belief that it was a young Python, the markings not being much dissimilar; it made no attempt to injure him, and he was only undeceived by one of his dogs being bitten and quickly killed by the snake.

Class AMPHIBIA.

30. Rana cyanophlyctis, Schneid.

Extremely common in tanks, keeping in the water or on the edge. My largest specimens are less than 2 inches in length, but I have seen some a little larger.

Loc. S. E. Berár, Chánda, Raipúr. I did not see this frog in the country east of Biláspúr where there are no large tanks.

31. Rana gracilis, Wieg.

Equally common with the last in Chánda and Raipúr. It keeps more in marshy ground at some distance from the water's edge.

Günther mentions that specimens of this frog received from Madras have the hind legs a little longer than examples from Indo-Chinese countries. I find them in frogs from the Central Provinces to be considerably longer than the dimensions said to prevail usually, instead of the distance from the vent to the metatarsal tubercle being equal to that of the body or a little more, it exceeds the latter in a proportion varying in different specimens between 6:5 and 10:9. I did not obtain a single example exceeding 1·3 inches in length of body. The coloration varies greatly, usually it is olive or brownish olive with large irregular dusky transverse bands on both body and limbs. Sometimes there is a pale yellowish or pinkish streak down the back, and this varies from a narrow line to a band one-third the breadth. All these variations may be found around the same tank. As a rule specimens with the pale dorsal line are much rarer and more local than those uniformly colored.

Loc. Chánda, Raipúr &c., in all damp places. I believe I met with this frog in Chota-Nágpúr also, but I can find no specimens amongst those collected.

32. Pyxicephalus breviceps, (Schneid.)

I obtained a single specimen of this frog, apparently young. It measures 1.5 inches from nose to vent, the hind leg from the vent to the end of the toes being just over 2 inches long. The coloration differs considerably from that given by Günther, there being no trace of a yellow dorsal band. The following description was taken from the living animal.

Upper parts yellowish brown (greyish in spirits) with a transverse dark mark between the hinder part of the eyes and some blackish patches in front of them and around the nostrils, the back with small imperfect black rings, some of which behind the shoulders are arranged in an arc with the convex side in front, others are irregularly scattered; sides of body and the thighs before and behind mottled with yellow; the limbs with some transverse dusky marks, and dusky patches on the sides of the chin; rest of the lower parts white except under the thighs where the skin is flesh coloured.

The abdomen and back part of the thighs are granular, the back and the remainder of the body smooth. Maxillary teeth very small scarcely perceptible, vomerine teeth separated from the choanæ by a wider space than from each other.

Loc. Udipúr between Chota-Nágpúr and Biláspúr.

33. Callula pulchra, Gray.

A single young specimen about an inch long was found under a large stone. The toes are absolutely free, but this is very probably due to immaturity, as it appears to differ in no other respect from larger specimens. The tongue is slightly notched behind and grooved above. The skin is perfectly smooth; colour brown above irregularly spotted with ash grey, below whitish.

Loc. Bhandára district, Nágpúr division of the Central Provinces.

34. Polypedates maculatus, (Gray.)

I found a few specimens mostly amongst bushes or grass by the sides of rivers. The largest procured measures 2.3 inches from nose to vent, hind leg from vent to end of toes 3·8 inches. In a small specimen the same measurements are 2 and 3 inches respectively. The following is a description of the coloration of fresh specimens.

Upper parts ochreous yellow, yellowish brown or chocolate, an indistinct dusky mark, often nearly obsolete, between the eyes, and transverse dark bands on the back of the limbs, occasionally some indistinct dusky blotches on the back also, but none of these are very constant, a dark band runs from the nostril to the eye and a broader one from behind the eye through the tympanum to above the shoulder; before and behind the thigh, and the hinder part of the side flesh coloured with large yellow spots; lower part of the limbs and belly pinkish white.

The skin is smooth above; there are fine, close, granular tubercles throughout the abdomen and the lower and hinder sides of the thighs.

The vomerine teeth are in very short rows widely separated from each other in the middle.

Loc. Eastern part of Chánda, Bilâspúr, Udipúr.

On the Method of Assaying Silver adopted in the Assay offices of H. M. Indian Mints, *by* H. E. Busteed, M. D., *H. M. Madras Army, Officiating Assay Master, Calcutta Mint.*

[with pl. xvii.]

[Read and received Sept 7th, 1870.]

The process of assaying silver about to be considered is one which (on a large scale, at least) is peculiar to the Indian Mints: it has been in practice in the Calcutta Mint since 1850, it extended thence in course of time to the Bombay Mint and more recently to the Madras one.

Though it has been favourably reported on, and described more or less fully as an official duty by various assay officers to local Mint Committees, &c., &c., no steps, that I am aware of, have yet been taken towards making more public the manipulatary details of the process.

It has been suggested to me that it might prove not only interesting, but useful to have described the practical working of a system, of the utility of which great experience has been afforded in the Indian Mints, as, on assays made by it, an amount of silver bullion reaching on an average the value of over seven* millions sterling is annually purchased by these Mints, and by it a silver coinage to about the same value annually, is watched over as regards its purity and maintained up to the legal standard of fineness.

I propose, therefore, to give a somewhat detailed account of the process, omitting only the minor steps in the manipulations, which it would be unprofitably tedious to attempt to bring within the compass of a description; practice alone can lead to an acquaintance, or can familiarize, with these.

To render more intelligible to the general reader the nature and object of this process of assay, and wherein it contrasts with the other methods in more general use, it may be desirable in the first place to allude briefly to the principles on which those other systems depend for their results, avoiding technicalities and details, as a full description of those processes may be found in any work on Assaying, and in most works of Chemistry and Metallurgy.

* Average for last 20 years.

In general terms then, it may be said, that the particular duty of an Assayer is to ascertain the proportion of pure gold or silver present in any specimen of mixed metal submitted to him for examination, so that from his report the value may be assigned by calculation to the mass which the sample is supposed to fairly represent.

This is done by the separation of the precious metals from the coarser ones with which they may happen to be alloyed.

The most ancient plan for thus separating silver is that by "Cupellation" which attains the end in view, owing to the fact that silver resists the action of air, at a high temperature, while the baser metals under identical circumstances become oxidized, and if a certain proportion of lead be present, its very fusible oxide unites with the other oxides produced during the operation and renders them capable of soaking with it into a porous little vessel (made of bone-ash), called a cupel, leaving behind on the surface of each cupel, a glistening button of pure metallic* silver, whose weight can be accurately ascertained.

A certain weight of the specimen of the metal to be assayed is folded up in a certain proportion of thin lead and placed on a cupel. The operation is conducted in a suitable oven (called a "muffle") and furnace. When the remaining little button of silver has cooled, it is weighed and the loss of weight of the specimen operated on represents the baser metals that have been removed: thus if the specimen weighed 20 grains and the resulting bead of pure metal weighs 15 grains the mass would be reported to contain 75 per cent. of pure silver.

Several contingencies, however, and collateral circumstances (known to assayers) tend to modify the result of an assay by cupellation, and the assayer has to consider them all in arranging his compensation, failing this the report would be most erroneous; everything, therefore, depends on his skill and experience; but even in the hands of the most experienced and the most skilful the result will fall short of accuracy, and a margin for error must be left, owing to unavoidable imperfection in the assay: the average

* Should gold or platinum happen to be present in the specimen assayed, as they also resist oxidation, they remain behind, included in the "button," and are under ordinary circumstances estimated as silver.

range of this error ought not, however, to exceed ½ dwt. (6 grs.) in the lb. Troy, or say 2 parts in 1000 ; so that this method is sufficiently accurate for keeping a coinage tolerably close to " Standard" and even well within* the legal limits on either side of it.

The assay report furnished by it, however, is too remote from accuracy, *i. e.*, is not within sufficiently narrow limits to fairly regulate the valuation of merchants' bullion with satisfaction to seller or buyer, the latter being, in this country, almost invariably the Mint.†

The above was the method of assay prevailing in this Mint up to 1850. Though it is still practised by many English assayers of great skill, it has been almost entirely superseded on the Continent in consquence of its short-coming by one contrived by Gay Lussac, which is less dependent on the individual operator.

This, known as La voie humide, or the volumetric process for ascertaining the fineness of silver bullion, consists in precipitating the silver as an insoluble chloride from the solution in nitric acid of a certain weight of the metal to be examined, and in effecting this by the use of a solution of common salt (chloride of sodium), containing a known proportion of salt ; this is added gradually till just sufficient has been used to throw down the whole of the silver present as chloride : as chlorine unites with silver in definite chemical proportion, the amount of silver present can be easily and accurately estimated by merely ascertaining the amount of salt which has been exactly necessary to convert the whole of it into chloride of silver.

This is the method practised at the Paris Mint, and by the eminent outside assayers to the Royal Mint of Great Britain, and I believe at most of the European and American Mints.

* It being impossible in the operations of a mint to produce a certain mixture of metals (such as silver and copper) with mathematical accuracy, a certain deviation is allowed above or below the legal standard: In India this deviation or "remedy" in fineness is 1 dwt. in the pound Troy *i. e.* $\frac{1}{240}$th part equal to about 4⅙ parts in 1000.

P. S. Since this paper was read, a Legislative Act of the Government of India has been promulgated which declares that the remedy in fineness is not to exceed 2 thousandths for the Rupee and Half Rupee, and 3 thousandths in the case of the smaller silver coins.

† *i. e.* The Mint receives the bullion in bulk and returns it in coin, a certain seignorage to cover expenses being deducted.

Assays can be confidently made by it to ¼ dwt. or about 6 grains in the pound Troy, or even indeed to half this, say to ½ part (0.5) in 1000.

The volumetric system is especially applicable where the silver to be assayed by it is alloyed with copper only, and where the fineness is approximately known beforehand; both these conditions to its successful usage exist in such Mints, where the only silver assays made are those of metal already alligated for coinage to the legal standard.

It is acknowledged by its advocates that the presence of mercury in the alloy would materially interfere with the accuracy of the assay, and a certain (rather tedious) modification of the process is essential to avoid error under such a contingency.

Its adoption in the Indian Mints was not considered desirable by their assay officers for reasons of which the following are a few :—1, A vast amount of the silver which comes to the Indian Mints, (*viz.*, China and Rangoon Sycee, bazaar cake silver, Japanese coins, &c.,) contains not only mercury, but lead and other coarse metals. 2, No sufficiently approximate idea of the fineness of such silver can be formed before hand, thus necessitating a preliminary assay by cupellation. 3, The high temperature of an Indian climate renders it impossible to retain the solution of salt at an uniform strength for any length of time; the evaporation and concentration derange the equivalence which it is essential to maintain between *it* and the proportion of silver meant to be precipitated by it; thus involving very frequent tedious testing to ascertain daily the actual strength of the standard solution. 4, The whole of the important manipulations should be gone through by the Assay Master himself or his Deputy, a labour beyond their strength in this climate with a very large daily number of assays of various finenesses; and one which would preclude the possibility of his attending to the many other important duties which devolve on the head of an Assay office to a Mint in India.

The method of assay by cupellation then not being accurate enough for the requirements of trade, and that by the French process being considered unsuited to the peculiar work devolving on the assay officers of the Mints in India (where there are no bullion refineries), it became necessary here to adapt and introduce a system more likely to fulfil all the objects required of it.

In the volumetric system it has been seen that the proportion of silver present in a mixed metal is estimated by ascertaining the exact amount of salt which it took to precipitate it in the form of chloride of silver; the same end can be attained by collecting, drying and weighing the chloride itself.

100 parts of it represent 75·3 of pure (metallic) silver.

Hitherto this process when resorted to at all seems to have been restricted to a very limited application, such as a solitary analysis for some special purpose, possibly the examination of a standard "trial-plate" where the greatest accuracy was required, or perhaps an assayer would resort to it as a delicate confirmatory test of one or two of his assays by the volumetric method.

Some books which go into the principles and details of the assaying of silver, make no mention of it whatever, others allude to it, merely to dismiss it, as "tedious and less exact" (than the French process). In *theory*, the process is allowed by all to have the merits of accuracy and simplicity, but it is implied that the tediousness and difficulties of the manipulations (supposed to be) necessary to the carrying out of the theory, detract materially from its practical value: certainly the few details of the manipulations occasionally given, such as the weighing the chloride of each assay (after collecting on a filter and fusion)* in a porcelain capsule, previously counterpoised, were calculated to deter from the idea of this process being ever made available for the assay of silver on a *large scale.*

The credit is due to Mr. J. Dodd, a former assay master of the Calcutta Mint (and a Surgeon in the Madras army) of having encountered those difficulties of manipulation, and of having overcome them inasmuch as he modified and simplified them, and in short so systematised the whole practical working of the process, as to render its application to the assaying of silver, to any amount, easy, accurate and economical.

* Of course in practice it would be necessary periodically to recover the silver (by reducing it to the metallic state) from the closely attached fused chloride in each capsule,—a very tedious measure.

That this result was not attained without much labour and much patient investigation, and that his successors in office acknowledge their deep obligation to Mr. Dodd's intelligent industry will be apparent from the officially recorded testimony of two of them, which I think it due to him and to them not to withhold, when making mention of the practical carrying out of this method of assay.

Viz. Sir Wm. O'Shaughnessy, who was Deputy Assay Master of the Calcutta Mint in Mr. Dodd's time, and himself a practical chemist of high reputation, writes in April, 1852.

"Previous to making over charge of the assay office to Dr. "Shaw on the occasion of my proceeding to England on duty, "I deem it an act of justice towards the assay master, Mr. James "Dodd to place upon record an acknowledgment of the emi- "nent service Dr. Dodd has rendered to the Assay Department "and to the art of assaying generally by his investigation of the "analytical process for assaying silver, his improvements in the "manipulation of the process, and his admirable system of arrange- "ment which renders it capable of effecting in 24 hours more "assays of silver than the mint can ever require in that time."

Dr. Shekleton the present assay master (now on leave), an assayer of long experience, when giving officially to the Mint Committee at their request a detailed statement of the process, says (April '55), "It would be quite impossible, however, by any "*mere* description to form an adequate idea of the elegance of the "process on the perfection to which it has been brought by the "skill and unwearying industry of Mr. Dodd, late assay master. "To him is due not only the merit of its introduction, but the "removal of every practical difficulty in its working; the confi- "dence with which his system has been adopted by all his succes- "sors is the highest tribute to its completeness and efficiency."*

Method of assaying silver by the "chloride process" (as conducted in the Calcutta Mint) given somewhat in detail.

The samples (or "musters") for assay are, to save time, first approximately weighed by an assistant, they are then placed

* When in the Madras Mint, I remember seeing recorded similar testimony from Dr. Shaw, the Assay Master, when describing the process on recommending to the Madras Government its adoption in his office.

(each sample in duplicate) in small shallow saucers of polished copper and so brought in batches of 40 on a board, containing in numerical order receptacles for the little saucer, to the Assay Master who, in the delicate assay balance, exactly brings each sample to the one required weight.*

As each sample is weighed, it is transferred from the platinum skiff of the balance to a bottle on the left hand of the assayer, by means of a small copper funnel. The bottles† for this purpose are held in readiness for the musters by an assistant and, on receiving them, are removed into the Laboratory in batches of six.

On being taken to the laboratory, they are ranged on a circular platform or turn-table and there one of the (European) assistants adds by means of a pipette 1½ drachms of nitric acid to each bottle, which are then (without their stoppers) transferred to a sand-bath and exposed to a considerable degree of heat, till solution of the contents is effected.

The specific gravity of the nitric acid used is generally 1200, *i. e.* in the case of known alloys of only copper and silver, such as the standard meltings, coins, &c., but when the nature of the alloy is uncertain, such as bazaar silver, or some sycee, (where the presence of mercury may be suspected), a stronger acid of sp. gr. 1320 is used. It has been found too by experience that the chlorides from fine bar silver eventuate better, when the solution has been effected in the stronger acid.

When the samples have been completely dissolved,‡ the bottles are brought back to the platform and there each receives through a glass funnel§ about six ounces of cold distilled water.

There is then added to each bottle through a glass pipette, as before, 1½ drachms of hydrochloric acid, sp. grav. 1060, which immediately converts the silver present into the characteristic white precipitate of chloride of silver, which forms in slow-falling curdy volumes.

* The amount of this weight will be more particularly referred to further on.

† The chief appliances will be described more fully in an appendix.

‡ A slight residuum of gold, as a black powder is very generally seen.

§ The portion of this which enters the neck of the bottle is protected, or sheathed, with an inch of India rubber tubing to prevent chipping, if struck against the neck of the bottle.

The stoppers (previously dipped in distilled water) are then carefully replaced and the bottles are allowed to stand for five minutes.

The bottles are next well shaken two and two by the laboratory workmen for three or four minutes till the chloride aggregates and rapidly falls down, any particles which may remain attached to the neck or upper part of the bottles are washed down by a quick circular motion, and more distilled water being added to within about two inches of the neck, (great caution being observed in removing and returning the stoppers); the bottles are then allowed to rest each in its assigned place on the platform for four hours.

At the expiration of that period, the clear supernatant liquid (blue coloured when copper is present) is removed by a glass syphon, which is lowered to within an inch of the deposited chloride, the greatest care being taken that none of it is drawn up into the syphon. As each platform is made to revolve on its centre, according as each bottle is syphoned, the operator sitting in one place brings the platform round till the next bottle in order gets under the syphon, which is thus in rotation lowered into each. The fluid escapes from the long leg of the syphon through a funnel fitted in the table to a jar placed underneath.

After the first syphoning, the bottles are immediately filled again with distilled water, and each gets a quiet circular motion for a few moments, and the precipitate is again allowed to settle as evenly as possible, this time it will be sufficient to allow them to rest for two hours, when they are again syphoned as before and the stoppers returned.

Under ordinary circumstances these two washings are sufficient, but if the silver is evidently "coarse," a third or fourth washing is similarly given.

When it is considered that the chlorides have been sufficiently washed, the bottles are placed for half an hour in a reclining position on their platforms, this causes the chloride to fall and settle to one spot and renders its removal from the bottles more easy.

Meantime a pneumatic trough has been got ready, capable of containing a batch of twenty inverted bottles; the trough is filled with distilled water: for each bottle there is placed on the floor of the trough a small porcelain saucer holding a little Wedge-wood crucible or cup, each numbered to correspond to the bottles. A laboratory workman then removes the stoppers from the bottles and hands them one by one to an assistant at the trough, who placing his forefinger over the mouth of each bottle inverts it over its corresponding cup, and does not remove his finger till the neck of the bottle has passed down through the water and well into the cup: then the finger being taken away the bulk of the chloride falls by its own weight to the bottom of the cup.

The bottle is held in the position by two rings one (the larger) above the other, which are fixed to the sides of the trough: this arrangement retains each bottle in situ, at the proper slant, and admits of the operator gently revolving or slightly raising the bottle with his left hand, while with the right he patiently taps the bottom and sides till the whole of the chloride has been dexterously got out, the finger is then again placed over the mouth and the bottle raised up through the rings and handed (mouth upwards) to the assayer, or to the supervising assistant standing by, who carefully examines it to see that every particle of chloride has been dropped into the cup. When this part of the manipulation has been neatly done, none of the chloride falls over into the saucer which is placed as a precautionary measure under each cup.

When the chloride falls into the cup, it is in an uneven lumpy state and not in a favourable condition for being uniformly dried, it has therefore next to be broken up. For this purpose the cups (containing the chlorides, and water to the brim) on removal from the trough are taken in batches on a tray to an assistant seated at a steady table, who first carefully decants off about half the water, and then with a finely polished glass rod (four inches long and one-third inch thick) gently stirs and beats the lumpy precipitate, while revolving the cup on the table; this causes it to lie evenly and loosely at the bottom of the cup as a purplish grey powder, not too fine.

He next washes the rod over the cup with distilled water from a drop bottle, lest any of the chloride may be adhering to it, and sprinkles a drop or two from it on to the surface of the water in each cup, so as to cause to sink any minute particles that may happen to remain floating. He then, after an interval of ten minutes, drains off about three-fourths of the supernatant water, which he lets run down the rod into a vessel near him, and with a tap or two with the rod to the outside of the cup to still further loosen the deposit, this part of the manipulation is concluded.

The crucibles are next taken to the drying furnace, where a steam bath is ready to receive them, on the perforated upper plate of this they are ranged, and allowed to remain for about an hour. This gradually and without spurting, frees the chlorides from moisture, which may be known by their caking, *i. e.*, leaving the sides of the cups round the edges and forming at the bottom of each a loose cake, resembling somewhat a gun-wad. The crucibles are then arranged on a hot air plate and there exposed to a temperature of between 300° and 350° (Fahr.) for about 2 hours, till thoroughly dried, when they are ready for weighing.* When the above manipulations have been carefully and satisfactorily gone through, each little cup contains an unbroken, tolerably firm, cake of chloride of silver, lying unattached, which admits of being easily grasped with a pair of forceps, and cleanly lifted out of the cup and conveyed to the skiff of the assay balance in which it is weighed. The cups are generally brought from the laboratory to the assayer at the balance, in batches of 8 or 10. A "Standard," synthetically prepared of pure silver and copper, and an assay pound of pure silver are introduced with each day's set of assays and their chlorides dried with the others, and the analysis of them verified before weighing the rest. Occasionally these "checks" are also fused and weighed in a porcelain capsule, but the weight found never differs from that of the chloride merely dried as above.

Once, or twice a month, the silver is recovered from the accumulated chlorides, which are well pounded in a mortar and brought to a powder and then mixed with a proper proportion of chalk and charcoal, and put into a wrought iron crucible and reduced with

* The chlorides are weighed warm, to obviate the risk of their absorbing moisture ; a precaution especially necessary in the heavy monsoon weather in this country.

heat. The metallic silver so recovered is transferred to the Mint.

Under the circumstances of the solution and of the precipitation as detailed above, should any gold happen to be present in the sample operated on, it is not dissolved, and therefore becomes entangled with the precipitated chloride of silver and dried and weighed with it, and accordingly comes to be regarded and valued as silver. In this the chloride process resembles that by cupellation, which likewise takes no distinguishing cognizance of gold, and both these processes contrast in this respect with the volumetric one which is a rigid analysis for silver alone ; so that, strictly speaking, an assay conducted by either of the first-named methods ascertains the proportion present of " the precious metals," *i. e.* silver and gold.*

Should mercury be present it does not interfere with the result, when the solution has been effected in excess of nitric acid with strong heat. Thus the mercury becomes peroxidized, and hydrochloric acid forms no precipitate in solutions of mercuric salts : any mercuric chloride resulting from the combination would remain in solution, and be washed away in the course of the process.

Should lead happen to be present, hydrochloric acid gives no *precipitate* in a dilute solution, the chloride of lead being soluble in a certain proportion of distilled water : but even were the proportion of lead to silver tolerably large, and the chloride of lead happened to be thrown down, the repeated washings would dissolve and get rid of it.

With regard to the weight of the small portion taken to represent the mass, the system prevails in the Indian Mints of taking samples for assay by granulating a small portion of the contents of each melting pot; when the metal is in a thorough state of fusion and has just been well stirred, a small ladleful of the molten metal is quickly poured from a tolerable height into

* Much of the silver which finds its way to the Indian Mints is rich in gold ; for instance sycee contains on an average somewhat about 12 grains in the Troy pound. This in minting operations is considered as silver, and as such it enters into the coinage. There being as yet no refineries established here, through which such silver could pass to the Mechanical Departments of the Mints, the silver coins made during a period when a heavy importation of sycee had been worked up, contain as much as 4 or 6 grains of gold in every 32 tolas or 1 ℔ Troy.

a vessel of water, and the granules so formed received on a strainer, lifted out and perfectly dried.* The weight of this specimen representing each pot was at first fixed at 24 grains technically called the "assay ℔"; this in the case of pure silver yielded 31.87 grains of chloride of silver, while the same quantity of Indian Standard silver (which is $\frac{11}{12}$th silver plus $\frac{1}{12}$th copper = 916.66 in 1000) yielded one-twelfth less or 29.21 grains;—on the weight of chloride being ascertained in each case a table which was calculated and prepared for the purpose was referred to and the equivalent fineness assigned to the $\frac{1}{2}$ dwt., plus the odd grains, when any. But when it became desirable to prepare for the decimal form of notation, a number more convenient than 31.87 was looked for to represent purity or 1000, and 25 was fixed on as a desirable starting point, particularly as the quantity of pure silver yielding that amount of chloride, *viz.* 18.825 grains, was quite large enough to represent each pot.†

The weight therefore of the "assay pound" in use at present is 18·825 grs. This produces (with chlorine) in the case of pure silver 25 grains of chloride of silver.‡

But to obviate the necessity of constant reference to a calculated table to find the equivalent in pure silver of the amount of chloride of silver found in each case, it was ingeniously arranged to stamp each of the assay weights not with its actual weight, but with the

* The introduction into the Calcutta Mint, of this system of taking musters is I find attributable to Dr. Boycott, late Assay Master, and to Dr. Shekleton, who by a number of interesting experiments satisfied themselves that samples so taken represent the mass of mixed metal to be valued much more fairly than samples of the same mass cut or gouged from it after it has been poured and allowed to cool in the ingot moulds where a partial separation of the copper from the silver seems to take place; the result being, according to the above experiments, that in the case of ingots cast in upright moulds, all the outside is much below the average fineness of the mass on assay, and the centre much above it. This refers to alloys of silver and copper mixed in or about the proportion of "standard." According to Monsieur Levol, however, it would appear that when an alloy of silver and copper in which the proportion of the latter is very high (*viz.* over 28 per cent.) has been melted, poured, and allowed to cool, an opposite result to the above is found, *viz.* the *outside* of the ingots is *above* the average fineness. An assay therefore from a granulated sample must give a much nearer approximation to truth, than one from a cut sample.

† The average weight of the contents of each melting pot is 12,500 tolas or about 390 pounds Troy, so that the specimen taken to represent this is but about the 119,000th part; each sample is assayed in duplicate.

‡ The basis for these numbers was founded on the proportion in which, *according to Turner,* silver combines with chlorine *viz.* 100 parts with 32.80.

figures representing the proportion per mille of pure metal which such a weight of chloride so found corresponds to; thus, supposing a melting of five franc pieces was being assayed, and the chloride resulting from the assay pound operated on, weighed 22.5 grains, (shewing the actual pure contents in the sample to be 16.94 grs.), instead of referring to a table to see the equivalent per mille-age of pure silver, that weight which is actually 22.5 grs. has 900 marked on it, and the assayer simply reads the touch from it.

Accordingly the assay weights are as follows :—

Actual Weight, in grains.	Figures marked on the weights.
25	1000
22·91 (Std.)	916·66
22·5	900
20	800
17·5	700
15·0	600
12·5	500
10	400
7·5	300
5·0	200
2·5	100
1·25	50
1·0	40
0·75	30
0·50	20
0·25	10
0·125	5
0·100	4
0·075	3
0·050	2
0·025	1

Assay ℔., weight = 18·825 grains.

The assays for the valuation of merchants' bullion are reported to the $\frac{1}{1000}$th part, *i. e.*, the value of our smallest weight, and as the distance from zero to the point (shown by a scale and indicator) at which the balance "breaks" with this weight in either pan is sub-divided into five, the decimals over or under one-thousandth can be read off.

Accordingly assays are reported to the mint office (as a matter of interior economy, for facilitating the alligation arrangements) to ·4 and ·6 (*e. g.* "997·4": "900·6"), and the assays of the standard meltings and of the local pyx coins are reported to ·2. Thus reports are made with confidence by this process to a little over 1 grain (1·152) in the Troy pound.

Though the whole process can be carried through to completion in the case of a small number of assays within 24 hours, still in the ordinary heavy current work of the office, assays are not completed till the third day. Thus, the samples are tendered suppose on Monday, they are "weighed in" dissolved and precipitated on that day, on the next they are washed and syphoned twice, and on Wednesday they are "potted," dried and reported. The certificates of value (payable on demand at the Government Bank) are examined and signed by the assay master on the following morning and handed to the merchant or his agent. In like manner samples tendered on Tuesday are, under ordinary circumstances, weighed and reported by the assay master on Thursday, and so the work goes on steadily, under a systematized routine, where each hour has its assigned duty.*

An ordinary day-work consists of eighty assays,† estimating imported bullion to the value of 4 lacs of rupees, and standard meltings and coins to the value of 5 lacs. But on emergencies, in time of heavy pressure, by working extra hours, as many as 164 assays have been daily conducted, estimating bullion to the value of eight lacs of rupees, and standard coins and meltings to the value of fourteen lacs.

Such is an outline of the method of assay, worked on a large

* When holidays or Sundays intervene, the current work is so arranged that the chlorides are not allowed to remain an undue time exposed in the bottles, more especially after the second syphoning, when a minimum of acid is present; under such circumstances, the chlorides are found to lose somewhat in weight, becoming finely divided, easily broken, and showing a tendency to adhere to the cups:—similar results from allowing the chlorides to remain in the bottles with insufficiency of acid have been found to follow even when the bottles have been the whole time secluded from light. Syphoning too low must also, for similar reasons, be guarded against.

† Exclusive of any gold assays which may be going on.

scale; of course successful results from it cannot be expected unless each step in the manipulation be conducted with great care and accuracy, and only then after much practice and experience.

The natives of this country possess great aptitude in acquiring the skill and confident lightness of touch, so essential for delicate manipulation; this, added to their characteristic patience, makes them admirable subordinates in an assay laboratory, under judicious supervision;* moreover, their labour is cheap, so that on the whole, the process seems to be especially suitable for an Indian Mint.

When bar silver is imported from the Continent, the assays of it, made here, almost invariably correspond most closely with those previously made of it in Paris by the volumetric method. But were further proof needed of the practical accuracy of our system, it is to be found in the very close proximity to the legal standard, at which the large Indian coinage has been maintained for many years, as annually reported by the assayers to the Royal Mint of Great Britain, who test the fineness of the Indian pyx coins by the French humid process.

Without this method (improved and made more perfect, as it has been, in the hands of successive Assay officers,) it would, to my mind, have been very difficult for the assay establishments of the Indian Mints to have dealt with, *in the same time and with the same accuracy*, the immense importation of silver to India during the last 15 years. In the single year 1865-66, there was poured into the Indian Mints, and manufactured into coin, silver alone reaching in value to the prodigious amount of over 14 millions sterling.

The system which enabled the assay officers to value such a rapid and heavy influx with accuracy, and with satisfaction to the importer on the one hand and to the mint (the buyer) on the

* The Calcutta Assay office has been fortunate in the possession of its Foreman, Mr. Frewin, who for over 30 years has been actively engaged in assay operations. He was head assistant in the office under Mr. Dodd when the latter was investigating the adaptation of this system, and no doubt Mr. Frewin's intelligence and dexterity contributed to its successful introduction and subsequent working; he has trained numerous subordinates to the laboratory work who have turned out expert manipulators.

other, and to faithfully maintain the immense resulting coinage close to legal standard, has been put to a severe test. If success be the criterion of merit, the 20 years' large experience of this method gained in the Indian Mints goes, I think, to show that it is worthy of a yet wider field of utility.

Appendix.

1. The bottles, used in this process, are of thin (but strong) white glass and contain about 12 fluid ounces : about 6 inches in height and 2½ inches in diameter at the bottom, which should present a perfectly even, level floor : they are without any (abrupt) shoulder, but become gradually pyramidal from about half way up to the neck : this shape favours the easy dropping out of the chloride. The neck is about one inch in length, polished on its inner surface ; the stoppers are of ground glass, polished, with globular heads, and are made to fit with the utmost accuracy and smoothness. The bottles and stoppers are numbered, to correspond with the number on the muster board and also on the cups.

2. The "cups" are Wedgwood crucibles, smooth and thin, about 1½ inches in height, 1½ inches in diameter above, and a little less than one inch in outside diameter at the bottom. The floor should be perfectly level, and neither it or the sides should present any roughness likely to retain the chloride. The cups are all numbered.

3. The porcelain saucers are shallow, ¾ of an inch in depth, the upper diameter is about 4 inches, the lower 2½ inches.

4. The turn-table is a circular board of about 3 feet in diameter, fenced by a brass railing (or by a simple ledge) ; its centre is occupied by a raised platform about 2 feet in diameter, between which and the rail the bottles (26 on each) stand, the round outer edge of the platform having semilunar niches cut in it, into which the bottles fit ; opposite to each niche on the platform is a little concavity in which the stoppers rest when not in the bottles. Each turn-table is made to revolve on its centre in either direction, and is raised about 6 inches above the long general table on which all are supported ; close to each a funnel is fitted into the lower (sup-

porting) table for conducting away the fluid syphoned from each set of bottles.

5. The trough is a basin of cast iron (painted), it may be oblong or round, raised to about the height of 3 feet from the ground; when round and large enough for 20 bottles, space and distilled water may be economised by having a platform insulated in the centre. This is convenient for resting the bottles on after the chlorides have been got out. A trough of this kind may be about $2\frac{1}{2}$ feet in diameter, having a space 7 inches broad and 4" deep all round between the circumference of the basin itself and the outer edge of the island platform. Into this space is poured distilled water to the depth of 3 inches. From the rim of the trough hang as many brass supports as there are bottles to be inverted, these are two circular clasps connected at the back to a bar common to both: one, the larger, is $1\frac{1}{2}$ inch above the smaller and lower one which is under water; they are open in front (or towards the centre of the basin) to about $\frac{3}{4}$ of an inch in width. The openings of both are in the same line owing to the lower (smaller) segment being projected towards the centre by an abrupt curve in the connecting bar, by which they hang from the brim. This arrangement receives and fixes the inverted bottles in the required position. The distilled water is removed from the trough by the withdrawal of a plug. These troughs are sometimes made to revolve on the centre.

6. The drop bottle used for washing down the glass rod when breaking up the chlorides, and for sprinkling the surface of the cups, is small sized, round, so as to be easily grasped; it holds about six ounces. The stopper is hollow, with 2 small tubes leading from its head, one opposite to the other. Glass is so liable to break or chip, that a hollow silver stopper is now generally substituted.

7. The steam-bath is simply a square vessel made of sheet copper, between three and four inches deep, the top or upper plate of which has a number of circular openings about two-thirds of the diameter of a wedge-wood crucible. There is also a steam escape pipe leading from the centre below to about a foot in height. They are of various sizes to contain from 10 to 150 pots: they are raised or moved by two lateral handles.

8. Hot air plate: of thin sheet iron bored with holes for the reception of the crucibles, raised by iron feet about 1½ inches above the furnace plate. It is furnished with a square tin cover which fits over it. This is provided with lateral apertures for the escape of heated air, and with a tube from its roof for the reception of a thermometer.

The drying furnace on which the above rest is surmounted by a hood, the door of which (glazed) slides up and down by weights and pulleys; the plate is heated by means of gas jets; it has a good draught, to carry off the nitrous fumes, as on it the musters are dissolved in the first instance on a sand bath.

9. The forceps for removing the cake of chloride from each cup to the skiff of the balance should not be too sharp in its grasp, it is much improved by having the blades tipped for about an inch from the points with platinum about ⅛ inch in width.

10. It is a convenience to have the assay weights arranged in a set of ivory compartments in the weight box; on the floor of each compartment are engraved the figures corresponding to those engraved on the weight which occupies it; by this means the assayer has merely to glance at his weight box to see what weights are in the pan of the balance, and to read off the "touch" when each chloride is counterpoised.

Description of the Figures.

No. 1. The fluid being syphoned from the bottles; those in a slanting position on the turn-table have been syphoned for the last time, and the chloride is being thus caused to collect to one spot.

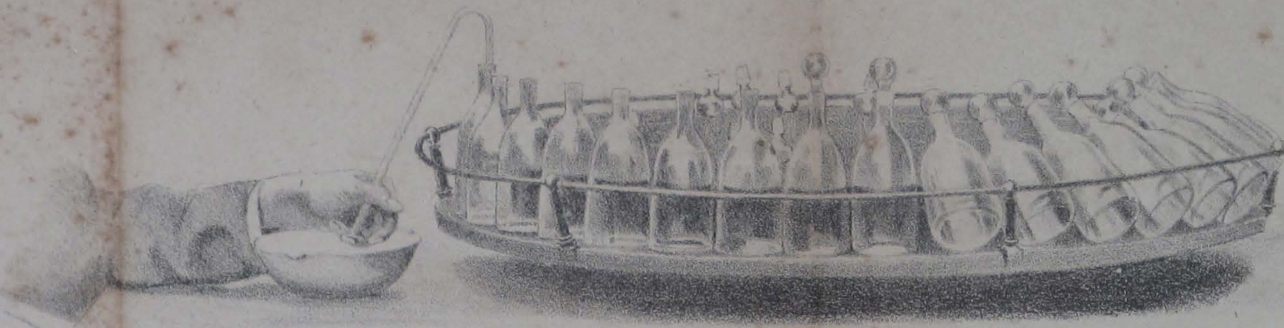
No. 2. The bottles in position in the trough—so as to let the chloride fall into the cups underneath the water.

No. 3. An assay bottle—in natural size—in which the sample is dissolved and the chloride of silver precipitated.

No. 4. Wedgwood cup in which the chloride is received, broken up and dried.

1. *Alycæus bifrons, p. 396.*
2. " *cucullatus, p. 396*
3. " *graphicus, Blf; var. p. 398.*
4. " *Feddenianus, p. 397.*
5. *Diplommatina scalaroidea, p. 399.*
7. *Nanina (Sesara) Attaranensis, p. 401.*
6. *Spiraculum Gordoni, p. 399.*
8. *Bythinia nassa, p. 402.*
9. *Lithoglyphus Martabanensis, p. 402.*

Dr. Busteed, Journ: Asiat: Soc: Bengal, Vol: XXXIX, Pt. II, 1870.



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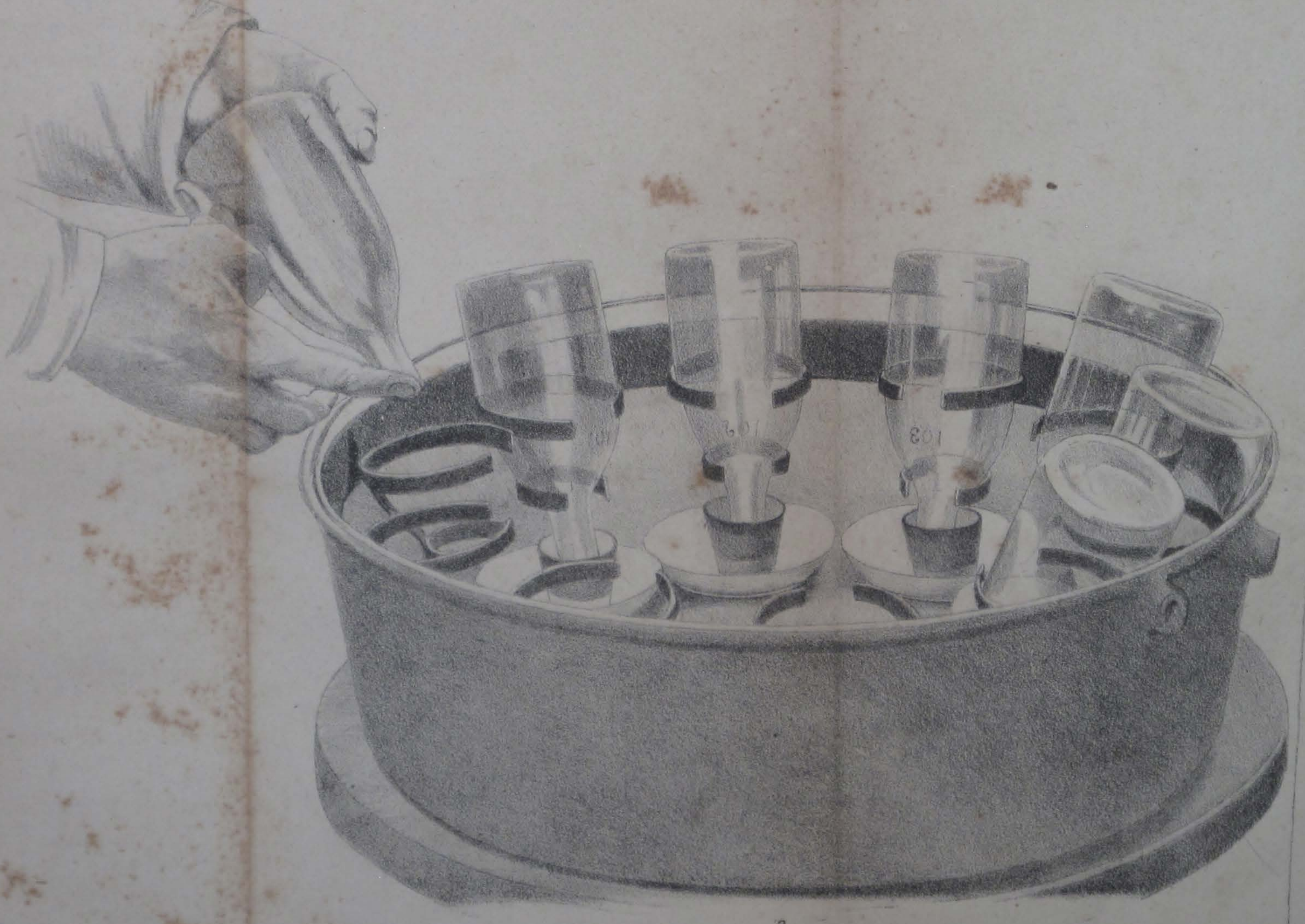


2.

4.

3.

Descriptions of some new land shells from the Shan States and Pegu,—*by* W. Theobald, Jun., Esq.

(With plate XVIII.)

[Received and read 7th September, 1870.]

On the return of my colleague, Mr. F e d d e n, from the valley of the upper Salwin, he was good enough to place in my hands a small, but most interesting collection of shells made in that region, of which I at once gave a meagre and imperfect list in the Journal Asiatic Society of Bengal (Vol. xxxiv, part ii, p. 273 etc.), with figures of some varieties of *Melania variabilis, &c.* I forwarded the greater part of the new shells home to Mr. B e n s o n in the hope, that they would be worthily described in the Annals and Magazine of Natural History. The bad health, however, of that veteran conchologist, prevented his publishing descriptions of them, and I have accordingly myself drawn up the characters of some of the new species from duplicates which I retained in my own hands. But as I have not as yet been able to recover the collection forwarded to Mr. B e n s o n, my present descriptions by no means embrace all the novelties procured by Mr. F e d d e n. In order to indicate the richness of the fauna, I must refer the reader to the rough list published in the above cited volume of our Journal. I may notice that, besides the new species here to be described from the Shan States, the following already known from the Burmese region are also represented in the collection; *Helix helicifera*, B l., *H. sanis*, B e n s.; *H. gratulator*, B l. (var.), *H. ansorina*, T h., *H. delibrata*, B e n s., *H. similaris*, F é r. var., *H. Oldhami*, B s., *H. Huttoni*, P f., *H. consepta*, B s., *Nanina vitrinoides*, D e s h., (?) *N. infula*, B s. (typical) and *N. attigia*, B s., *Hel. Blanfordi*, T h. *Bulimus Niligiricus*, P f., *B. vicarius*, B l., *Opeas Walkeri*, Bs., (this species and *H. sanis* were originally described from the Andamans); *Achatina (Glessula) Theobaldiana*, Hanley,* *Alycæus graphicus*, B l f. &c.

In addition to the new species from the Shan States, I have in the present communication also described a few interesting new

* Conch Indica. pl. xvii, fig. 5.

forms which I have within the last few years collected in Pegu and at Moulmein.

Jerdonia (?) Phayrei, n. sp.

Testâ parvâ, turbinatâ, perforatâ ; apice exserto ; anfractibus quinque, angulariter quadratis, convexe planatis, bicarinatis : carinâ quaque plurimis setis regulariter radiatim parumque sursum inclinatis armatâ, hâc peripheriali, illâ ad suturam positâ, in ultimo anfractu tantum carinis duabus solutis apparentibus; areâ circumumbiliacari duabus carinis filiformibus circumdatâ, umbilicum valde profundum coarctantibus. Epidermide vix scabriuscula, fusca, ad aperturam leviter striata. Aperturâ subcirculari, integrâ, haud obliquâ ; peristomate prope marginem superiorem breviter expanso. Diam. major .13, diam. min. .10, alt. .12 unc.

Habitat : " Shân States," valle superiori Salwin.

I have named this shell in compliment to Sir A. Phayre, first Chief Commissioner of British Burma, who directed the exploration of the upper Salwin. I include it merely provisionally in *Jerdonia*, as the operculum is unknown, and I have only one specimen to describe from. It may prove to be a *Cyathopoma.*

Alycæus bifrons, n. sp. Pl. XVIII, Fig. 1.

Testâ perspective umbilicata, depresse conoideâ, translucente, corneâ ; apice rubello ; spirâ elevatiusculâ, suturâ impressâ ; anfractibus quatuor, rotundis, juxta stricturam regulariter et confertim striato-costulatis, reliquâ parte aliquando fere lævigatis, aliquando levissime striatis. Stricturâ glabra, longâ, fere quartam partem ult. anfractus æquante, duabus costis fortissimis munitâ, quarum posterior paulo robustior et anteriore longior est ; tubulo suturali tenuissimo, adpresso, quartam peripheriæ æquante ; aperturâ ampla, circulari, sensim deflecta ; perist. duplici, albido, labio adnato angustissimo, labro infra modice incurvato. Diam. maj. .20, min. .15, alt. .10 unc.

Habitat : Shan States.

Alycæus cucullatus, n. sp. Pl. XVIII, Fig. 2.

Testâ umbilicatâ, depresse subdiscoideâ, rubente corneâ, transversim striatâ, juxta stricturam striis fortioribus sive costulis filiformibus confertissimis ornatâ; apice glabro, rufescente, elevatiusculo; anfractibus quatuor, convexis; tubulo suturali modico, quartam peripheriæ vix æquante; stricturâ brevi, lævigatâ, striis nonnullis costiformibus ad basin et costa crassa transversa notatâ. Apertura parum obliqua, subrotundata, fere soluta, labro externe modice expanso, lamellose undalato, ad marginem paulo incrassato, 5-inciso, lamella supera maxime producta; labio simplici, paulo arcuato, supra vix adnato; operculo corneo, margine elevato nucleoque centrali parum excavato. Diam. maj. .21, diam. min. .20, alt. .21 unc.

Habitat: Shan States.

This is a remarkably fine species with the crenulated lip of *A. plectocheilus* much exaggerated.

Alycæus Feddenianus, n. sp. Pl. XVIII, Fig. 4.

Testâ globoso subturbinata, profunde umbilicatâ, glabrâ, in ultimo anfractu ad suturam peculiariter deplanatâ, deinde subangulata et infra angulum levissime convexiuscula seu planata et angustata, solidâ, brunnea; anfractibus 3½, rapide crescentibus, superioribus, convexiusculis, ultimo supra et prope umbilicum angulato; tubulo suturali tenui, prope aperturam oriente et fere dimidium ultimi anfractus in longitudine æquante; strictura brevissima, vix conspicuca; apertura circulari, carneola, supra angustissime adanata; perist. duplici, interno integro, tenuissimo, externo breviter expansiusculo et reflexo. Diam. maj. .20, d. min. .16, alt. .16 unc.

Habitat: Shan States.

This shell is an interesting addition to the *Dioryx* group, the only other Pegu form being *A. (Dioryx) amphora*, B., first procured by myself at Moulmein. The latter is a very variable shell in size, unless two forms have been confounded under it, and Mr. Fedden's collection contained two examples of it from the upper Salwin, but I have not the means of re-examining these just now.

Out of four species of *Alycæus*, collected by Mr. Fedden, three are new; so that when greater facilities exist for examining this region, we may look for large additions to this very interesting genus of operculated land shells.

Alycæus graphicus, Blf., var., Pl. XVIII, Fig. 3.

Jour. Asiat. Soc., Bengal, 1862, Vol. xxxi, p. 137.

Beside the typical form described by Mr. Blanford from Arracan and Pegu, an interesting variety also occurs in the Shan States for the identification of which I am indebted to Mr. Blanford. It differs from the type by a shorter, more subtile and subglobose shape, and by the ribs on the whorls being slightly more distant from each other and very sharp. There are also some of the stronger ribs traceable even on the constriction near the aperture. The shell is pure white with the apex and the adjoining whorl beautifully pale yellow. I have given an illustration of this variety in order to facilitate comparison.

Diplommatina Salwiniana, n. sp.

Testâ sinistrorsâ, ovate turritâ, non rimatâ, pallidissime flavescente; suturâ impressâ; anfractibus 7½, convexis, regulariter crescentibus, transversim distincte striatis, striis in ult. anfractu magis distantibus; apertura rotundate ovata, margine columellari recto, dente parvo submediano instructo, margine externo uniforme curvato, tenuiter calloso. Long. .20, lat. .10 unc.

Habitat: Shan States.

Diplommatina pupæformis, n. sp.

Testâ sinistrorsâ, oblongo ovali, non rimatâ, pallidissime corneâ; suturâ impressâ; anfract. 7, regulariter crescentibus, transversaliter confertim striatis; apertura subcirculari, margine columellari brevi, recto, dente columellari modico instructo, labro duplici margine externo expanso. Long. .16, lat. ·08 unc.

Habitat: Shan States.

Diplommatina affinis, n. sp.

Testâ dextrorsâ, ovatâ, turritâ, vix rimatâ; anfract. 7, regulariter crescentibus, transversim leviter striatis, ultimo antice valde ascendente *D. pullulæ* modo; aperturâ ovali, margine columellari recto, dente parvo instructo, labro duplici, extra expansiusculo. Long. .18, lat. .08 unc.

D. pullula differt magnitudine, spirâ minus attenuatâ et aperturâ magis rotundatâ.

Habitat: Shan States.

Diplommatina scalaroidea, n. sp. Pl. xviii, Fig. 5.

Dipl. testa ovato turrita, sinistrorsa, albida, solidula, non rimata, apice subobtusa; anfractibus 7, convexis, sutura profunda junctis, antepenultimo latissimo, penultimo supra aperturam sensim constricto; anf. primis duobus ad apicem lævivgatis, ceteris costulis transversis, sub-oliquis, distantibus, filiformibus ornatis, interspaciis politis; apertura late ovato-rotundata, labio lateraliter incrassato, supra producto, adnato, medio tenuissimo; columella plica valida et infra eam incisione profunda instructa; labro duplici, incrassato, paulo dilatato, intus lævi, extra paulo reflexiusculo, prope medium insinuato. Alt. testæ 0.2, lat. max. 0.1; alt. apert. .07, lat. apert, circ. .06.

A very marked type of the sinistrorse *Diplommatinæ*, somewhat allied to the Assamese *D. Jaintiaca*, G.-Austen, but readily distinguished from it by its more turreted shape, and by the deep incision below the columellar fold.

Habitat: Mandalay, regno Burmanico.

SPIRACULUM GORDONI, Bens.? Pl. xviii, Fig. 6.

Opisthoporus Gordoni, Benson, Ann. and Mag. nat. hist. 1863.

Testâ planorbulari, late umbilicatâ; anfractibus 5, depressiuscule teretibus, sutura profunda junctis, transversim minute striolatis et rugis nonnullis tenuibus spiralibus notatis; ultimo prope aperturam sensim descendente, supra gibbsulo, tubulo ab apertura modice (circiter 4 m. m.) distante et postice curvato instructo, ad aperturam breviter soluto; colore albida, strigis castaneis latiusculis, fulguratim transeuntibus, et ad peripheriam ult. anf. fascia castanea dentata interruptis; epidermide cornea, rugulose striata; apertura obliqua, sub-circulari, perist. duplici, interno lævi, supra paulo emarginato, externo expanso et reflexiusculo, alato, ala intus excavata, angustatim in anf. penultimum ascendente et adnata. Diam. maj. .91, min. .75, alt. .27, apert. .27 unc.

Habitat: valle "Sittonug" prope Tonghu, teste F. Mason.

This fine species differs from *S. Avanum*, Blanf., (which it somewhat approaches in size), in the peculiarly deflexed last whorl towards the mouth, and in its greater volution, the last whorl being at the aperture slightly detached from the previous one. The wing too nearly lies in the plane of the aperture, and very little inclines forward. The tube is situated a short distance behind the aperture, and is rather strong and inclined backward in a curve, being sensibly constricted towards its end. I can hardly, see any difference between the Tonghu specimens and Benson's description of *Op. Gordoni*, except that Benson mentions in his species the existence of minute spiral striæ while in my specimens the striæ are in some rather strong and few, in others they are nearly quite obsolete.

Pupa fartoidea, n. sp.

Testâ cylindraceâ, politâ, diaphanâ, subrugose striatâ, pallidissime corneâ, ad apicem conoideum parum inflata; suturâ impressà, moniliforme serratâ; anfractibus 7; aperturâ quadrate ovali, labio albido, reflexiusculo, umbilicum fere obtegente, dentibus duobus instructo, dente parietali crasso, lamelliformi, alteroque mimimo, haud procul a suturâ posito. Long. .15, lat. .07 unc.

Hatitat:—Shan States.

Pupa Salwiniana, n. sp.

Testâ pyramidatâ, rimatâ, fusce-corneâ, epidermide lævi induta, anfractibus 6, convexiusculis, sutura impressa junctis, ultimo ad aperturam breviter ascendente; aperturâ rotunde oblongâ, parum dilatatâ et tertiam longitudinis superante, dentibus quinque, albidis instructa: dente primo parietali magno, lamellari, mediano, alteroque parietali mimimo juxta suturam posito, tertio parvo umbilicum juxta, quarto quintoque in labro submediano et ad basin sitis, modicis, æquidistantibus; labro simplici, non reflexo.

Long. .16, lat. .09, aperturæ alt. .06 unc.

Habitat: cum precedente.

This species resembles *P. bathyodon*, Bs., but is more accuminately and regularly pyramidal.

Vitrina (?) venusta, n. sp.

Testâ ovato auriforme, supra vix convexâ, diaphanâ, tenuissimâ, politâ, subrugose striatâ, læte flavescente brunneâ; anfractibus 1½ celerissime crescentibus; apertura latissimâ.

Diam. maj. .30, d. min. .17, alt. .10 unc.

Habitat: prope "Chuegale Sakan," montibus "Arakan" dictis, inter Tonghup et Prome. Though a small species, it is a well marked one, but I did not obtain it alive; it may be a *Helicarion*. The species is closely allied to the Nilgheri *V. auriformis*, Blanford, but is smaller and comparatively higher.

Vitrina Ataranensis, n. sp.

Testâ rotundate ovatâ, politâ, lineis incrementi leviter rugatâ ; anfractibus quatuor, regulariter crescentibus ; suturâ excavatâ ; apice elevatiusculo ; aperturâ obliquâ, quadrato-lunari, margine tenuissimo ; colore succinea, (junioribus virescentibus). Diam. maj. .64, d. min. .54, alt. .22 unc.

Habitat prope "Ataran" flumen, Provinciâ Martaban.

The animal is dark colored, mottled with paler, and belongs to the section *Helicolimax.*

Nanina (Sesara ?) Ataranensis, n. sp. Pl. xviii, Fig. 7.

H. testâ sub-lenticulari, imperforatâ, pallide castaneâ, ad perpheriam ultimi anfractus acute carinatâ ; spirâ convexiusculâ ; sutura vix impressa ; anfractibus 6½, angustis, supra transversim costulate striatis, striis apicem versus evanescentibus ; aperturâ verticali, angusta, labio tenuissimo, labro intus incrassato, albido, ad basin lamellis duabus armato; hác prope umbilicum costiformi, simplici, intrante, illâ longa, sub-hipposideriformi, incrassatâ, reclinatâ; anfractu ultimo ad aperturam non descendente; basi convexiuscula, infra peripheriam et regione centrali leviter excavata. D. maj. .40, d. min. .35, alt. .18 unc.

Habitat prope "Ataran" flumen Provinciâ "Martaban."

This elegant little shell is closely related in form to *H.* (*Stenotrema*) *spinosa*, Lea, of Alabama. I have not seen the animal, but from the relation of the shell to *Nanina* (*Sesara*) *pylaica*, Bens., which is, beside several others of the same type, also found about Moulmein, I suspect that it belongs to the sub-genus *Sesara.*

Stenogyra [Opeas] terebralis, n. sp.

Testâ elongatâ, imperforatâ, tenui, corneâ, non politâ, anfractibus 10½, depresse convexis, sutura impressa junctis, confertim striatis ; ultimo tertiam longitudinis vix æquante, epidermide scabra ; perist. acuto, margine columellari brevissime reflexo, leviter torto.

Long. testæ .95, lat. max. .17, alt. aperturæ .22 unc.

Habitat : Shan States.

BITHINIA NASSA, Theob. Pl. xviii, Fig. 8.

Jour. Asiat. Soc. Bengal, 1863, Vol. xxxiv, p. 275.

Bith. testa elongato turrita, polita, diaphana, solidiuscula, imperforata; anfractibus 6, lente convexis, sutura simplici junctis, striis exilissimis incrementi tectis; ultimo basi convexiusculo; spira breviore; apertura subovata, intus lævi, supra (vel postice) acute angulata, antice rotundata, sensim producta; labio et labro leviter curvatis, primo paulo incrassato, altero acuto, margine tenui, extra prope marginem costa solidiuscula crassa instructo; operculo testaceo, ovato, concentrice striato, nucleo subcentrali.

Alt. testæ .35, diam. max. .25, alt. apert. fere .2, lat. .15, unc.

Habit: Shan States.

This is a very interesting species. The shell is exactly like a *Blanfordia*, but it has the calcareous operculum of a *Bithinia*.

Lithoglyphus Martabanensis, n. sp. Pl. xviii, Fig. 9.

Testâ globose conicâ, imperforatâ, solidâ, virescente albidâ, translucente, fere lævi, transversim exilissime striatâ, spirâ parvâ, regulari, subobtusa; anfractibus $4\frac{1}{2}$, celeriter crescentibus, ultimo $\frac{3}{4}$ longitudinis æquante, aperturâ ellipticâ, antice rotundata, postice angulatâ. Columella callosâ, politâ, paulo dilatata, lâbro acuto leviter curvato, antice ad latus subtruncato. Long. .20, lat. .12, apertura 0 .10 unc.

Habitat rivulis quibusdam provinciâ " Martaban."

A few examples of this interesting addition to the Pegu fauna were forwarded to me from the Martaban district, by F. Nepean, Esq., of the Forest Department, mixed with the common *Paludinas* and *Melanias* of the district. The operculum is horny. The general form of the shell, and the peculiar flattening of the columellar lip, quite agrees with the European species of *Lithoglyphus*. Gould's *Amnicola cincta* from Tenasserim has been suspected by Frauenfeld to belong to *Lithoglyphus*, but it is tolerably certain that Gould's species is very closely allied to, if not identical with, *Paludomus labiosa* Benson.

On the Land Shells of Bourbon, with descriptions of a few new species,—*by* Geoffrey Nevill, C. M. Z. S.

[Received and read 7th September, 1870.]

The described land shells of Bourbon, or La Réunion, are far fewer in number than those of its sister Island. This can be accounted for, by the great difficulties the collector has to encounter in the mountainous districts,—always the most prolific, owing to the great height of the mountains, which are at the same time extremely rugged and precipitous;—secondly, by the greater part of the Island which is under cultivation being almost devoid of the deep, well-wooded ravines and small hills, rising abruptly from the table-land, which form such a characteristic feature of the present Mauritian scenery and still enable the naturalist, throughout that Island, to examine at his ease, at least some trace of the original fauna and flora. I have not the least doubt that in the centre of Bourbon, scarcely ever visited by any naturalist, on the slopes and plateaux of the almost unexplored lofty mountains,—in whose most inaccessible parts, descendants of the old Maroons are still said to exist in a perfectly wild and savage state,—many very interesting new species and even perhaps genera are yet to be found. I much regret not having had time to explore Cilaos, Plaine des Palmistes and the district round the still active volcano, all three evidently offering a rich field to the naturalist; unfortunately my time was limited in the walking tour which I made round the Island. I now give a list, with a few remarks attached, of all the species which, as far as I am aware, have as yet been described from Bourbon.

1. Helix cœlatura, Fér., Prod. 48. (*Nanina* apud Albers.) This is, as far as I can remember, a true *Helix* and not a *Nanina;* unfortunately I did not make any note on this point, when I examined the animal, though I probably should have done so, had it possessed a mucous gland.

The tentacles are purplish-black, the front of the neck stained dark brown, the posterior part of the animal yellowish-brown, sole of the foot the same. It is tolerably abundant in damp places under stones &c., in ravines, at an elevation of about 1000 feet above the sea. I found it alive in nearly all stages of growth; in the very young state it somewhat resembles the figure of *Vitrina Borbonica*, Morlt., Series Conchil. p. 48, 1860.

2. Helix (Dorcasia) similaris, Fér., Prod. 262 (var. *Borbonica*, Desh., Moll. de la Réun. p. 85).

This shell is very common everywhere throughout the Island; there are two common varieties:—var. A, very large, much more so than any I found at Mauritius or the Seychelles; var. B, smaller, with a broad brown band, much more developed than in any from the other localities of this widely distributed *Helix*. Deshayes makes a species, *H. Borbonica*, which is nothing but this variety, only the above characteristics are even more marked than usual. Animal light brown, closely mottled with minute, pale yellowish spots, tentacles brown.

3. Helix? detecta, Fér., (*Nanina* apud Albers).

This and the following 2 species I did not find myself.

4. Helix? Frappieri, Desh., Moll. de la Réun. p. 86.

5. Helix Eudeli, Desh., ibid. p. 87 (?-Barclayi, Bens.).

6. Helix imperfecta, Desh., ibid. p. 89.

At about 2000 feet elevation, rare and local, in damp woods; this species is also found at Mauritius, where it is far more abundant, creeping about on the ground amongst decaying vegetation; my specimens from both Islands cannot be distinguished from one another.

7. Helix setiliris, Bens., Ann. Mag. 1851, p. 252. (*H. Vinsoni*, Desh.).

Another species common to both Islands, found in the same localities as the preceding; it appears to be rare at both.

8. Helix Barclayi, Bens. (*Erepta* apud Albers).

This is, I believe, Deshayes' *H. Eudeli*, both description and figure agree admirably; the unique specimen, from which this latter was described, appears to have been accidentally broken, whilst being figured. Deshayes says, "from the debris I believe it to have been 6 to 7 mil. in diameter"; of *H. Barclayi*, however, I have never found any specimen more than 4 mil. At Bourbon I found this species rather local, on huge boulders, perfectly undistinguishable from Mauritian specimens.

Tentacles iron grey, posterior of foot white, the rest of the animal the same, with numerous and regular dark grey streaks, showing very distinctly through the transparent shell in a transverse pattern.

9. Helix Salaziensis, n. sp.

Shell very minute, somewhat turbinated, horny, thin and fragile; 4½ rather convex whorls, minutely transversely striated, striæ wide apart, acute and presenting, under a magnifying glass, a somewhat lamellar appearance; widely and deeply umbilicated; the base rather convex, in young specimens provided with a similar sculpture as on the whorls, becoming obsolete, however, in full grown ones; aperture small, with the margin of the outer lip simple and acute.

Diam. 2, Alt. 4—5 m.m.

I have named this minute species after the village near where I found it, about 24 miles up a steep pass towards the centre of the Island. Salazie is extensively used as a sanatarium, on account of the invigorating temperature and some noted mineral water-springs; it seemed to me, to be one of the most favourable localities I have yet visited in the tropics for the botanist and naturalist: plants and ferns, insects, birds, &c., all seemed equally attractive and abundant. I especially noticed many beautiful Orchids in my rambles towards the old extinct volcano, which towers, some little distance off, at the back of the village, some 11,000 feet above the sea. I found the little shell above described, in company with the preceding, on large masses of rock.

10. NANINA (MACROCHLAMYS) GEOFFREYI, H. Ad.
Proc. Zool. Soc., 1868, p. 289.

In the original description, there is unfortunately an error in the printing of a note from myself; it should be "the animal is yellow and black and resembles that of *N. nitella*, that of *N. virginea* is of a uniform dark grey, almost black."

Animal provided with a mucous gland, tail truncated; tentacles black, the black continued a short distance beyond their bases; neck yellowish-grey, slightly mottled with black, the hinder part of the animal yellow, mottled on the sides with black, bordered with a yellow margin; sole of foot yellow. It closely resembles the animal of *H. nitella*, as described by myself, Zool. Soc. Proc. 1868, p. 258, the shell, however, is very different, being not nearly so depressed, &c.; it is more like *H. proletaria*, Morlt., but the last whorl is not carinated, &c. It is abundant at Salazie under dead leaves, stones, &c., in damp woods.

11. NANINA (MACROCHLAMYS) MAILLARDI, Desh., Moll. de la Réun. p. 86.

I procured two or three specimens of a shell, which I have identified with this species, both at Mauritius and Bourbon; unfortunately I did not succeed in finding live specimens, or a sufficiently large set of the shells, to be perfectly certain of their identity.

12. NANINA LINOPHORA, Morlt., Ser. Conch. p. 57 (? *argentea* var.)

I did not succeed in finding this species myself; I consider it as the most aberrant form of a small group of Mascarene shells, probably all descended from a common stock at some not very remote period, now constituting more or less "good species," according to the individual opinion that each naturalist may have formed for himself, as to what should constitute a species and what a variety. I would class these species as follows:—

A. *Nanina linophora.* This is the most narrowly turbinated, exerted form of the group, with the strong keel visible on all the whorls, it is described as coarsely striated; it is apparently very scarce.

B. *Nanina argentea*, Rv., Conc. Icon. No. 1434. I should fancy this must be the oldest, or nearest to the original type, from almost perfectly similar forms being found in both the sister Islands, under circumstances that would seem to preclude the possibility of its having been introduced into either. In form it is very close to the preceding, but the last whorl is more dilated, not compressed, the sharp keel not visible on the other whorls ; it is finely striated.

C. *Nanina implicata*, n. sp. Closely allied to *N. semicerina* Morlt.; it differs by the whorls being rounder, more convex, the keel in consequence almost rudimentary ; the green band of the epidermis round the umbilicus is a little broader, without the conspicuous brown stripe next the suture, in its place the same green epidermis, as round the base, forms two bands in the centre of each whorl, the lower one being broad and distinctly marked throughout, the upper one indistinct and interrupted, only clearly developed in the last whorl ; the apex is more obtuse, but the most characteristic distinction is the absence of the coarse, regular striation, *N. implicata* being perfectly smooth ; the proportions of the two species are almost exactly the same.

In the style of colouring, it somewhat resembles *N. argentea*, it can, however, be easily distinguished by its more depressed and concave whorls, on the last of which, there is an almost imperceptible keel.

Rare ; Peter Botte Mn. Mauritius.

D. *Nanina semicerina*, Morlt., Rev. Zool. 1851, p. 219, (*Rawsonis*, Bens.). Locally abundant at Mauritius on shrubs, &c., in very damp woods. This handsome shell varies considerably in colouring, the whorls are a little less concave than in the last, the keel on the last whorl a little more developed ; it is the most strongly striated species of the group.

Animal whitish, neck mottled with black, tentacles grey.

13. Nanina argentea, Rv.

I have already spoken of the affinities of the shell of this species ; the animal is of a pure white, the front of the neck having a faint yellow tinge, the tentacles are orange with dark grey streaks ; the tail is sharply truncated, near it there is a mucous pore with a prominent, pointed, orange-coloured hook close to it. Found with *Helix cœlatura*, tolerably abundant, but local, at a considerable elevation, in damp places.

14. NANINA (MACROCHLAMYS) NITELLA, Morlt., Rev. Zool. p. 219.

This Mauritian species is recorded by Deshayes, Moll. de la Réun. p. 85, as also found in Bourbon, I did not find it, however, at the latter Island. I have described the animal from Mauritian specimens, Proc. Zool. Soc. 1868, p. 258.

15. NANINA? PROLETARIA, Morlt., Ser. Conch. p. 60.

Another Mauritian shell, mentioned by Deshayes as found with the preceding, I think it just possible, he may have mis-identified his Bourbon specimens, and that they may prove to belong to the species subsequently described by H. Adams as *N. Geoffreyi*. I certainly found no shell of this type, with the last whorl angulated, or carinated, at the periphery, agreeing with Morelet's description of *N. proletaria*.

16. NANINA PRÆTUMIDA, Fér. Bull. un. des sc. p. 303.

Animal white, thickly sprinkled with dark grey, especially on the neck, tentacles iron-grey; provided with a mucous pore. Very local, but not rare, found at a considerable elevation in damp woods amongst decaying vegetation &c; living under the same bushes; distinguishable only by the proportions and number of the whorls and by the total absence of the strong canaliculation of the sutures; I found a good many specimens of a shell which I will now describe.

17. NANINA CORDEMOYI, n. s.

Shell almost exactly like the preceding, only a shade smaller; with only five whorls, not compressed, with the suture not canaliculated, somewhat indistinctly banded with a rather broad brown belt; slightly more openly perforated.

N. prætumida, height 6½, diam. 9 m. m.;

N. Cordemoyi, ditto 6, ditto, 8½ m. m.

I have named this shell after M. Jacob de Cordemoy, a well known botanist at Bourbon.

18. STENOGYRA (OPEAS) CLAVULINUS, Pot. and Mich. Gall. de Douai, I, p. 136.

This little Bourbon *Opeas* is easily distinguished at a glance from the still more common and widely spread group, (*O. gracilis*, Hutt., *O. Mauritiana*, Pfr. &c.,) by its more polished and shining appearance, by its being devoid of regular and distinct striation, by its more swollen and more rapidly increasing whorls, this difference being especially noticeable in the first few whorls near the apex, by its more angular aperture, &c.; it is, I believe, the shell described by Pfr. Mon. Hel. Vol. I. p. 159, in the foot note marked with a single asterisk, where it is referred to the *Bul. clavulinus* of P. and M., he there gives the length of the species as 8 mill., this is probably my var. A.; in Vol. III. he re-describes the species from a Mauritian specimen, where he gives the length as only 6 mil. &c., agreeing with my var. B. I have never seen this species from Ceylon or any part of India, though the other group of *O. gracilis* &c., is as abundant at both, as at Mauritius and the Seychelles; I did not, however, find my var. B. of *O. clavulinus* at Bourbon, though I expect both it and *Opeas Mauritiana* and *gracilis* will eventually be discovered there; the habits of the subgenus *Opeas* are more favourable, than perhaps those of any other mollusk, to their introduction into distant countries, they are to be found in cultivated spots nearly everywhere, even in the gardens of large cities like Calcutta and Port Louis, where they bury themselves in the ground amongst the roots of plants, &c., sometimes under stones.

I divide this species (*O. clavulinus*, P. and M.) into two forms or varieties—

A. Whorls seven, the last one especially not quite so tumid as in the next variety. Bourbon, Mauritius and the Seychelles.

Long. 8½, diam. maj. 3; long. apert. 2¾, diam. 1½ m. m.

B. (Pfr. Mon. Hel. III. p. 394). Whorls six, broader in proportion to their length than those of the preceding. Mauritius and the Seychelles.

Long. 6, diam. 2⅜; long. apert. 2¼, diam. 1¼ m. m.

My numerous specimens of this variety all have the above measurements, agreeing with those given by Pfr. loc. cit., except as regards the aperture, to which he ascribes 2¾ in length and 1 in breadth. I purpose speaking of the other Mauritian species of this sub-genus in another paper, which I hope to publish shortly, on the land shells of Mauritius.

19. Bulimus venustus, Morlt. Journ. de Conch. 1861.

I found no species of this genus, and think it possible Maillard may have, by accident, sent some shell from the Comoro Is. to Deshayes, who has recorded this species from Bourbon.

20. Ennea bicolor, Hutt., J. A. S. Beng.; III, p. 93.

I believe myself that this little species has been introduced here amongst the roots of shrubs, &c., as well as into Mauritius, the Seychelles &c.; I have always found it in all these islands near the sea, in other words where there has been a great deal of cultivation.

21. Gibbus (Gibbulina) intersecta, Desh., Moll. de la Réun. p. 91, (? var. of *Bourguignati*, Desh.).

I think this species is very doubtfully distinct from the following, of which I found some undoubted varieties approaching, by a slight diminution in the convexity of the whorls, very closely to Deshayes' figure of the present species.

22. Gibbus (Gibbulina) Bourguignati, Desh., ibid p. 90. (*bacillus*, Pfr. var.).

I have hesitated some little time, whether to accept this species or not, it only differs from the Mauritian *G. bacillus*, Pfr., by its slightly smaller proportions and by a very marked difference in the sculpture, which in this species is very fine, hardly discernible except under the lens, whereas it is coarse and very distinct in *G. bacillus*, this characteristic has decided me on retaining the species; the animals are hardly distinguishable. I should have described the colour of the animal of *G. bacillus* as "yellowish inclined to green" in my description in Zool. Soc. Proc. 1868, p. 259, that of the present species is a decided yellow, with the front of the neck slightly crimson, sides of the foot mottled with dark brown, tentacles crimson. Not uncommon, widely spread, in damp woods. My specimens are all rather smaller than Deshayes' type, being 9½ mill. in length and 5¼ in diameter; a variety, probably Deshayes' *intersecta*, being in length 10 and in diameter 4¾. This shell agrees very fairly with a species figured as *P. versipolis*, Fér. in Deshayes' Hist. des Moll. and in Küster's Conch. Cab. Pl. XI, f. 11 and 12, though I believe them to represent Mauritian specimens of the allied *G. bacillus*, Pfr., despite the magnified sculpture in both agreeing far better with that of the present species. Morelet, Ser. Conch. p. 89, justly points out that the figured specimens do not agree with the original description; Férussac's remark that the animal of *G. versipolis* is of a rich orange red fortunately sets the question at rest, confirming Morelet; it can neither be *G. bacillus* nor *G. Bourguignati*, the animals of both of which are pale yellowish.

23. Gibbus (Gibbulina) versipolis, Fér., (=*funiculus*, Val.)
Of this species I only succeeded in finding one or two live specimens in a damp wood under stones; dead, bleached shells, on the other hand, were more plentiful and wider spread than those of any other Bourbon species of the genus, especially on the dry, sandy plateaux behind Salazie, where I could find no traces of any other land shells whatever; the animal is of a rich dark orange colour with purplish-black tentacles and with 2 broad streaks of the same shade on each side of the foot. This is, I have no doubt, the shell Férussac called *Pupa versipolis*, Prodr. 468. The figure given by Morelet, Ser. Conch. Pl. V, fig. 14, (the lower variety principally) corresponds perfectly with some of the varieties I found of the present species at Bourbon, though not *exactly* with any of the Mauritian species that I have seen, the nearest being *G. holostoma*, Morlt., var. and *G. Dupontiana*, mihi, one of which has probably given rise to the statement that *G. versipolis*, Fér., is also from Mauritius. Morelet states the specimen figured to be an authentic specimen of Férussac's type, but does not clearly mention whether it is from Bourbon or Mauritius; in any case it differs materially from both *G. bacillus* and *G. Bourguignati*, one of which, as I before

mentioned, was figured by Deshayes and Küster for this shell. Férussac's note that the animal is a handsome scarlet-orange colour answers perfectly to this species, the only shell of this type from Mauritius with a similar animal is *G. holostoma*, Morlt., one of these two then *G. funiculus*, or *G. holostoma*, must be Férussac's original *versipolis*, and if the type specimen was from Bourbon, it undoubtedly belonged to the present species, the colour of the animal precludes its having been either *G. bacillus*, Pfr., *striata-costa*, Morlt., or the shell kindly identified for me as it by Mr. H. Adams from the late Mr. Cuming's collection, the animal of which I wrongly described under this name in Proc. Zool. Soc. 1868, p. 260, and which is, I believe, a new species; these three last have as yet been found in Mauritius only.

24. Gibbus (Gibbulina) turgidulus, Desh., Moll. de la Réun. p. 93.

This shell appears to be very rare, I did not succeed in taking it alive, I procured my specimens on the road to Salazie; it most resembles a small variety of the Mauritian *G. callifer*, Morlt.

25. Gibbus (Gibbulina) uvula, Desh., ibid.

Also rare, with the preceding.

26. Gibbus (Gibbulina) cylindrella, H. Ad., Zool. Soc. Proc. 1868.

Very scarce, in damp woods at a considerable elevation.

27. Gibbus (Gibbulina) Deshayesi, H. Ad., ibid.

I only found a few specimens of this interesting little species amongst loose stones, on a very arid mountain close to the village of Salazie.

28. Vertigo (?) pupula, Desh., Moll. de la Réun. p. 92.

Abundant on large boulders, overgrown with creepers &c., near Salazie, I examined it carefully and could only detect a single pair of tentacles, unfortunately I had no magnifying glass with me at the time to make quite certain.

29. Vertigo (Alæa) Borbonica, H. A d., Zool. Soc. Proc. 1868, p. 290.

Very local, also found on huge masses of stone, at a great elevation.

30. Vertigo (Pagodella) incerta, n. sp.

Shell very closely resembling *Vertigo* (*Pagodella*) *ventricosa*, H. A d., from Mauritius; there are, however, two parietal teeth and within the outer lip a distinct, well-developed tooth, with occasionally another small, indistinct one close to it; the columellar is slightly more dilated and sub-angulated; rare, in company with *V. pupula* near Salazie.

This most perplexing of shells can only be distinguished from *Pagodella ventricosa*, H. A d., Proc. Zool. Soc. 1867, p. 303,—by the different dentition of the aperture; of the latter I found about 40 specimens, to all appearance full grown and in first rate condition, some of them, to my mind, very old specimens, in none of them were there any signs of any teeth whatever within the outer margin of the aperture! Of the Bourbon species, I only found 5 specimens, one evidently young, the other 4 full grown and all showing the peculiar characteristics pointed out in my description. Still the resemblance is so striking, that I think no naturalist would hesitate to avow, that they must at no very remote period have had a common origin; there is, indeed, just the chance that at Mauritius a similar variety may exist, but, from the number of specimens I found there, I doubt it exceedingly. I have, however, written to Mr. Dupont at Mauritius to ask him to kindly examine all he can possibly procure of this species, and to see if he can find any trace of the apertural teeth, which give such a different appearance to my *V. incerta.*

31. Tornatellina (Septinaria) cernica, Bens.,, Ann. Mag. 1851, p. 255.

This interesting shell is perfectly identical with the Mauritian form, described by Benson, I found it, at a considerable height, with *Vertigo Borbonica.*

32. Succinea mascarensis, n. sp.

This shell is also common at Mauritius, where it lives in the cultivated plains on walls &c., Deshayes records it, Moll. de la Réun. p. 90, as *S. striata ?* Krauss, which it certainly closely resembles, but can be distinguished by its less ventricose and more attenuated form. It also resembles Quoy's *Succinea australis* from Tasmania.

Shell resembling *S. striata*, Krauss, but smaller, with the last whorl and the aperture more compressly elongated; the apex also is more tumid, not so produced.

Length 7, diam. 4½, m.m.

33. Achatina fulica, Fér. Prod. p. 347.

Deshayes also mentions as found in Bourbon, *A. fulva*, Fér., this was probably one of the numerous varieties of this Protean species.

34. A. panthera, Fér. Prod. p. 349.

Deshayes records this species from Bourbon, where I suppose it was introduced as at Mauritius, I did not find it myself. I take the shell, mentioned on the same page as *A. purpurea*, to have been probably a variety of this species.

35. Hyalimax maillardi, Fisher, Journ. de Conch. Vol. XV.

Animal flesh colour, mantle brown, posterior of foot pointed, produced, thickly marked with longitudinal dark brown lines; 4 dark brown tentacles. The colour often varies in being of a lighter shade throughout. Abundant near Salazie, in damp woods under stones, leaves &c.

36. Cyclostoma (Tropidophora) tricarinatum, Lam.

I only found this curious species at Mauritius, where it is very rare and sub-fossil, as extinct there, I believe, as the Dodo.

37. Cyclostoma fimbriatum, Lam.

This, like the preceding, I did not find myself at Bourbon, they are both recorded by Deshayes.

38. OMPHALOTROPIS RUBENS, Quoy, Voy. de l'Astrol. p. 189, (var. *Moreleti*, Desh. Moll. de la Réun. p. 81).

Of this species I found two varieties, one the typical, often undistinguishable from the Mauritian form; the other a slightly smaller variety, named by Deshayes, *O. Moreleti*, Moll. de la Réun. p. 84; it is a little smaller, more attenuated, the whorls are slightly less ventricose, and the sculpture, though the same, a shade more obsolete, the broad brown bands round the whorls are very striking and are nearly always more or less present, the Bourbon typical form also often possesses them, though not so generally; at Mauritius, on the contrary, the striped variety, is very rare indeed, in this respect presenting a remarkable analogy to *Helix similaris*, of which Deshayes has also made a species from an extreme form, as I have previously mentioned, which may well be compared with his *Omphalotropis Moreleti* in their relationship to their respective type forms.

39. OMPHALOTROPIS BORBONICA, H. Ad., Proc. Zool. Soc. 1868, p. 289.

This very distinct species cannot be confounded with any other of the genus, it can instantly be distinguished from *O. rubens*, with which it agrees in size, by its being very minutely and indistinctly spirally punctated, instead of finely, distinctly, longitudinally striated, the whorls are much more convex, the last one more ventricose, the outer margin of the aperture not reflexed, the colouring more constant and more sombre, the umbilicus wider, the keel scarcely raised, obtuse, and broad, instead of narrow, acute and thread-like. In the plate accompanying Mr. Adams' description, the colouring does not give a quite correct idea, the ground colour is a darkish brown, sometimes indeed without any markings at all, but generally minutely and rather closely maculated with dull yellow, in rather a zigzag manner, the broad keel also, where it shows through in the interior of the aperture, as it does in fresh specimens, should be of a light yellow and not dark brown. I think too in the description, it should not be "et circa perforationem *compresse* carinato," as it is decidedly less compressly carinated round the umbilicus than its near ally, the type of the genus, *O. rubens*. In damp woods, tolerably abundant.

40. Omphalotropis expansilabre, Pfr.

This is another Mauritian species, my specimens from the two islands being perfectly undistinguishable after a most careful examination. Rare, at a considerable elevation, crawling on the ground in damp woods.

41. Omphalotropis picturata, H. Ad., Proc. Zool. Soc. 1869, p. 305.

Another of my new species from Mauritius, where it is extremely rare. I subsequently succeeded at Bourbon, with much trouble, in getting a better set of specimens, but it appears to be there also exceedingly local; it is distinguished at a glance by its more attenuated and produced form, and by its last whorl being ventricose, perfectly rounded at the periphery, not in the least angulated or keeled. A very faint keel round the umbilicus is discernible in all of my Bourbon specimens.

I have purposely not mentioned a species described by Morelet, Ser. Conch. p. 48, as *Vitrina Borbonica*, I cannot help having great doubts of the correctness of the recorded locality; Deshayes does not include it in his Cat. des Moll. de la Réunion. I know of no species of the genus from the Mascarene Islands.

INDEX

TO

PART II, VOL. XXXIX.

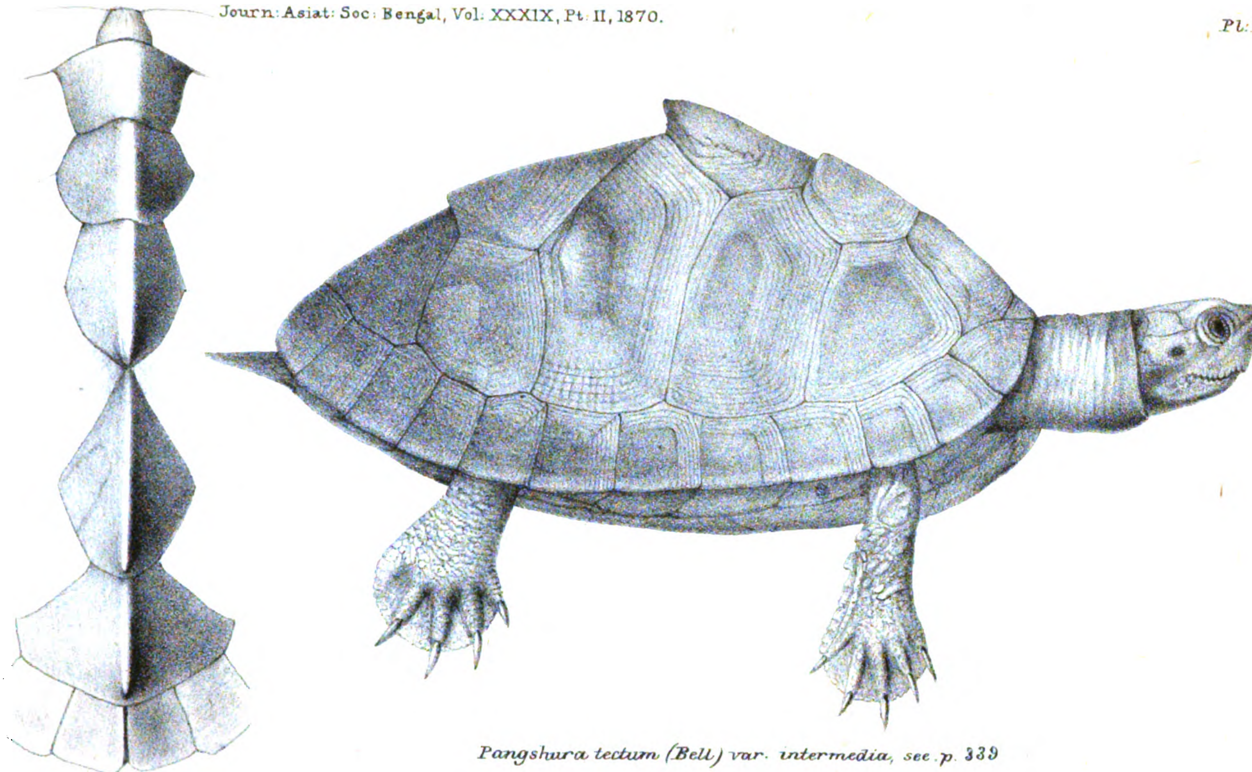
[NOTE.—The Index has been divided into four parts, 1. Names of Minerals, rocks, geographical places, &c. 2. Plants. 3. Invertebrate animals. 4, Vertebate animals. Names of new genera and species have been marked with an (*) asterisk.]

Names of Minerals, Geographical Stations, &c. &c.

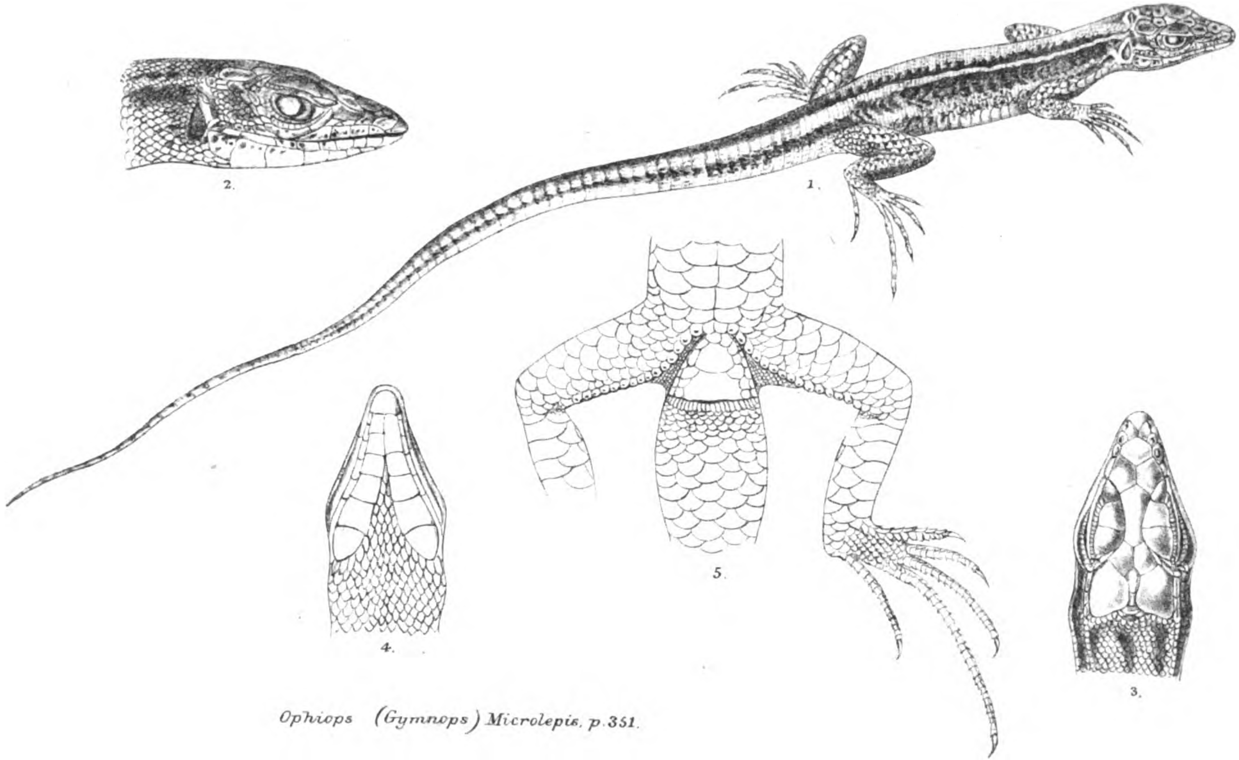
Plants.

Invertebrate Animals.

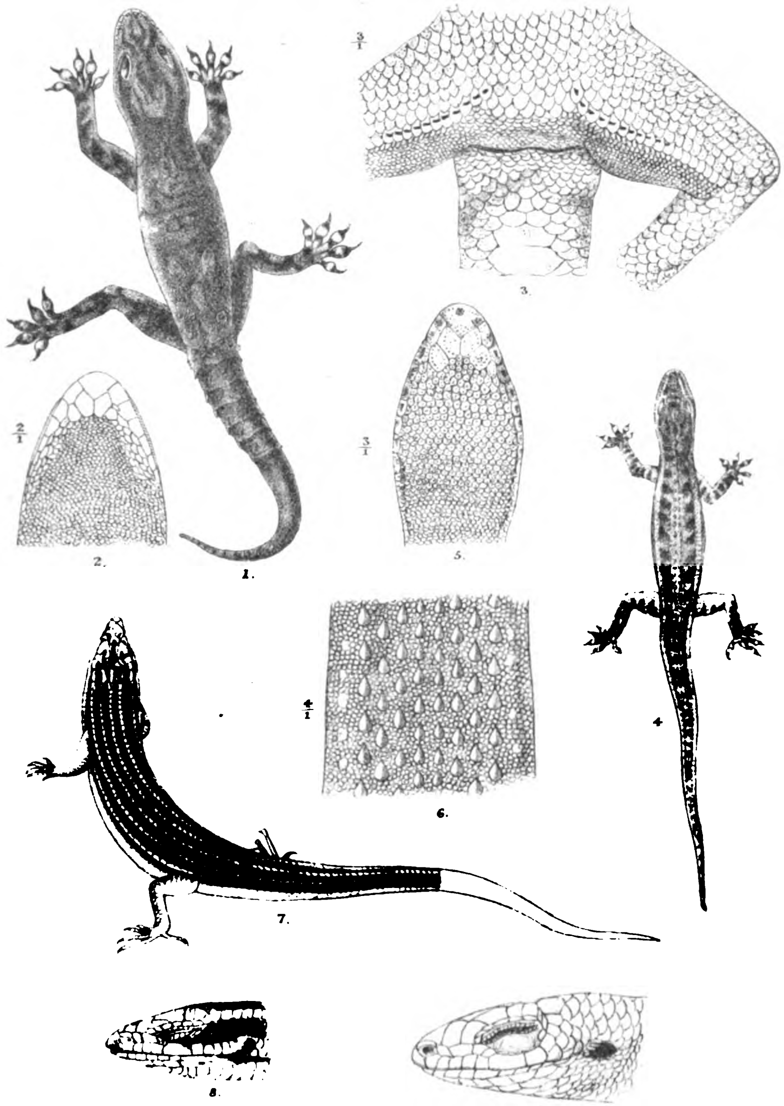
Vertebrate Animals.



Pangshura tectum (Bell) var. intermedia, see p. 339



Ophiops (Gymnops) Microlepis, p. 351.



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9 „ *innotatus*, p 354

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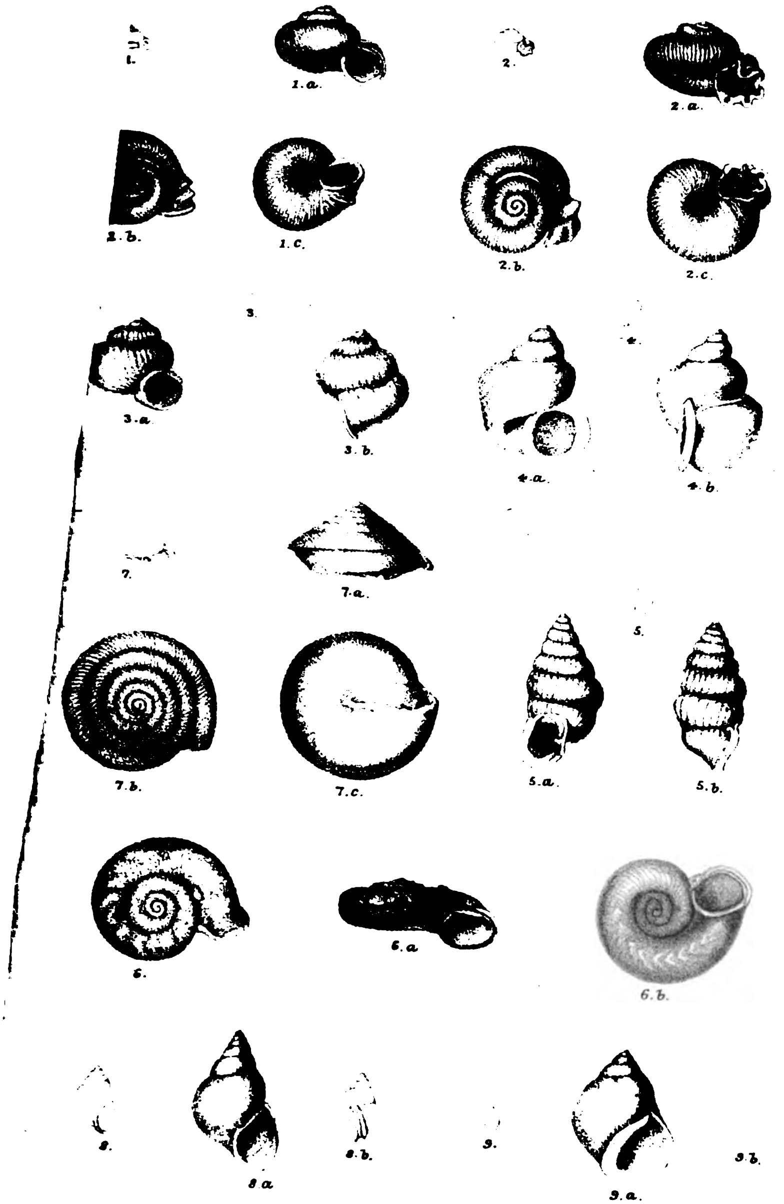

1. *Alycaeus bifrons*, p. 396.
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9. *Lithoglyphus Martabanensis*, p. 402.

***Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November* 1869.**

Latitude 22° 33′ 1″ North. Longitude 88° 20′ 34″ East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Date.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Temperature during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.972	30.038	29.929	0.109	77.4	84.9	70.5	14.4
2	.961	.035	.900	.135	75.8	82.9	69.8	13.1
3	.953	.038	.895	.143	74.5	82.0	69.0	13.0
4	.958	.027	.908	.119	72.7	80.4	65.5	14.9
5	.951	.021	.903	.118	72.1	79.7	65.2	14.5
6	.986	.053	.944	.109	72.4	80.0	65.5	14.5
7	30.019	.078	.981	.097	72.9	79.6	65.5	14.1
8	.038	.108	30.000	.108	73.3	81.2	66.0	15.2
9	.045	.124	29.993	.131	74.5	82.3	67.7	14.6
10	.034	.100	.983	.117	75.2	82.7	70.0	12.7
11	.046	.110	30.002	.108	75.7	82.7	69.4	13.3
12	.066	.145	.004	.141	75.4	82.6	69.5	13.1
13	.014	.085	29.947	.138	74.7	82.0	68.5	13.5
14	.001	.061	.947	.114	75.2	81.8	69.6	12.2
15	29.992	.063	.930	.133	75.6	84.0	69.0	15.0
16	.979	.048	.934	.114	76.1	84.3	69.0	15.3
17	.979	.049	.935	.114	75.1	82.0	70.0	12.0
18	.992	.069	.935	.134	72.6	80.2	66.0	14.2
19	30.017	.079	.979	.100	72.0	80.4	64.5	15.9
20	.012	.066	.955	.111	72.0	79.6	65.6	14.0
21	.018	.100	.965	.135	70.0	78.0	63.5	14.5
22	29.996	.068	.936	.132	69.0	77.5	62.0	15.5
23	30.008	.074	.950	.124	69.8	78.7	62.5	16.2
24	.047	.116	30.002	.114	71.7	79.7	63.5	16.2
25	.004	.062	29.919	.143	74.8	85.0	66.8	18.2
26	29.991	.080	.918	.162	73.6	82.5	65.5	17.0
27	.995	.075	.929	.146	72.5	81.5	64.0	17.5
28	.982	.065	.924	.141	71.4	79.6	61.7	14.9
29	.928	.010	.849	.161	70.4	80.5	62.2	18.3
30	.896	29.969	.843	.126	70.9	79.8	62.8	17.0

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1869.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Date.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	70.0	7.4	64.8	12.6	0.613	6.65	3.36	0.66
2	69.1	6.7	64.4	11.4	.605	.59	2.95	.69
3	66.1	8.4	60.2	14.3	.527	5.74	3.44	.63
4	64.3	8.4	57.6	15.1	.483	.28	.40	.61
5	64.9	7.2	59.1	13.0	.508	.56	2.97	.65
6	65.6	6.8	60.2	12.2	.527	.77	.83	.67
7	65.8	7.1	60.1	12.8	.525	.74	.99	.66
8	66.8	6.5	61.6	11.7	.552	6.02	.82	.68
9	68.6	5.9	64.5	10.0	.607	.62	.56	.72
10	69.2	6.0	65.0	10.2	.617	.73	.64	.72
11	69.1	6.6	64.5	11.2	.607	.61	.90	.70
12	67.6	7.8	62.1	13.3	.561	.11	3.32	.65
13	68.1	6.6	63.5	11.2	.588	.41	2.82	.69
14	69.2	6.0	65.0	10.2	.617	.73	.64	.72
15	69.9	5.7	65.9	9.7	.636	.92	.56	.73
16	69.4	6.7	64.7	11.4	.611	.65	.98	.69
17	67.9	7.2	62.9	12.2	.576	.18	3.06	.67
18	64.8	7.8	58.6	14.0	.499	5.46	.20	.63
19	65.1	6.9	59.6	12.4	.516	.66	2.84	.67
20	64.9	7.1	59.2	12.8	.509	.58	.92	.66
21	62.3	7.7	56.1	13.9	.459	.05	.95	.63
22	62.0	7.0	56.4	12.6	.464	.10	.66	.66
23	63.9	5.9	59.2	10.6	.509	.60	.35	.70
24	65.3	6.4	60.2	11.5	.527	.77	.66	.68
25	67.2	7.6	61.9	12.9	.557	6.07	3.19	.66
26	65.2	8.4	59.3	14.3	.511	5.58	.35	.63
27	64.5	8.0	58.1	14.4	.491	.38	.25	.62
28	64.0	7.4	58.1	13.3	.491	.39	2.96	.65
29	63.4	7.0	57.8	12.6	.486	.34	.76	.66
30	64.5	6.4	59.4	11.5	.513	.62	.61	.68

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1869.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Hour.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Temperature for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid-night.	29.998	30.070	29.895	0.175	70.1	75.2	64.0	11.2
1	.991	.066	.895	.171	69.4	74.8	63.5	11.3
2	.985	.063	.889	.174	68.8	73.4	63.0	10.4
3	.978	.058	.882	.176	68.3	72.8	63.0	9.8
4	.975	.055	.874	.181	67.7	71.5	62.8	8.7
5	.987	.074	.883	.191	67.1	71.5	62.5	9.0
6	30.003	.090	.893	.197	66.6	70.5	62.0	8.5
7	.024	.106	.908	.198	66.7	71.0	62.4	8.6
8	.046	.132	.937	.195	69.5	75.3	65.0	10.3
9	.065	.145	.969	.176	72.8	77.6	68.5	9.1
10	.065	.133	.965	.168	75.7	80.0	71.3	8.7
11	.044	.122	.946	.176	78.1	81.7	73.9	7.8
Noon.	.015	.079	.919	.160	79.3	83.1	75.5	7.6
1	29.981	.042	.880	.162	80.3	84.5	76.4	8.1
2	.958	.022	.856	.166	81.1	85.0	77.4	7.6
3	.945	.008	.843	.165	81.0	84.8	77.5	7.3
4	.945	.005	.846	.159	79.6	84.5	76.0	8.5
5	.952	.017	.849	.168	78.4	83.0	74.8	8.2
6	.961	.027	.856	.171	76.1	80.2	72.0	8.2
7	.977	.047	.869	.178	74.7	77.8	70.2	7.6
8	.993	.068	.889	.179	73.4	76.5	68.8	7.7
9	30.003	.076	.910	.166	72.3	76.2	67.2	9.0
10	.009	.083	.932	.151	71.5	76.0	66.0	10.0
11	.004	.077	.913	.164	70.6	74.0	65.2	8.8

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1869.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Hour.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid-night.	65.9	4.2	62.5	7.6	0.568	6.25	1.78	0.78
1	65.4	4.0	62.2	7.2	.563	.20	.66	.79
2	65.0	3.8	62.0	6.8	.559	.16	.55	.80
3	64.5	3.8	61.5	6.8	.550	.07	.53	.80
4	64.2	3.5	61.4	6.3	.548	.07	.39	.81
5	63.8	3.3	61.2	5.9	.544	.03	.29	.82
6	63.5	3.1	61.0	5.6	.541	5.99	.22	.83
7	63.6	3.1	61.1	5.6	.543	6.01	.22	.83
8	64.9	4.6	61.2	8.3	.544	.00	.88	.76
9	66.0	6.8	60.6	12.2	.534	5.84	2.87	.67
10	67.1	8.6	61.1	14.6	.543	.90	3.61	.62
11	67.6	10.5	60.2	17.9	.527	.70	4.52	.56
Noon.	67.6	11.7	59.4	19.9	.513	.53	5.06	.52
1	67.9	12.4	59.2	21.1	.509	.49	.42	.50
2	67.9	13.2	58.7	22.4	.501	.39	.78	.48
3	67.7	13.3	58.4	22.6	.496	.32	.82	.48
4	67.3	12.3	58.7	20.9	.501	.40	.29	.51
5	67.6	10.8	60.0	18.4	.523	.66	4.65	.55
6	68.3	7.8	62.8	13.3	.574	6.24	3.39	.65
7	68.1	6.6	63.5	11.2	.588	.41	2.82	.69
8	67.5	5.9	62.8	10.6	.574	.27	.60	.71
9	67.0	5.3	62.8	9.5	.574	.28	.30	.73
10	66.6	4.9	62.7	8.8	.572	.27	.11	.75
11	66.2	4.4	62.7	7.9	.572	.29	1.86	.77

All the Hygrometrical elements are computed by the **Greenwich Constants.**

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1869.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage $1\frac{1}{2}$ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	125.0	...	N.N.E.& W byN	...	47.5	Clear. Slightly foggy at 10 P. M.
2	119.5	...	W. by N. & W.	...	63.5	Clear.
3	118.3	...	W. & W. by S.	...	39.5	Clear. Slightly foggy from 4 to 8 P. M
4	120.5	...	W.S.W.&W.byS.	...	52.5	Clear. Slightly foggy from 8 to 10 P. M.
5	120.0	...	W. by S, & S. W	...	19.9	Clear. Slightly foggy at 7 A. M. & 6 P. M.
6	117.0	...	S. W. & W.	...	9.8	Clear. Slightly foggy at 7 A. M. & 7 P. M.
7	119.0	...	WbyN&W.S.W.	...	52.9	Clear.
8	121.0	...	W. S. W.	...	53.8	Clear. Slightly foggy at 7 & 8 P. M.
9	120.0	...	W.S.W.	...	67.5	Clear to 8 A. M. \i afterwards.
10	121.3	...	S.S. W &N.N.W.	...	56.4	Clear to 5 A.M. \i to 11 A.M. ⌒i to 5 P. M., clear afterwards.
11	119.5	...	W. by N. & W.	...	73.5	Clear to 10 A. M. ⌒i afterwards. Slightly foggy at 9 P.M.
12	122.0	...	WbyN.&N.N.W. [by N.	...	117.4	Clear to noon. \i to 6 P. M. clear afterwards.
13	122.0	...	NbyW,E.N.E&E.	...	177.2	Clear to 6 A. M. ⌒i to 5 P. M., clear afterwards.
14	124.0	...	E.byN,ENE&S.E	...	50.0	Clear to 4 A. M. \⌒i to 5 P.M., clear afterwards. Slightly foggy at 8 P. M.
15	120.0	...	S.E.&S.byE.	...	55.0	Clear to 10 A. M. _i & ⌒i to 4 P. M. clear to 8 P.M. \i afterwards. Foggy from 7 to 11 P M.
16	122.7	...	S,S.W. &W.byN.	...	79.9	Clear to 10 A.M. ⌒i to 3 P.M. _i afterwards.
17	122.5	...	N. byE.&N.byW.	...	168.2	Chiefly clear.
18	117.2	...	E.N.E. & N.N.W.	...	124.4	Clear.
19	116.5	...	N. N.W.&NbyW.	...	134.1	Clear. Slightly foggy at 8 & 9 P. M.
20	118.0	...	N.byW.&N.N.W.	...	179.7	Clear to 11 A. M. _i to 2 P. M. clear afterwards.
21	115.0	...	N.W. & W. byN.	...	135.2	Clear. Foggy at 10 P.M.
22	119.0	...	W N.W&W.byN.	...	95.8	Clear. Slightly foggy from 7 to 10 P. M.
23	116.5	...	W. N. W.	...	111.3	Clear to 11 A. M. ⌒i to 5 PM. clear afterwards. Slightly foggy at 5 & 6 A. M.
24	115.5	...	WNW,W&NbyE	...	106.0	Clear to noon \⌒i to 8 P. M. _i afterwards.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1869.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage $1\frac{1}{2}$ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
25	119.5	...	N.byE, & N.N.E.	...	151.8	∖_i & ⌒i to 8 A. M., clear to noon ∖_i & ⌒i to 5 P. M. clear afterwards.
26	122.6	...	N. N. E. & N.	...	207.5	Clear.
27	119.8	...	N. by W. & N.	...	166.5	Clear to 5 A. M. ∖_i & ∖i to 4 P. M., clear afterwards.
28	115.0	...	N.N.E.&W.N.W.	...	135.6	Clear.
29	116.8	...	W. N. W. & N.	...	93.7	Clear. Slightly foggy from 6 to 10 P. M.
30	118.0	...	N,NNW.&WbyE	...	54.9	Clear. Slightly foggy from 6 to 9 P. M,

∖i Cirri, —i Strati, ⌒i Cumuli, ∖_i Cirro-strati, ⌒-i Cumulo strati, ∖⌒-i Nimbi ∖⌒i Cirro cumuli.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1869.

Monthly Results.

		Inches.
Mean height of the Barometer for the month...	...	29.996
Max. height of the Barometer occurred at 9 A. M. on the 12th.	...	30.145
Min. height of the Barometer occurred at 3 P. M. on the 30th.	...	29.843
Extreme range of the Barometer during the month ...	...	0.302
Mean of the daily Max. Pressures	...	30.067
Ditto ditto Min. ditto	...	29.941
Mean daily range of the Barometer during the month ...	...	0.126

		o
Mean Dry Bulb Thermometer for the month	...	73.3
Max. Temperature occurred at 2 P. M. on the 25th. ...	...	85.0
Min. Temperature occurred at 6 A. M, on the 22nd. ...	...	62.0
Extreme range of the Temperature during the month ...	...	23.0
Mean of the daily Max. Temperature	...	81.3
Ditto ditto Min. ditto, ...	...	66.4
Mean daily range of the Temperature during the month...	...	14.9

Mean Wet Bulb Thermometer for the month	...	66.3
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer		7.0
Computed Mean Dew-point for the month	...	60.7
Mean Dry Bulb Thermometer above computed mean Dew-point	...	12.6
		Inches.
Mean Elastic force of Vapour for the month	...	0.536

		Troy grain.
Mean Weight of Vapour for the month	...	5.84
Additional Weight of Vapour required for complete saturation	...	3.00
Mean degree of humidity for the month, complete saturation being unity		0.66
		o
Mean Max. Solar radiation Thermometer for the month ...		119.5

		Inches.
Rained No days,—Max. fall of rain during 24 hours ...	...	Nil
Total amount of rain during the month	...	Nil
Total amount of rain indicated by the Gauge attached to the anemometer during the month	...	Nil
Prevailing direction of the Wind... ...		W.byN.&W.N,W.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Novr. 1869.

MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	W.	Rain on.	W. by N.	Rain on.	W. N. W.	Rain on.	N. W.	Rain on.	N. N. W.	Rain on.	N. by W.	Rain on.
																					No. of days																											
Mid night	3		1		1				1		1								1								1				1		4		1		1		5		3		1		2		3	
1	2		1		2				1		1								1				1						1		1		3		1		1		5		3		1		2		3	
2	1		1		3				1		1								1				1						1		1		3		1		1		4		4		1		2		3	
3	1		2		2				1		1								1				1						1		1		3		1		1		4		4		1		1		4	
4			3		2				1		1								1										2		1		3		1		2		4		3		1		2		3	
5			2		3				1		1								1										2		1		3		1		2		4		3		1		2		3	
6			2		3				2												1								2		1		3		1		2		4		3		1		2		3	
7			1		4				2												1		1						1		1		4				4		2		3		1		2		3	
8			1		4		1		2								1				1								1		1		4		1		3		2		3		1		2		2	
9	1		2		3		2		2		1		1																		2		4		1		3		1		3				1		3	
10			1		6		3		1				1				1														1		3		1		4		1		4						3	
11	3		2		5		2		1		1						1								1				1				1				3		3		2				2		2	
Noon.	5		1		2		3						2						1										1		2				3		2		4		2				1		1	
1	3		1		2		2		1						2				1												2		1		1		3		1		7				3			
2	4		1				1		1												2										1		2		1		4		3		4		1		3		2	
3	2		4		1				1										1				1								1				2		6		4		3		1		2		1	
4	3		2		1						1								1				1								1				3		3		6		3		1		2		2	
5	3		1				1				1								1				1								1		2		3		2		6		2				4		2	
6	3		1						1		1								1				1								1		4		1		2		5		3				4		2	
7	2		1						1		1								1				1								1		4		1		2		5		3				4		3	
8	2		1						1		1								1				1								1		3		2		2		5		3				4		3	
9	2		1				1		1										1				1								1		3		2		2		5		3				3		4	
10	2		1		1				1										1				1								1		3		2		2		5		3				3		4	
11	2		1		1				1										1				1								1		3		2		2		5		3				3		4	

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1869.

Latitude 22° 33′ 1″ North. Longitude 88° 20′ 34″ East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Date.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Temperature during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.908	29.989	29.837	0.152	71.5	79.5	66.0	13.5
2	.891	.976	.834	.142	70.7	79.5	63.4	16.1
3	.889	.957	.832	.125	69.7	78.0	63.0	15.0
4	.899	.977	.840	.137	68.0	77.4	61.5	15.9
5	.918	.988	.871	.117	67.8	78.6	59.6	19.0
6	.937	30.019	.879	.140	67.6	77.5	60.0	17.5
7	.969	.055	.914	.141	67.5	76.7	59.5	17.2
8	.985	.049	.918	.131	69.4	78.7	61.5	17.2
9	.980	.052	.919	.133	69.5	77.7	62.7	15.0
10	.993	.082	.945	.137	68.8	77.5	61.0	16.5
11	30.014	.088	.947	.141	69.5	79.3	61.5	17.8
12	.010	.099	.948	.151	69.5	79.3	61.6	17.7
13	.031	.101	.985	.116	69.2	78.6	61.0	17.6
14	.043	.118	.996	.122	68.3	76.7	61.0	15.7
15	.019	.103	.946	.157	67.6	77.2	60.4	16.8
16	29.964	.047	.907	.140	66.8	76.0	58.8	17.2
17	.960	.043	.908	.135	68.5	78.9	59.8	19.1
18	.950	.006	.902	.104	68.3	77.5	60.5	17.0
19	30.005	.075	.970	.105	67.5	76.2	60.5	15.7
20	.019	.092	.979	.113	68.4	76.4	60.8	15.6
21	.008	.079	.967	.112	71.6	79.4	67.3	12.1
22	.028	.103	.983	.120	71.0	79.2	64.1	15.1
23	.056	.137	30.002	.135	69.0	77.0	62.4	14.6
24	.055	.134	.005	.129	68.0	77.0	61.2	15.8
25	.049	.124	29.997	.127	68.1	78.0	60.0	18.0
26	.044	.117	30.001	.116	69.0	78.8	60.5	18.3
27	.036	.102	29.986	.116	68.4	77.0	62.2	14.8
28	.053	.139	.996	.143	68.0	77.4	61.4	16.0
29	.043	.122	.975	.147	68.3	77.6	62.1	15.5
30	.028	.118	.963	.155	64.6	74.4	56.8	17.6
	.014	.086	.957	.129	64.1	74.0	57.2	16.8

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1869.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Date.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	66.9	4.6	63.2	8.3	0.582	6.39	1.99	0.76
2	64.7	6.0	59.9	10.8	.521	5.72	2.46	.70
3	63.4	6.3	58.4	11.3	.496	.46	.47	.69
4	61.2	6.8	55.8	12.2	.455	.03	.50	.67
5	60.8	7.0	55.2	12.6	.415	4.92	.56	.66
6	60.5	7.1	54.8	12.8	.440	.85	.59	.65
7	61.2	6.3	56.2	11.3	.461	5.10	.32	.69
8	63.4	6.0	58.6	10.8	.499	.50	.36	.70
9	63.2	6.3	58.2	11.3	.493	.43	.45	.69
10	62.9	5.9	58.2	10.6	.493	.43	.28	.70
11	63.4	6.1	58.5	11.0	.498	.48	.40	.70
12	62.6	6.9	57.1	12.4	.475	.23	.65	.66
13	62.2	7.0	56.6	12.6	.467	.14	.67	.66
14	61.6	6.7	56.2	12.1	.461	.08	.52	.67
15	60.5	7.1	54.8	12.8	.440	4.85	.59	.65
16	60.1	6.7	54.7	12.1	.438	.85	.41	.67
17	61.8	6.7	56.4	12.1	.464	5.11	.54	.67
18	61.1	7.2	55.3	13.0	.447	4.94	.66	.65
19	61.4	6.1	56.5	11.0	.465	5.14	.28	.69
20	62.7	5.7	58.1	10.3	.491	.42	.20	.71
21	66.1	5.5	61.7	9.9	.554	6.07	.33	.72
22	65.7	5.3	61.5	9.5	.550	.04	.21	.73
23	61.7	7.3	55.9	13.1	.456	5.03	.73	.65
24	60.8	7.2	55.0	13.0	.442	4.89	.64	.65
25	62.4	5.7	57.8	10.3	.486	5.37	.18	.71
26	62.7	6.3	57.7	11.3	.485	.34	.42	.69
27	61.9	6.5	56.7	11.7	.469	.16	.46	.68
28	60.3	7.7	54.1	13.9	.429	4.74	.79	.63
29	60.6	7.7	54.4	13.9	.434	.78	.82	.63
30	56.7	7.9	50.4	14.2	.379	.22	.56	.62
31	56.5	7.6	49.7	14.4	.370	.12	.55	.62

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1869.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Hour.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer for each hour during the month. Max.	Min.	Diff.	Mean Dry Bulb Thermometer.	Range of the Temperature for each hour during the month. Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid-night.	29.992	30.054	29.886	0.168	65.1	69.8	59.8	10.0
1	.985	.048	.881	.167	64.4	69.0	59.0	10.0
2	.979	.042	.880	.162	63·8	68.5	58.8	9.7
3	.973	.037	.877	.160	63.1	67.4	58.4	9.0
4	.969	.042	.871	.171	62.5	67.4	58.2	9.2
5	.979	.058	.875	.183	62.0	67.3	57.5	9.8
6	.993	.078	.887	.191	61.5	67.3	57.0	10.3
7	30.013	.087	.899	.188	61.4	67.4	56.8	10.6
8	.041	.114	.936	.178	63.3	68.5	58.8	9.7
9	.065	.134	.954	.180	66.5	70.5	61.5	9.0
10	.069	.139	.957	.182	70.3	73.5	64.5	9.0
11	.050	.114	.943	.171	73.4	76.4	68.5	7.9
Noon.	.019	.085	.911	.174	75.3	78.0	70.2	7.8
1	29.985	.052	.875	.177	76.6	78.8	72.0	6.8
2	.959	.021	.851	.170	77.5	79.5	73.3	6.2
3	.944	.006	.834	.172	77.5	79.5	74.0	5.5
4	.940	.011	.832	.179	76.2	78.5	72.0	6.5
5	.947	.023	.839	.184	74.7	77.0	70·7	6.3
6	.958	.030	.845	.185	71.9	74.8	68.0	6.8
7	.975	.041	.863	.178	70.1	73.0	66.0	7.0
8	.991	.057	.880	.177	68.5	71.5	63.5	8.0
9	30.004	.068	.894	.174	67.3	70.5	63.0	7.5
10	.009	.072	.899	.173	66.3	69.5	61.5	8.0
11	.003	.059	.890	.169	65.4	68.8	60.0	8.8

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1869.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Hour.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid-night.	61.2	3.9	58.1	7.0	0.491	5.45	1.44	0.79
1	60.7	3.7	57.4	7.0	.480	.33	.41	.79
2	60.2	3.6	57.0	6.8	.473	.27	.34	.80
3	59.7	3.4	56.6	6.5	.467	.21	.26	.81
4	59.3	3.2	56.4	6.1	.464	.18	.17	.82
5	58.8	3.2	55.9	6.1	.456	.10	.15	.82
6	58.5	3.0	55.8	5.7	.455	.09	.07	.83
7	58.4	3.0	55.7	5.7	.453	.07	.07	.83
8	59.6	3.7	56.3	7.0	.462	.16	.35	.79
9	61.2	5.3	57.0	9.5	.473	.23	.96	.73
10	63.0	7.3	57.2	13.1	.476	.23	2.85	.65
11	63.8	9.6	66.1	17.3	.459	.02	3.85	.57
Noon.	64.1	11.2	56.3	19.0	.462	.03	4.37	.54
1	64.4	12.2	55.9	20.7	.456	4.94	.83	.51
2	64.7	12.8	55.7	21.8	.453	.90	5.14	.49
3	64.3	13.2	55.1	22.4	.444	.82	.22	.48
4	63.8	12.4	55.1	21.1	.444	.83	4.83	.50
5	64.2	10.5	56.8	17.9	.470	5.12	.11	.56
6	64.6	7.3	58.8	13.1	.503	.50	2.98	.65
7	63.9	6.2	58.9	11.2	.504	.55	.48	.69
8	63.2	5.3	59.0	9.5	.506	.58	.07	.73
9	62.4	4.9	58.5	8.8	.498	.50	1.87	.75
10	61.8	4.5	58.2	8.1	.493	.46	.69	.76
11	61.2	4.2	57.8	7.6	.486	.39	.56	.78

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1869.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	120.0	...	W. by N. & W. by S.	...	21.3	Clear to 10 A. M. _i & ⌒i to 2 P. M. clear afterwards. Foggy from 6 to 9 A. M.
2	118.5	...	W. by S. & W. by N.	...	48.4	Clear.
3	116.5	...	W. by N. & W. N. W	...	76.4	Clear.
4	113.5	...	W. N. W.	...	100.0	Clear to 2 P. M. \i to 5 P. M., clear afterwards.
5	116.5	...	W. N. W. & W.	...	96.0	Clear to 6 A. M. \i to 3 P. M. _i to 6 P. M. clear afterwards. Slightly foggy at 4 & 5 A. M. & from 6 to 11 P. M.
6	116.5	...	S. W., W. S. W. & W. N. W.	...	50.2	Clear. Slightly foggy from 4 to 6 A. M.
7	110.0	...	WNW. & N. N. W.	...	63.7	Clear. Slightly foggy from 3 to 6 A. M.
8	112.8	...	N. N. W. & N. N. E.	...	92.1	Clear.
9	113.0	...	N. N. E. & W. by N.	...	107.7	Clear. Slightly foggy from 7 to 11 P. M.
10	111.2	...	W.	...	51.0	Clear. Slightly foggy from midnight to 7 AM. & 7 to 11 P.M.
11	115.2	...	W, N. E. & N. by E.	...	49.3	Clear. Slightly foggy at midnight & 1 & from 5 to 7 A.M. & 7 to 11 P. M.
12	114.0	...	E. N. E. & N. by E.	...	100.6	Clear. Slightly foggy from 8 to 11 P. M.
13	112.5	...	E. N. E, N. N. E. & N. by E.	...	116.6	Clear.
14	112.6	...	N by E, N. E. & N.	...	158.7	Clear to 8 A. M. \i afterwards.
15	112.0	...	N. by W. & N. W.	1.6	114.0	Clear. Foggy at 10 & 11 P. M.
16	112.0	...	N. W. & W. by S.	...	89.6	Clear. Slightly, foggy at midnight & from 7 to 11 P. M.
17	113.5	...	W. by S & W. N. W.	...	79.1	Chiefly clear. Foggy from 7 to 11 P. M.
18	115.0	...	W. S. W. & W by N.	...	94.3	Clear. Foggy from 7 to 11 PM.
19	114.0	...	W by N. & W. N. W	...	74.2	Clear. Foggy from midnight to 6 A. M. & at 11 P. M.
20	111.0	...	W. by N. & N. W.	...	83.8	Clear to 8 A. M. \i afterwards. Foggy at 7 A. M.
21	115.0	...	N. W. & W. S. W.	...	44.0	\i & _i to 7 A. M. \i to 5 P. M. clear afterwards. Slightly foggy from 5 to 8 A M. & 7 to 9 P. M.
22	113.0	...	W. S. W & N. N. W.	...	69.9	Chiefly clear.
23	112.0	...	N, N. E. & N.	...	178.1	Clear.
24	116.0	...	N, N by E & N by W.	1.2	163.2	Clear.
25	115.3	...	N by W, WNW & N	...	95.2	Clear.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of February 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	Wind.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	o	Inches		lb	Miles	
27	122.0	...	W. by S. & S.S.W.	...	96.3	Stratoni to 7 A. M., \i to 11 A. M., clear afterwards.
28	124.0	...	S. S.W & W.N.W.	...	144.4	Clear. Slightly foggy at 8 & 9 P. M.

\i Cirri, —i Strati, ⌒i Cumuli, _i Cirro-strati, ⌒i Cumulo strati, \\~i Nimbi \\~i Cirro cumuli.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of March 1870.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	29.840
Max. height of the Barometer occurred at 10 A. M. on the 18th. ...	30.035
Min. height of the Barometer occurred at 4 P. M. on the 30th. ...	29.633
Extreme range of the Barometer during the month	0.402
Mean of the daily Max. Pressures	29.922
Ditto ditto Min. ditto	29.775
Mean daily range of the Barometer during the month	0.147

	o
Mean Dry Bulb Thermometer for the month	81.0
Max. Temperature occurred at 3 P. M. on the 30th.	101.2
Min. Temperature occurred at 6 A. M, on the 1st.	63.0
Extreme range of the Temperature during the month	38.2
Mean of the daily Max. Temperature	91.5
Ditto ditto Min. ditto, ...	72.1
Mean daily range of the Temperature during the month... ...	19.4

Mean Wet Bulb Thermometer for the month	71.0
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	10.0
Computed Mean Dew-point for the month	64.0
Mean Dry Bulb Thermometer above computed mean Dew-point ...	17.0
	Inches.
Mean Elastic force of Vapour for the month	0.597

	Troy grain.
Mean Weight of Vapour for the month	6.42
Additional Weight of Vapour required for complete saturation ...	4.72
Mean degree of humidity for the month, complete saturation being unity	0.58
	o
Mean Max. Solar radiation Thermometer for the month ...	127.8

	Inches.
Rained 5 days,—Max. fall of rain during 24 hours	0.03
Total amount of rain during the month	0.03
Total amount of rain indicated by the Gauge attached to the anemometer during the month	Nil.
Prevailing direction of the Wind... ...	S.S.W.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of March. 1870.

MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	W.	Rain on.	W. by N.	Rain on.	W. N. W.	Rain on.	N. W.	Rain on.	N. N. W.	Rain on.	N. by W.	Rain on.
																					No. of days																											
Mid night																									4		2		19		1		2		1		1		1									
1																									4		1		16		3		3		1		1		1				1					
2																									3		2		14		5		1		1		1		1		2		1					
3																									3				15		5		1		1		2		1		2		1					
4																									1		1		15		5		1		2		2		2		1		1					
5																									2		1		11		3		3		3		3		2		1		2					
6																					1				1		1		11		3		3		3		3		2		1		2					
7																									2		6		6		4		2		3		3	1	2		1		2					
8																									2		5		5		8	1	4		1		2		2		1				1			
9	1												1														2		10		5		5		1	1	1		1		3				1			
10	1						1		1				1												1		2		4		8		4		1	1	1		2		1		2		1			
11									2						2				1				1						7		5		4		2		2		1		1		2		1			
Noon.									1				3										2						3		6		2		1		8		2		2		1					
1							1						1						1				1				1		2		1		5		6		4		5		2		1					
2															1								1		1						4	1	7		8		3		2		4							
3															1						1								1		4		5		6		5	1	3		4				1			
4													1								1				1		1				1		5		5	1	8		4		2		2					
5															1						1		1				1		1		1		8		6		7		1		1		1		1			
6	1	1															1						1				3		3	1	3	1	6		5		4		1		2		1					
7																			2				2				3		6		1		5		5		3		2		1		1					
8																					1		1		2		4		8		3		2		5		2		1		1		1					
9																					1	1			3		5	1	9		5				3		1		1		1		2					
10																							2		5		4		12	1	3		2				1						2					
11																									5		3		16		3		1				1				1		1					

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1870.

Latitude 22° 33′ 1″ North. Longitude 88° 20′ 34″ East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Date.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Temperature during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.718	29.789	29.633	0.156	86.2	98.6	78.0	20.6
2	.822	.909	.730	.179	84.6	95.2	75.0	20.2
3	.863	.948	.812	.136	86.6	96.0	77.2	18.8
4	.854	.930	.799	.131	85.6	96.5	78.0	18.5
5	.803	.897	.720	.177	82.7	91.6	75.7	15.9
6	.706	.775	.621	.154	84.9	96.2	76.3	19.9
7	.692	.743	.626	.117	84.9	96.9	75.0	21.9
8	.711	.774	.626	.148	82.7	95.4	74.8	20.6
9	.697	.786	.568	.218	78.1	90.4	70.5	19.9
10	.717	.791	.654	.137	74.9	83.2	68.0	15.2
11	.785	.848	.716	.132	77.1	86.7	67.7	19.0
12	.823	.903	.742	.161	79.0	89.4	72.5	16.9
13	.718	.800	.625	.175	83.4	93.5	75.2	18.3
14	.707	.767	.651	.116	85.2	93.8	78.5	15.3
15	.733	.807	.658	.149	85.3	95.5	79.0	16.5
16	.713	.781	.630	.151	86.4	97.5	78.2	19.3
17	.732	.789	.672	.117	85.1	95.0	78.4	16.6
18	.805	.880	.743	.137	84.9	92.8	78.5	14.3
19	.848	.912	.765	.147	85.6	94.5	79.0	15.5
20	.841	.930	.763	.167	85.3	96.5	75.4	21.1
21	.834	.919	.746	.173	85.3	97.0	75.4	21.6
22	.816	.912	.737	.175	85.4	96.0	76.7	19.3
23	.750	.843	.654	.189	85.1	95.0	77.4	17.6
24	.676	.746	.583	.163	86.2	97.3	79.4	17.9
25	.707	.780	.623	.157	85.5	97.8	74.5	23.3
26	.727	.803	.636	.167	84.8	96.0	75.0	21.0
27	.709	.798	.614	.184	83.5	96.0	76.0	20.0
28	.709	.772	.625	.147	84.1	94.4	77.4	17.0
29	.733	.799	.666	.133	88 0	97.0	80.5	16.5
30	.759	.825	.698	.127	87.2	94.4	81.0	13.4

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1870.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Date.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	-
1	76.7	9.5	70.0	16.2	0.727	7.74	5.25	0.60
2	73.3	11.3	65.4	19.2	.626	6.69	.70	.54
3	73.0	13.6	64.8	21.8	.613	.53	6.61	.50
4	72.1	13.5	62.6	23.0	.570	.08	.68	.48
5	73.2	9.5	66.5	16.2	.648	.96	4.76	.59
6	75.2	9.7	68.4	16.5	.690	7.36	5.13	.59
7	74.8	10.1	67.7	17.2	.674	.21	.28	.58
8	75.4	7.3	70.3	12.4	.734	.89	3.83	.67
9	72.5	5.6	68.6	9.5	.695	.52	2.70	.74
10	69.8	5.1	66.2	8.7	.642	6.99	.29	.75
11	70.0	7.1	65.0	12.1	.617	.71	3.21	.68
12	73.8	5.2	70.2	8.8	.732	7.91	2.59	.75
13	77.8	5.6	73.9	9.5	.824	8.83	3.13	.74
14	79.9	5.3	76.2	9.0	.887	9.49	.12	.75
15	79.2	6.1	74.9	10.4	.851	.09	.55	.72
16	76.8	9.6	70.1	16.3	.729	7.77	5.29	.60
17	78.3	6.8	73.5	11.6	.814	8.69	3.88	.69
18	78.7	6.2	74.4	10.5	.838	.95	.54	.72
19	77.6	8.0	72.0	13.6	.776	.26	4.50	.65
20	74.8	10.5	67.4	17.9	.668	7.12	5.52	.56
21	75.5	9.8	68.6	16.7	.695	.41	.23	.59
22	75.9	9.5	69.2	16.2	.708	.56	.12	.60
23	77.3	7.8	71.8	13.3	.771	8.23	4.34	.66
24	76.8	9.4	70.2	16.0	.732	7.79	5.20	.60
25	77.9	7.6	72.6	12.9	.790	8.43	4.29	.66
26	76.9	7.9	71.4	13.4	.761	.13	.33	.65
27	75.4	8.1	69.7	13.8	.720	7.71	.29	.64
28	77.2	6.9	72.4	11.7	.785	8.39	3.82	.69
29	79 2	8.8	73.9	14,1	.824	.76	4.92	.64
30	78.8	8.4	73.8	13.4	.822	.75	.62	.65

All the Hygrometrical elements are computed by the Greenwich Constants

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Hour.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer for each hour during the month. Max.	Min.	Diff.	Mean Dry Bulb Thermometer.	Range of the Temperature for each hour during the month. Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid-night.	29.760	29.849	29.654	0.195	79.1	84.5	70.4	14.1
1	.752	.844	.679	.165	78.6	83.6	69.2	14.4
2	.742	.836	.668	.168	78.2	83.0	69.2	13.8
3	.733	.830	.657	.173	77.8	82.2	69.0	13.2
4	.733	.840	.650	.190	77.6	82.4	68.5	13.9
5	.747	.868	.663	.205	77.1	81.0	68.0	13.0
6	.766	.882	.678	.204	76.6	81.0	67.7	13.3
7	.788	.902	.700	.202	77.3	81.8	68.0	13.8
8	.811	.926	.723	.203	80.4	84.5	72.0	12.0
9	.826	.943	.734	.209	83.7	87.7	75.0	12.7
10	.826	.948	.743	.205	86.8	90.2	77.4	12.8
11	.816	.935	.724	.211	89.5	93.2	79.1	14.1
Noon.	.797	.923	.706	.217	91.3	95.0	80.2	14.8
1	.767	.880	.678	.202	92.9	97.8	81.7	16.1
2	.735	.849	.657	.192	93.8	98.0	83.0	15.0
3	.708	.822	.618	.204	93.8	98.5	76.0	22.5
4	.689	.815	.583	.232	93.3	98.6	81.7	16.9
5	.688	.812	.568	.244	91.2	97.0	74.8	22.2
6	.698	.823	.585	.238	88.6	94.0	77.5	16.5
7	.718	.848	.637	.211	85.5	90.5	72.8	17.7
8	.743	.847	.666	.181	83.3	89.0	71.5	17.5
9	.769	.868	.679	.189	81.5	87.5	72.0	15.5
10	.780	.880	.699	.181	80.8	87.0	72.0	15.0
11	.771	.857	.702	.155	80.0	85.6	70.5	15.1

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Hour.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid-night.	74.6	4.5	71.4	7.7	0.761	8.22	2.31	0.78
1	74.3	4.3	71.3	7.3	.758	.21	.17	.79
2	74.3	3.9	71.6	6.6	.766	.28	1.97	.81
3	74.2	3.6	71.7	6.1	.768	.33	.80	.82
4	74.0	3.6	71.5	6.1	.763	.28	.79	.82
5	73.8	3.3	71.5	5.6	.763	.28	.64	.84
6	73.7	2.9	71.7	4.9	.768	.35	.42	.86
7	74.4	2.9	72.4	4.9	.785	.51	.47	.85
8	76.0	4.4	72.9	7.5	.797	.59	2.35	.79
9	76.8	6.9	72.0	11.7	.776	.30	3.77	.69
10	77.6	9.2	72.1	14.7	.778	.27	4.91	.63
11	78.0	11.5	71.1	18.4	.753	7.98	6.31	.56
Noon.	78.0	11.3	70.0	21.3	.727	.66	7.40	.51
1	77.8	15.1	68.7	24.2	.697	.32	8.45	.46
2	77.6	16.2	67.6	25.9	.679	.13	9.05	.44
3	77.1	16.7	67.1	26.7	.661	6.93	.25	.43
4	77.3	16.0	67.7	25.6	.674	7.08	8.87	.44
5	76.6	14.6	67.8	23.4	.677	.14	7.88	.48
6	76.4	12.2	69.1	19.5	.706	.47	6.45	.54
7	75.8	9.7	69.0	16.5	.704	.50	5.22	.59
8	75.8	7.5	70.5	12.8	.739	.92	4.01	.66
9	75.1	6.4	70.6	10.9	.741	.97	3.34	.71
10	75.1	5.7	71.1	9.7	.753	8.11	2.96	.73
11	74.8	5.2	71.2	8.8	.756	.15	.66	.75

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	133.0	...	S. W. & S. S. W.	1.0	170.5	Clear to 2 P. M., ╲i to 6 P. M., ╲i afterwards. Lightning to W from 9 to 11 P. M.
2	128.9	...	W. by N. & N.	...	197.4	Clouds of different kinds.
3	131.2	...	S. & W.	...	134.9	Stratoni to 3 A. M., ╲i to 11 A. M., ╲_i & ╲i to 8 P. M., clear afterwards.
4	130.2	...	W.S.W.&S.S.W.	3.0	145.9	Clouds of different kinds. Brisk wind between 6 & 6½ P. M. Thunder & lightning at 5, 6 & 9 P.M. Drizzled at 5½ P.M.
5	125.0	0.27	S.S. E. &Variable	0.4	159.2	Overcast to 11 A. M.. clear afterwards. Thunder from 5 to 9 A. M. Lightning at 3, 4 & 7 A. M., slight rain at 3½, 6, 7 & 9 A. M.
6	132.2	...	S S W & S by W	...	143.4	Chiefly clear.
7	130.0	...	S. & S. S. W.	...	155.6	Clear to 1 P. M., ⌒i to 4 P. M., clear afterwards.
8	128.2	0.07	S. S. W.	18.0	245.2	Clearto 4 A. M., ⌒i to 10 A. M., clear to 3 P. M., clouds of different kinds to 8 P. M., clear afterwards. Storm between 4½ & 5 P. M. Thunder, lightning & rain at 5 P. M.
9	125.5	1.27	S & Variable.	40.0	225.7	Clouds of different kinds to 2 P. M., overcast afterwards. Storm at 6½ P. M., thunder & lightning at 4 A. M. 3 P. M. & from 5 to 8 P. M. Rain at 4 A. M. & from 4½ to 7½ P. M.
10	122.5	0.66	E.S.E.&N.N.E.	4.0	241.9	Clouds of different kinds to 6 A. M., clear to 10 A. M., ⌒i to 4 P. M., clear afterwards. Brisk wind between midnight & 1 A. M. Thunder & lightning from midnight to 2 A. M., rain at 1 P. M.
11	122.0	...	E, & E. by S.	...	137.4	Clear.
12	128.8	0.69	E. S. E. & S. S.E.	...	139.3	Clear to 10 A. M., ⌒i to 6 P. M., stratoni afterwards. Rain between 2 & 3 P. M.
13	125.5	...	S.SE,SbyE.&SW	...	167.5	Chiefly ⌒i. Lightning to S. at 4 A. M.
14	126.0	...	S.S.W,&.S.byW.	...	216.0	Clear to 4 A. M. Scuds from S S W to 8 A. M., clear afterwards.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage $1\frac{1}{2}$ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
15	129.0	...	S.S.W,S.&S.byW	0.4	243.2	Scuds from S. S. W to 8 A. M., clear to 7, P. M.. scuds from S by W afterwards.
16	127.5	...	SSW,W S W & S	...	245.6	Scuds from S. S. W. to 3 A. M., clear afterwards.
17	127.5	...	SSW.S & S by W	...	193.2	Chiefly clear.
18	127.7	...	S. S. W. & S by E	...	221.7	Stratoni & \i to 6 A. M. \i to 5 P.M., stratoni afterwards. Lightning to W at $6\frac{3}{4}$ & 8 P.M.
19	128.0	...	S. & S. by E.	2.8	158.7	Clouds of different kinds. Brisk wind at $9\frac{1}{2}$ P. M.
20	130.0	...	W.S.W. & S.S.E.	...	124.2	Clear to 11 A. M., \i to 5 P. M., clear afterwards.
21	129.9	...	W.S.W.&S.byW	...	109.2	Clear to 5 A. M., \i to 7 P. M., clear afterwards.
22	128.8	...	S. & S. S. W.	...	144.0	Clear to 7 A. M., \ to 10 A. M., clear afterwards. Foggy from 2 to 6 A. M.
23	127.0	...	S. & S. by W.	1.8	217.7	Clear. Brisk wind from 1 to $3\frac{1}{2}$ P.M. Lightning to W at 8 P. M.
24	130.0	...	S. & Variable.	3.8	262.2	\i to 7 A. M., clear to 4 P. M., stratoni afterwards. Brisk wind between 5 & $5\frac{1}{2}$ & at $6\frac{1}{2}$ P. M. Thunder & lightning to W at 6 P. M. Drizzled at $5\frac{1}{2}$ & 7 P. M.
25	133.0	0.04	S. & Variable.	3.0	222.3	Stratoni to 3 A. M., clear to 10 A. M., clouds of different kinds afterwards. Brisk wind from 2 to 11 P. M. Lightning to N W at 8 & 9 P. M. Thunder & rain at 9 P. M.
26	129.5	0.19	S. by E. & S.	2.4	256.8	Clouds of different kinds to 8 P. M., overcast afterwards. Brisk wind between $8\frac{1}{2}$ & 9 P. M. Thunder at 9 P M. Lightning from 7 to 10 P. M. Rain at 9 & 10 P. M.
27	129.4	0.84	S. S. W.&E.N.E.	...	169.2	Overcast to 3 A. M., \i to 7 A. M., clear to 4 P. M., overcast afterwards. Thunder at $7\frac{3}{4}$ P. M. Lightning to N W at 7 & 8 P. M. Rain from $7\frac{1}{4}$ to $8\frac{1}{2}$ P. M.

Abstract of the Result of the Hourly Meterological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1870.

Solar Radiation, Weather, &c.,

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
28	129.0	...	E. N.E& Variable	...	156.3	Overcast to 5 A. M., ⌒i to 11 A. M., ⌒i to 3 P. M., clouds of different kinds afterwards. Thunder at 2¾, 3 & 4 P. M. Drizzled at 5 P. M.
29	127.5	...	S S W & Variable.	...	133.7	Overcast to 7 A. M., clear to 2 P. M., \i to 8 P. M., clear afterwards.
30	127.0	...	S S W& Variable.	...	126.8	\i to noon, stratoni afterwards.

Cirri, —i Strati, ⌒i Cumuli, _i Cirro-strati, ⌒i Cumulo strati, \⌒i Nimbi, _i Cirro-cumuli.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1870.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	29.757
Max. height of the Barometer occurred at 10 A. M. on the 3rd. ...	29.948
Min. height of the Barometer occurred at 5 P. M. on the 9th. ...	29.568
Extreme range of the Barometer during the month	0.380
Mean of the daily Max. Pressures	29.832
Ditto ditto Min. ditto	29.678
Mean daily range of the Barometer during the month	0.154

	o
Mean Dry Bulb Thermometer for the month	84.1
Max. Temperature occurred at 4 P. M. on the 1st.	98.6
Min. Temperature occurred at 6 A. M. on the 11th.	67.7
Extreme range of the Temperature during the month	30.9
Mean of the daily Max. Temperature	94.5
Ditto ditto Min. ditto, ...	76.1
Mean daily range of the Temperature during the month... ...	18.4

Mean Wet Bulb Thermometer for the month	75.8
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	8.3
Computed Mean Dew-point for the month	70.0
Mean Dry Bulb Thermometer above computed mean Dew-point ...	14.1
	Inches.
Mean Elastic force of Vapour for the month	0.727

	Troy grain.
Mean Weight of Vapour for the month	7.78
Additional Weight of Vapour required for complete saturation ...	4.43
Mean degree of humidity for the month, complete saturation being unity	0.64
	o
Mean Max. Solar radiation Thermometer for the month ...	128.3

	Inches.
Rained 11 days.—Max. fall of rain during 24 hours	1.27
Total amount of rain during the month	4.03
Total amount of rain indicated by the Gauge attached to the anemometer during the month	3.38
Prevailing direction of the Wind... ...	S & S.S. W.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1870.

MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

No. of days.

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.
Mid night							1				1		2				2		2		1		2	
1									1	1			1				2				3			
2									1		1		2				1				1		1	
3									3				1				1				1		1	
4									1		1		1				2				1		1	
5							1		2		1		1				3						2	
6									1		1		2		1		3				1		2	
7									2				1		1		3		1		1		2	
8									1				2				3		3		2		1	
9	1				1	1	1		1						2		1		1		4		1	1
10	2						2				1				1		1				1		1	
11			1		1		1		2				2		1								1	
Noon.	2						1		1		1								2		3		2	
1	1		1				1		1				2				1		2		1		2	
2			1		1				1		1		1		1		1		1		2		2	
3	1				1				3		1								2		4	1	2	
4			1		1				1				1				1		1		2		4	
5			1								1		2						1		1	1	2	
6					1				1		1						2	1			3		1	
7	1				1				1		1								1	1	3		1	
8	1						1		1		1		1						1	1	1		1	
9	1				1	1	1		1						2				1		1		2	
10			1								1		4		1		1						3	
11			1										1				4		2		1		2	

Hour.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	W.	Rain on.	W. by N.	Rain on.	W. N. W.	Rain on.	N. W.	Rain on.	N. N. W.	Rain on.	N. by W.	Rain on.
Mid night	5		2		8				3										1					
1	6		3		9		1		3										1					
2	6		2		10		1		3								1							
3	6		3		8		1		3		1				1									
4	5		3	1	9		2		2				1	1	1									
5	4		2		7		2		1		1				1		1		1	1				
6	4		2		6		3		1		2	1			1									
7	5		2		6		2				1		1		1		1	1						
8	3		3		5		2		1				1		1		2							
9	3		3		5		6						1				1				1			
10	3		4		6		5		1				1						1					
11	5		5		6		1		1		1		1						1					
Noon.	4		3		5		3		2								1							
1	6		3		1		4				1		2									1		
2	6		3		2		1		3		1		1		1									
3	5		2		4				4						1									
4	3		7		3				1				2				1				1			
5	6		6		1		1	1	1				3	1	1		1				1	1		
6	3		6		4	1	1		2				3						1	1		1		
7	10		4		2		1		1		1	1	2											
8	9		6		3		1		1				1									1	1	
9	8		6		2						1		2	1					1	1				
10	6		5		2		1		2		1				1	1			1					
11	6		5		4				3								1							

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1870.

Latitude 22° 33′ 1″ North. Longitude 88° 20′ 34″ East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Date.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Temperature during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.738	29.810	29.650	0.160	88.3	96.5	82.4	14.1
2	.649	.714	.554	.160	89.4	100.8	82.0	18.8
3	.612	.684	.509	.175	89.5	100.5	82.0	18.5
4	.609	.678	.521	.157	89.0	97.4	83.2	14.2
5	.597	.671	.519	.152	90.1	103.4	82.6	20.8
6	.613	.672	.538	.134	89.3	99.0	82.5	16.5
7	.588	.664	.509	.155	89.2	98.2	83.5	14.7
8	.509	.586	.406	.180	90.1	101.0	82.6	18.4
9	.503	.584	.414	.170	91.5	103.6	83.0	20.6
10	.504	.572	.413	.159	90.4	101.0	82.2	18.8
11	.494	.547	.419	.128	89.5	100.6	81.6	19.0
12	.556	.613	.502	.111	89.0	98.5	82.0	16.5
13	.609	.667	.551	.116	88.7	98.5	81.0	17.5
14	.614	.686	.563	.123	87.8	96.7	81.7	15.0
15	.608	.674	.549	.125	87.6	96.5	81.2	15.3
16	.649	.703	.595	.108	88.0	98.0	81.2	16.8
17	.676	.744	.605	.139	89.0	98.0	82.5	15.5
18	.650	.702	.551	.151	88.7	97.5	82.5	15.0
19	.632	.758	.531	.227	86.8	97.0	75.0	22.0
20	.598	.676	.510	.166	84.4	93.6	76.5	17.1
21	.575	.666	.508	.158	86.3	94.1	75.7	18.4
22	.633	.731	.562	.169	85.2	92.2	75.5	16.7
23	.686	.766	.630	.136	85.3	93.2	76.6	16.6
24	.675	.748	.561	.187	86.2	94.0	79.0	15.0
25	.682	.770	.618	.152	87.2	95.4	80.5	14.9
26	.668	.712	.608	.104	84.7	92.7	81.0	11.7
27	.634	.680	.573	.107	84.2	91.5	79.5	12.0
28	.595	.651	.520	.131	85.3	94.5	78.7	15.8
29	.528	.605	.467	.138	84 7	89.7	80.5	9.2
30	.467	.532	.394	.138	84.9	96.6	80.0	16.6
31	.474	548.	.420	.128	87.7	100.9	78.0	22.9

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1870.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Date.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	81.0	7.3	76.6	11.7	0.899	9.54	4.26	0.69
2	81.7	7.7	77.1	12.3	.913	.68	.57	.68
3	82.7	6.8	78.6	10.9	.958	10.15	.14	.71
4	82.7	6.3	78.9	10.1	.967	.26	3.82	.73
5	81.3	8.8	76.0	14.1	.882	9.33	5.21	.64
6	81.9	7.4	77.5	11.8	.925	.80	4.41	.69
7	82.3	6.9	78.2	11.0	.946	10.02	.14	.71
8	82.7	7.4	78.3	11.8	.949	.03	.51	.69
9	80.2	11.3	73.4	18.1	.811	8.55	6.00	.56
10	81.5	8.9	76.2	14.2	.887	9.39	5.28	.64
11	81.7	7.8	77.0	12.5	.910	.63	4.66	.67
12	80.9	8.1	76.0	13.0	.882	.35	.73	.66
13	80.2	8.5	75.1	13.6	.857	.08	.88	.65
14	79.8	8.0	75.0	12.8	.854	.07	.53	.67
15	79.9	7.7	75.3	12.3	.862	.17	.35	.68
16	80.2	7.8	75.5	12.5	.868	.21	.47	.67
17	81.6	7.4	77.2	11.8	.916	.71	.37	.69
18	81.0	7.7	76.4	12.3	.893	.49	.47	.68
19	80.2	6.6	76.2	10.6	.887	.45	3.76	.72
20	77.0	7.4	71.8	12.6	.771	8.23	4.08	.67
21	79.4	6.9	74.6	11.7	.843	.98	.04	.69
22	80.0	5.2	76.4	8.8	.893	9.55	3.06	.76
23	79.8	5.5	75.9	9.4	.879	.40	.24	.74
24	79.7	6.5	75.1	11.1	.857	.13	.86	.70
25	80.9	6.3	77.1	10.1	.913	.72	.65	.73
26	80.1	4.6	76.9	7.8	.908	.70	2.72	.78
27	79.7	4.5	76.5	7.7	.896	.59	.65	.78
28	79.3	6.0	75.1	10.2	.857	.15	3.49	.72
29	80.2	4.5	77.0	7.7	.910	.73	2.69	.78
30	79.5	5.4	75.7	9.2	.873	.34	3.15	.75
31	79.7	8.0	74.9	12.8	.851	.04	4.52	.67

All the Hygrometrical elements are computed by the Greenwich Constants

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Hour.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Temperature for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid-night.	29.610	29.768	29.480	0.288	82.9	85.7	76.5	9.2
1	.597	.761	.468	.293	82.6	85.2	76.5	8.7
2	.586	.751	.459	.292	82.4	85.0	76.5	8.5
3	.579	.742	.453	.289	82.1	84.7	76.5	8.2
4	.582	.741	.456	.285	81.9	84.5	76.8	7.7
5	.598	.745	.466	.279	81.7	83.7	76.6	7.1
6	.614	.760	.486	.274	81.7	83.5	77.3	6.2
7	.634	.770	.495	.275	83.0	85.0	78.5	6.5
8	.659	.789	.493	.296	85.6	87.7	81.5	6.2
9	.661	.810	.503	.307	88.5	90.5	83.2	7.3
10	.660	.806	.497	.309	91.0	93.5	86.0	7.5
11	.648	.797	.489	.308	93.5	96.5	88.0	8.5
Noon.	.633	.785	.470	.315	94.8	99.5	89.0	10.5
1	.611	.758	.451	.307	96.0	101.4	86.5	14.9
2	.584	.738	.414	.324	96.2	101.8	84.8	17.0
3	.561	.715	.410	.305	95.9	103.1	83.0	20.1
4	.549	.689	.397	.292	95.0	103.6	82.6	21.0
5	.531	.650	.394	.256	93.3	103.0	82.6	20.4
6	.549	.651	.399	.252	90.9	99.6	82.8	16.8
7	.561	.668	.432	.236	87.6	94.5	75.0	19.5
8	.589	.758	.416	.342	85.8	91.2	76.0	15.2
9	.611	.748	.455	.293	84.6	88.0	75.7	12.3
10	.619	.736	.481	.255	83.9	89.5	76.5	13.0
11	.616	.726	.488	.238	83.5	87.4	75.5	11.9

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Hour.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid-night.	79.2	3.7	76.6	6.3	0.899	9.65	2.14	0.82
1	79.1	3.5	76.6	6.0	.899	.65	.08	.83
2	79.1	3.3	76.8	5.6	.905	.71	1.90	.84
3	79.2	2.9	77.2	4.9	.916	.85	.66	.86
4	79.2	2.7	77.3	4.6	.919	.88	.56	.86
5	79.3	2.4	77.6	4.1	.928	.99	.38	.88
6	79.4	2.3	77.8	3.9	.934	10.05	.32	.88
7	80.2	2.8	78.2	4.8	.946	.15	.67	.86
8	81.2	4.4	78.1	7.5	.943	.06	2.70	.79
9	82.2	6.3	78.4	10.1	.952	.10	3.78	.73
10	82.5	8.5	77.4	13.6	.922	9.73	5.20	.65
11	82.7	10.8	76.2	17.3	.887	.33	6.71	.58
Noon.	82.7	12.1	75.4	19.4	.865	.07	7.58	.55
1	82.2	13.8	73.9	22.1	.824	8.61	8.62	.50
2	81.8	14.4	73.2	23.0	.806	.41	.92	.49
3	81.3	14.6	72.5	23.4	.787	.23	.95	.48
4	81.4	13.6	73.2	21.8	.806	.43	.31	.50
5	81.3	12.0	74.1	19.2	.830	.73	7.22	.55
6	81.4	9.5	75.7	15.2	.873	9.22	5.67	.62
7	80.5	7.1	76.2	11.4	.887	.45	4.07	.70
8	80.1	5.7	76.1	9.7	.885	.44	3.39	.74
9	79.7	4.9	76.3	8.3	.890	.53	2.86	.77
10	79.4	4.5	76.2	7.7	.887	.51	.62	.78
11	79.5	4.0	76.7	6.8	.902	.66	.34	.81

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage $1\frac{1}{2}$ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	129.0	...	S.	...	92.7	Stratoni to 6 A. M., \⌒i & _i to 10 A. M., stratoni & \⌒i afterwards.
2	130.0	...	SSW,SW&SbyW	...	167.6	Stratoni to 6 A. M., clear to noon, ⌒i to 5 P. M., \i afterwards.
3	129.9	...	S.S.W, S &SbyW.	1.0	238.9	Chiefly clear.
4	128.0	...	S.S.W.& S.byW.	2.0	331.5	Chiefly clear. Brisk wind from 5 to 10 P. M.
5	135.6	...	S. by W. &S.SW.	0.8	319.0	Chiefly clear. Brisk wind from $4\frac{1}{4}$ to 7. M.
6	130.0	...	S.	0.4	251.5	Chiefly clear.
7	131.8	...	S. by W.&S.S.W.	0.2	268.0	Stratoni to 5 A. M., clear to 9 A. M., \i to 7 P. M., stratoni afterwards.
8	135.0	...	S. S. W.& S byW	0.2	246.1	Clear to 6 A. M., \i to 6 P. M., scuds afterwards.
9	135.0	...	S SW& S	...	205.6	Scuds to 4 A. M., clear to 5 P. M., \i afterwards.
10	130.0	...	S.& SbyW.	...	166.6	Stratoni to 4 A. M., \i to 1 P. M., ⌒i to 4 P. M., clear afterwards.
11	133.0	...	S byW &S	...	205.7	Clear to 6 A. M.,\i to 11 A. M., clear afterwards.
12	132.2	...	S. & S. by W.	0.2	258.3	Clear to noon, \i to 7 P. M., clear afterwards.
13	131.0	...	S. & S. by E.	0.8	259.7	Chiefly clear.
14	130.8	...	S. & S. by E.	...	263.0	Clear to 8 A. M., \i afterwards.
15	131.5	...	S.byW&S.	0.4	275.5	_i to 7 A. M., stratoni to noon, \i afterwards.
16	135.0	...	S.	...	244.8	Stratoni to 3 A. M., \⌒i to 2 P. M., \i to 6 P. M., clouds of different kinds afterwards.
17	128.7	...	S,SSW & S by E.	0.4	273.2	Chiefly clear.
18	130.2	...	S. by E, & S.	2.0	313.5	Stratoni to 4 A. M., scuds to 10 A. M., clear to 7 P. M., stratoni afterwards. Brisk wind from 1 to $5\frac{3}{4}$ P.M. Lightning at 8 & 9 P. M.
19	135.8	0.39	S. by E. & S.	7.9	317.5	Clear to7 A.M., ⌒i to 6 P.M., overcast afterwards. High wind between 6 & 7 P. M. Thunder at 7 P. M. Lightning from 7 to 9 P. M., Slight rain from $6\frac{1}{2}$ to $9\frac{1}{4}$ P. M.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
20	126.2	0.10	N. E. & S. S. W.	36.0	269.5	\i to 8 A. M., ⌒i to 3 P. M., \i to 6 P. M., overcast afterwards. Storm from 7 to 9¼ P. M. Thunder at 9¼ P. M. Lightning at 9 P. M. Slight rain at 7, 8 & 10 P. M.
21	126.5	0.43	S. by E, S.S.W. & S. by W	7.6	337.4	Clouds of different kinds. Brisk wind from 8¾ A. M. to 3 P. M. High wind between 8 & 9 P. M. Thunder & rain at 9 P. M. Lightning from 8 to 10 P. M.
22	124.0	...	S. & S. S. W.	3.8	350.2	Clouds of different kinds. Brisk wind between 9 & 10 A. M., & at 8¾ P. M. Thunder at 9¼ P. M. Lightning from 8 to 11 P. M. Drizzled at noon, 9 & 11 P. M.
23	127.8	...	S. S. W.	1.0	290.4	Clouds of different kinds. Lightning to W. at 8 P. M. Drizzled at mid-night.
24	129.5	...	S.S.W. & S. by E.	1.0	284.0	Overcast to 3 A. M., \i to 7 A. M., ⌒i to 5 P. M., clouds of different kinds afterwards. Brisk wind between 1 & 2 A. M. Lightning to W at 8 P. M. Drizzled at 10 P. M.
25	133.0	...	SSW, EbyS & SSE	...	233.0	\i to 2 P. M., stratoni afterwards.
26	127.5	...	SbyW SSW & SSE	...	277.3	Clear to 5 A. M., ⌒i to 1 P. M. overcast to 6 P. M., stratoni afterwards.
27	115.5	...	S. S. E. & S.S.W.	...	162.0	Stratoni to 2 A. M., clear to 5 A. M., ⌒i & \i to 1 P. M., overcast to 5 P. M., stratoni afterwards. Lightning from 7 to 9 P. M. Drizzled at 7¾ P. M.
28	130.0	...	SbyW & Variable.	1.6	138.9	Overcast to 5 A. M., \i to 6 P. M., overcast afterwards. Brisk wind between 7 & 8 P. M. Lightning from 8 to 10 P. M. Drizzled at 8 P. M.
29	...	...	S S W & S, by E.	...	127.8	Overcast. Drizzled at 8 & 10½ P. M.

Abstract of the Result of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1870.

Solar Radiation, Weather, &c..

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles.	
30	127.7	...	S S E & S	...	141.0	Overcast to 7 A. M., ⌒i to 3 P. M., overcast to 6 P. M., stratoni afterwards. Thunder & drizzled at 2¾ P. M.
31	134.8	...	S E,SSE&S.	...	153.0	Clear to 7 A. M., ╲i to 11 A. M., stratoni to 3 P. M., ╲i to 7 P. M., clear afterwards. Lightning to N. W. at 8 P. M.

╲i Cirri, —i Strati, ⌒i Cumuli, ╲_i Cirro-strati, ⌒ i Cumulo strati, ╲⌒i Nimbi, ╲⌒i Cirro-cumuli.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1870.

Monthly Results.

	Inches.
Mean height of the Barometer for the month...	29.601
Max. height of the Barometer occurred at 9 A. M. on the 1st. ...	29.810
Min. height of the Barometer occurred at 5 P. M. on the 30th. ...	29.394
Extreme range of the Barometer during the month	0.416
Mean of the daily Max. Pressures	29.671
Ditto ditto Min. ditto	29.525
Mean daily range of the Barometer during the month	0.146

	o
Mean Dry Bulb Thermometer for the month	87.7
Max. Temperature occurred at 4 P. M. on the 9th.	103.6
Min. Temperature occurred at 7 P. M, on the 19th.	75.0
Extreme range of the Temperature during the month	28.6
Mean of the daily Max. Temperature	97.1
Ditto ditto Min. ditto, ...	80.5
Mean daily range of the Temperature during the month... ...	16.6

Mean Wet Bulb Thermometer for the month	80.6
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	7.1
Computed Mean Dew-point for the month	76.3
Mean Dry Bulb Thermometer above computed mean Dew-point ...	11.4
	Inches.
Mean Elastic force of Vapour for the month	0.890

	Troy grain.
Mean Weight of Vapour for the month	9.48
Additional Weight of Vapour required for complete saturation ...	4.08
Mean degree of humidity for the month, complete saturation being unity	0.70
	o
Mean Max. Solar radiation Thermometer for the month ...	130.2

	Inches.
Rained 10 days,—Max. fall of rain during 24 hours	0.43
Total amount of rain during the month	0.92
Total amount of rain indicated by the Gauge attached to the anemometer during the month	0.75
Prevailing direction of the Wind... ...	S, S by W & S.S.W.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1870.

MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	W.	Rain on.	W. by N.	Rain on.	W. N. W.	Rain on.	N. W.	Rain on.	N. N. W.	Rain on.	N. by W.	Rain on.
Mid night																	1		2	1	3		3		14		5		3																			
1																			3		2		4		10		7		4		1																	
2							1								1				2		2		3		8		6		8																			
3							1								1				2		3		2		8		6		8																			
4							1								1				2		3		4		7		5		8																			
5							1								1				2		2		4		8		5		8																			
6													1				1		2		3		3		6		8		7																			
7									1		1				2		2				4		4		6		4		7																			
8							1						2				2				2		5		3		7		7		2																	
9									2		1								2		1		3		6		5		9		2																	
10											1		1		1				2		2				4		4		14		2																	
11									1						1				1		3				5		3		15		2																	
Noon.															1		1				3				9		6		10	1	1																	
1									1						1		1		1		2				7		5		11		2																	
2									1						1		2		1		2		1		9		4		8				2															
3															1		4		1		2				10		4		6	1	1		2															
4															1		1		1		5		2		10		6		3		1		1															
5																			2		2		5		13		4		4						1													
6																			1		3		6		10		9		1						1													
7																					3		6		13		6		1				1	1			1	1										
8	1	1																			3	1	7	1	12		6						1	1							1	1						
9					1	1															4		3		8		8		2		1		1				1	1					1		1	1		
10											1	1	2						1		3		2		12	1	5		4				1															
11									1						1		1		3		2		4	1	11	1	4		2		1								1									

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1870.

Latitude 22° 33′ 1″ North. Longitude 88° 20′ 34″ East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Date.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Temperature during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.542	29.690	29.458	0.232	87.0	97.5	76.5	21.0
2	.599	.665	.531	.134	84.4	92.5	78.0	14.5
3	.611	.693	.534	.159	86.9	95.6	77.5	18.1
4	.627	.697	.538	.159	87.1	95.0	80.6	14.4
5	.660	.707	.619	.088	87.2	93.6	82.0	11.6
6	.711	.768	.623	.145	87.3	93.8	79.5	14.3
7	.668	.745	.595	.150	86.2	92.5	80.0	12.5
8	.597	.668	.516	.152	87.7	92.9	84.2	8.7
9	.606	.696	.535	.161	87.3	93.8	77.8	16.0
10	.659	.706	.612	.094	86.1	92.7	80.3	12.4
11	.662	.725	.586	.139	87.6	94.5	82.5	12.0
12	.670	.736	.588	.148	88.0	94.8	82.5	12.3
13	.701	.741	.670	.071	83.7	90.7	80.0	10.7
14	.650	.708	.589	.119	86.0	91.7	80.5	11.2
15	.589	.644	.490	.154	87.5	94.5	82.2	12.3
16	.545	.592	.474	.118	84.5	91.9	81.4	10.5
17	.504	.554	.444	.110	82.8	88.2	78.5	9.7
18	.439	.521	.346	.175	83.9	89.9	80.2	9.7
19	.330	.403	.236	.167	83.0	87.0	80.2	6.8
20	.405	.536	.330	.206	79.3	80.8	78.2	2.6
21	.602	.686	.505	.181	79.8	84.8	77.0	7.8
22	.654	.716	.587	.129	84.0	89.8	79.4	10.4
23	.658	.698	.611	.087	80.5	83.7	78.0	5.7
24	.637	.692	.573	.119	79.8	82.6	77.5	5.1
25	.613	.656	.545	.111	82.7	88.5	79.0	9.5
26	.613	.655	.568	.087	83.6	88.8	78.8	10.0
27	.630	.677	.586	.091	83.0	87.7	80.3	7.4
28	.638	.686	.569	.117	83.9	88.7	80.0	8.7
29	.651	.698	.579	.119	85.4	91.8	80.8	11.0
30	.651	.688	.600	.088	84.5	89.0	81.0	8.0

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1870.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Date.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	80.7	6.3	76.9	10.1	0.908	9.66	3.63	0.73
2	79.6	4.8	76.2	8.2	.887	.51	2.80	.77
3	80.8	6.1	77.1	9.8	.913	.72	3.53	.73
4	81.8	5.3	78.6	8.5	.958	10.19	.14	.76
5	81.5	5.7	78.1	9.1	.943	.04	.33	.75
6	80.7	6.6	76.7	10.6	.902	9.58	.83	.71
7	80.2	6.0	76.0	10.2	.882	.41	.58	.72
8	81.3	6.4	77.5	10.2	.925	.84	.72	.73
9	80.5	6.8	76.4	10.9	.893	.51	.90	.71
10	80.8	5.3	77.1	9.0	.913	.74	.21	.75
11	81.2	6.4	77.4	10.2	.922	.81	.71	.73
12	81.4	6.6	77.4	10.6	.922	.79	.89	.72
13	79.9	3.8	77.2	6.5	.916	.81	2.26	.81
14	80.4	5.6	76.5	9.5	.896	.56	3.35	.74
15	81.1	6.4	77.3	10.2	.919	.78	.71	.73
16	81.4	3.1	79.2	5.3	.976	10.45	1.90	.85
17	81.0	1.8	79.7	3.1	.992	.66	.09	.91
18	81.1	2.8	79.1	4.8	.973	.42	.71	.86
19	80.5	2.5	78.7	4.3	.961	.33	.49	.87
20	78.6	0.7	78.1	1.2	.943	.21	0.38	.96
21	77.6	2.2	76.1	3.7	.885	9.55	1.20	.89
22	80.5	3.5	78.0	6.0	.940	10.07	2.10	.83
23	79.1	1.4	78.1	2.4	.943	.18	0.80	.93
24	78.6	1.2	77.8	2.0	.934	.09	.66	.94
25	79.8	2.9	77.8	4.9	.934	.03	1.69	.86
26	80.3	3.3	78.0	5.6	.940	.07	.96	.84
27	80.5	2.5	78.7	4.3	.961	.33	.49	.87
28	80.6	3.3	78.3	5.6	.949	.16	.97	.84
29	81 2	4.2	78.3	7.1	.949	.14	2.54	.80
30	80.8	3.7	78.2	6.3	.946	.13	.22	.82

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Hour.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer for each hour during the month. Max.	Min.	Diff.	Mean Dry Bulb Thermometer.	Range of the Temperature for each hour during the month. Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid-night.	29.613	29.745	29.346	0.399	82.0	85.5	78.0	7.5
1	.604	.736	.336	.400	81.8	85.2	78.5	6 7
2	.595	.712	.330	.382	81·6	84.8	78.5	6.3
3	.587	.692	.345	.347	81.3	84.6	78.2	6.4
4	.588	.706	.339	.367	81.2	84.5	78.5	6.0
5	.597	.732	.351	.381	81.1	84.5	78.5	6.0
6	.610	.740	.356	.384	81.2	84.2	78.0	6.2
7	.627	.751	.368	.383	82.4	85.2	79.7	5.5
8	.640	.763	.377	.386	84.1	87.4	78.0	9.4
9	.649	.768	.390	.378	85.7	89.6	77.7	11.9
10	.649	.767	.380	.387	87.0	91.7	77.5	14.2
11	.642	.756	.354	.402	88.1	93.7	78.0	15.7
Noon.	.628	.748	.337	.411	88.4	96.0	78.4	17.6
1	.607	.730	.315	.415	88.9	97.5	78.0	19.5
2	.586	.716	.299	.417	89.1	97.5	78.5	19.0
3	.566	.680	.283	.397	89.0	97.0	77.0	20.0
4	.547	.673	.247	.426	88.6	95.7	78.9	16.8
5	.544	.680	.236	.444	87.8	94.0	77·5	16.5
6	.555	.718	.255	.463	86.6	91.2	77.9	13.3
7	.577	.692	.279	.413	85.2	89.2	77.5	11.7
8	.605	.709	.287	.422	84.1	87.8	77.7	10.1
9	.623	.748	.310	.438	82.9	86.5	76.5	10.0
10	.632	.760	.331	.429	82.1	86.0	77.5	8.5
11	.628	.752	.335	.417	82.1	85.7	77.7	8.0

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Hour.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid-night.	79.5	2.5	77.7	4.3	0.931	10.02	1.45	0.87
1	79.5	2.3	77.9	3.9	.937	.08	.32	.88
2	79.4	2.2	77.9	3.7	.937	.08	.26	.89
3	79.4	1.9	78.1	3.2	.943	.16	.08	.90
4	79.4	1.8	78.1	3.1	.943	.16	.05	.91
5	79.3	1.8	78.0	3.1	.940	.13	.04	.91
6	79.5	1.7	78.3	2.9	.949	.22	0.99	.91
7	80.2	2.2	78.7	3.7	.961	.33	1.28	.89
8	80.9	3.2	78.7	5.4	.961	.31	.90	.84
9	81.4	4.3	78.4	7.3	.952	.17	2.63	.80
10	81.7	5.3	78.5	8.5	.955	.16	3.13	.76
11	81.9	6.2	78.2	9.9	.946	.05	.67	.73
Noon.	81.9	6.5	78.0	10.4	.940	9.99	.85	.72
1	81.6	7.3	77.2	11.7	.916	.71	4.33	.69
2	81.5	7.6	76.9	12.2	.908	.62	.50	.68
3	81.6	7.4	77.2	11.8	.916	.71	.37	.69
4	81.4	7.2	77.1	11.5	.913	.68	.24	.70
5	81.1	6.7	77.1	10.7	.913	.70	3.90	.71
6	80.8	5.8	77.3	9.3	.919	.80	.34	.75
7	80.5	4.7	77.2	8.0	.916	.79	2.82	.78
8	80.1	4.0	77.3	6.8	.919	.84	.37	.81
9	79.7	3.2	77.5	5.4	.925	.94	1.85	.84
10	79.3	2.8	77.3	4.8	.919	.88	.63	.86
11	79.4	2.7	77.5	4.6	.925	.94	.57	.86

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage $1\frac{1}{2}$ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	131.2	1.14	Variable.	4.8	276.8	B to 4 A. M., \⌒i to 8 A. M., clouds of different kinds to 7 P. M., O afterwards. Brisk wind at $8\frac{1}{2}$ P. M. Thunder at 8 & 9 P. M. Lightning from 7 to 9 P. M. Rain from 8 to 10 P. M.
2	129.8	...	E.byS. & S. byW.	2.8	258.6	O to 10 A. M., clouds of different kinds afterwards. Brisk wind at $8\frac{1}{4}$ P. M. Drizzled at $8\frac{1}{2}$ & 10 P. M.
3	130.0	1.65	S.S.W. & S	4.2	197.0	\⌒—i to 4 A. M., \⌒i to 9 A. M., ⌒i to 6 P. M., O afterwards. Brisk wind at $9\frac{3}{4}$ P. M. Thunder & lightning $9\frac{1}{4}$ & 10 P. M. Rain at 9 & 10 P. M.
4	129.5	...	S. by E. & S.	...	253.1	Clouds of different kinds to 8 A. M., ⌒i to 5 P. M., B afterwards.
5	130.0	...	S. & S. by E.	0.4	287.3	B to 6 A. M., ⌒i to 7 P. M, B afterwards.
6	124.8	...	S. & S. S. W.	1.4	324.7	B to 7 A. M., ⌒i to 4 P. M., clouds of different kinds afterwards. Brisk wind from noon to 6 P. M. Thunder at 10 P. M., lightning from 9 to 11 P. M. Drizzled at 8 A. M. & $9\frac{1}{2}$ P. M.
7	124.2	...	S. byE, S.S.W. & S. by W.	0.8	304.1	S to 8 A. M., ⌒i to 3 P. M., B afterwards. Brisk wind from 10 A. M., to $4\frac{1}{2}$ P. M.
8	127.3	...	S. S. W.	1.4	405.6	S to 5 A. M., clouds of different kinds to 1 P. M., B afterwards. Brisk wind from $8\frac{1}{2}$ to $9\frac{1}{2}$ A. M.
9	128.5	0.63	S. S. W.	2.8	376.3	Clouds of various kinds. Brisk wind at 4 & $7\frac{3}{4}$ P. M. Thunder, lightning and rain between 8 & 9. P. M.
10	127.0	...	S.S.W. & SbyW.	...	298.3	O to 12 A. M., ⌒—i to 4 P. M., \i afterwards. Drizzled at $9\frac{1}{2}$ A. M.
11	130.0	...	S&S.byW.	0.2	270.2	\i to 5 A. M., \⌒i to 10 A.M., ⌒—i to 5 P. M., \i afterwards.
12	133.6	...	S. by E. & S.	...	292.0	B to 5 A. M., ⌒—i to 5 P. M., \i afterwards.

\i Cirri, —i Strati, ⌒i Cumuli, \—i Ciro-strati, ⌒—i Cumulo-strati \⌒—i Nimbi, \⌒i Cirro-cumuli, B clear, S stratoni, O overcast.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	WIND. Prevailing direction.	WIND. Max. Pressure	WIND. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
13	109.6	0.30	S. & S. by W.	...	244.1	Clouds of different kinds to 10 A. M., O to 8 P. M., S afterwards. Thunder at 11½ A. M. Lightning to S. W. at 8 P. M. Slight rain from 9½ A. M. to 1 P. M. & at 6½ P. M.
14	129.8	...	S.S.W. & S.by W.	...	152.3	\i to 5 A. M., \⌒i & ⌒i to 6 P. M., S afterwards.
15	129.9	...	S. & S. S. W.	...	220.1	\i to 4 A. M. ⌒i to 4 P. M., S afterwards. Lightning to W at 8 P. M.
16	109.5	0.17	S.S.W. & S. by E.	...	185.0	S to 6 A. M., ⌒i to 12 A. M., O to 4 P. M., clouds of different kinds afterwards. Thunder at 9½ & 10 A. M. & at 1 & 2 P. M. Lightning to W. at 8 P. M. Slight rain at 9½ A. M. & from 1 to 3 P. M.
17	...	4.39	S. by E, & S.S.E.	...	105.3	\⌒i to 3 A. M., S to 10 A. M., O to 3 P. M., S to 7 P. M. _i afterwards. Thunder & lightning between 11 & 12 A. M. Rain from 11 A. M. to 4 P. M.
18	130.0	0.06	E. & S. S. E.	...	100.0	S to 4 A. M., ⌒i to 6 P. M., _i afterwards. Lightning at 8 & 10 P. M. Slight rain at 1½, 9 & 12½ A. M. & at 1½ P. M.
19	110.0	0.38	E. & E. N. E.	...	274.4	S to 5 A. M., scuds from E to 10 A. M., ⌒i to 3 P. M., O afterwards. Thunder at 12 A. M. & 4 P. M. Rain after intervals from 8½ A. M. to 9½ P. M.
20	...	2.53	E. S. E. & S.S. E.	...	301.8	O. Rain & drizzle whole day.
21	...	0.73	SbyW,SW&SSW	...	164.9	O. Thunder at 2½ & 6 P. M. Lightning to W at 9 P. M. Slight rain from 9½ A. M. to 9 P. M.
22	125.0	...	S. W. & S S. W.	...	197.6	S to 11 A. M. ⌒i to 3 P. M., S afterwards.
23	...	0.81	S.S.W,S.&S.byE.	...	178.5	S to 7 A. M., O to 8 P. M., \⌒_i afterwards. Thunder at A. M. Slight rain from 7½ A. M. to 7 P. M.

\i Cirri, —i Strati, ⌒i Cumuli, _i Cirro-strati, ⌒_i Cumulo-strati, \⌒_i Nimbi, \⌒i Cirro-cumuli, B clear, S stratoni, O overcast.

Abstract of the Result of the Hourly Meterological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1870.

Solar Radiation, Weather, &c..

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	WIND. Prevailing direction.	WIND. Max. Pressure	WIND. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles.	
24	...	2.86	S.byW&S.	...	142.0	O to 2 P. M., clouds of different kinds afterwards. Lightning to W at 8 P. M. Drizzled at 2 & 3 A. M. Rain from 5 A. M. to 3 P. M.
25	127.0	0.03	S.	...	110.5	S to 5 A. M, ⌒i to 7 P. M., B afterwards. Slight rain between 1 & 2 P. M.
26	130.0	0.22	S.byE. & S.S.W.	...	208.3	Chiefly ⌒i & ╲i. Rain at 1 & 10 A. M.
27	120.0	0.19	S,S.byE.&S.S.E.	...	239.5	╲i to 9 A. M., S to 6 P. M., B afterwards. Thunder at 1 & 2 P. M. Rain at 5½ A. M. & at 1, 2 & 3 P. M.
28	129.0	...	S. & S. by E,	...	197.9	B to 4 A. M., ⌒i & ╲i to 7 P. M., B afterwards.
29	131.3	...	S. & S. by E.	...	173.1	B to 3 A. M. ╲i to 6 A. M., ⌒i to 6 P. M., S afterwards. Drizzled at 2 & 10 A. M.
30	116.0	...	S. & S. by W.	...	205.9	S to 10 A. M., ⌒i to 4 P. M., S afterwards. Drizzled at 3 A. M.

╲i Cirri, —i Strati, ⌒i Cumuli, ╲_i Cirro-strati, ⌒—i Cumulo strati, ╲⌒—i Nimbi, ╲⌒i Cirro-cumuli, B clear, S stratoni, O overcast.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1870.

Monthly Results.

	Inches.
Mean height of the Barometer for the month...	29.604
Max. height of the Barometer occurred at 9 A. M. on the 6th. ...	29.768
Min. height of the Barometer occurred at 5 P. M. on the 19th. ...	29.236
Extreme range of the Barometer during the month	0.532
Mean of the daily Max. Pressures	29.668
Ditto ditto Min. ditto	29.535
Mean daily range of the Barometer during the month	0.133

	o
Mean Dry Bulb Thermometer for the month	84.7
Max. Temperature occurred at 1 & 2 P. M. on the 1st.	97.5
Min. Temperature occurred at 9 P. M, on the 1st.	76.5
Extreme range of the Temperature during the month	21.0
Mean of the daily Max. Temperature	90.6
Ditto ditto Min. ditto, ...	79.8
Mean daily range of the Temperature during the month... ...	10.8

Mean Wet Bulb Thermometer for the month	80.4
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	4.3
Computed Mean Dew-point for the month	77.4
Mean Dry Bulb Thermometer above computed mean Dew-point ...	7.3
	Inches.
Mean Elastic force of Vapour for the month	0.992

	Troy grain.
Mean Weight of Vapour for the month	9.87
Additional Weight of Vapour required for complete saturation ...	2·55
Mean degree of humidity for the month, complete saturation being unity	0.80
	o
Mean Max. Solar radiation Thermometer for the month ...	125.7

	Inches.
Rained 20 days,—Max. fall of rain during 24 hours	4.39
Total amount of rain during the month	16.09
Total amount of rain indicated by the Gauge* attached to the anemometer during the month	14.59
Prevailing direction of the Wind... ...	S, S. S. W. & S by E.

* Height 70 feet 10 inches above ground.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1870.

MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	W.	Rain on.	W. by N.	Rain on.	W. N. W.	Rain on.	N. W.	Rain on.	N. N. W.	Rain on.	N. by W.	Rain on.
Mid night									2						1		2	1			2		6		9		2		6																			
1											1		1		1		2	1			2		5		8		2		7	1					1													
2											1				2		1	1	1		2	1	8	1	7		1	1	7																			
3															2		1				2	1	9		6	1	2	1	7		1																	
4													1		1		1		2	1	1		7		7		2		7		1																	
5													1		1		2	1	1		1		7		5		4		6		1								1	1								
6													1				1	1	2		1	1	8		5		5		5		1								1	1								
7													1				2				1		7		7		5		5		1								1	1								
8													1				2	1			1		4		9		3		7	1	2	1									1	1						
9													1	1	1	1			1	1			4		8		2		10	1	2										1	1						
10											1				1	1					1	1	1	1	10	1	4		8	3	3	1	1	1														
11									1		1										2		1	1	5		9	2	7	1	2	1	2	1														
Noon.									2	1													2	1	8	1	6		7	1	2	1	3	2														
1									2	1											2	1	1		6	3	8	1	6		3	2	2	1														
2									1		1	1									1	1	1		7	3	5		13	3			1															
3									1						2	1					3		3	2	7	1	6		7	1			1															
4									1				1				1	1			1	1	3	1	11	1	5		7																			
5									1	1			1				1				2	1	4	1	9		7	1	5																			
6													2	1							3	1	4		10		6		5	1																		
7													2								2	1	6	1	10		4	1	6	1																		
8	1	1							1	1			1								2	1	7		6		7		4	1											1	1						
9													1		1	1					1		5		11	1	2		5	1	2	2	1	1							1	1						
10							1	1			1		1								1		5		10	1	2		6	1	1	1	1						1	1								
11											1		1				2				1		8		6		5		5		1																	

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1870.

Latitude 22° 33′ 1″ North. Longitude 88° 20′ 34″ East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Date.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Temperature during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.617	29.672	29.540	0.132	85.4	91.0	80.5	10.5
2	.550	.597	.471	.126	85.6	91.0	81.5	9.5
3	.514	.566	.482	.084	84.6	89.7	82.3	7.4
4	.597	.645	.560	.085	83.2	88.2	79.5	8.7
5	.642	.689	.589	.100	83.9	89.2	80.5	8.7
6	.632	.679	.575	.104	85.5	90.8	81.7	9.1
7	.597	.634	.533	.101	85.1	90.5	81.5	9.0
8	.596	.661	.551	.110	84.5	88.0	82.5	5.5
9	.639	.693	.588	.105	82.3	86.0	78.8	7.2
10	.639	.695	.570	.125	83.3	87.6	80.2	7.4
11	.609	.673	.533	.140	84.5	91.1	80.0	11.1
12	.569	.618	.502	.116	85.8	92.2	80.5	11.7
13	.508	.557	.433	.124	85.9	92.0	81.0	11.0
14	.458	.505	.389	.116	86.6	93.7	81.5	12.2
15	.458	.506	.384	.122	85.7	91.0	82.0	9.0
16	.457	.495	.401	.094	83.9	90.0	80.8	9.2
17	.486	.552	.439	.113	84.1	89.4	80.8	8.6
18	.507	.555	.440	.115	84.8	89.0	81.2	7.8
19	.484	.534	.413	.121	85.5	90.8	81.7	9.1
20	.441	.493	.372	.121	83.9	89.9	81.2	8.7
21	.479	.523	.440	.083	82.8	88.2	80.0	8.2
22	.513	.557	.467	.090	82.5	90.1	97.9	10.2
23	.542	.587	.491	.096	83.1	89.5	79.0	10.5
24	.520	.559	.450	.109	82.3	86.0	80.3	5.7
25	.488	.541	.430	.111	81.2	84.0	80.0	4.0
26	.459	.500	.401	.099	82.0	86.2	78.8	7.4
27	.446	.511	.396	.115	80.7	85.5	78.7	6.8
28	.477	.513	.421	.092	83.3	89.5	78.6	10.9
29	.461	.505	.381	.124	84.0	89.5	81.0	8.5
30	.414	.457	.355	.102	83.5	90.5	80.5	10.0
31	.382	.482	.324	.158	80.9	83.9	78.5	5.4

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made at the several hours during the day.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1870.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Date.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	80.8	4.6	77.6	7.8	0.928	9.91	2.77	0.78
2	81.7	3.9	79.0	6.6	.970	10.35	.41	.81
3	81.9	2.7	80.0	4.6	1.001	.70	1.69	.86
4	80.3	2.9	78.3	4.9	0.949	.18	.71	.86
5	80.5	3.4	78.1	5.8	.943	.10	2.03	.83
6	81.1	4.4	78.0	7.5	.940	.08	.69	.79
7	81.1	4.0	78.3	6.8	.949	.14	.43	.81
8	81.3	3.2	79.1	5.4	.973	.42	1.93	.84
9	80.4	1.9	79.1	3.2	.973	.47	.11	.90
10	80.8	2.5	79.0	4.3	.970	.42	.51	.87
11	81.0	3.5	78.5	6.0	.955	.23	2.12	.83
12	81.4	4.4	78.3	7.5	.949	.12	.71	.79
13	81.8	4.1	78.9	7.0	.967	.32	.55	.80
14	82.1	4.5	79.4	7.2	.983	.47	.67	.80
15	81.8	3.9	79.1	6.6	.973	.38	.42	.81
16	81.4	2.5	79.6	4.3	.989	.60	1.53	.87
17	81.4	2.7	79.5	4.6	.986	.55	.66	.86
18	81.8	3.0	79.7	5.1	.992	.61	.85	.85
19	81.8	3.7	79.2	6.3	.976	.43	2.29	.83
20	81.1	2.8	79.1	4.8	.973	.42	1.71	.86
21	79.7	3.1	77.5	5.3	.925	9.94	.81	.85
22	80.1	2.4	78.4	4.1	.952	10.23	.41	.88
23	80.7	2.4	79.0	4.1	.970	.42	.44	.88
24	80.4	1.9	79.1	3.2	.973	.47	.11	.90
25	79.6	1.6	78.5	2.7	.955	.29	0.92	.92
26	80.0	2.0	78.6	3.4	.958	.32	1.15	.90
27	79.4	1.3	78.5	2.2	.955	.31	0.73	.93
28	80.7	2.6	78.9	4.4	.967	.39	1.54	.87
29	81.0	3.0	78.9	5.1	.967	.37	.80	.85
30	81.2	2.3	79.6	3.9	.989	.60	.40	.88
31	79.5	1.4	78.5	2.4	.955	.31	0.79	.93

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Hour.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer for each hour during the month. Max.	Min.	Diff.	Mean Dry Bulb Thermometer.	Range of the Temperature for each hour during the month. Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid-night.	29.546	29.670	29.434	0.236	82.2	84.4	80.0	4.4
1	.534	.656	.416	.240	81.8	84.0	79.8	4.2
2	.523	.644	.378	.266	81·5	83.2	79.0	4.2
3	.512	.628	.365	.263	81.2	83.0	78.8	4.2
4	.506	.624	.355	.269	80.9	83.0	78.6	4.4
5	.511	.643	.351	.292	80.7	82.5	78.8	3.7
6	.523	.649	.357	.292	80.7	82.5	78.7	3.8
7	.539	.661	.372	.289	81.7	83.8	79.2	4.6
8	.552	.672	.380	.292	83.2	86.7	79.2	7.5
9	.560	.691	.386	.305	84.4	88.3	79.0	9.3
10	.560	.695	.383	.312	85.6	90.5	80.2	10.3
11	.554	.690	.372	.318	86.7	92.0	80.0	12.0
Noon.	.539	.670	.357	.313	87.1	93.3	80.4	12.9
1	.521	.659	.345	.314	88.0	93.7	81.2	12.5
2	.501	.643	.335	.308	87.9	92.6	81.2	11.4
3	.482	.622	.324	.298	86.7	92.2	80.5	11.7
4	.467	.602	.329	.273	86.2	92.0	80.0	12.0
5	.465	.599	.331	.268	85.9	91.0	80·2	10.8
6	.477	.603	.362	.241	85.0	89.0	80.5	8.5
7	.498	.639	.389	.250	84.1	87.0	79.5	7.5
8	.518	.658	.406	.252	83.4	86.2	78.8	7.4
9	.536	.668	.432	.236	83.0	85.2	78.5	6.7
10	.551	.689	.445	.244	82.7	84.9	79.0	5.9
11	.551	.693	.410	.253	82.3	84.5	78.8	5.7

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Hour.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid-night.	80.5	1.7	79.3	2.9	0.979	10.53	1.01	0.91
1	80.3	1.5	79.2	2.6	.976	.50	0.90	.92
2	80.0	1.5	78.9	2.6	.967	.41	.90	.92
3	79.7	1.5	78.6	2.6	.958	.32	.89	.92
4	79.6	1.3	78.7	2.2	.961	.37	.73	.93
5	79.6	1.1	78.8	1.9	.964	.40	.64	.94
6	79.6	1.1	78.8	1.9	.964	.40	.64	.94
7	80.2	1.5	79.1	2.6	.973	.47	.90	.92
8	80.9	2.3	79.3	3.9	.979	.51	1.38	.88
9	81.2	3.2	79.0	5.4	.970	.40	.91	.85
10	81.6	4.0	78.8	6.8	.964	.29	2.47	.81
11	81.9	4.8	79.0	7.7	.970	.33	.85	.78
Noon.	82.2	4.9	79.3	7.8	.979	.42	.91	.78
1	82.5	5.5	79.2	8.8	.976	.37	3.31	.76
2	82.2	5.7	78.8	9.1	.964	.25	.39	.75
3	81.9	4.8	79.0	7.7	.970	.33	2.85	.78
4	81.6	4.6	78.4	7.8	.952	.15	.84	.78
5	81.6	4.3	78.6	7.3	.958	.23	.64	.80
6	81.3	3.7	78.7	6.3	.961	.29	.24	.82
7	80.7	3.4	78.3	5.8	.949	.16	.05	.83
8	80.5	2.9	78.5	4.9	.955	.25	1.71	.86
9	80.5	2.5	78.7	4.3	.961	.33	.49	.87
10	80.6	2.1	79.1	3.6	.973	.45	.27	.89
11	80.6	1.7	79.4	2.9	.983	.56	.02	.91

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations. taken at the Surveyor General's Office, Calcutta, in the month of July 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage $1\frac{1}{2}$ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	125.0	...	S&S.byW.	...	227.1	B to 4 A. M., ⌒i & \i to 7 P. M., B afterwards.
2	119.0	...	S. & S. by E.	...	205.5	S to 8 A. M., ⌒i to 12 A. M., S afterwards. L at 8 & 9 P. M.
3	123.0	0.06	S & Variable.	...	165.6	S to 8 A. M., ⌒i to 1 P. M., clouds of different kinds afterwards. T at 1 P. M. Slight R at 3 & $7\frac{1}{2}$ P. M.
4	128.7	0.27	S. by W, S. S. E, & S. by E.	...	117.6	Clouds of different kinds to 7 A. M., \i to 11 A. M., ⌒i to 4 P. M., \⌒i afterwards. L to S. W. at midnight, R at 6 A. M.
5	126.0	...	S. by E.	...	136.0	S to 7 A. M., ⌒i & \i to 2 P. M., S afterwards D at 11 P. M.,
6	125.0	...	S. by E. & S.	...	183.8	_i & \i to 4 A. M., \⌒i afterwards.
7	130.0	0.03	S. & S. by W.	...	213.1	S to 8 A. M., clouds of different kinds afterwards. D at $8\frac{1}{4}$, 9 & 11 A. M. & 7 P. M.
8	110.8	0.10	S. & S. by W.	...	233.2	S to 9 A. M., O to 2 P. M., S afterwards. L to W at $11\frac{1}{4}$ P. M.
9	...	0.26	S. by W, & S.	...	193.0	Chiefly O. Slight R at $2\frac{1}{2}$ A. M. & from 9 A. M. to 5 P. M.
10	129.0	0.15	S. & S. S. W.	...	149.6	S to 3 A. M., \⌒i to 7 A. M., O to 12 A. M., ⌒i & \i afterwards. T at $3\frac{3}{4}$ P. M. Slight R from 9 to 12 A. M.
11	130.5	...	S. by W. & S.	...	127.7	\i to 6 A. M., ⌒i to 8 P. M., \i afterwards. D between 11 & 12 A. M.
12	131.0	...	S. & S. S. W.	...	165.7	\⌒i to 6 A. M., ⌒i to 5 P. M., B afterwards.
13	131.0	...	S.	...	195.7	\i to 8 A. M., ⌒i to 8 P. M., \i afterwards.
14	132.0	...	S. & S. by E.	...	141.5	B to 7 A. M., ⌒_i to 3 P. M., _i to 7 P. M., B afterwards. D at 3 P. M.
15	126.0	0.37	S.S.E. & S. E.	...	160.2	Clouds of different kinds to to 6 A. M., ⌒_i to 8 P. M., \i afterwards. Slight R at $2\frac{1}{2}$ & 11 A. M. & 2 & $5\frac{1}{2}$ P. M.
16	117.5	0.77	E.S.E.& variable.	...	180.0	\i to 8 A. M., \⌒_i to 7 P. M., S afterwards. R at 5 & 10 A. M. & 1, $4\frac{1}{2}$ & $6\frac{1}{2}$ P. M.
17	123.0	0.30	S. & S. by E.	...	129.6	Chiefly \i. T at $1\frac{1}{4}$ & 2 P. M. Slight R from $5\frac{1}{2}$ to $6\frac{1}{2}$, at $10\frac{1}{2}$ & $12\frac{1}{2}$ A. M. & from 2 to $3\frac{1}{2}$ P. M.

\i Cirri, —i Strati, ⌒i Cumuli, _i Ciro-strati, ⌒_i Cumulo-strati, \⌒_i Nimbi, \⌒i Cirro-cumuli, B clear, S stratoni, O overcast, T thunder, L lightning,

***Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July* 1870.**

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage $1\frac{1}{2}$ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
18	126.2	...	S. by E. & S.	...	128.0	∖i to 2 A. M., ∖⌒i to 5 A. M., ⌒i to 7 P. M., B afterwards. T at 6 P. M. D at 6 & 12 A.M.
19	130.0	0.03	S.byE,E.S.E,S.E. & S.	...	127.1	Clouds of different kinds to 7 A.M., ⌒i to 7 P.M., B afterwards. Slight R at 3 A. M. & 3 P. M.
20	125.0	0.08	S. E. & S.	...	203.3	S to 8 A. M., ⌒i to 3 P. M., O afterwards. T at $11\frac{1}{2}$ P. M. L at 9 & $11\frac{1}{2}$ P. M. Slight R after intervals from 12 A. M. to 11 P. M.
21	124.0	...	S. S. W. & S.byE.	...	113.9	∖_i to 2 A.M., ∖i to 10 A. M., clouds of different kinds afterwards. T at 1 P. M. L to N at $8\frac{3}{4}$ P. M. D at 1 & $2\frac{1}{4}$ P. M.
22	129.5	1.22	S. by E. & S.S.E.	...	115.0	∖i to 8 A. M., ⌒i to 2 P. M., O to 7 P. M., S afterwards. T at $2\frac{1}{2}$ & 3 P. M. R from $8\frac{1}{2}$ $9\frac{1}{2}$ A. M. & $2\frac{1}{2}$ to 6 P. M.
23	130.0	0.78	S. S. E, & S.S.W.	...	129.7	O to 4 A. M., clouds of different kinds to 8 A. M., ⌒i to 2 to P.M. O to 7 P. M., B afterwards. T at 3 P. M. R at 2&3 A, M. & 3, 4 & 11 P. M.
24	120.5	0.04	S,S.W.&S.byW.	...	79.0	S to 3 P. M., ⌒i to 7 P. M., S afterwards. Slight R at 11 & 12 A. M. & $8\frac{1}{2}$ P. M.
25	...	0.18	S.byW. & S.S.W.	...	126.2	S to 5 A. M., O to 1 P. M., S afterwards. Slight R from $7\frac{1}{4}$ to 12 A. M.
26	112.0	0.38	W.S.W,S.W.& S.	...	76.2	O to 4 A. M., S afterwards. R at 3 & 4 A. M. & 6 P. M.
27	119.0	1.25	S.	...	66.2	Chiefly O. T at $2\frac{1}{2}$ & 3 P.M. R from 1 to 6, 8 & 9 A. M. & at 1, 2, 4 & 5 P. M.
28	128.5	2.36	SSW,S.&S.byW.	...	131.9	O to 8 A. M., ⌒i afterwards. R from 1 to 8 A. M.
29	131.2	...	S.byW. & S.S.W,	...	41.5	B to 3 A. M., ∖i to 9 A. M., ⌒i to 3 P. M., O to 6 P. M., S afterwards. D at 4 P. M.
30	121.0	1.02	S.S.E. & S. E.	3.8	116.0	B to 3 A.M., S to 8 A. M., ⌒i to 2 P. M., clouds of different kinds afterwards. Brisk wind at $2\frac{3}{4}$ P. M. T at 3 & 4 P. M. R at 3, 8 & 9 P. M.
31	...	1.25	ENE.,NE&SSW.	...	166.6	Chiefly O. R at 3 & 5, from $8\frac{1}{4}$ to $11\frac{1}{2}$ A. M. & from 4 to 9 P. M.

∖i Cirri, —i Strati, ⌒i Cumuli, ∖_i Cirro-strati, ⌒_i Cumulo-strati, ∖⌣i Nimbi, ∖⌒i Cirro-cumuli, B clear, S stratoni, O overcast, T thunder, L lightning, R rain, D drizzle.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1870.

Monthly Results.

	Inches.
Mean height of the Barometer for the month...	29.702
Max. height of the Barometer occurred at 10 A. M. on the 15th. ...	29.894
Min. height of the Barometer occurred at 4 P. M. on the 22nd. ...	29.487
Extreme range of the Barometer during the month	0.407
Mean of the daily Max. Pressures	29.764
Ditto ditto Min. ditto	29.635
Mean daily range of the Barometer during the month	0.129

	o
Mean Dry Bulb Thermometer for the month	83.2
Max. Temperature occurred at 1 P. M. on the 18th & 20th	92.0
Min. Temperature occurred at 6 A. M, on the 5th.	77.8
Extreme range of the Temperature during the month	14.2
Mean of the daily Max. Temperature	88.3
Ditto ditto Min. ditto, ...	79.9
Mean daily range of the Temperature during the month... ...	8.4

Mean Wet Bulb Thermometer for the month	80.0
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	3.2
Computed Mean Dew-point for the month	77.8
Mean Dry Bulb Thermometer above computed mean Dew-point ...	5.4
	Inches.
Mean Elastic force of Vapour for the month	0.934

	Troy grain.
Mean Weight of Vapour for the month	10.03
Additional Weight of Vapour required for complete saturation ...	1·86
Mean degree of humidity for the month, complete saturation being unity	0.84
	o
Mean Max. Solar radiation Thermometer for the month ...	140.0

	Inches.
Rained 24 days,—Max. fall of rain during 24 hours	2.44
Total amount of rain during the month	9.01
Total amount of rain indicated by the Gauge* attached to the anemometer during the month	8.38
Prevailing direction of the Wind... ...	S, S S E & S by E.

* Height 70 feet 10 inches above ground.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1870.

MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	W.	Rain on.	W. by N.	Rain on.	W. N. W.	Rain on.	N. W.	Rain on.	N. N. W.	Rain on.	N. by W.	Rain on.
																					No. of days																											
Mid night									1										3		3		5		12		5		2																			
1									1								1		2	1	3		6		11	2	4		2				1															
2									1								1		2		3	1	6		9	1	4		3	1			1		1													
3									1	1							1		2		2	2	5	1	10	1	5		3	1			1	1	1	1												
4							1										1		2		3		5		9	1	5		3	1			1	1	1													
5							1	1									1	1	2		3		5		8	1	5		4	1			2															
6									1								1		3	1	3		3	1	10	1	4	1	4	1			2															
7							1										2		4	1	1		3		10		4		3	1	2		1															
8							1	1									3		2		3		2		5		8	2	5	2	2																	
9							1										1		3		4		1		3		9	3	6	2	3	1																
10			1	1													1		3		4	1			3		13	4	3	1	3																	
11	1	1											1	1			4		3	1	2		1		9	2	4	2	3	1	1		2															
Noon.											2	1	1		2	1	3	1	1		1		3	1	7	1	1		5	1	3	2	1												1	1		
1									1		1		1		1	1	2	1	3	1	1		2		9	1	3		2		4	1	1															
2									1		2	1			1	1	2	1	2	1	4		3		9	1			4	1	2		1															
3									1				1				1		1	1	2	1	6	3	6	2	6	1	5	1	1		1	1														
4							1				1						1		4	1	1		6	3	8	2	6	1	2	1	1																	
5													2	1					2		1		6	2	9	1	5		4		2	1																
6									1								1		2	1	1	1	9	1	6		4		5		2	1																
7											1						1				4		9		5		7		3	1					1	1												
8																	1	1	1		1		9	2	10	1	5		2		2	1																
9																	1		1	1	3		7		12		2		4	2	1																	
10																			3		3		7		11		4	1	3																			
11																			4		2		8	1	8		5		4	2																		

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1870.

Latitude 22° 33′ 1″ North. Longitude 88° 20′ 34″ East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Date.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer during the day. Max.	Min.	Diff.	Mean Dry Bulb Thermometer.	Range of the Temperature during the day. Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.521	29.598	29.441	0.157	81.7	86.5	78.3	8.2
2	.571	.634	.507	.127	82.3	85.7	79.6	6.1
3	.536	.577	.465	.112	84.5	89.0	80.8	8.2
4	.558	.626	.504	.122	80.8	83.5	78.4	5.1
5	.659	.711	.605	.106	83.1	89.0	79.0	10.0
6	.710	.760	.640	.120	83.9	90.8	80.0	10.8
7	.736	.783	.684	.099	84.3	90.2	80.4	9.8
8	.764	.815	.705	.110	84.9	90.0	81.4	8.6
9	.726	.799	.650	.149	85.5	91.8	81.5	10.3
10	.666	.727	.577	.150	85.5	90.5	81.0	9.5
11	.632	.687	.565	.122	84.9	91.5	80.0	11.5
12	.606	.659	.511	.118	82.1	86.2	78.7	7.5
13	.561	.614	.472	.142	81.2	86.0	78.5	7.5
14	.475	.541	.380	.161	81.7	89.4	78.0	11.4
15	.454	.512	.415	.097	80.1	86.5	76.6	9.9
16	.510	.561	.467	.094	81.3	87.2	78.0	9.2
17	.529	.580	.467	.113	81.9	85.0	79.0	6.0
18	.553	.596	.501	.095	83.0	88.5	80.0	8.5
19	.545	.601	.481	.120	83.3	88.8	80.6	8.2
20	.547	.593	.495	.098	81.7	85.4	80.5	4.9
21	.549	.596	.490	.106	81.9	84.5	80.4	4.1
22	.551	.607	.496	.111	82.4	85.5	80.3	5.2
23	.561	.627	.492	.135	81.7	85.0	79.5	5.5
24	.604	.647	.557	.090	78.3	79.5	76.5	3.0
25	.623	.673	.578	.095	79.5	80.7	78.0	2.7
26	.626	.676	.549	.127	81.6	86.5	78.5	8.0
27	.628	.677	.555	.122	82.2	87.0	78.4	8.6
28	.650	.708	.604	.104	82.3	87.7	80.0	7.7
29	.682	.745	.609	.136	83.0	87.3	79.8	7.5
30	.596	.677	.513	.164	82.6	86.5	80.2	6.3
31	.515	.569	.437	.132	82.2	87.5	80.0	7.5

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made at the several hours during the day.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1870.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Date.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	78.9	2.8	76.9	4.8	0.908	9.76	1.61	0.86
2	79.7	2.6	77.9	4.4	.937	10.08	.50	.87
3	80.8	3.7	78.2	6.3	.946	.13	2.22	.82
4	79.3	1.5	78.2	2.6	.946	.19	0.88	.92
5	80.0	3.1	77.8	5.3	.934	.03	1.83	.85
6	80.8	3.1	78.6	5.3	.958	.28	.85	.85
7	80.6	3.7	78.0	6.3	.940	.07	2.21	.82
8	81.1	3.8	78.4	6.5	.952	.17	.32	.81
9	81.3	4.2	78.4	7.1	.952	.17	.55	.80
10	81.8	3.7	79.2	6.3	.976	.43	.29	.82
11	81.6	3.3	79.3	5.6	.979	.46	.03	.84
12	80.4	1.7	79.2	2.9	.976	.50	1.01	.91
13	78.9	2.3	77.3	3.9	.919	9.90	.31	.88
14	79.0	2.7	77.1	4.6	.913	.82	.55	.86
15	78.4	1.7	77.2	2.9	.916	.89	0.95	.91
16	79.7	1.6	78.6	2.7	.958	10.32	.92	.92
17	80.5	1.4	79.5	2.4	.986	.62	.82	.93
18	81.0	2.0	79.6	3.4	.989	.63	1.19	.90
19	81.0	2.3	79.4	3.9	.983	.54	.39	.88
20	80.5	1.2	79.7	2.0	.992	.68	0.69	.94
21	80.6	1.3	79.7	2.2	.992	.68	.76	.93
22	80.5	1.9	79.2	3.2	.976	.50	1.11	.90
23	79.1	2.6	77.3	4.4	.919	9.90	.47	.87
24	77.2	1.1	76.4	1.9	.893	.68	0.60	.94
25	78.8	0.7	78.3	1.2	.949	10.27	.39	.96
26	79.4	2.2	77.9	3.7	.937	.08	1.26	.89
27	79.3	2.9	77.3	4.9	.919	9.88	.66	.86
28	80.1	2.2	78.6	3.7	.958	10.30	.28	.89
29	80 1	2.9	78.1	4.9	.943	.12	.70	.86
30	80.1	2.5	78.3	4.3	.949	.20	.48	.87
31	79.9	2.3	78.3	3.9	.949	.20	.34	.88

All the Hygrometrical elements are computed by the **Greenwich Constants.**

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Hour.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer for each hour during the month. Max.	Min.	Diff.	Mean Dry Bulb Thermometer.	Range of the Temperature for each hour during the month. Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid-night.	29.613	29.778	29.466	0.312	81.0	84.6	78.4	6.2
1	.602	.769	.449	.320	80.8	84.5	78.2	6 3
2	.591	.761	.436	.325	80·6	84.3	77.5	6.8
3	.580	.751	.427	.324	80.3	84.0	77.0	7.0
4	.576	.747	.423	.324	80.0	81.6	76.5	5.1
5	.586	.754	.427	.327	79.9	81.5	76.5	5.0
6	.598	.762	.439	.323	79.7	81.8	76.5	5.3
7	.613	.778	.445	.333	80.3	82.3	77.0	5.3
8	.629	.791	.462	.329	81.2	84.2	78.0	6.2
9	.640	.809	.473	.336	82.5	85.6	78.0	7.6
10	.643	.815	.485	.330	83.4	87.0	78.4	8.6
11	.634	.806	.484	.322	84.9	89.0	78.5	10.5
Noon.	.616	.787	.460	.327	85.7	90.0	78.6	11.4
1	.594	.773	.448	.325	85.7	91.5	78.5	13.0
2	.571	.749	.433	.316	85.5	90.8	78.0	12.8
3	.549	.725	.397	.328	85.5	91.8	78.0	13.8
4	.538	.717	.380	.337	85.0	91.0	78.7	12.3
5	.535	.705	.383	.322	84.1	89.5	79·0	10.5
6	.549	.722	.401	.321	83.2	88.2	79.0	9.2
7	.567	.733	.437	.296	82.5	86.5	78.5	8.0
8	.591	.759	.457	.302	82.0	85.5	78.6	6.9
9	.613	.792	.474	.318	81.8	85.3	79.0	6.3
10	.625	.792	.487	.305	81.4	85.0	79.0	6.0
11	.626	.783	.480	.303	81.1	84.8	78.5	6.3

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Hour.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Midnight.	79.5	1.5	78.4	2.6	0.952	10.25	0.89	0.92
1	79.5	1.3	78.6	2.2	.958	.31	.73	.93
2	79.5	1.1	78.7	1.9	.961	.37	.64	.94
3	79.3	1.0	78.6	1.7	.958	.34	.57	.95
4	78.9	1.1	78.1	1.9	.943	.18	.63	.94
5	78.9	1.0	78.2	1.7	.946	.21	.57	.95
6	78.8	0.9	78.2	1.5	.946	.21	.51	.95
7	79.2	1.1	78.4	1.9	.952	.27	.64	.94
8	79.7	1.5	78.6	2.6	.958	.32	.89	.92
9	80.0	2.5	78.2	4.3	.946	.17	1.47	.87
10	80.4	3.0	78.3	5.1	.949	.18	.78	.85
11	81.0	3.9	78.3	6.6	.949	.14	2.35	.81
Noon	81.3	4.4	78.2	7.5	.946	.09	.71	.79
1	81.1	4.6	77.9	7.8	.937	.00	.80	.79
2	81.1	4.4	78.0	7.5	.940	.03	.69	.79
3	81.2	4.3	78.2	7.3	.946	.11	.61	.80
4	81.0	4.0	78.2	6.8	.946	.11	.42	.81
5	80.5	3.6	78.0	6.1	.940	.07	.14	.83
6	80.1	3.1	79.9	5.3	.937	.06	1.83	.85
7	80.0	2.5	78.2	4.3	.946	.17	.47	.87
8	80.0	2.0	78.6	3.4	.958	.32	.15	.90
9	79.9	1.9	78.6	3.2	.958	.32	.08	.90
10	79.6	1.8	78.3	3.1	.949	.22	.05	.91
11	79.6	1.5	78.5	2.6	.955	.29	0.88	.92

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	119.5	0.04	S. S. W.	...	230.4	O to 2 A. M. S to 5 A. M. O to 10 A. M. S to 3 P. M., \⌒i to 7 P. M., B afterwards. Light R at 6, 7, 9 & 11 A. M.
2	120.0	...	S. S. W. & S. W.	...	150.8	Chiefly S. D at 9½ A. M. & 7 P. M.
3	128.5	...	S.S.W. & S by W.	...	79.2	S to 5 A. M., \⌒i to 11 A. M. ⌒i & \i to 3 P. M., S to 6 P. M. clouds of different kinds afterwards. L on N at 9 P. M. D at 10½ A. M. & 8 P. M.
4	...	1.59	S. by W.	...	74.8	_i to 2 A. M., O to 7 P. M., B afterwards. T & L at 3 & 4 A. M. R from 4½ to 8, 10 to 12 A. M., & at 6 P. M.
5	129.5	0.70	S. S. E. & S.	...	146.3	Chiefly ⌒_i, T at 2¾ P. M. R at 1½, 2 & 4 P. M.
6	130.0	...	S. & S. S. W.	...	98.9	B to 7 A. M., ⌒i to 3 P. M., O to 6 P. M., \⌒i afterwards. T at 3½ & 4 P. M. D at 3½ & 5½ P. M.
7	127.5	...	S. S.W. & S by W.	...	59.8	B to 5 A. M., \i to 10 A. M., ⌒i to 3 P. M. O to 6 P. M. S afterwards.
8	129.0	...	S. by W. & S.SW.	...	163.5	\i to 2 A. M., \⌒i to 7 A. M., ⌒i to 4 P. M., \i afterwards. D at 9 A. M. & 1½ P. M.
9	128.0	...	S. by W. & S.S.W.	0.6	193.7	Chiefly ⌒i. T at 10 P. M. L on W at 8 & 10½ P. M. D at 11½ P. M.
10	130.0	...	S. W. & S. S. W.	0.3	218.2	\i & ⌒i to 4 A. M., \⌒i to 10 A. M., ⌒i to 4 P. M., \i afterwards.
11	135.0	0.30	S. W. & S. S. W.	...	179.5	\i to 8 A. M., ⌒i to 5 P. M., \⌒i afterwards. T at 4 P. M. R at 2½ A. M.
12	...	1.15	SSW, N by W & W. [S.W	...	121.8	Chiefly O. T at 3¼ A. M. & 6 P. M. L from 2 to 4 A. M. & at 7 P. M. R from 3¼ to 12 A. M. & at 6, 10 & 11 P. M.
13	110.4	1.06	W.S.W. & W by N.	...	109.1	O to 6 A. M., \⌒i to 5 P. M., O afterwards. R after intervals.
14	130.0	0.18	S.W, WSW & S. by [W.	...	108.1	O to 8 A. M., ⌒_i to 4 P. M., O afterwards. T at 7½ P. M. Slight R after intervals.
15	116.4	2.20	S. by W. & S.	0.1	94.3	O to 9 A. M., S to 12 A. M., O afterwards. T & L at 2 P. M. R from 3 to 7 A. M. & 1 to 4 P. M.
16	127.6	1.00	NE, NN E & vari- [able	...	44.6	O to 12 A. M., S to 4 P. M., O afterwards. L on S at 8 P. M. Slight R from 1¾ to 9 A. M. & 4½ to 6 P. M.

\i Cirri, —i Strati, ⌒i Cumuli, _i Ciro-strati, ⌒_i Cumulo-strati, \⌒_i Nimbi, \⌒i Cirro-cumuli, B clear, S stratoni, O overcast, T thunder, L lightning R rain, D drizzle.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage $1\frac{1}{2}$ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
17	...	0.79	N. N. E. & N. E.	...	48.1	S to 3 A. M., O afterwards. R after intervals from 12 A. M. to 10 P. M.
18	122.5	0.16	E.E.N.E.&E.S.E.	...	110.1	Chiefly S. R at $5\frac{1}{2}$ & 11 A.M.
19	125.0	0.38	E. S.E & E.	0.8	114.2	Chiefly S. T at $3\frac{1}{2}$, 4 & 5 P. M. L on SW at $9\frac{1}{4}$ P. M. R at 2, $3\frac{1}{2}$ & 7 P. M.
20	...	0.35	E. S. E & S. by E	...	163.9	O & T at $1\frac{1}{4}$ P.M. Slight R at 3 & from $9\frac{1}{2}$ A. M. to 3 P. M.
21	...	...	S. by E. & S.	...	107.5	S to 5 A.M., O to 9 A.M., S to 12 A.M., O afterwards. L on S at 8 & 9 P. M. Light R at $3\frac{1}{2}$ A. M. & 6 P. M.
22	...	0.28	S. S.W, & S.S. E.	...	126.6	S to 7 A.M., O to 10 A.M., ⌒i to 3 P. M., S afterwards. T at $8\frac{1}{2}$ & $9\frac{1}{4}$ A. M. L on S at 8 & 9 P. M. Slight R at 3, 8, 9 & 10 A. M. & 7 & $9\frac{1}{2}$ P. M.
23	133.5	0.05	S. S. W. & S. W	...	37.4	∖⌒i to 2 A.M., S to 10 A.M., ⌒i to 4 P.M., S afterwards. L at midnight. Slight R at $4\frac{1}{4}$ A. M. & 2 & $3\frac{1}{2}$ P. M.
24	...	0.44	S.S.W.&S.W.	...	132.1	Chiefly O. T at 2 P.M. Slight R from 4 to 12 A.M. & at 4 P.M.
25	...	0.85	S.S.W. S.SE & S. by E	...	99.7	Chiefly O. T at $6\frac{1}{2}$ & $7\frac{1}{2}$ A. M. Slight R from $1\frac{3}{4}$ to 4 & 7 A. M. to 3 P. M.
26	139.2	0.06	SE, S.S.E.&S by E	...	78.5	S to 9 A.M., ⌒i & ∖i to 6 P. M., B afterwards. Slight R at $5\frac{3}{4}$ & 11 A. M.
27	145.5	0.05	S. by E. & S.S.E.	...	122.2	S & ∖i to 10 A.M., S to 2 P.M., ∖i & ⌒i to 7 P. M., S afterwards. Slight R at 12 A.M. & $11\frac{1}{2}$ P. M.
28	147.0	0.46	S. by E & S. S .E.	...	93.1	O to 5 A. M., ⌒i to 1 P. M., O to 5 P. M., B afterwards. Slight R at midnight & 1 A.M. & from $1\frac{1}{4}$ to 5 P.M. & at $7\frac{1}{4}$ P.M.
29	142.5	0.12	S.S.E. & S. by E.	...	63.4	∖_i to 5 A.M., S to 12 A. M., ∖i to 7 P. M. B afterwards. R at $4\frac{1}{2}$ P. M.
30	141.4	0.35	S.	...	73.6	Chiefly S. R at 8 A.M. & $6\frac{1}{2}$ P.M.
31	140.3	0.36	S. & S. E.	0.3	48.4	∖_i to 4 A.M., ⌒i to 3 P.M., clouds of different kinds afterwards. T & Brisk wind at $3\frac{1}{2}$ P. M. Slight R at $2\frac{1}{4}$, $3\frac{1}{2}$, 8 & $9\frac{1}{2}$ P. M.

∖i Cirri, —i Strati, ⌒i Cumuli, ∖_i Cirro-strati, ⌒_i Cumulo-strati, ∖⌒_i Nimbi, ∖⌒i Cirro-cumuli, B clear, S stratoni, O overcast, T thunder, L lightning, R rain, D drizzle.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1870.

Monthly Results.

	Inches.
Mean height of the Barometer for the month...	29.595
Max. height of the Barometer occurred at 10 A. M. on the 8th. ...	29.815
Min. height of the Barometer occurred at 4 P. M. on the 14th. ...	29.380
Extreme range of the Barometer during the month	0.435
Mean of the daily Max. Pressures	29.651
Ditto ditto Min. ditto	29.530
Mean daily range of the Barometer during the month	0.121

	o
Mean Dry Bulb Thermometer for the month	82.4
Max. Temperature occurred at 3 P. M. on the 9th.	91.8
Min. Temperature occurred at 4, 5 & 6 A. M, on the 24th.	76.5
Extreme range of the Temperature during the month	15.3
Mean of the daily Max. Temperature	87.1
Ditto ditto Min. ditto, ...	79.4
Mean daily range of the Temperature during the month... ...	7.7

Mean Wet Bulb Thermometer for the month	80.0
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	2.4
Computed Mean Dew-point for the month	78.3
Mean Dry Bulb Thermometer above computed mean Dew-point ...	4.1
	Inches.
Mean Elastic force of Vapour for the month	0.949

	Troy grain.
Mean Weight of Vapour for the month	10.20
Additional Weight of Vapour required for complete saturation ...	1·41
Mean degree of humidity for the month, complete saturation being unity	0.88
	o
Mean Max. Solar radiation Thermometer for the month ...	130.4

	Inches.
Rained 29 days,—Max. fall of rain during 24 hours	2.20
Total amount of rain during the month	12.92
Total amount of rain indicated by the Gauge* attached to the anemometer during the month	11.62
Prevailing direction of the Wind... ...	S S W & S by E.

* Height 70 feet 10 inches above ground.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1870.

MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	W.	Rain on.	W. by N.	Rain on.	W. N. W.	Rain on.	N. W.	Rain on.	N. N. W.	Rain on.	N. by W.	Rain on.
Mid night					1								2				1				2		5	1	4		4		9		2	1	1	1														
1					1								1		1		1				1		6	1	4		4		9		2								1	1								
2					1								1		1		1		2	1	2		4		3		4		9	1	2								1									
3					1								2	1			2	1	1		3	1	3		3		4	1	8	2	2	1			2	1												
4					1				1	1			1				2		1		3		3	1	3		5	1	6	3	2	1	2	1													1	1
5					1				1	1	1		1				1		1	1	4		2		3		3	1	7	1	2	1	2	1	1	1											1	1
6					1				1	1	1				1	1	1		1		5		1		3		3	1	7	2	2		2	1							1	1					1	1
7					1						1		1				1		1		7				2		3	1	7	3	3		1		1	1					1	1					1	1
8					1				1				1				1		2		4	1	1	1	3	1	1		8	2	4		1		1	1					1	1					1	1
9							1		1						1		2		3		2		1		3	1			5	4	7		3						2	2								
10	1								1				1		2	1			2		4	1	2		2				6	2	5	2	2	1			2		1									
11									1	1					3				4	2	4	1			1		1		4	1	7	2	2	1	2	1			1								1	
Noon.							1				1		1				2		3	1	2	1	1	1	3		1		5	1	7	2	1		2	1									1	1		
1							1				1		1				2	1	2		6	2	1				3		4		6		2						1				1	1				
2							1				1		1	1	1	1	1		4	2	3	2	3		1		2		5	1	4	1	2				1	1									1	1
3	1						1		1				1	1			1		2		4	2	4	1	1		3		6		3		3															
4							2	1			1		2	2	1	1	1	1	2	1	3	1	2		4		3		7	1	2	1	1															
5							2	1					3		1		1				3	1	1		5		3		9		2												1	1				
6							2	2					1				1				4		4	1	3	1	2	1	10	1	3	1									1	1						
7					1		1										2	1			1	1	7		3	1	3		10	2	1		1						1	1								
8					1		1										2				1		6		4	1	3	1	10		1		1						1	1								
9					1								1	1			2		1	1	1		6		4		2	1	11				2	1														
10					1								1	1			2		1	1	1		5		5		2	1	11	1			2	1														
11					1								2				1		1		1		6	1	4		5	1	8				2	2														

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1870.

Latitude 22° 33′ 1″ North. Longitude 88° 20′ 34″ East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Date.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Temperature during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.589	29.722	29.512	0.210	80.3	82.2	78.7	3.5
2	.771	.836	.703	.133	80.5	86.0	78.5	7.5
3	.800	.870	.728	.142	81.6	85.0	79.5	5.5
4	.735	.787	.670	.117	80.5	85.5	78.2	7.3
5	.719	.775	.655	.120	81.3	86.3	77.8	8.5
6	.737	.795	.682	.113	81.6	86.4	78.4	8.0
7	.773	.814	.700	.114	82.4	87.0	78.5	8.5
8	.748	.804	.681	.123	83.4	87.5	80.0	7.5
9	.713	.778	.634	.144	83.6	87.7	80.0	7.7
10	.705	.753	.626	.127	82.6	89.1	78.0	11.1
11	.759	.813	.710	.103	81.3	85.6	78.0	7.6
12	.768	.817	.709	.108	82.6	88.8	79.2	9.6
13	.776	.820	.705	.115	85.0	91.2	80.2	11.0
14	.792	.817	.720	.127	84.7	91.2	81.8	9.4
15	.826	.894	.786	.108	84.0	90.6	81.0	9.6
16	.810	.881	.725	.156	85.4	91.4	80.7	10.7
17	.740	.829	.648	.181	86.8	91.7	82.0	9.7
18	.709	.769	.645	.124	85.0	92.0	82.0	10.0
19	.701	.766	.621	.145	85.0	91.5	81.0	10.5
20	.662	.728	.584	.144	85.4	92.0	81.5	10.5
21	.635	.706	.559	.147	81.9	87.3	80.0	7.3
22	.557	.611	.487	.124	82.4	88.0	79.2	8.8
23	.574	.639	.511	.128	82.1	85.2	79.5	5.7
24	.569	.624	.504	.120	83.3	86.8	80.0	6.8
25	.573	.625	.521	.104	83.9	88.0	81.0	7.0
26	.603	.668	.536	.132	83.8	89.0	80.0	9.0
27	.622	.669	.561	.108	84.1	89.5	80.5	9.0
28	.661	.712	.602	.110	84.6	90.4	80.0	10.4
29	.693	.740	.640	.100	82.5	88.0	80.3	7.7
30	.745	.809	.689	.120	84.0	89.5	80.0	9.5

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made at the several hours during the day.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1870.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Date.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	78.8	1.5	77.7	2.6	0.931	10.04	0.87	0.92
2	79.2	1.3	78.3	2.2	.949	.24	.74	.93
3	79.7	1.9	78.4	3.2	.952	.25	1.09	.90
4	79.0	1.5	77.9	2.6	.937	.10	0.88	.92
5	79.0	2.3	77.4	3.9	.922	9.93	1.31	.88
6	78.8	2.8	76.8	4.8	.905	.73	.61	.86
7	78.9	3.5	76.4	6.0	.893	.60	2.01	.83
8	79.7	3.7	77.1	6.3	.913	.80	.16	.82
9	79.8	3.8	77.1	6.5	.913	.78	.25	.81
10	79.5	3.1	77.3	5.3	.919	.88	1.80	.85
11	79.1	2.2	77.6	3.7	.928	.99	.25	.89
12	79.5	3.1	77.3	5.3	.919	.88	.80	.85
13	80.8	4.2	77.9	7.1	.937	10.02	2.51	.80
14	80.6	4.1	77.7	7.0	.931	9.96	.46	.80
15	80.7	3.3	78.4	5.6	.952	10.19	1.98	.84
16	80.9	4.5	77.7	7.7	.931	9.94	2.74	.78
17	81.8	5.0	78.8	8.0	.964	10.27	.94	.78
18	81.0	4.0	78.2	6.8	.946	.11	.42	.81
19	80.7	4.3	77.7	7.3	.931	9.96	.57	.80
20	81.1	4.3	78.1	7.3	.943	10.08	.60	.80
21	79.7	2.2	78.2	3.7	.946	.17	1.27	.89
22	79.4	3.0	77.3	5.1	.919	9.88	.73	.85
23	80.1	2.0	78.7	3.4	.961	10.35	.16	.90
24	80.6	2.7	78.7	4.6	.961	.31	.62	.86
25	80.9	3.0	78.8	5.1	.964	.34	.79	.85
26	80.2	3.6	77.7	6.1	.931	9.98	2.12	.83
27	80.7	3.4	78.3	5.8	.949	10.16	.05	.83
28	80.0	4.6	76.8	7.8	.905	9.67	.72	.78
29	79.9	2.6	78.1	4.4	.943	10.14	1.50	.87
30	80.8	3.2	78.6	5.4	.958	.28	.89	.85

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Hour.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Temperature for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid-night.	29.713	29.851	29.546	0.305	81.3	84.0	78.0	6.0
1	.703	.840	.532	.308	81.0	83.4	78.0	5 4
2	.694	.830	.525	.305	80·8	82.7	78.0	4.7
3	.686	.818	.513	.305	80.6	82.7	78.0	4.7
4	.682	.813	.511	.302	80.4	82.5	78.0	4.5
5	.692	.821	.524	.297	80.2	82.5	77.9	4.6
6	.705	.833	.536	.297	80.1	82.0	77.8	4.2
7	.724	.863	.538	.325	81.0	83.0	78.7	4.3
8	.745	.870	.568	.302	82.8	86.0	78.7	7.3
9	.757	.890	.592	.298	84.1	88.0	79.0	9.0
10	.755	.894	.597	.297	85.4	89.0	80.4	8.6
11	.745	.880	.581	.299	86.2	90.6	80.0	10.6
Noon.	.724	.861	.559	.302	86.9	91.5	81.4	10.1
1	.698	.825	.539	.286	87.1	92.0	80.5	11.5
2	.670	.797	.506	.291	86.9	91.7	79.5	12.2
3	.651	.792	.492	.300	85.9	91.2	80.2	11.0
4	.644	.788	.487	.301	85.5	91.5	79.0	12.5
5	.648	.786	.490	.296	85.0	91.3	78·6	12.7
6	.661	.794	.512	.282	83.7	89.9	78.7	11.2
7	.680	.812	.529	.283	83.0	88.5	78.5	10.0
8	.702	.829	.549	.280	82.7	87.7	79.5	8.2
9	.723	.842	.581	.261	82.3	87.0	78.5	8.5
10	.733	.814	.585	.259	81.9	86.2	78.5	7.7
11	.727	.853	.561	.292	81.6	84.5	78.0	6.5

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Hour.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid-night.	79.6	1.7	78.4	2.9	0.952	10.25	0.99	0.91
1	79.4	1.6	78.3	2.7	.949	.22	.92	.92
2	79.2	1.6	78.1	2.7	.943	.16	.91	.92
3	79.2	1.4	78.2	2.4	.946	.21	.80	.93
4	79.2	1.2	78.4	2.0	.952	.27	.67	.94
5	79.1	1.1	78.3	1.9	.949	.24	.64	.94
6	79.0	1.1	78.2	1.9	.946	.21	.63	.94
7	79.5	1.5	78.4	2.6	.952	.25	.89	.92
8	80.2	2.6	78.4	4.4	.952	.23	1.52	.87
9	80.6	3.5	78.1	6.0	.943	.10	2.11	.83
10	80.9	4.5	77.7	7.7	.931	9.94	.74	.78
11	81.2	5.0	77.7	8.5	.931	.92	3.07	.76
Noon.	81.1	5.8	77.6	9.3	.928	.89	.36	.75
1	81.0	6.1	77.3	9.8	.919	.78	.55	.73
2	80.8	6.1	77.1	9.8	.913	.72	.53	.73
3	80.5	5.4	76.7	9.2	.902	.62	.25	.75
4	80.3	5.2	76.7	8.8	.902	.62	.10	.76
5	80.3	4.7	77.0	8.0	.910	.73	2.80	.78
6	80.0	3.7	77.4	6.3	.922	.89	.18	.82
7	80.1	2.9	78.1	4.9	.943	10.12	1.70	.86
8	80.0	2.7	78.1	4.6	.943	.12	.60	.86
9	80.0	2.3	78.4	3.9	.952	.23	.35	.88
10	79.9	2.0	78.5	3.4	.955	.29	.15	.90
11	79.7	1.9	78.4	3.2	.952	.25	.09	.90

All the Hygrometrical elements are computed by the Greenwich Constants.

***Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September* 1870.**

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage $1\frac{1}{2}$ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	124.5	0.18	S. E.& S. by E.	...	104.3	Chiefly O. Slight R after intervals from 6 A. M. to 2 P. M. & at $6\frac{1}{2}$ P. M.
2	137.8	2.41	S. S. E. & S.	1.3	161.1	Chiefly O. Brisk wind at $4\frac{1}{4}$ P. M. T at 11 & 12 A. M. & 3 P. M. R from $1\frac{3}{4}$ to 3 & $11\frac{1}{2}$ A. M. to 7 P. M.
3	119.5	0.06	S.	...	88.0	Chiefly S. T at $1\frac{3}{4}$ P. M. Slight R at 1 P. M.
4	134.0	1.00	S.S.W.&.S. by W.	1.0	146.1	⌒_i to 3 A. M., \⌒i to 12 A. M., O to 6 P. M., _i & \i afterwards. T at 1 P. M. R at Midnight & 1 A. M. & from $12\frac{1}{2}$ A. M., to 2 P. M.
5	140.0	0.03	S.	...	144.4	_i & \i to 4 A. M., ⌒i afterwards. Light R at 12 A. M., $3\frac{1}{2}$ & 4 P. M.
6	142.0	0.05	S. & S. by E.	...	134.0	\i & _i to 5 A. M., ⌒i to 2 P. M., \i & _i afterwards. Light R at 7 & 10 A. M. & $2\frac{1}{2}$ P. M.
7	142.2	...	S. by E.& S.	...	168.7	\i & ⌒i. D at 7 P. M.
8	145.3	...	S. by E, S. & S. by W	...	223.7	⌒i to 3 P. M., \i afterwards. L on N & W at 7 P. M.
9	139.0	...	S. by W. & S.	0.8	229.0	\i to 9 A. M., \i & ⌒i to 8 P. M. S afterwards. D at $3\frac{1}{2}$ & $4\frac{1}{2}$ A. M.
10	137.5	0.87	S. S. W. & S. by W.	1.6	273.0	S to 11 A. M., i to 2 P. M., O afterwards. Brisk wind at $5\frac{3}{4}$ P. M. T at 4 A. M., 3, $4\frac{1}{2}$, $5\frac{3}{4}$ & $6\frac{1}{2}$ P. M. L at $5\frac{3}{4}$ & $6\frac{1}{2}$ P. M. R from $3\frac{1}{2}$ to 11 P. M.
11	128.0	0.32	S.S.E. & S by E.	...	101.0	O to 6 A. M., ⌒i to 1 P. M., S & \i afterwards. T at $2\frac{1}{2}$ P. M., R from $2\frac{1}{2}$ to $3\frac{1}{2}$ P. M.
12	142.0	...	E.N.E.&E by S.	...	21.0	Clouds of different kinds. T at 3, 4 & 5 P. M.
13	145.8	...	E. S. E.	...	56.8	\i to 3 A. M., \⌒i to 8 A. M., ⌒i to 7 P. M., B afterwards.
14	144.0	0.12	E. S. E. & E by N.	0.2	56.2	B. to 5 A. M., _i to 10 A. M., ⌒i to 6 P. M., B afterwards. T at 4 & 5 P. M., R at 5 P. M.
15	148.3	0.16	E. by N. & S.S.E.	0.3	98.8	B to 3 A. M., \i to 12 A. M., clouds of different kinds afterwards. T at 2 & 3 P. M., R at 2 P. M.
16	145.2	...	S. S. E. & S.	...	27.8	B to 6 A. M., ⌒i to 7 P. M., B afterwards. T & L at 8 & 9 P. M.
17	145.8	...	S. & S. E.	...	36.6	\i to 6 A. M., ⌒i afterwards. T & L from 7 to 11 P. M., D at $10\frac{1}{4}$ P. M.

\i Cirri, —i Strati, ⌒i Cumuli, _i Ciro-strati, ⌒_i Cumulo-strati, ⌒_i Nimbi, \⌒i Cirro-cumuli, B clear, S stratoni, O overcast, T thunder, L lightning, R rain, D drizzle.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage $1\frac{1}{2}$ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
18	145.0	...	S. by W, S.S.W. & W S. W.	...	59.0	S to 5 A. M., \i & ⌒i to 1 P. M. O to 6 P. M., S afterwards. L from midnight to 3 A. M., T from 1 to 4 P. M. D at 4 P. M.
19	149.4	...	S. S. E. & S. E.	...	68.8	B to 7 A. M., ⌒i to 5 P. M., \i afterwards. T at 3 P. M. L on S W at 4 & 5 A. M. & 3 & $9\frac{1}{4}$ P. M.
20	146.5	...	S. S. E & E. S. E	...	78.2	\⌣i to 4 A. M., \i to 8 A. M., ⌒i to 3 P. M., \i to 6 P. M. B afterwards. T at 12 A. M. & 3 P. M., L on N at 8 P. M. D at 3 P. M.
21	132.3	0.42	S. S. E. & E. S. E.	1.5	138.8	B to 3 A. M. \i to 7 A. M., ⌒i to 11 A. M., O to 3 P. M., S afterwards. T at 12 A. M., L on N at 7 & 8 P. M., Slight R from 11 A. M., to 2 P. M.
22	146.5	0.37	E. S. E, & S. S. W.	...	45.0	S to 4 A. M, ⌒i to 6 P. M. O afterwards. T at $8\frac{1}{2}$ P. M. L from $6\frac{1}{2}$ to 11 P. M. Slight R at $5\frac{1}{2}$, $8\frac{1}{2}$ 10 & 11 P. M.
23	122.0	2.44	S. W. & S. S. W.	4.0	176.0	Chiefly O. High wind at $11\frac{1}{2}$ P. M. T at 4 & 6 A. M. & 11 P. M. R at 6, 7 & $10\frac{1}{2}$ A. M. & from 9 to 11 P. M.
24	131.2	...	S. S. W. & S.	...	236.4	O to 8 A. M., S to 3 P. M., \i to 7 P. M., S afterwards. T at $4\frac{1}{2}$ A. M., L on E at midnight, 1 & 4 A. M. & 7 & 8 P. M., D at midnight.
25	132.8	...	S. by E. & S.	...	162.5	⌣i to 6 A. M., ⌒i to 6 P. M., B afterwards. D at $10\frac{1}{2}$ A. M.
26	145.5	...	S by E, S S E & S.	...	117.6	B to 4 A. M. i to 6 P. M. B afterwards. T at $8\frac{3}{4}$ A. M., L on N W at 7 & 8 P. M. D at $5\frac{1}{2}$ & 9 A. M.
27	148.5	...	S. by E & S. S. E.	...	102.7	B to 7 A. M., ⌒i to 6 P. M., B afterwards. L on N E at 7 P. M. D at $2\frac{1}{2}$ & 4 P. M.
28	146.0	...	S. S. E. & S. E.	...	14.9	B. to 5 A. M. ⌒i to 5 P. M. B afterwards
29	145.2	...	S by E, S E. & S. S. E.	...	84.8	B to 5 A. M., clouds of different kinds afterwards. T at 12 A. M., & 1 P. M. D at 11 A. M., 3, 4, & 5 P. M.
30	148.5	0.58	S. S. E. & S.	...	51.5	B to 6 A. M., ⌒i to 7 P. M., B afterwards. T & L at 6 P. M. R at 9 A. M.

\i Cirri, —i Strati, ⌒i Cumuli, _i Cirro-strati, ⌒_i Cumulo-strati, \⌣i Nimbi, \⌣i Cirro-cumuli, B clear, S stratoni, O overcast, T thunder, L lightning, R rain, D drizzle.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1870.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	29.702
Max. height of the Barometer occurred at 10 A. M. on the 15th. ...	29.894
Min. height of the Barometer occurred at 4 P. M. on the 22nd. ...	29.487
Extreme range of the Barometer during the month	0.407
Mean of the daily Max. Pressures	29.764
Ditto ditto Min. ditto	29.635
Mean daily range of the Barometer during the month	0.129

	o
Mean Dry Bulb Thermometer for the month	83.2
Max. Temperature occurred at 1 P. M. on the 18th & 20th	92.0
Min. Temperature occurred at 6 A. M, on the 5th.	77.8
Extreme range of the Temperature during the month	14.2
Mean of the daily Max. Temperature	88.3
Ditto ditto Min. ditto, ...	79.9
Mean daily range of the Temperature during the month... ...	8.4

Mean Wet Bulb Thermometer for the month	80.0
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	3.2
Computed Mean Dew-point for the month	77.8
Mean Dry Bulb Thermometer above computed mean Dew-point ...	5.4
	Inches.
Mean Elastic force of Vapour for the month	0.934

	Troy grain.
Mean Weight of Vapour for the month	10.03
Additional Weight of Vapour required for complete saturation ...	1·86
Mean degree of humidity for the month, complete saturation being unity	0.84
	o
Mean Max. Solar radiation Thermometer for the month ...	140.0

	Inches.
Rained 24 days,—Max. fall of rain during 24 hours	2.44
Total amount of rain during the month	9.01
Total amount of rain indicated by the Gauge* attached to the anemometer during the month	8.38
Prevailing direction of the Wind... ...	S, S S E & S by E.

* Height 70 feet 10 inches above ground.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Sept. 1870.

MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	W.	Rain on.	W. by N.	Rain on.	W. N. W.	Rain on.	N. W.	Rain on.	N. N. W.	Rain on.	N. by W.	Rain on.
																					No. of days																											
Midnight											1						2		1		10	1	4		8	1	2		1		1	1																
1									1		1						2		1		9		6		5				4	1	1																	
2									1		1						2		3		6		7	1	5				4		1																1	
3									1		1						3		2		8	1	5		5				5																			
4									1		1						3		2		8		5		5	1			4		1																	
5									1		1				1		4				7		6		5	1			3		1		1															
6									1				1				5	1	1		5		6		5	1	2		2				2	1														
7									1						1		5		3		4		5		5	1	2		2		1	1	1															
8									1						2		4		2		5	1	4		5		2		3		1		1															
9									1				1		1		3		6	1	5	2	3		5		1		2		2																	
10									1		1		1		1		2		5		3		4		4	2			6		2	1																
11							1		1	1			1		2		1		5		4	1	5	1	3	1			5		2	1																
Noon.							1						2		3	1	2		4		3	1	1		5	1	6		3																			
1							1						2		1		3	1	4	1	4	1	1		7	1	2		4		1	1																
2									1				1	1	2		1	1	5		3	1	4	1	7		1		2	1	2																	
3									1		1	1			1		3	1	1		6	2	3	1	5		5	2	2				1										1					
4											1						4	2	5	1	2		5	2	4	2	4		3		1								1									
5									1				1	1	2		1		2	1	5		3		7	1	4	1	3		1																	
6											1				2		2				7		4		6		5	2	2																1			
7															1		2				7		5	1	8	2	4		2														1	1				
8											1				1		2				7		5		9		3		1												1	1						
9											1						2		1		7		5		8		4		1	1	1	1																
10											1						2		1		7		5		9		3	1	1	1	1	1																
11											1						2				8	1	5		11		1	1	1	1	1	1																

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1870.

Latitude 22° 33′ 1″ North. Longitude 88° 20′ 34″ East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Date.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Temperature during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.785	29.850	29.737	0.113	84.3	91.2	80.3	10.9
2	.796	.843	.736	.107	84.8	91.2	81.0	10.2
3	.819	.875	.747	.128	81.7	83.7	77.7	6.0
4	.785	.844	.712	.132	79.5	83.2	77.5	5.7
5	.734	.797	.662	.135	82.0	87.5	77.2	10.3
6	.753	.826	.700	.126	84.3	90.0	80.5	9.5
7	.788	.857	.729	.128	85.1	90.5	81.3	9.2
8	.798	.868	.730	.138	85.3	90.8	81.4	9.4
9	.797	.854	.744	.110	83.5	90.0	79.0	11.0
10	.828	.900	.754	.146	82.9	87.5	79.8	7.7
11	.845	.911	.784	.127	84.1	89.0	79.5	9.5
12	.833	.906	.769	.137	83.8	89.0	80.3	8.7
13	.798	.873	.729	.144	83.7	90.0	80.5	9.5
14	.803	.869	.756	.113	84.1	89.4	80.0	9.4
15	.802	.867	.737	.130	84.6	89.6	80.5	9.1
16	.813	.870	.762	.108	83.6	89.8	80.5	9.3
17	.848	.908	.810	.098	82.0	90.5	78.8	11.7
18	.872	.935	.815	.120	81.2	88.0	78.0	10.0
19	.872	.947	.804	.143	82.5	89.0	77.5	11.5
20	.884	.946	.822	.124	83.2	89.5	76.6	12.9
21	.893	.968	.825	.143	84.3	91.6	78.0	13.6
22	.873	.943	.801	.142	84.6	91.0	79.4	11.6
23	.868	.922	.812	.110	80.2	83.3	76.0	7.3
24	.879	.962	.831	.131	77.5	80.6	75.0	5.6
25	.827	.895	.760	.135	81.0	87.5	76.5	11.0
26	.767	.826	.712	.114	78.2	79.8	76.0	3.8
27	.751	.831	.699	.132	79.6	85.0	76.7	8.3
28	.843	.907	.799	.108	79.9	85.6	75.2	10.4
29	.868	.932	.805	.127	81.7	87.0	77.5	9.5
30	.883	.936	.839	.097	81.6	86.7	76.8	9.9
31	.880	.946	.823	.123	80.9	86.2	77.0	9.2

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made at the several hours during the day.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1870.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—(*Continued.*)

Date.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	80.6	3.7	78.0	6.3	0.940	10.07	2.21	0.82
2	81.1	3.7	78.5	6.3	.955	.23	.23	.82
3	79.5	2.2	78.0	3.7	.940	.11	1.26	.89
4	78.0	1.5	76.9	2.6	.908	9.80	0.86	.92
5	78.8	3.2	76.6	5.4	.899	.67	1.89	.84
6	80.5	3.8	77.8	6.5	.934	.99	2.29	.81
7	81.2	3.9	78.5	6.6	.955	10.21	.36	.81
8	81.3	4.0	78.5	6.8	.955	.21	.43	.81
9	79.7	3.8	77.0	6.5	.910	9.75	.25	.81
10	79.6	3.3	77.3	5.6	.919	.86	1.93	.84
11	79.4	4.7	76.1	8.0	.885	.48	2.73	.78
12	79.4	4.4	76.3	7.5	.890	.53	.57	.79
13	79.0	4.7	75.7	8.0	.873	.36	.71	.78
14	79.9	4.2	77.0	7.1	.910	.75	.46	.80
15	80.2	4.4	77.1	7.5	.913	.76	.63	.79
16	79.8	3.8	77.1	6.5	.913	.78	.25	.81
17	78.5	3.5	76.0	6.0	.882	.48	1.99	.83
18	77.7	3.5	75.2	6.0	.860	.26	.95	.83
19	76.6	5.9	72.5	10.0	.787	8.46	3.18	.73
20	76.0	7.2	71.0	12.2	.751	.05	.84	.68
21	77.8	6.5	73.2	11.1	.806	.63	.65	.70
22	78.5	6.1	74.2	10.4	.832	.91	.48	.72
23	77.8	2.4	76.1	4.1	.885	9.55	1.33	.88
24	75.9	1.6	74.8	2.7	.849	.20	0.84	.92
25	77.4	3.6	74.9	6.1	.851	.17	1.97	.82
26	77.2	1.0	76.5	1.7	.896	.71	0.54	.95
27	78.0	1.6	76.9	2.7	.908	.80	.89	.92
28	77.2	2.7	75.3	4.6	.862	.31	1.47	.86
29	78.5	3.2	76.3	5.4	.899	.59	.78	.84
30	77.8	3.8	75.1	6.5	.857	.21	2.13	.81
31	76.8	4.1	73.9	7.0	.824	8.88	.22	.80

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Hour.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Temperature for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid-night.	29.831	29.904	29.736	0.168	80.4	82.7	76.3	6.4
1	.822	.893	.729	.164	80.0	82.6	75.6	7 0
2	.815	.887	.717	.170	79.8	82.5	75.0	7.5
3	.808	.883	.708	.175	79.5	82.4	75.0	7.4
4	.806	.884	.703	.181	79.3	82.2	75.0	7.2
5	.817	.904	.718	.186	79.1	82.5	75.5	7.4
6	.834	.914	.729	.185	79.0	82.4	75.5	6.9
7	.855	.929	.745	.184	79.9	83.0	75.5	7.5
8	.875	.954	.755	.199	81.4	85.1	75.5	9.6
9	.888	.968	.781	.187	82.9	86.0	76.0	10.0
10	.885	.957	.787	.170	84.2	87.6	76.5	11.1
11	.868	.939	.775	.164	85.2	89.6	76.0	13.6
Noon.	.843	.912	.752	.160	86.1	90.6	77.0	13.6
1	.813	.873	.725	.148	86.6	91.2	76.5	14.7
2	.786	.854	.684	.170	87.2	91.6	77.0	14.6
3	.772	.813	.636	.177	86.8	91.6	78.0	13.6
4	.768	.839	.662	.177	86.0	90.0	78.0	12.0
5	.775	.846	.677	.169	84.9	89.2	76.0	13.2
6	.787	.861	.688	.173	83.3	87.2	76.3	10.9
7	.806	.881	.704	.177	82.3	86.3	76.5	9.8
8	.827	.891	.724	.167	81.8	85.0	76.8	8.2
9	.840	.900	.733	.167	81.3	81.0	77.0	7.0
10	.845	.913	.749	.164	80.9	83.5	77.0	6.5
11	.842	.908	.747	.161	80.6	83.0	76.7	6.3

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Hour.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Midnight.	78.6	1.8	77.3	3.1	0.919	9.92	1.02	0.91
1	78.4	1.6	77.3	2.7	.919	.92	0.89	.92
2	78.2	1.6	77.1	2.7	.913	.86	.89	.92
3	77.9	1.6	76.8	2.7	.905	.77	.89	.92
4	77.8	1.5	76.7	2.6	.902	.74	.85	.92
5	77.7	1.4	76.7	2.4	.902	.76	.77	.93
6	77.8	1.2	77.0	2.0	.910	.85	.65	.94
7	78.4	1.5	77.3	2.6	.919	.92	.86	.92
8	78.7	2.7	76.8	4.6	.905	.73	1.54	.86
9	79.1	3.8	76.4	6.5	.893	.58	2.21	.81
10	79.3	4.9	75.9	8.3	.879	.42	.82	.77
11	79.5	5.7	75.5	9.7	.868	.27	3.34	.74
Noon.	79.4	6.7	74.7	11.4	.846	.03	.92	.70
1	79.3	7.3	74.9	11.7	.851	.60	4.08	.69
2	79.4	7.8	74.7	12.5	.846	8.99	.38	.67
3	79.4	7.4	75.0	11.8	.854	9.09	.12	.69
4	79.0	7.0	74.1	11.9	.830	8.85	.06	.69
5	78.8	6.1	74.5	10.4	.840	9.00	3.49	.72
6	78.8	4.5	75.6	7.7	.871	.33	2.60	.78
7	78.7	3.6	76.2	6.1	.887	.54	.04	.82
8	78.7	3.1	76.5	5.3	.896	.65	1.75	.85
9	78.7	2.6	76.9	4.4	.908	.78	.46	.87
10	78.7	2.2	77.2	3.7	.916	.87	.23	.89
11	78.6	2.0	77.2	3.4	.916	.89	.21	.90

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	150.0	...	S. & S. S. E.	...	69.8	B to 8 A. M., ⌒i to 6 P. M., \i afterwards.
2	155.0	...	S.S.E. & S. by W.	...	59.8	B to 5 A. M., ⌢i to 7 P. M., \i afterwards. L on N W at 7 P. M.
3	128.0	0.40	S. by W. & S.S.E.	0·4	57.0	\i to 6 A. M., S to 4 P. M., \i afterwards. T at 8 A. M. R from 7½ to 9 A. M.
4	119.0	0.36	S.S.E. & S. by W.	...	38.8	\i to 4 A. M., O to 7 P. M., S afterwards. Slight R from 6½ to 8, at 11 A.M. & from 2 to 6 P.M.
5	144.2	...	S. S. W. & S. W.	...	58.3	\i & ⌢i. L on W at 8 P. M.
6	149.3	...	S. W & S. S. W.	...	40.9	⌢i to 7 P. M., B afterwards. L on E at 4 A. M.
7	151.3	...	S, S.S.W & S by W.	...	97.0	B to 6 A. M., ⎵i to 4 P. M., B afterwards.
8	144.4	...	S. by W. & S.S.W.	...	107.9	\i to 3 A. M., B to 12 A. M., ⌒i afterwards. L on N at 11 P. M.
9	147.0	0.07	S. E. & S. S. E.	...	86.1	S to 2 A. M., B to 6 A. M., ⌢i afterwards. T at 12 A. M., 1 & 2½ P. M., L on W from 6 to 8 P. M. Slight R at 12½ A. M.
10	145.0	0.05	S. S. E.	...	66.0	Chiefly ⌢i. T at 10 A. M. & from 2½ to 7 P. M., L on W at 7 P. M. Slight R at 10 A.M., & 2½ P. M.
11	150.0	...	S. S.E.S. by E.&S.	...	29.7	B to 7 A. M., ⌒i to 5 P. M., B afterwards.
12	156.0	...	S. & S by E.	...	22.3	B to 8 A. M., ⌢i to 6 P. M., B afterwards.
13	145.5	0.02	S. & S. by E,	...	44.3	B to 9 A. M., ⌢i to 6 P. M., B afterwards. Light R at 11¼ A. M.
14	149.0	...	S. & E. S. E.	...	40.2	B to 6 A. M., ⌒i to 6 P. M., B afterwards.
15	144.9	...	S. E. & S. W.	...	30.3	B to 7 A. M., ⌒i to 5 P. M., B afterwards. D at 11½ A. M., & 1½ P. M.
16	154.0	...	S.S.W, SW & SSE.	...	41.4	B to7 A. M., ⌢i afterwards. L at 7 & 8 P. M.
17	149.0	...	S. S. E.	...	50.5	\i to 8 A. M., ⌒i to 6 P. M., B afterwards.
18	146.0	...	S. S. E, E. & S. E.	...	69.5	\i to 4 A. M., ⌒i to 6 P. M., B afterwards.

\i Cirri, —i Strati, ⌒i Cumuli, ⎵i Ciro-strati, ⌢i Cumulo-strati, ⌣i Nimbi, \i Cirro-cumuli, B clear, S stratoni, O overcast, T thunder, L lightning R rain, D drizzle.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
19	146.0	...	E. N. E & S. E.	...	65.0	_i & ⌒i to 3 P. M., B afterwards.
20	151.0	...	E. N. E. & N. E.	...	97.9	Chiefly B. Foggy at 11 P. M.
21	146.3	...	N E, E & S. S. W. [& S. by E.	...	53.9	B to 11 A. M., ⌒i afterwards. L on S E at 6 P. M.
22	150.0	...	S.S.W, S E, E by S	...	35.8	\\i to 9 A. M., ⌒i to 7 P. M., _i afterwards. L on S W at 5½ P. M.
23	...	0.10	S. by E. & E S. E.	...	27.2	S to 11 A.M., O afterwards. Slight R at 9 A. M., & from 12 A. M. to 5 P. M.
24	...	0.81	E.N.E. & E.S. E.	...	65.1	O. Slight R from 4½ to 10 A. M., at 2 P. M., & from 7 to 11 P. M.
25	139.7	...	E. S. E. & S.	...	115.0	O to 6 A.M., ⌒i afterwards. D at 11 P. M.
26	...	0.96	S. S. E.	0.9	121.3	Chiefly O. T at 10, 11 & 12 A. M. L at 11 A. M. 8 & 10 P. M. R from 10 A. M. to 1 P. M., & at 7 P. M.
27	117.0	0.88	S.S.E. & variable.	...	65.4	_i to 4 A. M., S to 3 P. M., O afterwards. T at 4½ & 11 P. M. L at 7, 8, 10 & 11 P. M. R at 2 A. M. 4, 7½ & 8¼ P. M.
28	142.3	0.28	N.W. & W. by S.	...	68.8	O to 9 A. M., ⌒i to 7 P. M., B afterwards. T at midnight. L at 3 A. M. & 6 & 7 P. M. Slight R at 1, 3, 6½ & 7½ A. M.
29	148.5	...	N. & E. N. E.	...	44.4	Chiefly ⌒i.
30	143.5	...	N. E. & N by W.	...	111.0	B to 4 A. M., _i to 7 A. M. ⌒i to 7 P. M. B afterwards.
31	144.0	...	N by W & NNW.	...	83.0	B to 6 A. M., \\i to 10 A. M., ⌒i to 5 P. M. B afterwards.

\\i Cirri, —i Strati, ⌒i Cumuli, _i Cirro-strati, ⌒_i Cumulo-strati, \\⌒i Nimbi, \\⌒i Cirro-cumuli, B clear, S stratoni, O overcast, T thunder, L lightning, R rain, D drizzle.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October* 1870.

Monthly Results.

	Inches.
Mean height of the Barometer for the month...	29.825
Max. height of the Barometer occurred at 9 A. M. on the 21st. ...	29.986
Min. height of the Barometer occurred at 4 P. M. on the 5th. ...	29.662
Extreme range of the Barometer during the month	0.306
Mean of the daily Max. Pressures	29.891
Ditto ditto Min. ditto	29.766
Mean daily range of the Barometer during the month	0.125

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	o
Mean Dry Bulb Thermometer for the month	82.4
Max. Temperature occurred at 2 & 3 P. M. on the 21st.	91.6
Min. Temperature occurred at 2, 3 & 4 A. M, on the 24th.	75.0
Extreme range of the Temperature during the month	16.6
Mean of the daily Max. Temperature	87.9
Ditto ditto Min. ditto, ...	78.5
Mean daily range of the Temperature during the month... ...	9.4

Mean Wet Bulb Thermometer for the month	78.7
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	3.7
Computed Mean Dew-point for the month	76.1
Mean Dry Bulb Thermometer above computed mean Dew-point ...	6.3
	Inches.
Mean Elastic force of Vapour for the month	0.885

	Troy grain.
Mean Weight of Vapour for the month	9.51
Additional Weight of Vapour required for complete saturation ...	2·10
Mean degree of humidity for the month, complete saturation being unity	0.82
	o
Mean Max. Solar radiation Thermometer for the month ...	144.9

	Inches.
Rained 12 days.—Max. fall of rain during 24 hours	0.96
Total amount of rain during the month	3.93
Total amount of rain indicated by the Gauge* attached to the anemometer during the month	3.74
Prevailing direction of the Wind... ...	S S E & S

* Height 70 feet 10 inches above ground.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1870.

MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	W.	Rain on.	W. by N.	Rain on.	W. N. W.	Rain on.	N. W.	Rain on.	N. N. W.	Rain on.	N. by W.	Rain on.
Midnight							2		2				1				2		2		8		2		4		3		2		1												1				1	
1							2		2								2		2		8		2		4		3		2		1				1	1							1				1	
2							2		2								2		2		8	1	2		4		2		3		1				1												2	
3	1						2		2								1		3		8		2		4		2		3		1				1	1											1	
4	1						2		2								1		3		8		2		4		2		3		1				1												1	
5	1						2		2	1							1		4		8		1		5		2		2		1				1												1	
6	1						3		2	1							1		4		8		1		5		2		2		1																1	
7	2						2		1		1	1					2		3		9	1			4		2		4										1	1								
8			1				2	1	2								3	1	3		9	1			4		1		4										1	1					1			
9	1						2		4	1					1		2	1	3	1	5		2		5				3		2								1									
10			1		1		2		2		2				2		2		1	1	2	1	3	1	4		4		3		1		1															
11			1		1		2		1		2		2				4		2		2	1	3		1		4		4		1						1											
Noon.			1				2		1				6	1	2		2	1	1		1	1	3	1	2	1	3		2		3						1								1			
1	1	1					2				1		3		2		3		1		2	1	1		2		2		3	1	2		1		1				1						1		2	
2									3		1		4	2	2		2				1		1		3	1			5	1	2		2										1		2		2	
3	1		1				1		1		2		4		1		2		3		2		1		3	2	1		2				3						1	1			1		1			
4							1		2				4		1		1		3	1	2		2	1	4		3	1	1				2				1				1		2		1			
5							1		3		1		1		1		4	1	2		5		1		3		2	1	1				2								1		2		1			
6							1		2		1		2				3		2		7		1		3		3	1	1		2												1		1		1	
7							1		3						2		3	1	1		8	1	1		3		3		1		2												1		1		1	
8					1	1	1		2								3	1	2		7		2		3		3		2		2												1		1		1	
9							3	1	1								3	1	1		8		2		3		3		2		2												1		1		1	
10							3		1								8	1	1		8		2		3		3		3		1												1		1		1	
11							8		1						1		1	1	1		8	1	2		3		3		3		1												1		1		1	

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1870.

Latitude 22° 33′ 1″ North. Longitude 88° 20′ 34″ East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Date.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Temperature during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	°	°	°	°
1	29.852	29.916	29.789	0.127	81.4	86.8	76.5	10.3
2	.806	.865	.745	.120	82.2	87.0	77.6	9.4
3	.799	.865	.750	.115	80.1	84.0	78.4	5.6
4	.798	.845	.744	.101	78.5	83.7	75.5	8.2
5	.817	.878	.772	.106	79.3	86.1	75.5	10.6
6	.826	.899	.774	.125	80.9	86.2	76.7	9.5
7	.843	.901	.803	.098	82.0	86.7	79.0	7.7
8	.901	.949	.848	.101	81.9	86.5	78.6	7.9
9	.965	30.024	.921	.103	80.7	85.0	77.5	7.5
10	.967	.033	.907	.126	80.0	84.6	76.5	8.1
11	.956	.018	.892	.126	76.2	82.0	70.5	11.5
12	.976	.052	.927	.125	71.5	80.8	68.3	12.5
13	.970	.044	.913	.131	75.7	82.0	70.5	11.5
14	.960	.025	.905	.120	75.9	81.8	70.5	11.3
15	.974	.043	.929	.114	75.9	81.5	70.5	11.0
16	.992	.067	.940	.127	75.8	82.0	72.0	10.0
17	30.009	.091	.956	.135	74.5	81.5	69.0	12.5
18	29.977	.055	.919	.136	73.7	80.5	68.0	12.5
19	30.011	.081	.952	.129	73.8	80.6	68.0	12.6
20	.067	.147	30.020	.127	74.3	81.5	68.5	13.0
21	.058	.129	.011	.118	74.2	80.9	69.0	11.9
22	29.988	.075	29.911	.164	73.2	80.0	68.0	12.0
23	.913	29.978	.854	.124	73.9	82.0	68.0	14.0
24	30.005	30.065	.926	.139	74.5	83.0	68.7	14.3
25	.048	.120	.997	.123	70.5	79.0	63.7	15.3
26	.048	.113	30.005	.108	69.2	77.0	62.0	15.0
27	.034	.087	29.975	.112	71.0	78.2	65.0	13.2
28	.041	.109	.996	.113	70.9	78.2	64.0	14.2
29	.039	.102	.988	.114	71.5	79.4	65.0	14.4
30	.041	.105	.996	.109	70.5	78.6	64.0	14.6

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made at the several hours during the day.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1870.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Date.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	77.2	4.2	74.3	7.1	0.835	8.99	2.28	0.80
2	78.0	4.2	75.1	7.1	.857	9.21	.33	.80
3	77.8	2.3	76.2	3.9	.887	.58	1.26	.88
4	76.4	2.1	74.9	3.6	.851	.21	.14	.89
5	77.3	2.0	75.9	3.4	.879	.51	.08	.90
6	78.2	2.7	76.3	4.6	.890	.59	.51	.86
7	78.0	4.0	75.2	6.8	.860	.24	2.23	.81
8	78.2	3.7	75.6	6.3	.871	.37	.07	.82
9	78.0	2.7	76.1	4.6	.885	.53	1.51	.86
10	76.8	3.2	74.6	5.4	.843	.11	.70	.84
11	69.8	6.4	65.3	10.9	.623	6.78	2.88	.70
12	68.5	6.0	64.3	10.2	.603	.59	.59	.72
13	70.6	5.1	67.0	8.7	.659	7.17	.34	.75
14	70.7	5.2	67.1	8.8	.661	.19	.38	.75
15	70.6	5.3	66.9	9.0	.657	.15	.42	.75
16	69.5	6.3	65.1	10.7	.619	6.74	.80	.71
17	68.7	5.8	64.6	9.9	.609	.64	.54	.72
18	67.6	6.1	63.3	10.4	.584	.38	.58	.71
19	68.0	5.8	63.9	9.9	.595	.50	.48	.72
20	69.3	5.0	65.8	8.5	.634	.91	.21	.76
21	68.5	5.7	64.5	9.7	.607	.62	.47	.73
22	67.9	5.3	63.7	9.5	.591	.46	.36	.73
23	68.3	5.6	64.4	9.5	.605	.61	.40	.73
24	68.3	6.2	64.0	10.5	.597	.50	.68	.71
25	62.8	7.7	56.6	13.9	.467	5.13	3.00	.63
26	63.4	5.8	58.8	10.4	.503	.54	2.27	.71
27	65.7	5.3	61.5	9.5	.550	6.04	.21	.73
28	66.1	4.8	62.3	8.6	.565	.20	.03	.75
29	66.6	4.9	62.7	8.8	.572	.27	.11	.75
30	64.6	5.9	59.9	10.6	.521	5.72	.41	.70

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Hour.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Temperature for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid-night.	29.953	30.063	29.797	0.266	73.5	81.0	65.5	15.5
1	.945	.055	.785	.270	73.1	80.0	64.8	15 2
2	.936	.044	.770	.274	72·6	79.9	64.0	15.9
3	.929	.032	.757	.275	72.1	79.8	63.0	16.8
4	.931	.038	.756	.282	71.7	79.5	62.8	16.7
5	.942	.056	.760	.296	71.4	79.5	62.5	17.0
6	.961	.079	.792	.287	71.0	79.0	62.0	17.0
7	.981	.101	.814	.287	71.3	79.2	62.0	17.2
8	30.004	.128	.820	.308	73.5	81.2	66.0	15.2
9	.020	.147	.838	.309	75.8	82.4	68.5	13.9
10	.020	.142	.843	.299	78.0	84.0	70.5	13.5
11	.001	.119	.823	.296	79.9	86.2	73.2	13.0
Noon.	29.973	.087	.804	.283	80.8	86.5	75.0	11.5
1	.943	.061	.775	.286	81.4	86.8	76.0	10.8
2	.923	.038	.753	.285	81.6	87.0	77.0	10.0
3	.910	.029	.744	.285	81.4	86.3	77.0	9.3
4	.907	.020	.747	.273	80.5	86.0	76.0	10.0
5	.918	.031	.762	.269	79.6	85.6	75·0	10.6
6	.928	.046	.773	.273	77.6	84.0	72.5	11.5
7	.947	.060	.787	.273	76.4	83.0	70.5	12.5
8	.962	.067	.804	.263	75.6	82.4	69.0	13.4
9	.970	.077	.809	.268	74.8	82.5	68.0	14.5
10	.973	.080	.809	.271	74.1	82.0	66.8	15.2
11	.968	.075	.798	.277	73.6	81.5	66.5	15.0

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—(*Continued.*)

Hour.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid-night.	70.8	2.7	68.9	4.6	0.701	7.66	1.24	0.86
1	70.5	2.6	68.4	4.7	.690	.54	.25	.86
2	70.1	2.5	68.1	4.5	.684	.47	.19	.86
3	69.8	2.3	68.0	4.1	.681	.47	.06	.88
4	69.6	2.1	67.9	3.8	.679	.45	0.98	.88
5	69.3	2.1	67.6	3.8	.672	.38	.97	.88
6	69.0	2.0	67.4	3.6	.668	.33	.92	.89
7	69.3	2.0	67.7	3.6	.674	.40	.93	.89
8	70.2	3.3	67.9	5.6	.679	.42	1.48	.83
9	71.2	4.6	68.0	7.8	.681	.41	2.13	.78
10	71.8	6.2	67.5	10.5	.670	.26	.93	.71
11	72.1	7.8	66.6	13.3	.651	.02	3.76	.65
Noon.	72.1	8.7	66.0	14.8	.638	6.87	4.20	.62
1	72.1	9.3	65.6	15.8	.630	.78	.49	.60
2	71.9	9.7	65.1	16.5	.619	.66	.68	.59
3	71.8	9.6	65.1	16.3	.619	.67	.60	.59
4	71.5	9.0	65.2	15.3	.621	.70	.28	.61
5	72.0	7.6	66.7	12.9	.653	7.04	3.65	.66
6	72.6	5.0	69.1	8.5	.706	.64	2.43	.76
7	72.4	4.0	67.6	8.8	.672	.31	.41	.75
8	71.9	3.7	69.3	6.3	.711	.74	1.74	.82
9	71.4	3.4	69.0	5.8	.704	.67	.59	.83
10	71.0	3.1	68.8	5.3	.699	.63	.44	.84
11	70.6	3.0	68.5	5.1	.692	.57	.36	.85

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage $1\frac{1}{2}$ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	147.0	...	N E, E N E & N by W	...	79.0	B to 9 A. M., ⌒i to 5 P. M., ╲i afterwards.
2	140.0	...	N E. & N.	...	64.2	B to 5 A. M., ╲i to 9 A. M., ⌒i & ╲i to 5 P. M. S afterwards. L on S at 7 P. M.
3	122.0	0.03	NNE,ENE&SSE	...	87.4	╲i & ╲_i to 5 A. M. O to 6 P. M. S afterwards. Slight R at 10 A. M., 1, 2, & 3 P. M.
4	111.0	1.22	SE,EbyN&ENE.	...	59.5	Chiefly O. R at 12 A. M., & from $5\frac{1}{4}$ to 7 P. M.
5	143.4	0.41	E N E. & S S W.	1.2	60.9	╲⌒i to 8 A. M., ⌒i to 4 P. M., ╲i to 7 P. M., B afterwards T at $1\frac{1}{2}$ P. M. Slightly foggy at 9 & 10 P. M. R at 2 P. M..
6	145.2	...	S S W. & W.	...	16.6	B to 7 A. M., ⌒i afterwards. Foggy from 2 to 7 A. M., L on N at 6 P. M., T at $6\frac{1}{4}$ & 7 P. M., D at $1\frac{3}{4}$ & 4 P. M.
7	145.5	...	W. & N E.	...	24.3	Chiefly ⌒i. T at $4\frac{1}{2}$ A. M. D at 3 & $4\frac{1}{2}$ A. M.
8	137.8	...	E S E. & S E.	...	37.8	╲⌒i to 12 A. M., ⌒i to 4 P. M. B afterwards. Slightly foggy at 7 & 8 P. M.,
9	142.0	...	Variable.	...	44.2	╲⌒i & ⌒i D at $4\frac{1}{2}$ P. M.
10	142.0	...	N N W& variable	...	61.6	⌒i to 4 P. M., B afterwards.
11	142.7	...	N N E.& W by N.	...	125.5	B to 12 A. M., ⌒i to 5 P. M. B afterwards.
12	135.0	...	W by N&W N W.	...	34.7	B.
13	138.0	...	W N W. & N W.	...	77.3	B to 10 A. M., ⌒i to 4 P. M., B afterwards.
14	138.5	...	N W. & E by N.	...	50.2	B to 10 A. M., ⌒i to 4 P. M., B afterwards. Slightly foggy from 3 to 6 A. M.,
15	139.5	...	NE,ENE&NbyWbyN.	...	58.2	B to 5 A. M., ⌒i to 5 P. M., B to 9 P. M., ⌒_i afterwards.
16	142.3	...	NbyW,NbyE&W	...	32.7	╲i & ╲_i to 6 A. M., ⌒i to 4 P. M., B afterwards.
17	140.8	...	W by N. & S W.	...	29.7	B to 11 A. M., ⌒i to 4 P. M., B afterwards.
18	140.0	...	S W & S by W.	...	24.2	B.
19	145.0	...	S by W. & S W.	0.2	69.0	Chiefly B. Slightly foggy at 8 P. M.
20	141.3	...	S W.	...	74.3	B to 11 A. M., ⌒i to 4 P. M. B afterwards.
21	135.6		SW,SSW&WbyS	...	58.5	B. Foggy at 9 & 10 P. M.

╲i Cirri, —i Strati, ⌒i Cumuli, ╲_i Ciro-strati, ⌒_i Cumulo-strati, ╲⌒_i Nimbi, ╲⌒i Cirro-cumuli, B clear, S stratoni, O overcast, T thunder, L lightning R rain, D drizzle.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage $1\frac{1}{2}$ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
22	135.4	...	S by W, S, WSW & S W.	...	46.8	B to 10 A. M., \i to 4 P. M., B afterwards. Slightly foggy from 8 to 11 P. M.
23	137.2	...	S W & S S W.	...	89.4	B.
24	138.5	...	SSW, SW & WNW	...	100.0	Chiefly B.
25	134.8	...	N W & N by E.	0.2	165.1	B. Foggy at 9 P. M.
26	128,8	...	N by E & N by W.	...	144.5	B.
27	130.6	...	N by W. & N.	0.4	145.8	B to 10 A. M., _i to 2 P. M. B afterwards.
28	134.2	...	N by W. & N W.	...	80.0	B to 11 A. M., \i to 4 P. M. B afterwards. Slightly foggy from 7 to 10 P. M.
29	133.0	...	N W. & N.	...	64.7	B. Foggy from 7 to 10 P. M.
30	133.8	...	N. & N by W.	...	76.8	B to 5 A. M., \i to 11 A. M. B afterwards. Foggy from 7 to 11 P. M.

\i Cirri, —i Strati, ⌒i Cumuli, _i Cirro-strati, ⌒_i Cumulo-strati, \⌒_i Nimbi, \⌒i Cirro-cumuli, B clear, S stratoni, O overcast, T thunder, L lightning, R rain, D drizzle.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1870.

Monthly Results.

	Inches.
Mean height of the Barometer for the month...	29.956
Max. height of the Barometer occurred at 9 A. M. on the 20th. ...	30.147
Min. height of the Barometer occurred at 3 P. M. on the 4th. ...	29.744
Extreme range of the Barometer during the month	0.403
Mean of the daily Max. Pressures	30.023
Ditto ditto Min. ditto	29.902
Mean daily range of the Barometer during the month	0.121

	o
Mean Dry Bulb Thermometer for the month	75.9
Max. Temperature occurred at 2 P. M. on the 2nd.	87.0
Min. Temperature occurred at 6 & 7 A. M. on the 26th.	62.0
Extreme range of the Temperature during the month	25.0
Mean of the daily Max. Temperature	82.2
Ditto ditto Min. ditto, ...	70.8
Mean daily range of the Temperature during the month... ...	11.4

Mean Wet Bulb Thermometer for the month	71.0
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	4.9
Computed Mean Dew-point for the month	67.6
Mean Dry Bulb Thermometer above computed mean Dew-point ...	8.3
	Inches.
Mean Elastic force of Vapour for the month	0.672

	Troy grain.
Mean Weight of Vapour for the month	7.32
Additional Weight of Vapour required for complete saturation ...	2·25
Mean degree of humidity for the month, complete saturation being unity	0.77
	o
Mean Max. Solar radiation Thermometer for the month ...	137.4

	Inches.
Rained 6 days,—Max. fall of rain during 24 hours	1.22
Total amount of rain during the month	1.66
Total amount of rain indicated by the Gauge* attached to the anemometer during the month	1.56
Prevailing direction of the Wind... ...	S W & N by W

* Height 70 feet 10 inches above ground.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Nov. 1870.

MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	W.	Rain on.	W. by N.	Rain on.	W. N. W.	Rain on.	N. W.	Rain on.	N. N. W.	Rain on.	N. by W.	Rain on.
Mid night	1		3				2		1								1				2				1		2		2		4						1		2		1		3		1		3	
1	1		3				2		1								1				2				1		2		2		4						1		2		1		3		1		3	
2	1		2		1		2		1								1		1		1				1		2		2		4						1		2		1		3		1		3	
3	1		1		2		2		1								1		1		1				2		1		2		4						1	1	2		1		3				4	
4	1		1		2		2		1						1		1		1						1		2		2		4						1		2		1		3				4	
5	2		1		3		1		1						1		2		1						1		1		2		4						1	1	2		1		3				3	
6	2		1		3		1		2						1		2								1		1		2		4						1		2		1		3				3	
7	3		2		2		1		1		2				1		2								1		1		4		2						1		2		1		3				1	
8	2		1		1		3		3		2								2						1		2		2		3						1		2		1		2		1		1	
9	3		1		3		1		3		1		1		1		1										3		3		2						1		2		1		1				2	
10	1		2		3		2		3	1	2		1		1		1				1						2		4		1		1				1		1		1		1				1	
11	2		3		2		1		4		2		1				2								1		1		3		4						1		1		1		1					
Noon.	3		3		1		1		3		3	1	1				1		1												7		1				1		1				3					
1	2		2						3				2	1	1		1		1												5		3				2		1		1		2		4			
2	4						2		2						1						1	1			2	1					5	1	2						1		6		1		1		2	
3	2		1				1		2		1								1				1	1							4		2		1		2				5		2		2		3	
4	1		1		1		1		1								1						1		1				1		3		2		2		1	1			4		3		1		5	
5	2		1				3				1								1						2				2		3		2		1		1				4		2		1		4	
6	2		1				2				1				1				1				1	1			1		2		5		1		1				2		2		2		1		4	
7	2		1				2				1						1	1	1				1				1		2		5		1		1				2		2		2		1		4	
8	2		1				2		1		1								1		1		1				1		2		4				1				2		3		2		1		4	
9	2		1				2		1		1										2		1				1		2		4				1				2		2		3		1		4	
10	2		1				2		1		1										2				1		1		2		4				1				2		2		3				5	
11	2		2				1		1		1						1				2				1		1		2		4				1		1		2		1		3				4	

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1870.

Latitude 22° 33′ 1″ North. Longitude 88° 20′ 34″ East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Date.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Temperature during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	30.058	30.135	30.011	0.124	69.5	79.0	61.5	17.5
2	.065	.132	.009	.123	69.0	78.5	61.2	17.3
3	.094	.164	.039	.125	68.1	78.0	60.4	17.6
4	.086	.149	.025	.124	67.6	77.3	60.2	17.1
5	.078	.144	.017	.127	66.2	74.4	60.0	14.4
6	.059	.126	.009	.117	65.8	74.7	58.2	16.5
7	.082	.150	.039	.111	67.1	76.6	60.2	16.4
8	.083	.152	.038	.114	66.4	75.8	58.5	17.3
9	.076	.157	.024	.133	65.6	74.6	57.8	16.8
10	.066	.121	.020	.101	65.8	75.5	58.6	16.9
11	.051	.125	29.979	.146	65.4	74.5	75.6	16.9
12	.022	.102	.964	.138	64.5	72.8	57.5	15.3
13	.032	.091	.988	.103	66.0	74.9	58.5	16.4
14	.083	.152	30.038	.114	65.4	75.2	57.6	17.6
15	.100	.184	.045	.139	66.4	75.5	58.5	17.0
16	.057	.136	29.986	.150	67.1	75.8	60.6	15.2
17	.018	.104	.958	.146	65.9	75.0	58.6	16.4
18	29.994	.068	.927	.141	64.8	73.5	75.5	16.0
19	30.008	.095	.940	.155	63.9	72.4	57.2	15.2
20	29.929	.010	.851	.159	64.2	73.4	57.0	16.4
21	.850	29.919	.789	.130	66.1	75.8	58.0	17.8
22	.930	30.019	.846	.173	67.1	77.0	59.0	18.0
23	30.043	.126	.991	.135	66.4	75.5	59.0	16.5
24	.058	.137	30.015	.122	66.7	75.3	60.5	14.8
25	.029	.118	29.956	.162	65.8	74.0	59.1	14.9
26	29.983	.063	.929	.134	66.1	74.5	59.4	15.1
27	.982	.052	.932	.120	65.7	74.6	58.0	16.6
28	30.018	.108	.969	.139	66.2	75.9	58.5	17.4
29	.004	.078	.939	.139	67 0	77.2	59.6	17.6
30	29.961	.025	.900	.125	68.2	77.8	60.8	17.0
31	.916	29.997	.852	.145	70.2	80.1	62.8	17.3

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made at the several hours during the day.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1870.

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Date.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	63.3	6.2	58.3	11.2	0.494	5.44	2.44	0.69
2	62.4	6.6	57.1	11.9	.475	.23	.53	.67
3	60.7	7.4	54.8	13.3	.440	4.85	.70	.64
4	60.5	7.1	54.8	12.8	.440	.85	.59	.65
5	58.6	7.6	52.5	13.7	.407	.51	.61	.63
6	59.6	6.2	54.6	11.2	.437	.85	.19	.69
7	61.5	5.6	57.0	10.1	.473	5.23	.09	.71
8	60.6	5.8	56.0	10.4	.458	.08	.09	.71
9	60.2	5.4	55.9	9.7	.456	.06	1.94	.72
10	60.2	5.6	55.7	10.1	.453	.03	2.01	.71
11	59.4	6.0	54.6	10.8	.437	4.85	.10	.70
12	59.2	5.3	55.0	9.5	.442	.92	1.84	.73
13	60.0	6.0	55.2	10.8	.445	.94	2.14	.70
14	60.3	5.1	56.2	9.2	.461	5.12	1.83	.74
15	60.7	5.7	56.1	10.3	.459	.10	2.07	.71
16	62.0	5.1	57.9	9.2	.488	.39	1.93	.74
17	60.4	5.5	56.0	9.9	.458	.08	.98	.72
18	58.6	6.2	53.6	11.2	.422	4.69	2.14	.69
19	58.2	5.7	53.1	10.8	.415	.63	.00	.70
20	58.9	5.3	54.1	10.1	.429	.78	1.90	.71
21	59.9	6.2	54.9	11.2	.441	.89	2.21	.69
22	61.3	5.8	56.7	10.4	.469	5.18	.14	.71
23	60.4	6.0	55.6	10.8	.452	.01	.16	.70
24	61.1	5.6	56.6	10.1	.467	.17	.06	.72
25	60.8	5.0	56.8	9.0	.470	.21	1.83	.74
26	60.5	5.6	56.0	10.1	.458	.08	2.02	.72
27	60.5	5.2	56.3	9.4	.462	.14	1.88	.73
28	61.6	4.6	57.9	8.3	.488	.40	.72	.76
29	61.4	5.6	56.9	10.1	.472	.21	2.09	.71
30	62.7	5.5	58.3	9.9	.494	.45	.13	.72
31	63.9	6.3	58.9	11.3	.504	55.	.50	.69

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

Hour.	Mean Height of the Barometer at 32° Faht.	Range of the Barometer for each hour during the month. Max.	Min.	Diff.	Mean Dry Bulb Thermometer.	Range of the Temperature for each hour during the month. Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid-night.	30.029	30.108	29.864	0.244	62.8	66.0	60.2	5.8
1	.021	.095	.858	.237	62.1	65.2	59.5	5 7
2	.013	.088	.855	.233	61·5	65.0	59.0	6.0
3	.006	.081	.848	.233	60.9	64.0	59.0	5.0
4	.001	.074	.823	.251	60.3	64.0	58.3	5.7
5	.011	.091	.834	.257	59.8	63.5	57.4	6.1
6	.026	.106	.842	.264	59.3	62.8	57.0	5.8
7	.050	.124	.853	.271	59.2	63.0	57.0	6.0
8	.075	.164	.884	.280	61.7	65.0	58.5	6.5
9	.096	.181	.906	.275	64.8	69.4	60.8	8.6
10	.099	.184	.919	.265	68.5	73.2	64.0	9.2
11	.081	.170	.894	.276	71.3	75.5	66.7	8.8
Noon.	.050	.136	.859	.277	73.1	77.1	69.0	8.1
1	.015	.100	.825	.275	74.5	78.5	69.8	8.7
2	29.992	.063	.803	.260	75.4	79.5	71.6	7.9
3	.978	.051	.789	.262	75.5	80.1	72.4	7.7
4	.973	.048	.790	.258	74.2	79.5	70.7	8.8
5	.979	.057	.796	.261	72.7	78.0	69·7	8.3
6	.989	.062	.807	.255	69.8	74.0	67.4	6.6
7	30.008	.088	.829	.259	67.8	71.5	65.8	5.7
8	.025	.100	.845	.255	66.5	70.5	64.5	6.0
9	.037	.110	.869	.241	65.3	69.2	63.0	6.2
10	.040	.120	.876	.244	64.3	68.0	62.0	6.0
11	.034	.119	.867	.252	63.5	66.5	61.2	5.3

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1870.

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—*(Continued.)*

Hour.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid-night.	59.7	3.1	56.9	5.9	0.472	5.26	1.15	0.82
1	59.0	3.1	56.2	5.9	.461	.15	.12	.82
2	58.5	3.0	55.8	5.7	.455	.09	.07	.83
3	58.1	2.8	55.6	5.3	.452	.07	0.97	.84
4	57.5	2.8	55.0	5.3	.442	4.97	.96	.84
5	57.1	2.7	54.7	5.1	.438	.92	.91	.84
6	56.7	2.6	54.4	4.9	.434	.87	.87	.85
7	56.7	2.5	54.4	4.8	.434	.87	0.86	.85
8	58.1	3.6	54.9	6.8	.441	.93	1.26	.80
9	59.7	5.1	55.6	9.2	.452	5.03	.80	.74
10	61.5	7.0	55.9	12.6	.456	.03	2.62	.66
11	62.5	8.8	55.5	15.8	.450	4.94	3.39	.59
Noon.	62.7	10.4	54.4	18.7	.434	.73	4.06	.54
1	63.2	11.3	55.3	19.2	.447	.88	.30	.53
2	63.6	11.8	55.3	20.1	.447	.87	.56	.52
3	63.4	12.1	54.9	20.6	.441	.79	.67	.51
4	63.0	11.2	55.2	19.0	.445	.86	.23	.54
5	63.4	9.3	56.0	16.7	.458	5.00	3.68	.58
6	63.5	6.3	58.5	11.3	.498	.48	2.47	.69
7	62.8	5.0	58.8	9.0	.503	.55	1.93	.74
8	62.1	4.4	58.6	7.9	.499	.53	.66	.77
9	61.3	4.0	58.1	7.2	.491	.45	.48	.79
10	60.7	3.6	57.5	6.8	.481	.35	.37	.80
11	60.1	3.4	57.0	6.5	.473	.27	.28	.81

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	Wind.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	o	Inches		lb	Miles	
1	132.0	...	N by W & N by E	...	89.1	B. Foggy at midnight and from 7 to 11 P. M.
2	132.0	...	N N E & N by W	...	63.3	B. Slightly foggy at midnight & 1 A. M., & from 7 to 11 P. M.
3	133.5	...	N by W, N N W & N	...	120.5	B. Slightly foggy from 8 to 11 P. M.
4	133.5	...	N & N by E.	...	163.5	B.
5	132.8	...	N & W by N.	...	116.4	B.
6	130.0	...	W N W, W by N & W	...	115.0	B.
7	132.0	...	W & W N W.	...	99.3	Chiefly B. Slightly foggy at 11 P. M.
8	130.5	...	W N W & W by N.	...	73.0	B. Slightly foggy from midnight to 4 A. M., & 7 to 11 P. M.
9	131.5	...	W & W by N.	...	82.3	B to 9 A. M., \i to 3. P. M. B afterwards. Slightly foggy from midnight to 8 A. M., & 7 to 9 P. M.. & at 11 P. M.
10	130.8	...	W by N & W	...	64.2	B. Foggy from midnight to 2 A. M.
11	130.0	...	W.	...	65.0	B to 7 A. M., \i to 6 P. M., B afterwards. Slightly foggy from 8 to 11 P. M.
12	134.0	...	W & W by N.	...	95.5	B to 4 A. M., \i to 6 P. M., B afterwards.
13	128.0	...	W by N.	...	106.8	B. Slightly foggy from 8 to 11 P. M.
14	129.2	...	W & W N W.	...	83.6	B to 6 A. M., \i to 5 P. M., B afterwards. Slightly foggy at midnight & 1 A. M., & at 6 P. M.
15	128.0	...	W N W & N W.	...	126.9	B to 6 A. M., \i to 5 P. M., B afterwards.
16	129.5	...	N by E & N E.	...	97.3	B.
17	128.5	...	N by E.	...	166.4	B.
18	129.4	...	N by E & W N W.	...	99.3	B.
19	126.7	...	W N W & N N E.	...	134.1	B.
20	127.8	...	N N E & W by N.	...	115.2	B. Slightly foggy from 7 to 11 P. M.
21	132.0	...	W S W & W by S.	...	104.2	B to 10 A. M., \⌒i to 4 P. M. B afterwards. Slightly foggy at 5 & 6 A. M.
22	129.0	...	W by S & N W.	...	80.2	B. Slightly foggy at 6 & 7 P. M.
23	129.5	...	N W & N by E.	...	121.4	B.
24	127.0	...	N by E & N N E.	...	205.4	B.

\i Cirri, —i Strati, ⌒i Cumuli, _i Ciro-strati, ⌒-i Cumulo-strati, \⌒-i Nimbi, \⌒i Cirro-cumuli, B clear, S stratoni, O overcast, T thunder, L lightning R rain, D drizzle.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1870.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
25	130.0	...	N N E & N.	...	126.0	B to 11 A. M., _i to 5 P. M., B afterwards.
26	129.4	...	N, N by E & W N W	...	131.2	B to 6 A. M., \\⌒i to 7 P. M., B afterwards.
27	126.8	...	W N W	...	87.7	B. Foggy at 11 P. M.
28	128.0	...	W N W	...	79.0	B. Slightly foggy from midnight to 3 & at 7 A. M., & from 7 to 11 P. M.
29	130,8	...	W N W.	...	75.8	B. Foggy from midnight to 7 A. M. & 7 to 11 P. M.
30	130.0	...	W N W.	...	88.6	B to 3 A. M., \\⌒i to 10 A. M., \\i afterwards. Foggy from midnight to 2 & at 6 A. M., & from 7 to 11 P. M.
31	134.8	...	W & W N W.		121.7	Chiefly B. Slightly from 7 to 11 P. M.

\\i Cirri, —i Strati, ⌒i Cumuli, _i Cirro-strati, ⌒_i Cumulo-strati, \\⌒_i Nimbi, \\⌒i Cirro-cumuli, B clear, S stratoni, O overcast, T thunder, L lightning, R rain, D drizzle.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1870.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	30.026
Max. height of the Barometer occurred at 10 A. M. on the 15th. ...	30.184
Min. height of the Barometer occurred at 3 P. M. on the 21st. ...	29.789
Extreme range of the Barometer during the month	0.395
Mean of the daily Max. Pressures	30.101
Ditto ditto Min. ditto	29.969
Mean daily range of the Barometer during the month	0.132

	o
Mean Dry Bulb Thermometer for the month	66.5
Max. Temperature occurred at 3 P. M. on the 31st.	80.1
Min. Temperature occurred at 6 & 7 A. M, on the 20th.	57.0
Extreme range of the Temperature during the month	23.1
Mean of the daily Max. Temperature	75.6
Ditto ditto Min. ditto, ...	59.1
Mean daily range of the Temperature during the month... ...	16.5

Mean Wet Bulb Thermometer for the month	60.6
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	5.9
Computed Mean Dew-point for the month	55.9
Mean Dry Bulb Thermometer above computed mean Dew-point ...	10.6
	Inches.
Mean Elastic force of Vapour for the month	0.456

	Troy grain.
Mean Weight of Vapour for the month	5.05
Additional Weight of Vapour required for complete saturation ...	2·14
Mean degree of humidity for the month, complete saturation being unity	0.70
	o
Mean Max. Solar radiation Thermometer for the month ...	130.2

	Inches.
Rained No day,—Max. fall of rain during 24 hours	Nil.
Total amount of rain during the month	Nil.
Total amount of rain indicated by the Gauge* attached to the anemometer during the month	Nil.
Prevailing direction of the Wind... ...	W N W, W by N & W.

* Height 70 feet 10 inches above ground.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Dec. 1870.

MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.
Mid night	2		4		2																											
1	2		4		2																											
2	3		3		3																											
3	4		3		3																											
4	3		4		3																											
5	2		5		3																											
6	2		4		4																											
7	2		4		4																											
8	2		3		4		1																									
9	2		3		4		1																									
10	2		4		4		1																									
11	3		3		3		2																									
Noon.	4		2																													
1	1		2		2																											
2	3				2																											
3	1				3																											
4	1		4		1																											
5	2		5		2																											
6	2		5		2																											
7	2		5		2																											
8	2		5		2																											
9	2		5		2																											
10	2		5		2																											
11	2		5		2																											

Hour.	W. S. W.	Rain on.	W. by S.	Rain on.	W.	Rain on.	W. by N.	Rain on.	W. N. W.	Rain on.	N. W.	Rain on.	N. N. W.	Rain on.	N. by W.	Rain on.
Mid night	1		1		6		3		7		2				3	
1	1		1		6		3		7		2				3	
2	1		1		6		3		7		2				2	
3	1		1		6		2		8		1				2	
4	1		1		6		2		8		1				2	
5	1		1		6		2		8		1				2	
6	1		1		6		2		8		1				2	
7	1		1		6		2		8		1				2	
8	1		1		6		2		8		1		1		1	
9	1		1		5		4		7		1		1		1	
10	1		1		4		5		7		1				1	
11	1		1		3		5		9		1					
Noon.			1		1		8		11		2		1		1	
1	1				3		8		9		2		1		2	
2			1		2		6		11		1		5			
3			1		2		8		9		2		2		3	
4			1		2		8		8		2		3		1	
5			1		2		7		9		2				1	
6			1		4		5		9		2				1	
7			1		4		5		9		2				1	
8			1		4		5		9		2				1	
9			1		4		5		9		2				1	
10			1		4		5		9		2				1	
11			2		5		3		9		2				1	

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