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EDITED BY THE

NATURAL HISTORY SECRETARY.

"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 of 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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No. I.—1904.

The recent excessive heat in Bengal and its probable cause.—*By* C. LITTLE.

[Read 1st July, 1903.]

It is, I presume, quite unnecessary to inform the members of this Society that during the past season unusual temperature conditions prevailed in Bengal. There may, however, be some who are not aware that, while Bengal was not the only part of Northern India in which exceptional temperature was experienced, it had a practical monopoly of the high temperatures. The period of excessive heat which began in Bengal about the middle of April and ended on the 24th of May was without precedent as regards length, and just failed to surpass previous records as regards intensity. Taking the case of Calcutta and keeping in mind that on several occasions during the past ten years the record of previous maximum temperatures has been broken, a comparison of the highest temperatures will show how the present year surpasses other years since the beginning of systematic meteorological observation.

The following Table gives all maximum temperatures above 103° with dates of occurrence, at Alipore since 1893.

TABLE I.

1893		1894		1895		1896		1897		1898	
Max.	Date	Max.	Date	Max.	Date	Max.	Date	Max.	Date	Max.	Date
None		103·4	April 8th	107·0	May 21st	104·9	April 10th	103·4	April 13th	103·4	April 9th
		103·4	May 17th	103·9	May 22nd	104·9	April 11th	103·4	April 14th	103·4	May 19th
		104·9	May 18th	103·4	May 30th	104·4	April 12th	103·9	April 18th		
						107·0	April 16th	104·4	May 10th		

1899		1900		1901		1902		1903	
Max.	Date	Max.	Date	Max.	Date	Max.	Date	Max.	Date
104·4	April 28th	103·4	April 3rd	103·7	April 17th	None		104·4	April 16th
103·9	April 29th			104·2	May 10th			104·4	April 17th
105·4	April 30th			108·2	June 12th			104·9	April 26th
103·4	May 3rd			105·7	June 13th			106·9	April 28th
103·4	May 5th							106·4	April 29th
103·9	May 7th							107·4	April 30th
104·4	May 8th							105·4	May 3rd
104·9	May 9th							105·4	May 22nd
								106·4	May 23rd
								103·4	May 24th
								106·4	May 25th

It will be seen that the average number of days on which temperature exceeded 103° in the preceding ten years is less than 3: and that in 1899 when the previous largest number of hot days occurred there were eight such days. In the past season there have been eleven, on seven of which the highest in 1899 was equalled or exceeded. On only one occasion, *viz.*, on 12th June, 1901, was the highest temperature of this year exceeded, but I find that there is some doubt as to the accuracy of the reading 108°·2 on that occasion, and that the temperature recorded in the Indian Daily Weather Report is 107°·4.

It may, I think, be reasonably assumed that high temperature, so unusual and prolonged, must have been due to well-defined causes, and the object of this short paper is to show at least one respect in which the atmospheric conditions have differed materially from those of past years. The difference has, in my opinion, not been noticeable in ground level conditions, that is, neither pressure distribution, nor surface winds will account for the excessive heat, whereas there has been a very noticeable difference in the upper atmosphere, a fact which gives additional force to the contention that until more is known regarding the pressure, temperature and movement of the upper layers of the atmosphere, little progress can be made in explaining, still less in forecasting, weather changes.

This unusual heat in Bengal is the more remarkable when it is considered that in another part of Northern India, that is, in the extreme north-west, temperature varied from the normal in the opposite direction, and at times to an even greater extent as measured by the variation from the normal.

It is not, I think, advisable in connection with a brief paper, such as this, to give full statistics for the temperature conditions in India for several consecutive months, or even to show fully the daily temperatures for Bengal in which there are 46 observatories. It is necessary, however, that some indication may be given of the variation from the normal; and I have, therefore, prepared tables showing the difference from the normal in maximum and minimum temperatures day by day, from the beginning of April to nearly the end of June, for four more or less characteristic areas. These areas are:—

(1) North-West India represented by { Cherat, Peshawar, Khushab, Dera Ismail Khan

(2) North-East India represented by { Berhampur, Rampore Boalia, Bogra, Dinajpur

(3) Central India represented by { Malegaon, Akola, Amraoti, Khandwa, Nagpur

(4) South India represented by { Tinnevelly, Madura, Trichinopoly, Coimbatore

TABLE II.

	South India.		Central India.		North-East India.		North-West India.	
	Average maximum abnormal.	Average minimum abnormal.	Average maximum abnormal.	Average minimum abnormal.	Average maximum abnormal.	Average minimum abnormal.	Average maximum abnormal.	Average minimum abnormal.
April 1908 1	+1·6	+2·9	−2·3	−8·8	+4·1	+4·1	−13·5	−14·9
2	+3·1	+1·2	−8·0	−13·5	+3·9	+0·3	−10·9	−13·1
3	+2·8	−1·0	−7·3	−9·5	−0·6	−6·3	−7·6	−12·2
4	−0·6	+0·9	−2·9	−3·6	−0·5	+0·4	−5·4	−7·7
5	−6·0	−0·3	−0·9	−0·7	−6·9	−6·4	−5·3	−7·3
6	−3·9	0	−1·0	+0·6	−5·3	−4·7	−2·8	−5·9
7	−5·4	−0·5	+0·3	+1·6	−6·9	−6·5	−0·6	−6·8
8	−5·3	−1·4	+1·4	−1·8	−4·9	−5·4	+0·2	−3·5
9	−1·8	−1·5	−1·8	−5·0	−9·9	−5·6	−4·0	−1·9
10	−1·4	−0·5	·· 3·4	−4·6	−5·9	−3·3	−2·6	−2·6
11	−4·5	−1·3	−8·5	−4·7	−4·7	−4·7	−5·5	−1·0
12	−1·2	0	−2·0	−3·2	−3·1	−5·4	−10·0	−1·4
13	−1·3	+0·4	−1·7	−4·7	−2·0	−5·5	−9·9	−0·5
14	−1·0	−0·7	+1·5	−1·4	+2·6	−2·6	−13·4	−6·4
15	+0·5	−3·9	+3·2	−1·0	+4·2	−0·7	−9·2	−5·5
16	+0·5	−1·9	+4·4	+1·6	+5·6	−0·4	−6·5	−4·2
17	+1·4	+1·1	+5·0	+4·2	+7·8	−0·1	+0·7	−2·4
18	+2·1	+1·6	+5·9	+3·5	+9·2	+1·0	+2·3	+4·2
19	−2·9	−1·7	+5·5	+7·2	+7·8	+1·4	−4·3	−0·3
20	−0·1	−1·2	+3·1	+1·7	+6·8	+4·3	−4·2	−1·3
21	+1·8	+1·1	0	−1·2	+8·4	−0·4	−6·7	−6·3
22	+1·8	+1·9	−0·6	+1·1	+6·5	+1·8	−4·9	+4·8
23	+2·5	−0·5	+0·2	−0·4	+8·1	+2·8	−11·3	−3·8
24	+2·8	0	+0·9	−0·5	+9·9	+4·9	−4·6	−0·2
25	+2·5	−0·8	+1·9	+3·4	+8·6	+5·4	−10·1	−4·3
26	+2·4	+0·8	+3·4	+4·2	+11·6	+4·8	−8·0	−0·8
27	+2·4	+1·8	+3·0	+2·4	+13·1	+4·2	−14·2	−5·5
28	+0·8	+0·9	+3·4	+6·2	+12·8	+2·9	−8.3	−3·5
29	+1·4	+1·1	+1·9	+3·7	+13·3	+5·0	−18·0	−9·0
30	0	+1·6	+2·5	+2·3	+13·8	+5·0	−14·1	−8·0

TABLE III.

	South India.		Central India.		North-East India.		North-West India.	
	Average maximum abnormal.	Average minimum abnormal.	Average maximum abnormal.	Average minimum abnormal.	Average maximum abnormal.	Average minimum abnormal.	Average maximum abnormal.	Average minimum abnormal.
May 1903 1	+1·2	+2·2	−1·4	−3·1	+13·7	+5·7	−7·1	−4·7
2	+1·0	+0·2	−2·7	−2·2	+9·6	+0·9	−4·7	−0·5
3	−1·1	−0·1	−1·4	−0·2	+13·0	+1·8	−4·4	+4·1
4	−0·9	−1·3	+2·5	+2·0	+12·9	+3·2	−7·2	−2·6
5	+0·2	+1·5	+2·5	+3·0	+12·8	+5·1	−5·1	−2·0
6	+2·4	+1·1	+4·0	+2·7	+14·3	+4·3	−5·0	−0·3
7	+2·5	+2·0	+4·8	+4·6	+8·7	+4·5	−3·4	−3·9
8	+1·9	−2·6	+2·4	+4·2	+9.3	−0·7	−2·8	−4·1
9	0	+0·2	+3·2	+2·9	+4·3	−4·4	−0·2	−0·8
10	+1·1	+0·4	+1·0	−3·7	+2·3	−3·5	+2·3	+3·7
11	+0·4	+1·0	−1·6	−2·7	+2·2	−2·5	−3·1	+3·6
12	+0·8	−1·5	+0·2	+1·7	+2·5	−1·7	−14·8	−4·7
13	−3·3	−4·6	−0·2	+1·4	+2·1	+1·0	−21·5	−12·4
14	−2·6	−0·7	−1·8	−2·0	+4·8	+1·9	−18·1	−9·9
15	−2·5	−3·4	−2·8	−3·2	+2·3	−3·3	−12·6	−6·3
16	−2·6	+0·4	−0·5	−2·8	+3·8	−1·4	−9·9	−6·7
17	−2·1	+1·6	+0·6	−0·1	+8·0	+1·7	−17·4	−9·7
18	−4·2	−2·4	−3·2	−1·4	+8·0	+4·2	−26·9	−11·3
19	−8·0	−5·7	−2·5	−1·3	+3·7	+2·1	−20·6	−11·8
20	−13·5	−4·7	+0·2	0	+8·0	+1·3	−15·0	−7·8
21	−10·5	−3·7	−4·1	+0·8	+10·1	+5·9	−4·6	−5·3
22	−7·0	−3·0	−5·7	−1·7	+12·6	+2·8	−2·3	−3·3
23	−4·0	−3·0	−8·9	−7·5	+8·2	+4·8	+0·1	−3·1
24	−2·5	−1·2	−10·3	−5·8	+10·5	+4·1	−3.0	−0·5
25	−1·3	0	−9·2	−6·4	+2·9	−1·6	−2·6	−3·3
26	−0·3	+1·4	−14·4	−9·4	−1·0	−1·0	−1·7	−3·2
27	+0·3	−0·2	−17·1	−7·8	−0·2	−1·5	−1·1	−3·8
28	+0·4	−0·3	−5·9	−5·5	−3·5	−1·0	−3·0	−2·6
29	−0·4	+1·5	−2·5	−3·6	−7·6	−1·1	−1·3	+0·3
30	+0·5	+1·7	−0·4	−0·3	+0·1	−0·1	+1·8	+1.5
31	+1·0	0	+0·6	−1·3	−0·6	−5·0	+0·7	−0·6

TABLE IV.

	South India.		Central India.		North-East India.		North-West India.	
	Average maximum abnormal.	Average minimum abnormal.	Average maximum abnormal.	Average minimum abnormal.	Average maximum abnormal.	Average minimum abnormal.	Average maximum abnormal.	Average minimum abnormal.
June 1903 1	+1·2	+0·6	+0·9	−0·9	+0·4	−1·5	+0·8	−3·0
2	+1·7	−0·3	+2·6	+0·3	−5·2	−1·8	+2·9	+0·1
3	+1·5	+1·7	+3·8	+2·3	−0·2	−4·0	+4·6	+0·5
4	+2·6	+2·8	+6·2	+0·1	−2·7	+0 4	+6·4	+8·2
5	+0·1	+0·3	+5·6	+0·7	−0·8	−2·7	+1·9	+0·5
6	+2·1	+0·2	+5·1	+0·9	−1·1	−0·7	−1·1	−0·9
7	+2·5	+2·0	+6·3	+2·1	+1·5	+1·0	−1·3	−1·6
8	+3·1	+2·1	+9·8	+7·5	+0·5	+1·4	−2·6	+0·8
9	+3·1	+2·3	+11·7	+7·2	+1·9	+2·9	+0·3	−0·5
10	+2·7	+0·7	+10·1	+5·5	+4·4	0	+3·0	−0·8
11	+0·9	+1·3	+7·6	+6·7	+4·0	+0·7	+3·5	−1·8
12	+2·3	+0·6	+10·5	+4·1	+2·1	−1·1	+7·5	+1·2
13	−2·9	−0·7	+11·0	+5·4	+0·1	−0·7	+8·5	+2·8
14	−3·2	−0·8	+8·9	+6·1	+0·3	−1·7	+7·9	+6·4
15	−1·1	−0·1	+6·0	+3·4	+0·6	+0·7	+1·1	+6·5
16	+0·9	+1·9	+6·9	+3·0	−1·2	−2·7	+2·4	+0·2
17	−4·4	+0·3	+6·6	+4·1	−3·0	−2·3	+0·7	+3·2
18	+0·4	−0·5	+6·6	−0·1	−4·7	−0·8	+4·0	+2·0
19	−3·5	+0·2	+3·4	+0·5	−4·7	−3·1	0	+3·6
20	−1·3	+0·7	+4·1	+1·3	−2·8	−2·4	+0·7	−1·8
21	+0·6	+1·0	+3·7	+2·9	−4·0	−2·0	+1·1	+1·3
22	−0·2	+1·0	+5·9	+4·0	−0·9	+1·0	+4·2	+3·8
23	+2·2	+1·1	+8·5	+2·4	−0·2	−0·3	+6·1	+7·5
24	+2·1	+1·2	+8·4	+1·5	−2·5	−2·9	+6·5	+3·4
25	+1·1	+0·7	+4·1	+0·5	+2·9	+1·2	−0·8	−0·1
26	0	+1·0	+5·8	−1·4	−0·3	+0·7	+0·1	−2·1
27	+1·6	+0·5	−5·2	−0·4	−0·9	−0·8	−0·1	−3·4

The general features in these areas are as follows: In North-West India prolonged low temperature; in North-East India prolonged high temperature; and in Central and Southern India fairly normal temperature with small variations sometimes on the one side sometimes on the other, except during two brief periods. The noticeable features, therefore, are the high temperature in Bengal and the low temperature in the North-West, with the latter of which I have not much concern.

In connection with my attempt to find an explanation of the recent high temperatures, I may point out that in the Indian plains where high temperature prevails between March and June, it is a much more difficult matter to account for temperatures which are in large excess than for temperatures which are in large defect. The latter are usually, probably in all cases, due to local disturbances if the cool weather be of brief duration, and to the direction of the surface air-currents in cases where as lately in North-Western India, the cool weather continues for weeks. The cause of prolonged depression of temperatures, being surface winds, is to be found in the record of the observatories. But high temperature cannot in the same way be accounted for by surface winds nor by surface conditions. For if an examination of the meteorological records be made, it will be found that, with high temperature, there have in the past co-existed an infinite variety of surface conditions, pressure sometimes below the normal, winds sometimes in one direction sometimes in another, humidity high and humidity low. There must, of course, be an absence of cloud. A sufficient test of the accuracy of the above difference between high and low temperature conditions may be given from weather forecasting experience. Meteorologists have hitherto failed to find any indication of coming high temperature, and they have been equally unable to say for what time it will continue, whereas low temperature is rapidly seen advancing over an area of observation such as the United States. Anyone who follows the progress of meteorology in the United States will remember how accurate are the forecasts of advancing " frosts," and readers of the daily papers will remember the severe criticism to which the Head of the United States Weather Bureau was subject, two years ago, when he attempted to forecast the continuance of the excessive heat in New York and other parts of America. According to telegrams which reached this country the opinion of the American press was that the Weather Bureau could not have been in possession of the information on which such a forecast could, with any possibility of success, be based.

In such matters it is easy to be wise after the event, and it is equally easy to suggest causes which may or may not have contributed towards the event. Where the causes are not indicated by the meteorological record the only check upon an alert imagination is ordinary commonsense or a knowledge of physical laws. I think I may safely infer from past experience without unduly straining my powers of imagination or the faith of the members of this Society, that to explain the excessive heat in Bengal during April and May something more than ground level observations are required. If information regarding the lower layers of the atmosphere is not sufficient, there is only one opening to progress. We must find out more about the upper layers, and my chief object in offering this paper for publication is to put on record a few observations which I have made during the past season on cloud movement and thunderstorms, as they have appeared to a resident of the European quarter of Calcutta. In one respect these observations appear to me to indicate an exceptional condition of the upper air, a condition which may have, and which I believe, had an important influence on the temperature in Bengal.

In ordinary years, I believe, the main upper current as it flows over the south-western districts of this Province in the hot season is from the north-west. The chief item of evidence in favour of that is the popular term "nor'wester." These thunderstorms drift with the upper current, and their line of advance is therefore the direction of the wind aloft. One or two other items of information could be given in support of this upper north-westerly wind. Calcutta residents may remember Spencer's balloon ascent from the neighbourhood of the race-stand some years ago, about the beginning of the hot season, and how the balloon disappeared at what was probably a great height, moving in a south-easterly direction. I have occasionally sent up small hydrogen balloons about three feet in diameter and have watched them through opera glasses until they disappeared. The direction of their motion was the same as that of Spencer's balloon, and of the thunderstorms, that is to the south-east. I think it likely that a continued series of observations for a number of years would have established as a fact that generally a north-westerly wind continues throughout the greater part of the hot season in this part of India at a height of 10,000 to 20,000 feet.

The past year has, in my opinion, been exceptional as regards the direction of the upper wind. All the observations I have made (and I have watched every storm which has passed over Calcutta, and the cloud movement whenever cloud existed) have shown that, throughout the season, from the 23rd of February when the first thunderstorm occurred until the middle of June, the wind instead of being north-westerly has been from a direction almost due west. The cloud movement, so far as I have been able to fix it without instrumental aid, has been from the west. This cloud motion was steady and probably of considerable amount during the early part of the season, and it became feeble and intermittent after the middle of May. Nothing is known as to the height of the light cumulus cloud occasionally visible in the hot season. Its motion shews that at that particular height the air is moving from the west, but whether that westerly air-current extends much higher than the cloud or begins much lower can be only a matter of surmise.

Thunderstorms, however, give some additional information. The drift of a thunder cloud, which extends from about 4,000 feet above the earth's surface to something like 30,000 feet, cannot be determined by an air-current which is not one of great depth, and the thunderstorms of the past season have throughout confirmed the cloud observations.

The most important observation which I wish to record is that the thunderstorms of the past hot season have, with a few exceptions which occurred in the latter half of June, approached Calcutta from the west instead of from the north-west, and have passed away eastward instead of south-eastward. I have no hesitation in stating that, so far as Calcutta is concerned, although there have been a great many thunderstorms, there has not been a single nor'wester, if the scientific meaning of that term of popular origin, be the same as its ordinary meaning.

The main assumption which I make towards explaining the excessive heat of April and May is that the upper air-current across the western border of the province of Bengal was westerly instead of north-westerly. This assumption is based upon the observations of cloud and thunderstorms mentioned in the previous paragraphs, and receives but little support from the ground level observations.

There is another assumption which I must make, which is of the nature of an inference from the previous assumption, and so far as I am aware is not supported by any direct evidence, because I have no information regarding the upper air movement except for Calcutta. The assumption is that the upper westerly current is warmer than if it had been from the north-west. If a line be drawn north-west from Calcutta on a map it will be seen that as the crow flies we are only 400 miles from the Himalayas. Allowing 20 miles an hour as the velocity of the upper current (possibly an under estimate) it may be stated that the air which passes over Calcutta from the north-west, may 20 hours before have been, the whole or part, in the cool region of the Himalayas. With a westerly current, on the other hand, there has been no cool region to pass over. Instead there have been the hot plains of Central India, and the air of the upper current has during its passage been steadily becoming warmer by convection from the lower layers daily raised to a high temperature by the hot ground surface.

Still another assumption is required, but not one made by me. It rests on the highest meteorological authority, and I give below its expression, as the idea of a well-known European Meteorologist in the words of an equally well-known American Meteorologist. "Summer hot waves are explained as stagnant masses of air in which heat gradually accumulates at the ground and then increases to a great height." The assumption involved is that there is a more or less stagnant mass of air associated with hot summer waves. The question, therefore, is, if the winds are westerly in the western districts of Bengal, where is the stagnant air which meteorological authorities appear to require? My opinion, for some years now, has been that during the hot weather months a very gradual change takes place over Assam and Bengal, and that a region of comparative calm in the upper air is over East Bengal in the latter half of April and May; that under normal conditions it moves westward in advance, and renders possible the commencement of monsoon weather in Bengal. Any direct information regarding such atmospheric conditions is not readily attainable, as what meteorological observers collect refers to the ground level only. But I occasionally see in the local papers items of information of the greatest possible interest. I will give one of these from memory which I saw last year in a copy of the *Englishman* about the end of April or beginning of May.

It may be in the recollection of some that in the latter half of April 1902 unusual weather was experienced in East Bengal and the adjacent part of Assam. Its chief feature was heavy rain; 10 to 20 inches fell over a wide area in as many days, and if the quantity of rainfall were taken as a definition of monsoon weather I should say that last year in those eastern districts there was a stronger south-west monsoon during the latter half of April than at any other time up to the end of October. A correspondent of the *Englishman* writing from one of these eastern districts told of the heavy rainfall and went on to give the information which interested me. He described how they had been bombarded by thunderstorms, and how the storms had come up from every point of the compass. Now seeing that thunderstorms drift with the upper atmospheric current, the variable directions of these thunderstorms showed that there was in that area of heavy rainfall in East Bengal the stagnant condition of the upper air. I believe that if such information were available we would find that year after year there is the same stagnant condition, and that it is only noticed in extraordinary circumstances such as prevailed in East Bengal last year.

I will anticipate the explanation of the heat in Bengal this year to some extent to show how the rainfall last year was possible with the still condition of the air indicated by the thunderstorms referred to above. The overhead air last year was cold whereas this year it has been warm. The difference is the same as for a condensing engine working with the cold water of northern seas and the hot water of tropical seas: that is, the vapour with which the air in Bengal is at all times well supplied was much more easily condensed last year than this, and with that condensation there was a much more effective overturning of the layers of atmosphere due possibly to the electrical developments.

I will quote the same high meteorological authority as before, regarding the condition of the air favourable for the development of thunderstorms:—

"A strong and even abnormal vertical temperature gradient accompanies the formation of thunderstorms, which are attended by an inversion of the over-lying strata."

That is, there must be not only a large difference of temperature between the air below and the air above, but there must be an exceptionally large difference. This is described by some as an unstable condition of the atmosphere, the use of the word unstable in that connection being fatal to close reasoning unless clearly defined.

Before proceeding further I will briefly summarise the assumptions which appear to be necessary to account for the high temperature in Bengal in April and May. They are—

(1) A westerly instead of a north-westerly wind across the western boundary of Bengal in the upper region of the atmosphere.

(2) That the air carried by this current into Bengal was warmer than with the more usual north-west wind.

(3) That during the hot weather months the air over East Bengal and Assam becomes comparatively still, and that this condition of the air moves slowly westward in advance of the establishment of the monsoon or rainy season.

As I am writing for Indian readers and not for professional meteorologists or for the information of physicists in general, I venture to make my argument clear by referring to some of the simpler atmospheric processes which are constantly going on around us. On a normal hot season day in India, say in Calcutta, in May, when the sun is about vertical at midday and there is no cloud to intercept the sun's heat, the maximum shade temperature occurring about 2 P.M. should be about 96°. This is the temperature of the air close to the earth's surface, and the increase of temperature from the early morning onwards is largely due to the warming effect of the earth, which first absorbs the radiant heat from the sun and then gives it out slowly to the air in contact with it. The temperature of the air would increase more rapidly if it were not for well-known processes the most important of which is convection. The air as it becomes warmer also becomes lighter than the over-lying stratum. Breaking through that over-lying stratum in places, it streams upwards in what are called convection currents, and the colder air settles down from above, to become warmer in turn.

The resultant effect, in a normal day, of the sun's heat modified by convection currents is to raise the temperature of the air at the ground level to 96° at Calcutta. Now year after year the sun on the same day in May gives out the same amount of heat from the same series of positions, and the ground surface may be taken to be in the same condition as regards absorption of heat, &c. Any considerable variation of temperature from the normal, therefore, may, in the assumed absence of local disturbances, be taken to be due to the convection currents being weaker.

Maximum temperature over Bengal, as may be seen from the table given above, was from the middle of April till nearly the end of May continuously above the normal at times by as much as 15°.

This high temperature appears to me to be fully accounted for by the warmer air above, owing to which convection was seriously impaired and the air below had to be heated more than usual before its buoyancy was sufficient to carry it away from the earth's surface.

I have pointed out as clearly as I can, and I hope I have made it manifest that the above explanation rests upon inferences from what I believe to be facts. The main fact is the westerly wind, and the main inference is that the temperature of that wind was higher than that of the more usual north-westerly wind. No one can say that the inference is a wrong inference, because no information has been collected regarding the condition of the upper atmosphere. But there are other facts which support the inference that the upper air over Bengal was warmer than usual during the past hot season, and these I give for what they are worth in connection with the present argument.

I have already quoted the opinion of a distinguished meteorologist as to the condition of the upper air favourable for the development of thunderstorms. What he requires is "a strong and even abnormal temperature gradient." If, then, the upper air is warmer than usual, it is evident that the abnormal temperature gradient would be more difficult to bring about. The temperature below would have to be higher, and when thunderstorms did occur it might naturally be expected that as thunderstorms they would not be on the same grand scale. It is impossible to record all the characteristics of thunderstorms or even many of them, and the items of information which are generally available for those who have not been in touch with the storms are the rainfall, the change of temperature and occasionally the strength of the wind. Taking then the rainfall and the change of temperature as tests of the character of the numerous thunderstorms which have occurred in Bengal during the past season, there can, I think, be no question but that according to these tests thunderstorms have been a comparative failure. The rainfall has been much lighter than usual, and many thunderstorms have caused no rainfall at all. Temperature though it fell during these disturbances, changed by smaller amounts than we generally experience. The comparative failure of thunderstorms at Calcutta must have been observed by all, and any information that has reached me from other parts of Bengal has been to the same effect. I was informed by a resident at one of the headquarter stations that on one occasion while the ground temperature below was high, there appeared daily for a week the cloud which is the first sign of the coming thunderstorm. As day after day the cloud appeared and the storm failed to develop, heavy betting began amongst the people with large odds against rainfall.

I have seen occasional references to the continued absence of rainfall in the newspapers, and in a few of these remarks were made as to the failure of thunderstorms. As an example of these I may give the following extract from the *Bengalee*. "The long continued drought and the peculiar character of the clouds which only vanished in dust storms, were causing great anxiety. The villagers have suffered most. Those who live in towns have very little idea of the commodity which the poor rural people call water."

"The spell of the season was broken yesterday (May 25th) by a series of thunderclaps, and the showers that followed both during the day and night were very soothing. The change in the atmosphere wrought by the downpour is being well enjoyed."

I might continue this paper by commenting on some of the peculiarities of the thunderstorms of the past season, more especially of those which accompanied the important change about the 25th of May. That change began in the east on the 24th, passed over Calcutta between the evening of the 25th and the evening of the 26th. But its influence on the weather in the western districts of Bengal could not, in my opinion, be fully estimated or accounted for without reference to important weather changes then in progress in Western and Central India. These changes are shown in the table above by the low temperature in Southern India on May 19th or 23rd, in Central India between the 22nd and 28th, and in the western districts of Bengal during the closing days of that month. I think, however, it will be better to defer consideration of these matters to another communication.

Some new plants from Eastern Asia.—*By* D. Prain.

[Received 3rd September. Read 4th November, 1903.]

While recently engaged in laying into the Calcutta Herbarium a number of Eastern Asiatic specimens, the writer has found it necessary to prepare descriptions for the following ten plants which are species that were either previously undescribed or imperfectly characterised. These descriptions he now offers to the Asiatic Society.

Convolvulaceæ.

ERYCIBE Roxb.

1. Erycibe albiflora Hallier f. Bull. Herb. Boiss. v. 1052. A large climber over 50 feet long; branches angled, puberulous; branchlets angled, closely rusty-puberulous; *leaves* elliptic, base wide-cuneate, apex abruptly shortly acuminate with an obtuse tip; 3-7 in. long, 1·25—3 in. wide; chartaceous, glabrous on both surfaces, dark-green above, paler beneath; lateral nerves 7-8 pairs, very oblique, ascending, distinct on both surfaces, raised beneath; secondary reticulate venation very distinct on both surfaces, but especially beneath; petiole ·4-·6 in. long, adpressed rusty-pubescent. *Flowers* in narrow but lax terminal panicles of 5-9-flowered cymes; panicles 8-12 in. long, 1·5 in. wide; the rachis and peduncles of cymes ·1-·25 in. long, adpressed rusty-pubescent; pedicels ·15 in. long and lanceolate bracteoles rusty-pubescent. *Sepals* orbicular, rusty-pubescent externally. *Corolla* white, ·5 in. across; lobes spreading, glabrous internally; interlobular spaces externally densely rusty-pubescent; lobes semicircular, margins undulate. *Fruit* ellipsoid, black, ·7 in. long ·4 in. wide. *E. subspicata* Prain Journ. As. Soc. Beng. lxiii. 2, 84 (as to the Bootan and Assam plant only); C. B. Clarke in Hook. f. Flor. Brit. Ind. iv. 181, partly (as to the Silhet plant only); Hallier f. Bull. Herb. Boiss. v. 737. *E. paniculata* Wall. Cat. 1330/1, not of Roxb.

Sikkim: 4-6,000 ft., *Hooker*! Ryang at 1,500 ft., *King*! Rungjo, 1,400 ft., *King*! Bootan: at 2000 ft., *King*! Assam: Gauhati, *Griffith*! Golaghat, *Mann*! Khasia: *Mann*! Nya bungalow, 2,500 ft., *Clarke*! Silhet: *Gomez*; *DaSilva* (Wall. Cat. 1330).

This very distinct species was compared by Wallich with the quite different *E. paniculata* Roxb., and was subsequently issued, from Sikkim, under the same name in the *Herb. Ind. Or.* of Hooker and Thomson; it forms therefore some part of the *E. paniculata* of the Flora of British India. Recognising its very marked differences it was separated by the writer in 1894 and included by him (*Journ. As. Soc. Beng.* lxiii. 2, 84) in *E. subspicata* Wall., a species of which there is no Wallichian specimen at Calcutta. At the same time the writer placed what now proves to be the true *E. subspicata* from Assam and Khasia with *E. Princei* Wall., to which species *E. subspicata* is very closely allied. Dr. Hallier, the greatest living authority on the difficult family *Convolvulaceæ*, when working at Calcutta accepted the writer's identification of this species with *E. subspicata*, but (Bull. Herb. Boiss. v. 737) threw a doubt on the accuracy of the identification of the specimens from Assam and Khasia mentioned above, that had been referred to *E. Princei*. Working subsequently in Europe Dr. Hallier made the discovery that these latter specimens are examples of the true *E. subspicata* of Wallich; this being the case, it was necessary to provide a new name for the plant which constitutes *E. subspicata* of the Journ. As. Soc. Beng. lxiii. 2, 84.

It may be mentioned here that among the plants collected by Dr. Henry in the Szemao Mountains of S.-W. Yunnan there are four gatherings of what appears to the writer to be *E. subspicata* Wall., the previously recorded localities for which are Assam, Khasia and the Taong Doung Mountains in Burma. These numbers are *Henry* 10825, 12514, 12739, 13430.

It may also be mentioned that the same collection contains, in Henry 11863, a gathering of *E. laevigata* Wall., previously known only from Sikkim, Khasia and Jaintea.

2. ERYCIBE HENRYI Prain. A shrub with spreading shoots, or a climber; branches angled, bark fissured, glabrous; branchlets angled, glabrous or very sparingly and finely puberulous; leaves elliptic, base wide-cuneate, apex rather gradually narrowed to a subacuminate apex with obtuse tip; 3 in. long, 2 in. wide; chartaceous, glabrous on both surfaces, dark-green above, paler beneath; lateral nerves 6-7 pairs, straight not very oblique, visible above, slightly raised beneath; secondary reticulate venation very distinct beneath, obscure above petiole ·6 in. long, glabrous. *Flowers* in terminal panicles passing into the axils of the uppermost leaves; axillary racemes and individual branches of panicle 1-1·5 in. long; peduncles ·25-·5 in. long, sparsely puberulous as are the main-rachis, the pedicels ·1 in. long, and the ovate-lanceolate deciduous minute bracts and bracteoles. *Sepals* orbicular, sparingly puberulous externally. *Corolla* white; lobes spreading, rather short, glabrous internally; interlobular spaces externally densely pubescent; lobules nearly semi-circular, margins entire. *Erycibe* n. 3 Hallier f. Bull. Herb. Boiss. v. 737.

CHINA: Formosa; Takow, Ape's Hill, *Henry* 1884!

3. ERYCIBE FORBESII Prain. A small tree with long spreading branches; branches cylindric, faintly puberulous or glabrous; branchlets cylindric, adpressed rusty-pubescent; *leaves* ovate-lanceolate to lanceolate, narrowed to the cuneate base and to the acuminate apex with obtuse tip; 4—6 in. long, 1·25—2 in. wide; chartaceous, glabrous on both

surfaces, rather dark-green above, paler beneath; lateral nerves 4-5 pairs, very obliquely ascending, visible below but not at all conspicuous, not visible above; secondary venation not visible. *Flowers* in terminal and axillary panicles of 5-7-flowered cymes; terminal panicles 6-8 in. long, axillary 4 in. long; main-rachis adpressed rusty-pubescent; peduncles of individual cymes short, rusty-pubescent; pedicels slender ·2 in. long and short lanceolate bracteoles rusty-pubescent. *Sepals* orbicular, sparsely adpressed rusty-pubescent externally. *Corolla* clouded-white, glabrous within, ·4 in across; lobes rather deeply divided; interlobular spaces closely rusty-pubescent externally; lobules nearly semi-circular, margins erose. *Erycibe* n. 24 Hallier f. Bull. Herb. Boiss. v. 739.

MALAYA: Sumatra; Lampongs, Gunong Trang, by edge of forest, *Forbes* 1454!

4. ERYCIBE LEUCOXYLOIDES King MSS. ex Ridl. in Herb. Singap. A very large climber with slender cylindric branches, bark fissured and covered with a close grey pubescence; branchlets numerous, very slender, rather distinctly angled, grey- or rusty-pubescent; *leaves* subbifarious, ovate or ovate-lanceolate, base rounded, apex subacuminate or abruptly narrowed to an obtuse tip; 1-1·75 in. long, ·4-·6 in. wide, membranous or thinly chartaceous, quite glabrous on both surfaces; rather dark-green above, paler beneath; secondary nerves about 3 pairs, very oblique and hardly visible above except in young leaves, not visible beneath even when dry and even when young; petiole ·1 in. long, grey-pubescent. *Flowers* axillary, solitary; pedicels ·2 in. long, somewhat recurved in fruit, grey-pubescent, bracteolate under the calyx. *Sepals* orbicular, sparsely pubescent on the centre externally, elsewhere glabrous except the ciliate margins. *Corolla* white, sweet-scented, ·5 in across; interlobular spaces brown-tomentose externally; lobules broad semi-orbicular, entire. *Fruit* elliptic, black, smooth, glabrous, ·6 in long, ·4 in. wide.

MALAYA: Singapur; climbing in secondary jungle, *Hallier*! *Ridley* 2051! 6897! 10927! Selangor; Kwala Lumpar, *Curtis* 2402!

5. ERYCIBE SAPOTACEA Hallier f. & Prain MSS. in Herb. Calcutta. A tree? branches slightly angled, with fissured bark, quite glabrous; *leaves* elliptic, base cuneate, apex abruptly shortly acuminate with tip obtuse; 5 in. long, 2-2·5 in. wide; firmly coriaceous; quite glabrous on both sides, bright-green and glossy above, pale beneath; lateral nerves 6 pairs, distinct above and rather prominent beneath, secondary reticulate venation very distinct on both surfaces; petiole ·5 in. long, glabrous. *Flowers* in few-flowered congested, axillary subsessile cymes. *Sepals* and *Corolla* not seen. Fruit ovoid, quite glabrous, the epicarp very coriaceous, almost woody, wrinkled and fissured, with a rounded base

and conical pointed apex, 2 in. long, 1 in. in diam.; fruiting pedicels ·3 in. long, with epidermis fissured like that of the branches.

PENANG: Government Hill, *Curtis* 772!

A very distinct and striking species, the flowers of which are as yet unknown. In shape the fruit is most like that of *E. Griffithii*, but besides being about twice the size it has none of the scurfy covering of the fruit of that species. The leaves of the two are very different.

6. ERYCIBE CITRINIFLORA Griff. Notul. iv. 284. A small tree, 10–20 feet high, with strong straggling shoots; branches terete with numerous lenticels, glabrous, bark not fissured; branchlets terete or faintly angular, finely rusty-puberulous; *leaves* obovate-lanceolate, narrowed from the middle or beyond to the cuneate base, rounded or gradually narrowed to a shortly acuminate apex with obtuse tip; 5-8 in. long, 2-3·5 in. wide; coriaceous, quite glabrous on both sides; lateral nerves 7-8 pairs, very faintly impressed above, prominently subalately raised beneath; secondary reticulate venation visible but not distinct above, hardly discernible beneath; petiole ·2 in. long, finely puberulous. *Flowers* in small 12–20-flowered axillary cymes, ·5 in. across, in clusters of 3-5; peduncles ·2-·5 in. long, closely rusty-pubescent; pedicels ·1 in. long closely rusty-pubescent as are the lanceolate bracteoles. *Sepals* orbicular, rusty-pubescent. *Corolla* creamy yellow within, "smelling exactly like unripe white turnips" (*Proudlock*), ·3 in. across, glabrous within; lobes rather wide; interlobular spaces closely yellowish-brown pubescent externally; lobules ovate, slightly crenulate on their outer margins. *E. glomerata* Clarke in Hook. f. Flor. Brit. Ind. iv. 183 in part, not of Bl., nor of Wall.; Prain Journ. As. Soc. Beng. lxiii. 2, 85, not of Clarke, nor of Wall., nor of Kurz. *E. coriacea* Kurz For. Flor. Brit. Burm., ii. 213 in part, not of Wall. *Erycibe* n. 28 Hallier f. Bull. Herb. Boiss. v. 739.

TENASSERIM: Mergui; *Griffith* 5881 K.D! *Proudlock*! *Manson*! Pilai, in the Mergui Archipelago, *J. Anderson*! Tavoy; Laso Rocks, *Shaik Muqim*, 302!

Always growing close to the sea.

7. ERYCIBE WALLICHII Prain & Hallier f. Bull. Herb. Boiss. v. 382. A small tree; branches cylindric, much verrucosely lenticelled; branchlets cylindric, dark tawny-pubescent; leaves elliptic or ovate-lanceolate, base cuneate; apex rather gradually narrowed to a shortly acuminate obtuse tip, 4-7 in. long, 1·5–3 in. wide; thinly coriaceous, glabrous above, dark-green, beneath paler and glabrous except the midrib and main-nerves which even in adult leaves are beset with spreading tawny hairs; lateral nerves 9–11 pairs, straight, very slightly

oblique, raised on under surface, impressed as upper surface; secondary reticulate venation very distinct beneath, obscure above; margin of leaf slightly revolute; petiole tawny-pubescent, ·15 in. long. *Flowers* in very densely congested axillary cymes, about ·5 in. wide; peduncles very short; petioles and bracteoles tawny-pubescent. *Sepals* orbicular, externally tawny-pubescent. *Corolla* white, ·5 in. across; lobes spreading, glabrous within; interlobular spaces externally tawny-pubescent; lobules wide-falcate, margins entire. *Fruit* ellipsoid, black, glabrous, ·75 in. long, ·4 n. wide. Hallier f. Bull. Herb. Boiss. v. 738. *E. glomerata* Wall. Cat. 1338; Kurz. For. Flor. Brit. Burm. ii. 213; Clarke in Hook. f. Flor. Brit. Ind. iv. 183 (syn. *E. citriniflora* Griff. excluded), not of Bl.

BURMA: Rangoon, *Cleghorn* 188! Amherst, *Falconer* 516! Mergui; *Griffith* CULT. in Hort. Bot. Calcutta, "26/9/58."

The two species *Erycibe Wallichii* and *E. citriniflora* are confused under the name *E. glomerata* in the *Flora of British India*; it is therefore advisable to give here fuller description of both. They were not confounded by Mr. Kurz in the *Forest Flora of British Burma;* Kurz accepted the one with leaves glabrous beneath as *E. coriacea*, to which it is indeed very closely related though it is nevertheless quite a distinct species; the other, which is Wallich's *E. glomerata*, he treated as true *E. glomerata*.

The writer in *Journ. As. Soc. Beng.* lxiii. 2, 85 (1894) could not, on account of its leaves with nerves pubescent beneath, accept Wallich's *E. glomerata* as the same thing as Blume's. Unfortunately he tentatively adopted that with glabrous leaves as being possibly Blume's tree, with the result that he provided for the true *E. glomerata*, which is common in the Malay Peninsula, a new name *E. albida*. This mistake Dr. Hallier has pointed out (Bull. Herb. Boiss. v. 739) and the rectification of this mistake rendered it necessary for Hallier and the writer to provide a name for Wallich's erroneous *E. glomerata*. The adoption of the name *E. citriniflora* for the tree that is associated with *E. glomerata* in the *Flora of British India*, but that is different from Wallich's plant, is made in spite of Griffith describing the leaves of his tree as "subglabrous" only. We have, at Calcutta, examples of both the species collected by Griffith at Mergui, and his description of the distinctive odour of the flowers tallies so well with that of Proudlock that there can be no doubt as to the tree he intended as *E. citriniflora*.

8. ERYCIBE MAGNIFICA Prain. A strong creeper 80–100 ft. long, stem 2-3 in. in diam.; old branches ·75 in. in diam., still densely tomentose, quite cylindric, with large pith, branchlets ·3 in. in diam., densely velvety with a tawny to rusty matted tomentum; leaves elliptic or elliptic-obovate, with a narrowly truncate or rounded base, and an obtuse or sometimes retuse apex, the margin strongly revolute; 8–10 in. long, 3·5–4 in. wide; coriaceous; upper surface quite glabrous, dark-green and shining, with sometimes a silvery sometimes a rich coppery sheen; under surface velvety, pale brownish-green, the tomentum longer, looser, and sometimes whitish on the main-nerves; lateral nerves rather

straight, spreading, 12–15 pairs, rather distinctly looped along the margin, prominent beneath, deeply impressed above as is the secondary reticulate venation; petiole ·35 in. long, densely rusty-velvety. *Flowers* in short axillary racemes, sometimes clustered, of close-set 2-3-flowered individual cymules; the racemes 1-2 in. long; peduncles, short pedicels and small ovate bracts and bracteoles densely rusty-velvety. *Sepals* orbicular, densely velvety outside, quite glabrous within, coriaceous, in fruit ·2 in. across. *Corolla* ·5 in. across; lobes slightly spreading, glabrous within and waxy-white or yellow, narrow and deeply divided; interlobular spaces densely dark-brown, almost black-velvety pubescent externally; lobules very small oblong. *Fruit* ellipsoid, 1·25 in. long, 1 in. in diam., densely softly velvety, of a rich brown colour.

PERAK: Larut, *Kunstler* 3454! 3879! 6721!

In the first of his three gatherings Kunstler has noted this as a tree 50–70 feet high, but in the two subsequent ones as a large creeper, which is, from the appearance of the specimens, undoubtedly the case with the first gathering also.

LETTSOMIA Roxb.

LETTSOMIA SPHAEROCEPHALA Prain. A shrubby climber; branches irregularly angled with ridged bark, brownish on young shoots, pale-straw coloured on older twigs, sparingly beset with adpressed acicular hairs; leaves ovate-lanceolate, acute, base rounded, purplish beneath; very sparingly beset on both surfaces with adpressed hairs; length 4-5 in., width 1·5-2 in.; petiole 1-1·25 in., sparsely pubescent above with adpressed hairs. *Flowers* in compact capitate globose cymes, 1·5-2 in. across, on long slender peduncles, 2-12 in. long, sparingly adpressed pubescent; surrounded by large orbicular purple involucrant sessile bracts, 1·5 in. across, sparsely hirsute externally, quite glabrous internally, the individual flowers enveloped in similar but smaller, suborbicular to spathulate bracteoles ·5 in. long, ·25-·5 in. wide; pedicels short, adpressed-setose. *Sepals* glabrous externally except at their setose apices, the outer subacute, the inner wider obtuse, ·25 in. long. *Corolla* ·75-1 in. long, infundibuliform-campanulate, pink, softly adpressed-hirsute externally. *Berry* not seen. *Argyreia sphaerocephala* Prain MSS.

PERAK: Krian, Abu Salama, Gunong Harang Ryah, *Scortechini*!

A very striking and remarkable species. The corollas do not appear to be full-sized. Scortechini, on the ticket of his Gunong Harang Ryah specimens, has written "fruit from Maxwell's Hill" but unfortunately the fruiting specimens alluded to are not at Calcutta.

Labiatae.

NOSEMA Prain.

Calyx per anthesin ovatus, fructifer tubulosus haud fenestratus, 2-labiatus, labiis postico oblongo integro persistente, antico rotundato integro subdeciduo. *Corollae* tubus cylindricus fauce parum ampliatus; limbus 2-labiatus, labio postico breviter 3-lobato lobo medio parum latiore emarginato, antico paullo breviore oblongo integro concavo. *Stamina* 4 declinata, filamentis liberis, posticis basi dente auctis: antherae confluentia 1-loculares explanatae. *Discus* antice vix tumens. *Stylus* apice breviter bifidus lobo antico longiore. *Nuculae* ovoideae, laeves. —Herbae erectae. Verticillastri in capitula terminalia globosa vel dense cylindracea conferta. Flores parvuli. Species 3-4, Monsunenses.

The genus now described is most nearly allied to the genus *Mesona* Bl., the two agreeing in the spurred character of the posterior filaments. To the courtesy and kindness of Mr. C. B. Clarke, F.R.S., to whom he had submitted for an expression of opinion the proposed new genus, the writer is indebted for the subjoined concise and effective diagnosis.

I. Mesona *Blume.*—*Calyx* with 2 membranous coloured lips, the upper 3-fid, the lower entire. *Inflorescence* interrupted; fruiting calyces fenestrate with transverse bars, held up on pedicels.

II. Nosema *Prain.*—*Calyx* with 2 membranous coloured lips, both undivided. *Inflorescence* dense; fruiting calyces not transversely barred, subsessile, the pedicels finally buried in the agglomerated calyces.

1. Nosema capitatum Prain. A branching herb over 15 in. in height; stems 4-grooved, with rounded angles, beset with adpressed reflexed hairs. *Leaves* opposite, narrowly oblong, tapering from below the middle to the cuneate base with entire margin, margin elsewhere finely crenate, apex obtuse or subacute; chartaceous, pubescent on both surfaces, but especially on the nerves beneath; lateral nerves 9-10 pairs, oblique, straight, rather close-set, conspicuous; length 2-2·5 in., width ·6-·75 in.; petiole pubescent ·25 in. long. *Flowers* in dense terminal capitula ·25-2 in. long; *calyx* in fruit ·15 in. long, upper lip half as long as tube, lower lip less than half as long as upper and soon deciduous; tube not fenestrately transversely barred, densely tawny-tomentose with spreading hairs; *corolla* half as long again as calyx, both lips sparsely pubescent externally; *stamens* exserted, declinate, the posterior pair inserted higher up than the anterior and strongly toothed just above their bases. *Nutlets* all ripening, ovoid, glabrous, smooth.

Indo-China: Siam; Kanboerie, *Teysmann*!

In Herb. Kew. there are two gatherings from Java, by Junghuhn (nn. 8, 51), of which the writer has seen ripe fruits. As to calyx and nutlets they agree exactly with the Siam plant, and may prove only a variety. But the inflorescence of the Java plant is narrower, denser, and more hairy than that of the Siam plant. This Java plant is written up in Herb. Kew. as *Mesona* sp. nov. Bentham MSS. [1879] and for the moment may bear the name *Nosema capitatum* VAR.? *javanica*, C.B. Clarke MSS.

There are two other distinct species of *Nosema* in Herb. Kew.

2. NOSEMA PRUNELLOIDES *C. B. Clarke; leaves* ovate-oblong, 1-1·25 in. long; lateral nerves mostly 7 pairs. *Mesona prunelloides* Hemsl. in Forbes & Hemsl. Journ. Linn. Soc. xxvi. 267.

CHINA: Pakhoi, *Playfair* 110.

3. NOSEMA TONKINENSE, *C. B. Clarke MSS.; leaves* narrow-oblong, up to 1·5 in. long, ·25 in. wide; lateral nerves about 5 pairs. *Mesona chinensis* Herb. Kew. partim, non. Benth.

INDO-CHINA: Tonking; *Balansa*, 993.

Noviciæ Indicæ XXI. *An undescribed Indian* Musa.—*By* D. PRAIN.

[Read 2nd December, 1903.]

Three years ago a native collector in the service of the Royal Botanic Garden, Shibpur, sent to Calcutta the rootstocks of a *Musa* from the Jaboca Naga country. The plant has thriven well and has recently flowered. As the species is very different from any *Musa* hitherto in cultivation in the Royal Botanic Garden, is unrepresented in the herbarium collections either at Kew or at Calcutta, and is undescribed in Mr. Baker's *Synopsis of the Genera and Species of Museæ* or in Professor Schumann's article *Musaceæ* in Engler's *Pflanzenreich*, a formal description of the plant is herewith offered to the Society.

MUSA (§ Eumusa) NAGENSIUM *Prain* sp. nov. Herba stolonifera, rhizomate perenni caule sub-cylindrico ultra 6-metrali, innovationibus glaucissimis. *Folia* petiolata laminis longitudine ultra 3-metralibus, sursum viridibus nitidis, subtus densissime glaucis. *Inflorescentia* terminalis, nutans; rachi ultra 2-metrali, glabra; bracteis oblongo-lanceolatis, inferioribus 20–24 cm. longis, 10 cm. latis, summis 15–18 cm. longis, 7 cm. latis, externe lateritio-miniatis, intus nitidis aurantiacis, singulis flores 18–20 2-seriatos includentibus. *Flores* inferiores perpanci tantum fœminei; perigonio aurantiaco 6 cm. longo, 1·25 cm. lato, loborum exteriorum 2 parte libera 1·5 cm. longo basi 3 mm. lata anguste lanceolata, interiorum 2 parte libera 6 mm. longa basi 2·5 mm. lata; tepalo libero albo fere pellucido versus apicem minopere primulino, ovato-lanceolato, 3 cm. longo, 1·5 cm. lato, basi rotundato, apice acuto rarius acuminato integro vel nonnunquam indistincte trilobato; staminibus perfectis 5, 4·5 cm. longis, filamentis crassiusculis pallide flavis 1·25 cm. longis, antheris 3·25 cm. longis connectivoque pallide aurantiacis, pollinis granulis albis globosis lævibus, stamine sexto ad staminodium subulatum flavum 5 mm. longum reducto; ovario sæpe 2-loculari stylo filiformi cylindrico pallide flavo 5 cm. longo, stigmate 6-lobo clavato; ovulis numerosis anatropis. *Fructus* anguste clavato-oblongus, distincte angulatus, viridis, lævis, exsuccus, 12–15 cm. longus, 3 cm. latus, longius stipitatus, ad rachin virgatim approximatus; seminibus irregulariter tessaroideis 11 mm. longis, 8 mm. latis, 6 mm. crassis, testa ossea brunneo-nigra, praeter area circumhilaris alba.

ASSAM: in montibus Nagensibus orientalibus in ditione Jaboca dicta, *Abdul Huq*!

This very fine species in habit much resembles the common *Musa paradisiaca* Linn., SUBSPECIES *seminifera* Lour., VAR. *pruinosa* King, from Sikkim, with which it moreover agrees in height, in having the leaves very densely glaucous beneath, and in having the fruit distinctly angular. The two are however different as regards the colour of the bracts which in the Sikkim plant are violet-purple, in the present species are of a warm 'Indian red' outside and a bright shining orange colour inside. The stem in the Naga plant is more graceful and slender than in the Sikkim one. The most salient difference however is in the fruits which in the Sikkim plant are stouter and are recurved as in all other varieties of *M. paradisiaca*, whereas in *M. Nagensium* they point persistently forward and downward in the direction of the apex of the long pendulous rachis; the rachis too in the Naga plant is much more slender and the bracts are much more remote than is ever the case in *M. paradisiaca*; the cone formed by the bracts is consequently longer, narrower and more sharply pointed in the Naga plant than in *M. paradisiaca*. Another nearly related species is *Musa glauca* Roxb. from Burma, which however differs greatly in the colour of its bracts which are almost green, in the size of its leaves, which are less than 2 metres long; and in the shape of its fruit which is ellipsoid and not angular, and though wider (5 cm.) than in the Naga plant is only 9 cm. long and is not stipitate.

Noviciæ Indicæ XXII. *An undescribed* Araliaceous *Genus from Upper Burma.—By* D. Prain.

With Plate I.

[Read 2nd December, 1903.]

Among the plants obtained by a native collector of the Royal Botanic Garden, Calcutta, while working in the Kachin Hills under the kind supervision of Lieutenant Cruddas, S.C., Commandant of the Military Police Battalion at Myitkyina, one of the most striking is a hitherto uncharacterised Araliaceous plant which cannot be referred to any known genus of the order. The necessary generic definition, and a detailed description of the species on which the new genus is based, are herewith submitted to the Asiatic Society.

WOODBURNIA Prain.

Calycis margo longissime 7–10-dentatus. *Petala* 5, valvata. *Stamina* 5, antheræ oblongæ. *Discus* crassior. *Ovarium* 8-13-loculare; styli in columnam cylindricam coaliti; stigmatibus ad apicem sursum spectantibus. *Fructus* (immaturus) ovoideus.—Arbuscula aculeata. Folia digitato-palmata. Umbellæ axillares simplices solitariæ pendulæ pro ordine prægrandes. Bracteolæ magnæ lanceolatæ. Pedicelli cum flore continui.

Species singula montium Kachin nucupatorum incola, speciei nulli generum adhuc notorum arcte affinis ideoque pro specie generis cujusdam novi typica habenda.

Woodburnia penduliflora *Prain.* Arbuscula 4–5-metralis, caudice simplici aculeato. *Folia* circa 20 ad caudicis verticem aggregata, digitato-palmata; petiolis crassis 60 cm. longis, laminis ambitu fere circularibus 75 cm. latis; petiolulis 15 cm. longis, alis interpetiolularibus coriaceis margine integerrimis, supra intense viridibus glabris, subtus pallidioribus nervis parce pubescentibus ceterum fere glabris, prorsus arcte connatis; segmentis alarum singulis 8 cm. latis subhorizontaliter 10–12-nervis; lobis vel foliolis oblongis, apice acutis 20 cm. longis 14 cm. latis, margine basi late cuneata vel subtruncata integra excepta argute irregulariterque serrato, coriaceis, supra indumento stellato mox deciduo sparse obsitis, subtus praesertim secus nervos tomento simplici indutis, nervis subbasalibus 5, mediano tamen iterum nervos 8–10 utrinque emittente. *Inflorescentia* simplex umbellata; pedunculis axillaribus, pendulis, dense rufo-velutinis aculeisque recurvis gracilioribus irregulariter obsitis, 60 cm. longis, 1·5 cm. crassis; umbellis ultra 50-floris. *Flores* longe pedicellati; pedicellis 6–10 cm. longis, apice cum flore continuis ibique 5 cm. crassis, tomento simplici dense contexto prorsus velutinis; bracteolis lanceolatis 2–3·5 cm. longis, basi 5 mm. latis, supra glabrescentibus, subtus dense velutinis. *Calyx* turbinatus 1·25 cm. longus, 1 cm. latus dense rufo-velutinus; dentibus 7–10 lanceolatis æquilongis, 2·5 cm. longis, basi 4 mm. latis, minute sed dense velutinis. *Petala* 5, induplicato-valvata, apice subspathulata rotundata, extus puberula intus glabra, 1 cm. longa, 3·5 mm. lata. *Stamina* 5, filamentis gracilibus, antheris oblongis versatilibus. *Ovarium* 8–13-loculare; stylis in columnam cylindricam centralem glabram 1·5 cm. longam connatis, stigmatibus apicalibus minutis sursum spectantibus; ovulis in loculis singulis solitariis ab apice loculorum pendulis. *Fructus*, haud maturus, subdrupaceus.

BURMA: Kachin; inter Sadon et Myitkyina, alt. 4500′, *Shaik Muqim*!

This very striking plant has the habit, appearance and much the foliage of *Trevesia palmata* and *Brassaiopsis palmata.* The simple umbels are, however, very unusual in the order *Araliaceæ* and equally unusual are the very large flowers, the only genus inviting comparison in this respect being the widely different genus *Tupidanthus.* The absence of ripe seeds is unfortunate since it prevents us from definitely deciding whether the genus should be referred to the *Panaceæ* or the *Hedereæ;* the probability, however, is that it belongs to the former series.

The genus is dedicated to the memory of our lamented former President, H.H. Sir John Woodburn, K.C.S.I.

EXPLANATION OF PLATE I.

Woodburnia penduliflora *Prain.*

1, Single lobe of leaf, with portion of interpetiolular wings, × ½; 2, an inflorescence, × ½; 3, a single flower, *nat. size;* 4, flower, dissected, showing stellate calyx-lobes, petals and stamens (removed), disc, and style, *nat. size;* 5, transverse section of top of ovary; 6, vertical section of ovary; 7, half of ovary in transverse section, showing attachment of ovules, *enlarged;* 8, ovule, × 4.

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On the Life-History and habits of the moth Duomitus leuconotus, *Walker in Calcutta.—By* E. P. Stebbing.

[Read 4th November, 1903.][1]

I propose in this paper to make a few remarks upon the life history of a moth, by name *Duomitus leuconotus*, Wlk. about whose larval and pupal stages little would appear to have been observed or placed upon record.

Duomitus leuconotus is one of the wood-boring moths belonging to the family *Cossidæ*. Turning to Hampson's Moths in Blanford's Fauna of British India we find that but six genera of this family are at present known in India: *Cossus*, *Duomitus*, *Azygophleps*, *Eremocossus*, *Phragmatæcia*, and *Zeuzera*. This paucity in the known genera of the family is carried into the described species of which a list of but twenty-three are known, the numbers per family being as follows: *Cossus* 6, *Duomitus* 6, *Azygophleps* 3, *Zeuzera* 5, *Phragmatæcia* 2, and *Eremocossus* 1. About the habits of the majority of these species little is known. It is probable that most of, if not all, the larvæ live and feed in the wood of trees, and some of them may spend several years in this manner before changing to pupæ. In most instances, however, neither the larvæ nor

[1] Publication delayed by proofs having to be sent to England.

pupæ have yet been discovered and described. While, however, this is the rule in the family, there are two notable exceptions, in each of these cases the insects being of economic importance. *Duomitus niger*, an insect closely allied to the species we are considering in this paper, is the moth whose larva is known as the 'Black Borer' of Coffee-planters, and has proved a source of considerable loss on Coffee estates, whilst *Zeuzera coffeæ*, the moth whose larva is known as the Red-Borer (called by Hampson White-Borer[1]), commits great destruction in Southern India and is a pest well-known to Coffee-planters. The life-histories and habits of these two insects are more or less well known. Of the other representatives of the family in the Indian Region we have, however, little on record save the descriptions of the moth, in some cases both the ♂ and ♀ of a species having been described, in others the description of the ♂ or the ♀ only being extant. During the last few months I have had an opportunity here in Calcutta of working out a portion of the life-history of one of the other known species of Duomitus, that bearing the name of *D. leuconotus*, Walker, and my observations are recorded below.

The moth of which descriptions of both male and female are given by Hampson in the Fauna is a large, stout, striking-looking insect with a white thorax and greyish mottled wings. Hampson gives the wing expanse in the ♂ as varying from 98-128 millim, that of the ♀ being given as 180 millims. The specimens obtained by me this year show that there is a very much greater variation in size in both sexes. The following dimensions of 32 moths all taken from the same tree are, I think, well worthy of being placed upon record :—

Expanse of wings in ♂		Expanse of wings in ♀
80 millims	... ...	116 millims.
110 ,,	... ...	88 ,,
108 ,,	... ...	88 ,,
90 ,,	... ...	77 ,,
83 ,,	... ...	100 ,,
78 ,,	... ...	100 ,,
90 ,,	... ...	115 ,,
95 ,,	... ...	98 ,,
82 ,,	... ...	84 ,,
73 ,,	... ...	96 ,,

1 The real 'White Borer' is the larva of a Cerambyx beetle. *Vide* my 'Note on the Sandal wood boring insects of Madras' published in the Appendix Series of the *Indian Forester*, Vol. XXIX, No. 7 (1903).

Expanse of wings in ♂			Expanse of wings in ♀
70 millims	...	...	... 108 millims.
85 "	...	...	... 125 "
74 "	...	...	... 80 "
99 "	...	...	... 120 "
72 "	...	...	... 80 "
70 "	...	...	... 85 "
♂—70 to 110 "	...	...	♀—77 to 125 "

The above figures show the very great variation in size to be found in both sexes.

Neither larva nor pupa appear to have been previously described.

Larva (almost half-grown).—General tint, a dark flesh colour with brown head, yellow prothoracic segment edged in front with black with a few black specks behind; canary-yellow mesothorax and flesh-coloured metathorax. Following eight segments are flesh-coloured, lighter at junction of segments. Last segment is canary-yellow, becoming orange-yellow at extremity.

The head is dark chestnut-brown anteriorly, shining, chitinous, ovate, and large; mouth parts black, antennæ short, 3-jointed, yellow-brown. Posteriorly head shades off into pale-brown and yellow. It is followed by a large prothoracic shield which is hard and chitinous and shining, slightly convex. The chitin terminates at the sides, the under-surface of prothorax being canary-yellow in colour and soft. The large chitinous shield is ovate, anterior margin straight, posterior ovate, elliptical. At the posterior edge of the thoracic plate is an elliptical circle of small raised spikes or spade-like protruberances, doubtless used to shovel out of the way wood refuse and perhaps for scraping purposes. They are set backwards and are club-shaped. Behind these are a number of minute black spots placed in a crescent-shaped manner on the mesothorax, the angles pointing forwards. The mesothorax is much narrower and smaller and with a quite soft skin. The following segments are equal in size, about a third less in diameter than the prothorax, and have a few scattered black tubercles on them, each bearing a thin white hair. The last segment tapers to a blunt point.

Mouth parts pale-yellow beneath. Thorax beneath dark canary-yellow and rest of segments dark-yellow. Thoracic legs canary-yellow, pro-legs dark-yellow, flat and thick. Length $1\frac{1}{4}$ inch.

Pupa.—Sub-cylindrical, stout. Dark chestnut-brown to almost black. Black ventrally. Segmental bands orange, as also is front of thorax. Wing covers, eyes, antennæ and legs well marked on outer covering. Stigmata black with a circular orange edging. Nine dorsal segments plainly visible, and 5 ventral ones.

Length 2 to $2\frac{1}{4}$ inches. Size very variable.

The moths appear on the wing in the latter half of September, and are to be found during the remainder of that month and on up to about the third week in October. They are extremely sluggish during the daytime, but are powerful fliers at night. In the day they are to be found clinging to the bark of trees which their general colouration greatly resembles, thus serving to protect them from the attacks of enemies. The male lives but a few days and dies after pairing with the female. The latter lays her eggs, which are small, yellowish and deposited in irregular-shaped masses stuck together with some siccable material upon the bark of trees. She dies as soon as she has finished ovipositing. Examination of attacked trees has shown that these eggs are laid anywhere upon the woody parts of the tree, and that the young larvæ on hatching out bore straight through the bark to the sap-wood and feed in this for a time, subsequently going into the hard wood of the stem or branch. The mortality amongst the young larvæ must be very high since it would be quite impossible for any one tree to support the large number of larvæ the eggs of a single moth gives rise to, it being remembered that almost the whole of this stage is spent feeding in the wood. The larva almost certainly spends not less than two years feeding in the wood of the tree. The evidence for this assertion was found in the case of a tree which had practically been killed by the insects. Mature pupæ and moths were taken from this tree and also two half-grown (or less) larvæ. Since the moths only issue in September-October it is evident that these larvæ hatched from eggs laid at the very latest in the year before.

The larva bores in an irregular manner in the wood, the tunnel having apparently no regular or definite direction. The tunnel increases in diameter with the growth of the grub, finally measuring over half an inch across. It is packed with the wood sawdust and excreta of the larva. When fullgrown the larva carries its tunnel to the outside, boring a hole through the bark, and this hole will be observable on the outside owing to the fresh sawdust to be seen just below it on the bark of the tree. Having thus prepared an exit, the caterpillar larva backs down its tunnel for a distance of 2-3 inches (this space being kept quite free of wood particles) and spins a stout web-like series of strands of a coarse yellowish-brown silk across and below the mouth, thus effectually preventing any intruder, entering the tunnel from outside, getting near it. The larva then pupates. These strands of coarse brown silk are very charactristic of the pupation of this *Duomitus*. The pupal stage is probably a short one—at the most from six weeks to two months. Pupæ were found fully mature and also but newly changed from larvæ early in September, but they had all issued by the end of the third week in the following month. The hole bored to the outside by the larva is more or less vertical, only inclining to the horizontal just near the bark, so that the pupa, when the moth is ready to emerge, creeps up the tunnel and projects from it at an angle at right angles to the stem of the tree. In doing this the pupa bends over at an angle, the upper half being almost horizontal, whilst the lower portion remains in the almost perpendicular tunnel. The pupal skin then splits down at its anterior end both dorsally and ventrally as far as the posterior edge of the last thoracic segments and the moth crawls out. In the cleavage the head and antennal covering comes away as one piece.

It has been said that the larvæ live in the wood of living trees, and observations have shown that they will desert trees which have been cut down and the wood of which has consequently begun to dry. On the 22nd September of this year my attention was drawn to a small *Cassia nodosa* in the Indian Museum compound, which was evidently in a dying condition, the spring crop of leaves having all dropped and no new ones having replaced them. Examination showed that the tree was infested by this moth, several holes with half-protruding empty pupal cases being perceivable. The tree was but 15 feet high with a girth of twenty inches at the base. It was much branched all the way up and had a whippy spreading crown. I had this tree cut down and placed in a large wire gauze cage. In addition to two half (or less) grown larvæ and some live pupæ (taken to preserve in spirits) the following moths were obtained from the stem as they issued on the dates noted. [A portion of this stem, with the empty pupal cases *in situ* protruding from the bark, is now exhibited in the Insect Pest Gallery at the Museum; the other half will be sent to the British Museum.]

Date of issue.	♂	♀
22nd September, 1903	1	1
23rd ,, ,, ...	2	...
24th ,, ,, ...	...	3
25th ,, ,, ...	1	1
26th ,, ,, ...	2	...
27th ,, ,, ...	1	1
29th ,, ,, ...	4	...
30th ,, ,, ...	...	3
3rd October, ,, ...	...	2
4th ,, ,, ...	2	1

Date of issue.		♂	♀	
8th October, 1903	... ...	2	1	
10th " "	... ...	1	2	
16th " "	... ...	...	1	
Total	...	16	16	=32 moths.

In addition to these 32 moths there were two others which never acquired their proper wings on issuing, probably due to the handling the chrysalids received. It is probable that at least 40 moths left this tree during September and October.

In addition to the small *Cassia nodosa* tree, which may be said to have been killed by this insect during the present year, a much larger tree some 35 feet high and three feet in girth has been attacked, more especially at its base, as evidenced by several empty pupal cases protruding from the bark surface.

The moth was noticed in various parts of Calcutta during the above-mentioned weeks, and was evidently this year fairly abundant. We have yet to discover what other trees it infests in addition to the *Cassia nodosa* which Major Prain, who very kindly identified the tree for me, tells me was originally sent to the Museum from the Royal Botanic Gardens at Sibpur.

The Cyclone in the Bay of Bengal, between the 13*th and* 15*th November,* 1903.—*By* C. Little, Esq.

With four plates.

[Read 2nd March, 1904.][1]

In the early days of meteorological study in India, a first place was naturally given to the cyclone, and numerous discussions of more or less remarkable examples of cyclonic storms are on record. Piddington, Blanford, Wilson, Pedler, and last but not least, Sir J. Eliot have added to that record, of which a summary may be found in the Handbook of cyclonic storms by the last-named. A reference to the original memoirs will show that the investigators, at all events the later ones, overlooked not the smallest details, with the result that these details almost appear to be the main object of the discussion. But that had carried with it its own cure. Now it is recognised that many

1 Publication delayed by proofs having to be sent to England.

of the details are unimportant in their bearing on the grand central problem of the cyclone. As a consequence, a cyclonic storm such as that of the 14th November last, receives less voluminous attention now than it would have done fifteen or twenty years ago.

I have a two-fold purpose in offering this brief paper for publication :—

(1) To show by means of the experiences of the Steamers *Madura* and *Pentakota*, one from Calcutta to Rangoon, the other from Rangoon to Calcutta, how difficult it is to avoid the dangerous central area of cyclones by a study and application of the rules given in Sir J. Eliot's Handbook, even supplemented by such local observation as is possible in stormy weather.

(2) To point out that the peculiarity called "recurving," present in all severe cyclones, has never been investigated or explained, and that until more is known regarding that part of the cyclonic phenomenon, rules may enable seamen to evade imaginary cyclones where no danger exists, but will be of little avail in dangerous storms.

In the introduction to the Second Edition of the Handbook of Cyclonic Storms, Sir J. Eliot says :—

"By following these or similar instructions he (the mariner) will, in the great majority of cases, if not in all, when he is involved in cyclonic weather in the Bay of Bengal, be enabled to avoid the inner storm area of dangerous winds, and fierce squalls and rapid shifts of wind."

"I may here point out that my aim throughout the book has not been to give hard and fast rules, the observance of which will enable any seaman to pursue the safest course when he meets with a cyclonic storm in the Bay of Bengal. I do not believe it is possible to draw up rules which will be of use without the co-operation of the full intelligence of the person who wishes to employ the experience embodied in any series of rules drawn up for his guidance."

As I understand the above remarks, the difficulty is not considered to be as regards the reliability of the rules, but as regards the "full intelligence of the person." Now, in my opinion, and it is based on fifteen years' experience not only of telegraphed reports but of personal observation, rules are quite useless in the case of a storm such as that of the 14th November, and will continue to be useless until one is added enabling the sailor to estimate the amount of recurving. Until then the intelligence of the sailor cannot be implicated.

When I use the expression personal observation, I do not wish it to be understood that that part of my experience was gained at sea. I refer to storms which have recurved over Lower Bengal. In all cases, whether at sea or on land, I have seen no reliable indication supplied by the telegraphed reports, on which could be based any statement beforehand that the storm will recurve. But that recurving is readily shown afterwards by ground-level observations. Now, because the recurving is so readily shown, and because the result of it may be that ships or ports, to all appearance free from danger, become involved in the storm, the onus of proving that this occurrence could not be foreseen may at any time fall upon some individual ill-prepared to meet the charge. It, therefore, appears to me to be important that it should be fully recognised that, as far as present-day knowledge of storms goes, recurving can be neither foreseen nor provided against. In support of this belief I put forward the cyclonic storm of November 14th last, and the tracks of the two steamers. This is not, it should be understood, the only storm in the period over which my experience extends, that might be brought forward as evidence in favour of my contention. But a rapidly-moving cyclone, such as the one of the 14th November, last was, with the accident of two ships moving from opposite directions on the outer boundary of the storm at noon and involved in the hurricane area before midnight, gives a very rare combination—so rare that full advantage should be taken of the lessons to be extracted. It will be seen that both ships, under entirely different circumstances, continued steering almost directly towards the storm area, and this is more remarkable in the case of the *Madura*, because everything was done that a study of the rules laid down by Sir J. Eliot in the Handbook and "the full co-operation of the intelligence of the person" could do to keep away from the storm centre. It should be remembered that these ships were navigated by men who have had many years' experience of weather in the north of the Bay, who have made a careful study of the historical survey of the various storms in the Handbook, and have been compelled by circumstances to watch weather changes very carefully. It should also be remembered that besides the Captain of the ship there was on each vessel a member of the Hooghly Pilot Service, whose members are specially acquainted with weather conditions in the north of the Bay. My information was in the first instance received from Mr. Thorpe, of that Service, who was on board the *Madura;* and such facts as have reached me since have all tended to confirm my opinion that the statement of the first page of the Handbook, that in the great majority of cases, if not in all, the mariner will be enabled, by following these instructions, to avoid the storm area, will not be true until meteorologists have accounted for the part of the phenomenon called "recurving" or "recurvature."

I have attempted to show in other papers that the recurving of depressions over Central and Northern India is associated with important variations in rainfall distribution in India. Its further importance, as a feature of all severe cyclones in the north of the Bay, has, I believe, merely to be recognised to show that this phenomenen of recurving is the most important meteorological problem at present awaiting solution. I consider, therefore, that it cannot be too often repeated that the explanation cannot be supplied by an examination of registers only. It is, in all probability, an effect jointly dependent on changes indicated by the ground level instruments, and on the upper strata of the atmosphere. Should that assumption be correct, its solution must, of a certainty, await observation of the upper strata, and those interested must remain satisfied that no forecast except of the most general kind is possible where recurving is an element to be considered.

The following is an account of the experiences of the S.S. *Madura* on the voyage from Calcutta to Rangoon :—

"Left moorings at 7-0 A.M. 14th, and proceeded down the river, where after an uneventful trip we passed Saugor at 2-0 P.M. The weather signals hoisted there were somewhat nasty, L standing for the part of the Bay we were going to, which means strange winds and probable squally weather, forming apparently part of a cyclonic whirl; but the weather looked so fine that no one was anxious. At 5 P.M. Captain took charge, and we headed away for the Alguada, weather remaining very fine, and with the exception of a slight southerly swell, perfectly calm. Sunset that evening was a sight to behold, being a most magnificent one—clouds soft and woolly in long streaks across the sky, packed close together, being lighted into an extraordinary glow of deep blood-red which lasted for some considerable time. Everyone went to bed early, expecting a pleasant trip, and the weather for the first part of the night remained calm and fine; but towards morning it steadily began to get worse, the wind which had been blowing S.E. and E.S.E. backing round to East till at 4 a strong East breeze was blowing, and a moderate to rough sea was running, and the weather overcast and rainy. 6-0—The wind was still E. but the weather was thickening; at 7-0 the wind and weather much the same; at 7-45 the wind back to E.N.E. with increasing force and heavier sea and a nasty swell from S. It being certain now that a cyclone was approaching, the vessel was hove to, to see what direction the storm was travelling; at 8-0 Bar. 29·86, the wind was still E.N.E., making the storm S.S.W. of us; a strong wind was blowing and hard squalls with continuous rain. High head sea and heavy swell from S. 10-0—Bar: keeping steady, wind hauled E. × N., but the weather did not improve .11-30—Bar : 29·84, altered course E. × S, storm centre then bearing S.W. × S. from the direction of the wind. 12-0—Wind still E. × N., strong wind and high sea with very heavy squalls, Bar: 29·80. 1-0—Wind back to E.N.E. 2-0—Bar: 29·75, wind N.E. and the weather getting worse, showing storm was crossing our bows. Altered course to S.W. and went full speed. 2-5, wind back N.N.E. and the swell which was very heavy came from S.S.E. 2-25, wind hauled E.N.E. 3-0 Bar: 29·60, wind back for a few minutes to N.N.E. but went round almost at once to E.N.E. 3-25, Bar : 29·50, wind E.N.E. 3-40, wind E, both wind and sea decreasing but heavy swell from S.S.W., which taken with the hauling of the wind and the rapid fall of the Bar. showed storm was setting nearer and crossing our bows, so altered course S.E., having run 18 miles on the previous course: the Bar. now remained steady for a bit but then commenced to fall and the weather to get very much worse. At 4 Bar: 29·45, wind backing again to E.N.E., very strong, with a high confused sea and heavy swell from S.S.W. 5-10, Bar: 29·40, wind again backed to N.E. and weather got worse and worse, showing that storm had probably recurved and was coming towards us. So the course was again altered to S.W. At 5-15 a terrific squall struck the vessel with hurricane force N.N.E., carrying away awnings, after boat and doing damage generally; this kept on with unabated force till 7-15, when the wind which gradually backed from N.N.E. through N to N.N.W. suddenly shifted to N.W., and the Bar: which was pumping badly from 29·35 to 29·40 suddenly jumped up a tenth and a half; from this the weather rapidly improved, the vessel being kept before the wind until at 8-30 with the wind still N.W.; Bar: rising we went on our course again full speed."

The accompanying charts show more clearly—

(1) that from 8 A.M. of the 15th, when the centre of the cyclone was about 200 miles distant, until 8 P.M. of the same day when the centre had passed to the north-east of the vessel, the officers were engaged in a continued effort to follow the instructions of the Handbook.

(2) that the general effect of trying to follow the rules, was not to keep the ship away from the storm area, but to carry her directly towards the approaching centre.

(3) that the failure to avoid the storm centre was due to the recurving which is so conspicuous a feature of the storm.

It may be said that recurving is so frequently present in cyclones in November that it should have been possible to allow for it on this occasion. In my opinion recurving is present in all severe cyclones, but it occurs in great variety of degree. Anyone sceptical on this point has only to look at plate XLVII of the Handbook, 2nd edition, and he will find there the tracks of the eight severe cyclones described in the text. The chief feature is that no two are alike, and that not one is like the track of the cyclone of the 14th November.

If it had been possible to estimate on Sir J. Eliot's system of forecasting, that is, by considering changes of pressure and variations from the normal, what the future of the storm would be, it might be expected that it would be shown in the Indian Daily Weather Review for those days. The opinions therein expressed are arrived at on lines laid down by him, and by subordinates directly responsible to him. Reference is made to the numbers from November 13th to 15th, from which the following extracts are made.

November 13th.

"The fall of pressure is perhaps most significant at the coast stations round the Bay, as it has been accompanied with a change in the direction of the winds."

"The change in the direction of the winds on the Coromandel and Circars coasts makes it probable that rain will decrease during the day in the south of the Peninsula."

November 14th.

"Another general fall of pressure has taken place and the fall has been rapid on the Orissa and North Ganjam coasts......A depression is forming in the Bay of Bengal and pressure is in considerable to large defect at the stations round the North of the Bay."

"Winds are strong at Diamond Island and are cyclonic in direction round the Bay, though the circulation is not well defined."

"The depression in the Bay will probably intensify during the day. It is apparently advancing in a northerly direction."

November 15th.

"The depression in the Bay has advanced in a north-easterly direction, and its lowest point is this morning lying off the Arakan coast near Akyab, where pressure is nearly a quarter of an inch in defect."

"Winds show a cyclonic circulation round the depression in the north-east of the Bay......"

"The depression in the north-east of the Bay will probably cross the coast during the day and fill up rapidly."

The above remarks are all that were made regarding the storm on the dates referred to. They appear to me to show—

(1) that when the *Madura* was within 200 miles of the centre of a disturbance sufficiently wide-spread to affect the whole of

the northern coast of the Bay, the only indication that could be given on Sir J. Eliot's system was that "a depression has begun to form over the Bay."

(2) the chief indication given was that the coast most affected at 8 A.M. on the 14th, and therefore the probable objective of the approaching storm was the Orissa and North Ganjam coast. With this may be compared the statement in the report of the *Madura* that at 3-30 P.M. on the 14th the storm had crossed, the bows of the ship then steaming south-west, the course being immediately afterwards changed to south-east.

(3) that neither from the coast observations at 8 A.M. nor from the observations made on the ship up to 3-30 P.M. of the 14th was it possible to say that the storm was moving in a direction with an easterly element.

I believe the above remarks show clearly that, so far from Sir J. Eliot's statement being correct, that the inner storm area can be avoided, it is in the present state of our knowledge of meteorology a matter of good fortune rather than of management that ships are not more frequently involved in severe storms. Luckily severe storms are rare, their danger extends over a small area, and the rapid rate at which they move further diminishes the risk of many vessels becoming involved.

There is another matter on which this question of recurving bears with no small importance, that is, the storm warning of ports. My practice has been, when a storm such as the cyclone of the 14th November 1903, or the Chittagong cyclone of October 1897, enters the north of the Bay, to issue warnings to all the ports in the north of the Bay. It must be obvious that this storm of the 14th November last, might have struck the land at the mouth of the Hooghly, or Chittagong or Akyab according to the amount of recurving. I had the same difficulty with the cyclone of November 26th 1901, which came on the mouth of the Hooghly and which residents of Calcutta will remember passed a little to the west of this city.

The result of this system of warning is that the port affected is generally warned beforehand, but along with that port there are perhaps six others where precautions have been taken and weather has not been to any great extent affected. A further result is damaging suspicion as regards what Sir J. Eliot calls the "intelligence of the person" who issued the warnings. The difficulty arises from the recurving of all dangerous storms; in fact it may almost be said that recurving is rarely present at sea where there is not danger. It appears then to be associated with exceptionally strong winds, just as inland it is associated with exceptional distribution of rainfall, frequently with heavy flooding.

The only remedy is investigation of the upper strata of the atmosphere, because ground level observation fail to display the causes, and therefore fail to indicate its occurrence beforehand.

It may be said that with the introduction of wireless telegraphy earlier and better information will be available. The experience of these two ships in the cyclone of November 14th shows how difficult it is for ships at sea to find out what is happening within a few miles of them, and it may be inferred that, even with an efficient system of wireless telegraphy, guaranteed to continue working in all kinds of weather, and more especially to be independent of thunderstorms, it is doubtful whether much information will be procurable from the shipping in the Bay at the time of the storm.

The Andaman connection might have given some information on the 13th which would have shown that a storm was approaching the north of the Bay and moving towards Gopalpur, but on the point of greatest importance, *viz.*, whether the storm would strike the mouth of the Hooghly or Chittagong or Akyab, information from the Andamans would have been of no assistance.

When we come to consider that wireless telegraphy fails when thunderstorms are occurring, and that thunderstorms are constantly occurring in the early stages of cyclonic weather, the probability of assistance in forecasting weather by that means becomes practically nil. Wherever wireless telegraphy has been tried so far, its working has been temporarily abandoned during thunderstorms; and this is so great a drawback in storm warning work that the United States Weather Bureau, after a lengthy trial of wireless telegraphy, have put it aside for the present, and are continuing the laying of submarine cables over the short distances between their mainland and neighbouring islands. If wireless telegraphy fails for that reason as an aid in storm warning in the temperate region, it is much more likely to fail in the tropics where lightning is an almost constant accompaniment of even a slight atmospheric disturbance. Those who doubt the interference of lightning with wireless telegraphic work may refer to the latest Administration Report of the Telegraph Department in India.

It is practically certain that no improvement in storm warning will follow the introduction of wireless telegraphy. A cable to the Andamans would, undoubtedly, give valuable information, but only ground level information which is not sufficient to settle the important question of recurving. There remains the investigation of the upper strata suggested by Mr. H. F. Blanford more than twenty years ago and still awaiting introduction in India. For what is being done in this direction in other countries the reader may be referred to pages 7 to 14 of the Report for 1903 of the Chief of the United States Weather Bureau, and more especially to the subsequent pages in which some idea is given of the lavish expenditure at present being incurred in establishing a central observatory for purposes of training and research. To quote the report :—

"The Weather Bureau is so far convinced of the importance of finding out the laws of this cosmical physics, by which alone the problem can be conclusively solved, that it has been thought proper to found a research observatory at Mount Weather, on the crest of the Blue Ridge mountains, and equip it suitably for these investigations."

"Generally, the idea is to bring together for study under one direction the most valuable and practical observations having a direct bearing on the higher meteorology, which is now engaging the attention of many able physicists and astronomers."

"Plans are being prepared for a plant adapted to generate large quantities of hydrogen, for balloon ascensions, including a shop for the construction of balloons and kites. The ascensions will be limited to about 4 miles in height, our immediate purpose being to measure the temperatures and thermal gradients, which will enable us to construct daily isothermal charts on the two upper planes already described, (3,500 and 10,000 feet high) so as to provide isotherms as well as isobars on the high levels. It is proposed to make a complete series of ascensions—first at Mount Weather, and afterwards in different portions of the United States, in order to observe the temperature conditions in all classes of cyclones and anticyclones. We may attempt some high ascensions, up to 10 or 12 miles from the ground, when our experience and other conditions warrant ; but since storm movements are practically limited to the strata within 4 miles of the ground, the first group of ascensions will be to moderate elevations."

If the most experienced meteorologists of the time consider such operations necessary to further meteorological research in the United States, it may be safely anticipated that in India where the upper atmosphere, more especially in Bengal, passes through a cycle of change of greater variety and interest, the advantage of similar investigation to both storm and flood warning would be enormous.

Notes on the Roxburghiaceæ, with a description of a new species of STEMONA.—*By* D. PRAIN.

[Read 1st June, 1904.]

In 1892 a native collector, in the employment of the Royal Botanic Garden, sent from the Shan Hills a specimen of a *Stemona* which appeared to be a marked variety *S. Griffithiana* Kurz, a species first described by Griffith in his *Journal of Travels*, p. 149, but there left without a name, though Griffith indicated his belief that it represented a new genus of *Roxburghiaceæ.* The only salient character by which it differs from the other known species of *Stemona* is, however, its erect instead of climbing habit. Two years ago another plant collector brought with him from Lower Burma living examples of Griffith's original plant, which were found, on flowering, to agree exactly with the original description drawn up by Griffith, but to deviate in certain respects from the description given by Kurz in the Society's *Journal* for 1873.

During the present year Mr. Burkill has sent from Burma (Katha) yet another living plant which has flowered in the Botanic Garden side by side with the plant referred to above. Mr. Burkill's plant is found to agree absolutely with the Shan Hill specimen already alluded to, and to differ so markedly from the Griffithian one as to deserve to be regarded as a distinct species. The necessary description has been accordingly prepared and is now offered to the Society. The task of describing this new species has involved an examination of all the material of this natural order present in the Calcutta Herbarium and a consultation of various references to its species. Advantage has therefore been taken of the opportunity afforded by this study to draw up a key that may be of use in discriminating the various species; in the list that follows the key notes are given, enlarging the existing knowledge of their nomenclature and distribution as well as of the distribution of *Stichoneuron*, the only other Indian genus belonging to this order.

1. STEMONA Lour.

Key to the species.

Leaves whorled or opposite :—
  Leaves sessile or shortly petioled, 3–4-nate, 3-veined ... *sessilifolia.*
  Leaves long-petioled, more than 3-veined :—
    Leaves 3–6-nate, 5–7-nerved ... ... *japonica.*
    Leaves opposite at least below, sometimes alternate towards ends of branches :—
      Leaves oblong-cordate, 7–13-veined, peduncles 1–2-flowered ... ... *tuberosa.*
      Leaves ovate-cordate, 7-11-veined; peduncles 2–3-flowered ... ... *moluccana.*

Leaves all alternate, long-petioled :—
  Stems twining :—
    Leaves ovate-cordate :—
      Stems slender; peduncles 1–2-flowered; leaves 7-veined ... ... *jacaniva.*
      Stems stout; peduncles 3—more-flowered; leaves 13–15-veined ... ... *Curtisii.*
    Leaves oblong :—
      Leaves truncate at base, 7–10 in. long, 9–11-veined; stem stout ... ... *Kurzii.*
      Leaves cuneate at base, 3 in. long or less, 7–veined; stem slender ... ... *minor.*
  Stems erect; leaves ovate-cordate; main-nerves 13–17 :—
      Flowers greenish-white flushed with pink; perianth-lobes linear lanceolate, 1 in. long ... ... *Griffithiana.*
      Flowers brownish-red; perianth-lobes ovate-acute, ·6 in. long ... ... *Burkillii.*

1. STEMONA SESSILIFOLIA Miq. Prol. Fl. Jap. 386 (1867); Franch. & Savat. Enum. Pl. Japon. ii. 92.

Roxburghia sessilifolia Miq. Ann. Mus. Bot. Lugd. Bat. ii. 211 (1866).

JAPAN.

Figured by Yokusai in *Somoko Zusets* ii. (2 ed.) t. 55.

2. STEMONA JAPONICA Miq. Prol. Fl. Jap. 386 (1867); Franch. & Savat. Enum. Pl. Japon. ii. 92.

Roxburghia japonica Blume, Enum. i. 9. (1827).

JAPAN.

Figured by Yokusai in *Somoko Zusets* ii. (2 ed.) t. 56.

3. STEMONA TUBEROSA Lour. Flor. Cochin-Chin. 404 (1790); Flor. Brit. Ind. vi. 298.

Inhame maderasp. foliis binis pulchre venosis Petiv. Gazophyl. 50, t. 31, f. 6 (1702).

Ubium polypoides album Rumph. Herb. Amboin. v. 364, t. 129 (1750).

Dioscorea oppositifolia Linn. Sp. Pl. 1032 in part (1753).

Roxburghia gloriosoides Jones in Roxb. Corom. Pl. i. 26, t. 32 (1795).

R. viridiflora Sm. Exot. Bot. i. 111. t. 57. (1804).

R. gloriosa Pers. Syn. 412 (1805).

R. Stemona Steud. Nomencl. (2 ed.) ii. 475 (1841).

Stemona gloriosoides Voigt Hort. Suburb. Calcutta. 650 (1845).

INDIA: Circars! INDO-CHINA: Assam! Silhet! Khasia! Jaintea: Naga Hills! Chittagong! Siam (*fide* Kunth); Cochin-China (*fide* Loureiro). CHINA: Hupeh! Formosa! PHILIPPINES: Luzon! MOLUCCAS! (*fide* Rumphius).

Dioscorea oppositifolia Linn., Sp. Pl. 1032, is based on two plants one being the *Dioscorea foliis oppositis ovatis acuminatis* of the *Flor. Zeylan.*, p. 361, which still is accepted as *D. oppositifolia* Linn.; the other plant to which, in Linnaeus' work, the name gave cover, is the *Inhame maderasp. foliis binis pulchre venosis* of Petiver (*Gaz.* 50, t. 31, f. 6). The expression 'pulchre venosis' ought alone to have been sufficient to exclude Petiver's plant from association with the Ceylon one, and a cursory glance at the figure could not fail to show that the two did not agree. It, however, occurred to Mr. Burkill and myself, who have been of late engaged in studying the Indian *Dioscoreas*, that Petiver's plant might not be a *Dioscorea* at all. We therefore referred the subject to the Keeper of the Botanical Department, British Museum, in which institution the actual specimens from which Petiver's drawings were made are preserved. The result has been that our friend, Dr. Rendle, to whom the enquiry was entrusted, finds that the plant in Petiver's collection which Linnaeus has included in his *Dioscorea oppositifolia* is really *Stemona tuberosa.*

Occasionally, but very rarely, the leaves low down may be 3-nate, and occasionally those at the tips of branches are alternate, but this has not been noticed by the writer on any of the stout main-stems.

4. STEMONA MOLUCCANA Prain.

Ubium polypoides rubrum Rumph. Herb. Amboin. v. 365 (1750).

Roxburghia moluccana Blume, Enum. i. 9 (1827); Kunth, Enum. v. 289.

MOLUCCAS: (*fide* Rumphius); Amboina, *Barclay*!

This species is very closely related to *S. tuberosa* but differs, in Barclay's specimen, in shape of leaf and style of inflorescence, in both which particulars it resembles *S. Curtisii;* that species, however, has smaller flowers and only alternate leaves: according to Rumphius the present plant has the leaves scattered towards the ends of the branches, opposite below.

5. Stemona javanica, Engl. Natürlich. Pflanzenfam. ii. v. 8, (1888).

Roxburghia gloriosoides Zoll. Plant. Jav. n. 2441 (1850); Hassk. Neuer Schluess. Herb. Amboin. 275 (1864); not of Jones.

R. javanica Kunth. Eunm. v. 288 (1850).

Java: Malang; in woods near the sea, *Zollinger*!

There is no doubt as to the validity of this species, which was proposed by Kunth and has been since accepted by Engler. Besides having thinner, smaller, and fewer-veined leaves than *S. tuberosa*, its flowers, which are noted by Zollinger in his field-note as dark-red, are about one-fifth the size of those of that species.

6. Stemona Curtisii Hook. f. Flor. Brit. Ind. vi. 298 (1892).

Malay Peninsula: Penang; Waterfall, *Curtis*! Perak; Batu Gaja, *Scortechini*! Lumut, *Ridley*!

7. Stemona sp., ? nov.

Roxburghia gloriosoides Kurz in Herb. Calcutta, hardly of Jones.

Burma: Pegu; Laelo Choung, *Kurz*!

Leaves all alternate, oblong, 7-10 in. long, 3 in. wide, base truncate.

This has narrower and firmer leaves than is usual in *S. tuberosa*, though *some* of our examples of that plant have leaves very like those of the present one. In texture and also in shape its leaves accord best with those of *S. minor*, but they are much larger and the stem is much stouter than in that plant. But for the fact that the leaves on a stout main-stem are alternate, a character never met with in true *Stemona tuberosa*, the identification of Kurz might almost have been accepted. Meanwhile, however, this is one of the cases where it is safer to doubt the determination, and when fuller material is available it may be necessary to recognise this as a distinct species, *S. Kurzii*. For the present it must be accepted as, at least, a distinct variety of *S. tuberosa*.

8. Stemona minor Hook. f. Flor. Brit. Ind. vi. 298 (1892).

Roxburghia gloriosoides Wight, Icon. t. 2061 (1853), not of Jones.

R. gloriosoides var. *minor* Thw. Eunm. Pl. Zeyl. 432 (1864).

S. India: Malabar, *Wight*! Ceylon: Trincomali, *Glenie*.

The relationship of this to *S. tuberosa* is much the same as that of the preceding form; the most salient character being again that here all the leaves are alternate. This plant, however, further differs in being distinctly smaller in all its parts, and there is no doubt that Sir Joseph Hooker is amply justified in considering it a distinct species.

9. Stemona Griffithiana Kurz in Journ. As. Soc. Beng. xlii. 2, 109 t. 10 (1873); Hook. f. Flor. Brit. Ind. vi. 299.

[*Gen. Nov.* near *Roxburghia*] Griff. Journ. Trav. 149 (1847).

Indo-China: Burma; valley of the Irrawaddy from Ava to Pegu.

The description given by Kurz, which, so far as reference to coloration goes, has been followed in the *Flora of British India*, deviates somewhat from the original account written by Griffith in the field. Most of the specimens which Kurz had before him when writing his description are in Herb. Calcutta now, but here is a note in Kurz's handwriting that indicates the removal of two of these subsequent to the preparation of his description. There is nothing to show that Kurz had the advantage of studying an original Griffithian specimen; and while most of the specimens named *Griffithiana* by Kurz himself belong to the plant that *does* accord exactly with the description drawn up by Griffith, one of Kurz's specimens appears to the writer to belong to the species next to be described. In any case the account that Kurz gives of the colour of the flower seems to suggest that Kurz must have seen, in the field, plants of both species. Though the two plants are very closely allied the writer is satisfied, after a careful examination of the two in the living state, and while flowering side by side, that they are distinct, and that the distinction is too marked to admit of their being deemed merely two varieties of one species. Both plants, it may be noted, begin to flower before the leaves are fully developed, but flowering does not cease, in either case, till some time after the leaves have attained their full size.

The diagnosis between the two plants is as follows :—

Internodes less than ·5 in. long; perianth-segments 1 in. long or rather longer, linear-lanceolate, white with a greenish tinge externally and a pinkish tinge within; fleshy keel of filaments purple ... ... *Griffithiana.*

Internodes more than 1 in. long, perianth-segments ·5–·6 in. long, ovate-lanceolate, greenish-red externally, dull red within; fleshy keel of filaments cobalt-blue ... *Burkillii.*

10. Stemona Burkillii Prain.

Burma: Shan Hills; *Abdul Huq*! Katha; *Burkill*!

Rootstock stout, hypogaeous. *Leaves* ovate, acute, slightly cordate. 3–4 in. long, 2·5–3 in. wide, 13–15-nerved; petioles 4–6 in. long, alternate, *Stems* slender, erect, 6-18 in. high; internodes 1 in. or more long. *Flowers* greenish-red externally, dull-red within, bracts ·5 in. long, lanceolate; pedicels 1·5 in. long, strict; perianth-segments ·5-·6 in. long, ovate-lanceolate, acute. *Stamens* 4, filaments broad, dull-red, with sometimes one, sometimes 2 linear fleshy cobalt-blue keels on inner face; anthers yellow. *Fruit* not seen.

Though so nearly related to the foregoing species this plant differs in too many characters to be satisfactorily dealt with as a mere variety of *S. Griffithiana.* The roots, which were brought to Mr. Burkill's notice during a recent tour in Burma, in connection with the enquiry for species of *Dioscorea*, are known as *Tham-yan-nyet.* They are not eaten but are used as an insecticide.

2. STICHONEURON Hook. f.

Stichoneuron membranaceum Hook. f. Flor. Brit. Ind. vi. 299 (1892).

Add to localities of F.B.I.:—

Malay Peninsula: Perak; *Scortechini*!

As regards distribution we find that *Stemona* exhibits in a very striking fashion the peculiarities characteristic of many of the genera that are confined to the monsoon-region. It is, to begin with, remarkably wide-spread within that area, extending from Malabar and Ceylon to Japan on the one hand, and to the Philippines and the Moluccas on the other. But with the exception of the wide-spread *Stemona tuberosa*, which occupies almost the whole of the central portion of this large area, the individual species are much localised. In this instance, no species has so far been actually obtained from the Himalayan region, through the central species, *S. tuberosa*, has been collected by Mr. G. Mann in the Charduar, near the base of the Eastern Himalaya. The genus *Stichoneuron* occurs in Khasia and Silhet; and has been gathered again in the Malay Peninsula. The sub-joined tabular statement shows that of the 10 species known, one occurs in Ceylon, two in India, four in Indo-China, one in China, two in Japan, one in the Philippines, two in the Moluccas (Malaya east of the Wallace line), and two in Malaya proper west of the Wallace line. Of the Indian species, one is confined to Malabar and Ceylon and is the only species in these areas. Of the Indo-Chinese form three are endemic; as are both the Japanese, both the western Malayan, and one of the two Moluccan species.

Table of distribution of the genera Stemona *and* Stichoneuron.

Species.	Ceylon.	Malabar.	Circars.	Assam.	C. China.	Formosa.	Japan.	Cochin China.	Burma.	Siam.	Philippines.	Moluccas.	Java.	Malay Peninsula.	Remarks.
Stemona minor ...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	Group of closely related forms.
tuberosa	...	...	1	1	1	1	...	1	...	1	1	1	...	...	
moluccana	...	...	...	...	...	...	...	...	...	...	...	1	...	...	
Kurzii ...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	
japonica ...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
sessilifolia	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
Curtisii ...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	
javanica...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	
Griffithiana	...	...	...	...	...	...	...	...	1	...	...	...	...	...	Do.
Burkillii...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	
	1	1	1	1	1	1	2	1	3	1	1	2	1	1	
Stichoneuron membranaceum	...	...	...	1	...	...	...	...	...	...	...	...	...	1	

The Asiatic species of Ormosia.—*By* D. Prain.

[Read 1st June, 1904.]

In the *Journal of the Asiatic Society of Bengal*, vol. lxix, pt. 2, pp. 175, *et seq.*, a list of the Asiatic species of the genus *Ormosia* was published. The list included 22 species. Since 1900, when the list appeared, further material has been communicated from S. China. This material includes examples in flower of one species, *O. yunnanensis*, of which previously only the fruits were known; it also includes material both in flower and in fruit of a distinct new species that has been described by Mr. S. T. Dunn, in the *Journal of the Linnean Society*, under the name *O. striata*. More recently Mr. F. B. Manson, of the Indian Forest Department, has sent from Tavoy a specimen representing yet another species. As it is desirable, therefore, to bring the census of the genus, published four years ago, up to date, the necessary notes, references and descriptions are now offered to the Society.

The species reported from Tavoy is a member of the group *Macrodisca*, within the section *Ormosia* proper, and its place in the genus, most in accordance with the arrangement adopted in the previous paper, will be within the group mentioned, and immediately before 7. *Ormosia travancorica* Bedd. The new Chinese species is compared by Mr. Dunn with *O. gracilis* Prain, and in general appearance this is the species that it most resembles. But while it is undoubtedly, like *O. gracilis*, a member of the section *Ormosia* proper, the structure of the fruit and the size of the seeds are repugnant to its inclusion in the group *Macrodisca* to which *O. gracilis* belongs. As a matter of fact the fruit does not accord with the characters of any of the three subsections or groups that it has been found advisable to recognise within the section *Ormosia*, but shows that *O. striata* probably deserves to be considered the type of a distinct sub-section, the "Striatæ," connecting *Macrodisca* with *Amacrotropis*, to be placed alongside and on an equal footing with the sub-section *Layia*, with which last it agrees in having the valves thickly woody and the seeds small, but from which it differs in not having the pods septate.

1. Ormosia robusta *Bak.*

Add to localities hitherto recorded :—

Lower Burma: Tavoy, *Shaik Muqim*!

6b. ORMOSIA TAVOYANA *Prain*; leaflets 7—9, oblong, dull pale-green, distinctly stalked; flowers in axillary racemes, pedicels very short; pod large, ovate-oblong, with thick valves rounded on the back.

BURMA: Tenasserim; Tavoy, *Manson's Collector* n. 301!

A tree, with thickish, dark-brown, glabrous branches. *Leaflets* thickly chartaceous and rigid in texture, pale-green, quite glabrous on both surfaces, ovate-oblong, acute, terminal rather the largest, 3·5—4·5 in. long, 1·5—2 in. wide, main-nerves about 5 pairs curving forwards and rather prominent beneath; petiolules ·25 in. long, and main-rachis 6—8 in. long, quite glabrous. *Peduncle* glabrous, 2·5 in. long, stout as is the rachis of the raceme 1·5 in. long, which is glabrous or slightly puberulous towards the apex. *Flowers* not seen. *Fruiting pedicel* stout, ·25 in. long. *Pod* umber-brown, 2·75 in long, 1·8 in. wide, ·75 in. thick. *Seed* oblong, ·75 in. long, scarlet.

This species most resembles *O. travancorica* but has larger, more acute leaflets and a larger pod.

The Burmese name is *Talaing-sin*.

¶ STRIATÆ. [Sub-sect. nov. post ¶ LAYIAM ponenda.]. Pods with thickly woody valves, not septate between the small, often solitary seeds.

13b. ORMOSIA STRIATA *Dunn, Journ. Linn. Soc.* xxxv. 492, (1903).

CHINA: Yunnan; mountains in Western Szemao, 4000—5000 ft., *Henry* 11886! 12843; 12979!

The outer layer of the valves of the pod is firmly coriaceous, the endocarp is woody and subcrustaceous; the apex like the base is oblique and projects as a straight or slightly uncinate beak at right angles to the long axis of the pod and diagonally opposite to the stipe.

15. ORMOSIA YUNNANENSIS *Prain, Journ. As. Soc. Beng.* lxix. 2, 183.

Add to description:—*Corolla* white. *Stamens* 10, all fertile, exserted; anthers oblong, versatile.

Add to citation of gatherings from CHINA:—Yunnan; mountains to the south of Szemao, 5000 ft., *Henry* 12885!

INDEX SLIPS.

BOTANY.

KING, SIR GEORGE, AND GAMBLE, J. SYKES.—Materials for a Flora of the Malayan Peninsula. No. 15. Journ. As. Soc. Bengal, LXXIII, pt. ii, 1904, pp. 47–135.

RUBIACEÆ.

Key to twenty-three remaining genera from Malayan Peninsula, pp. 47–50.

New species from Malayan Peninsula.

Timonius Wrayi, p. 54, *T. laxus* and *T. malaccensis*, p. 56.

Canthium pauciflorum, p. 58, *C. molle*, p. 60.

Webera Curtisii, p. 67, *W. Wrayi*, p. 69, *W. Yappii*, p. 70.

Ixora humilis, p. 79, *I. Scortechini*, p. 80.

Morinda lacunosa, p. 87.

Rennellia paniculata, p. 89.

Saprosma glomerulatum, p. 98, *S. Scortechinii*, p. 99.

Geophila humifusa, p. 102, *G. Scortechinii*, p. 104.

Cephaelis Ridleyi, p. 106.

Lasianthus scabridus, p. 111, *L. Ridleyi*, p. 115, *L. flavicans*, p. 116.

L. Singaporensis, p. 117, *L. subspicatus*, p. 118, *L. Wrayi*, p. 119.

L. sub-inæqualis and *L. coronatus*, p. 120, *L. robustus*, *L. coriaceus* and *L. pergamaceus*, p. 123, *L. malaccensis*, p. 124.

L. perakensis, and *L. augustifolius*, p. 126, *L. oblongus* and *L. montanus*, p. 127, *L. Curtisii* and *L. pseudo-lucidus*, p. 128.

L. nervosus and *L. Harveyanus*, p. 129, *L. ferrugineus*, p. 130.

L. scalariformis and *L. filiformis*, p. 131, *L. gracilis* and *L. lucidus*, p. 132.

The following genera and species from the Malayan Peninsula described:—

Coelospermum, p. 50, key to species, p. 51, *C. scandens* and *C. truncatum*, p. 51.

Guettarda and *G. speciosa*, p. 52.

Timonius and key to species, p. 53.

T. Jambosella, p. 53, *T. Rumphii*, p. 55.

Knoxia corymbosa, p. 57.

Canthium and key to species, p. 58, *C. confertum*, p. 60.

C. didymum and *C. glabrum*, p. 61, *C. griseum*, p. 62.

C. parvifolium, p. 59.

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JOURNAL

OF THE

ASIATIC SOCIETY OF BENGAL,

Vol. LXXIII. Part II.—NATURAL SCIENCE.

No. 3.—1904.

Materials for a Flora of the Malayan Peninsula.—*By* Sir GEORGE KING, K.C.I.E., LL.D., F.R.S., *late Superintendent of the Royal Botanic Garden, Calcutta, and* JAMES SYKES GAMBLE, Esq., C.I.E., M.A., F.R.S., *late of the Indian Forest Department.*

No. 15.

[Read March 2nd, 1904.]

In the last of these contributions thirty genera of *Rubiaceæ* were described. In the present one descriptions are given of the twenty-three remaining genera. Our account of the species of *Psychotria* ought to have been included here. But, owing to an unfortunate circumstance, it has been necessary to keep it back for publication in the next paper of the series. In the accompanying key to the genera, *Psychotria* is however included. The species described in the present paper number 123, and of these 47 are believed to be new.

Ovary 2-celled with 2 ovules in each cell, or imperfectly 4-celled with 1 ovule in each cell, always pendulous from about the middle of the septum; calyx-limb truncate; drupe with 2 or 4 pyrenes; flowers umbellate; corolla-lobes narrow, valvate in bud; scandent shrubs ... 31. COELOSPERMUM.

Ovules solitary in each cell; ovary 2- to many-celled:—
Radicle superior:—
Ovules pendulous from the apex of the cell:—
Fruit composed of several cohering woody pyrenes; stamens inserted on the mouth of the corolla-tube:—
Pyrenes 4 to 9: corolla imbricate, calyx-limb deciduous: shrubs or trees ... ... 32. GUETTARDA.
Pyrenes 12 to 24: corolla valvate; calyx-limb persistent, cupular: shrubs or trees ... 33. TIMONIUS.
Fruit 2-celled, consisting of 2 dry small indehiscent cocci; herbs with connate setaceous stipules ... 34. KNOXIA.
Ovules pendulous from the septum near its apex:—
Drupe with 2 free or cohering pyrenes; trees or shrubs with axillary inflorescence:—
Stipules equal: shrubs (often climbing); drupe didymous and 2-seeded or sub-globose and (by abortion) 1-seeded; seeds oblong ... ... 35. CANTHIUM.
Stipules unequal, (one very large); seeds cup-shaped; a tree ... ... 36. MESOPTERA.
Radicle inferior:—
Ovules on the septum of the ovary:—
Corolla-lobes imbricate in bud:—
Ovary 2-celled, each cell with an ovule on the middle of the septum; flowers ebracteate, in small supra-axillary clusters, 5-merous: calyx-lobes as long as the tube, thickened and persistent, stamens 5, inserted near the base of the corolla-tube; style short; stigma fusiform; fruit boldly 10-ridged; a shrub ... ... 37. GARDENIOPSIS.
Corolla-lobes twisted in bud:—
Ovary 2-celled, each cell with one ovule (in one species with 2 ovules); flowers 5-merous; style short, pubescent; stigmas stout and grooved: fruit with scanty pulp; seeds plano-convex, often cupped ... ... 38. WEBERA.
Ovary 2-celled, each cell with one ovule inserted near the middle of the cell, not basilar; flowers 4-merous (5-merous in one species of *Ixora*); style long, slender, glabrous, exserted; stigmas slender, smooth; fruit globose or didymous with leathery or pulpy pericarp; pyrenes 2, coriaceous, each with a single plano-convex seed:—
Style exserted but never twice as long as the corolla-tube; stigma thicker than the style, bifid: stipules and bracts of the inflorescence coriaceous, usually small, the latter not sheathing; leaves usually coriaceous ... 39. IXORA.
Style very slender much longer (often twice

as long) than the corolla-tube; stigma not thicker than the style (sometimes thinner), usually entire; stipules and bracts of the inflorescence large and membranous (the latter sheathing); leaves membranous ... 40. PAVETTA.

Corolla-lobes valvate in bud :—

Stamens 4 or 5, usually inserted on the mouth of the corolla (rarely in the tube); ovules usually inserted below (rarely above) the middle of the septum, amphitropous; fruit a 2- or- 4-celled berry or a drupe with 2 or 4 pyrenes; trees or shrubs, (sometimes scandent) :—

Flowers united by their calyx-tube into more or less fleshy heads :—

Heads many-flowered, ovoid, solitary or in axillary or terminal umbels or panicles; seeds obovoid or reniform ... 41. MORINDA.

Heads few-flowered, sub-spicate in terminal panicles; seeds thin, orbicular ... ... 42 RENNELLIA.

Flowers free :—

Flowers unisexual :—

Calyx-limb cupular; throat of corolla glabrous, stamens included in its tube; flowers terminal and axillary; berry 1- to 2-seeded; seeds sub-globose, peltate 43. PRISMATOMERIS.

Calyx-limb annular, truncate, entire or 5-toothed; throat of corolla woolly and bearing the stamens; flowers in axillary heads; drupe globose; seeds compressed ... ... 44. GYNOCTHODES.

Flowers bisexual :—

Calyx-limb truncate, entire or obscurely lobed; throat of corolla glabrous or hairy; flowers in umbels; fruit a berry or drupe with 2 to 4 pyrenes; seeds obscurely trigonous ... ... 31. COELOSPERMUM.

Stamens 4, inserted on the throat of the corolla; style filiform; stigma capitate or bifid; ovules inserted on the middle of the septum; fruit a crustaceous or coriaceous dehiscent mericarp; seeds oblong or ovoid with ventral groove; herbs ... ... 45. SPERMACOCE.

Ovules basilar, erect :—

Corolla-lobes inflexed-valvate in bud :—

Stamens 4 or 5, inserted in the corolla-tube; style-arms 2, twisted; fruit capsular, compressed or globular, containing 2 dorsally compressed,—winged or cupped pyrenes often pendulous from a columella; seeds compressed, the testa membranous; fœtid climbing shrubs ... 46. PAEDERIA.

Corolla-lobes valvate in bud; stamens usually 4, but sometimes 5 to 7, inserted near mouth of the corolla; ovules cuneate, anatropous; drupe with 2 or more pyrenes:—

Flowers axillary and terminal, solitary or in small fascicles; anthers 4, sub-sessile:—

Calyx-limb dilated, unequally 4- to 6-lobed; drupe with 2 pyrenes; fœtid terrestrial shrubs ... ... 47. SAPROSMA.

Calyx-limb truncate; drupe with 2 pyrenes; epiphytes with tuberous honey-combed stems 48. HYDNOPHYTUM.

Flowers solitary, capitate or fascicled, axillary or terminal:—

Flowers solitary; calyx with 4 rather long lobes; stamens 4 to 7; creeping herbs often with cordate leaves ... ... 49. GEOPHILA.

Flowers numerous, in heads surrounded by many large thick involucres; calyx-limb entire; style-arms 2; stamens 4 or 5 ... 50. CEPHAELIS.

Flowers in axillary fascicles or condensed cymes, calyx-limb 3- to 6-fid or entire and truncate; stamens 4 to 6; style-arms 3 to 9: leaves distichous, not cordate; pyrenes 3 to 9 51. LASIANTHUS.

Flowers in terminal (rarely axillary) corymbose or panicled, rarely capitate, never involucrate cymes:—

Calyx-limb short, 4- or 5-toothed; corolla-tube usually long and curved; seeds orbicular, very concave on the ventral surface ... 52. CHASALIA.

Calyx-limb short, 4- to 6-toothed; corolla-tube usually short, straight; seeds plano-convex ... ... 53. PSYCHOTRIA.*

31. COELOSPERMUM, Blume.

Scandent glabrous shrubs; the young branches often compressed. *Leaves* coriaceous, elliptic, oblong or obovate, with few and indistinct nerves; stipules short, broad, connate below, acute or bifid at the apex, caducous and leaving an annular scar on the branch. *Flowers* in 3-6-flowered panicled umbels. *Calyx-tube* short, campanulate or hemispheric; the limb membranous, truncate or obscurely lobed, sometimes deciduous. *Corolla* coriaceous, clavate in bud, funnel-shaped or salver-shaped; the limb with 4 or 5 linear-oblong or lanceolate, sub-acute, patent or reflexed lobes longer than the tube, in bud valvate, the edges and apices often recurved. *Stamens* 4 or 5, on the throat of the corolla;

* The descriptions of the species of this genus will be printed in No. 16 of the present series of papers.

filaments slender; anthers linear, versatile; exserted. *Ovary* 2-celled or imperfectly 4-celled; style filiform; stigmas 2, linear-lanceolate. *Ovules* 2 in each cell in the 2-celled species and 1 in each cell in the 4-celled species, on fleshy placentas. *Fruit* depressed-globular, dry or fleshy, containing 2 or 4 pyrenes.—Distrib. Malaya and Australia—about 10 species.

Limb of calyx membranous, deciduous: cells of ovary 2, each with 2 or more ovules ... ... 1. *C. truncatum.*
Limb of calyx coriaceous, permanent: cells of ovary 4, cells uni-ovulate ... ... 2. *C. scandens.*

1. Coelospermum truncatum, King & Gamble. A shrubby glabrous creeper: youngest branches thinner than a goose-quill, pale-brown, terete. *Leaves* coriaceous, elliptic-oblong, or sub-obovate, shortly and rather obtusely acuminate, the base cuneate; both surfaces (when dry) dark-brown with a tinge of olivaceous, dull; the midrib depressed on the upper, prominent on the lower; main-nerves about 4 pairs, curving upwards, slender, distinct on the lower surface; length 3 to 4 in., in breadth 1·25 to 2·5 in.; petiole ·3 to ·5 in. *Stipules* small, transversely oblong, very short (often only ·05 in. long), pale: coriaceous, 2-lobed. *Panicles* about 1 in. long and twice as broad, ternately umbellate on the apex of naked compressed peduncles as long as or longer than the leaves: the umbels with 5 or 6 spreading flowers, minutely but deciduously bracteolate at the base. *Flowers* ·4 in. long, on unequal pedicels shorter than themselves. *Calyx-tube* campanulate, the limb membranous, truncate or obscurely 5-toothed, deciduous, ·1 in. long, *Corolla* ·35 in. long, clavate in bud, the tube short, hairy within, the throat glabrous, the lobes 5, valvate in bud, their apices inflexed. *Stamens* 5, inserted in the throat of the corolla. *Anthers* linear, exserted. versatile. *Ovary* 2-celled with ovules 2 (or more ?) in each cell. *Coelospermum scandens*, Hook. fil. Fl. Br. Ind. III. 159 *in part. Trisciadia truncata*, Hook. fil. in Gen. Plant. II. 69; Fl. Br. Ind. III. 94. *Webera truncata*, Roxb. Fl. Ind. ed. Carey and Wall. II. 538. *Stylocoryna truncata*, Wall. Cat. 8403. *Cupia truncata*, DC. Prod. IV. 394. *Pseudixora truncata*, Miq. Fl. Ind. Bat. II. 210.

Penang: *Wallich*. Singapore: *Maingay* (K.D.) 933.

2. Coelospermum scandens, Blume Bijd. 994. Scandent: the young branches cylindric, pale-brown, thinner than a goose-quill. *Leaves* broadly elliptic, or obovate-elliptic, much narrowed to the base; midrib and 4 or 5 pairs of spreading nerves faintly depressed on the upper surface, slightly prominent on the lower; length 2·5 to 5 in.; petioles ·35 to ·6 in. *Stipules* less than ·1 in. long, narrow. *Peduncles* usually longer than the leaves, slender, compressed, bearing at the apex three pedunculate few-flowered umbels. *Flower-pedicels* unequal, shorter than

the flowers. *Calyx* campanulate, less than ·1 in. long, the mouth truncate, usually with 5 minute teeth. *Corolla* four times as long as the calyx, clavate in bud, salver-shaped, coriaceous; the tube slender, longer than the 5 reflexed linear-oblong valvate lobes. *Anthers* as long as the corolla-lobes, much exserted. *Ovary* 4-celled, each cell with a single ovule. *Fruit* depressed-globular, ·4 in. across and ·35 in. long, glabrous, shining, smooth but with 4 shallow ventral grooves and a minute apical areolus: pyrenes two, each 2-seeded. DC. Prod. IV. 468; Hook fil. Fl. Br. Ind. III. 159 (in part).

MALACCA: *Griffith* (K.D.) 3087. SINGAPORE: *Ridley* 109; *Hullett* 623. PERAK: *King's Collector* 3992, 7248.

The material is imperfect and we describe the characters of the ovary and ovules with some hesitation.

32. GUETTARDA, Linn.

Trees or shrubs. *Leaves* sometimes three in a whorl; stipules deciduous. *Flowers* secund on the branches of axillary forked pedunculate cymes. *Calyx-tube* short; the limb tubular, toothed, usually deciduous. *Corolla* with a long cylindric straight or curved tube, the limb with 4 to 9 lobes imbricate in bud. *Anthers* 4 to 9, linear, subsessile, included within the glabrous tube. *Ovary* with 4 to 9 elongate cells, with a solitary ovule in each cell; style filiform; stigma sub-capitate. *Drupe* more or less globular, crowned by the short calyx-limb; endocarp 4- to 9-celled, perforated near the apices of the cells. *Seeds* pendulous, oblong cylindrical or curved, testa membranous, albumen scanty or none. —DISTRIB. About 45 species; mostly American.

1. GUETTARDA SPECIOSA, Linn. Sp. Pl. 991. A small evergreen polygamous tree; young branches as thick as a goose-quill, deciduously puberulous. *Leaves* membranous, broadly obovate or ovate, cuspidate, narrowed to the rounded or sometimes minutely cordate, rarely acute base; upper surface pale-brown when dry, glabrous; the lower pale-greenish, puberulous, minutely reticulate; main-nerves 7 to 8 pairs, little curved, spreading, thin but rather prominent on the lower surface, faint on the upper; length 4 to 8 or 10 in.; breadth 3 to 7 in.; petioles ·5 to 1·5 in.; stipules lanceolate or oblong, deciduous, ·3 in. long. *Cymes* axillary or from the axils of fallen leaves; few-flowered, little-branched, on puberulous peduncles 1·5 to 2·5 in. long. *Flowers* 1·5 to 2 in. long, some sessile others on short pedicels. *Calyx* about ·2 in. long, minutely velvety; tube short-grooved; limb widely cupular, truncate entire or faintly and irregularly toothed. *Corolla* salver-shaped, many times longer than the calyx, softly pubescent outside; the tube narrow; the limb 1 in. in diam. divided into 7 or 8 obtuse lobes. *Style* glabrous stigma conical. *Drupe* depressed-ovoid or turbinate, woody, globose,

obscurely lobed, 4- to 6-celled, about 1 in. in diam. Lam. Ill., t. 154 f. 2; Roxb. Fl. Ind. I. 686. Wall. Cat. 6219; W. & A. Prod. Fl. Pen. Ind. 422; Wight Ic. t. 40; Kurz For. Flor. Burm. II. 37; Hook. fil. Fl. Br. Ind. III. 126. *Cadamba jasminiflora*, Sonner. Voy. Ind. II. t. 128. *Nictanthes hirsuta*, Linn. Sp. Pl. 8. *Jasminum hirsutum*, Willd. Sp. Pl. I. 36.—Rheede Hort. Mal. t. 47, 48.

In all the provinces—on the sea-coasts.—DISTRIB. Shores of the tropics of old and new worlds.

33. TIMONIUS, Rumph.

Shrubs or trees: stipules ovate-lanceolate, deciduous: leaves more or less coriaceous. *Flowers* rather small, polygamo-dioecious, in axillary cymes. *Male* cymes with few or many secund flowers. *Female* 1- to 3-flowered, the pedicels bibracteolate. *Calyx-tube* short; the limb cupular, persistent. *Corolla* coriaceous, pubescent, funnel-shaped; the throat and the tube within glabrous; limb with 4 or 5 (rarely with 10) lobes, valvate in bud or nearly so. *Stamens* as many as the lobes of the corolla, inserted by short filaments in the tube; anthers linear, dorsifixed. *Disk* small, hispid. *Ovary* many-celled; style short, thick, hairy, with several more or less united linear (often unequal) branches; *ovules* solitary in each cell, pendulous. *Fruit* ovoid or globose, usually 4-grooved, composed of 12 to 24 or even 30 small elongated 1-celled 1-seeded pyrenes cohering by their sides and sunk in a 4-armed, placentiform mass, the whole being enclosed in an epicarp crowned by the remains of the calyx. *Seeds* cylindric, straight, rarely curved, with thick funicles and membranous testas; albumen scanty or absent: cotyledons small, radicle long.—DISTRIB. About 30 species, Tropical Asiatic and Polynesian.

Female flower solitary on a long peduncle :—
- ♂ peduncles long, slender, glabrous; leaves glabrous except the nerves beneath; fruit 4-grooved, glabrous ... ... 1. *T. Jambosella.*
- ♂ peduncles short, rusty-pubescent; leaves rusty-pubescent beneath; fruit not grooved, rusty-pubescent ... ... 2. *T. Wrayii.*

Female flowers in small pedunculate cymes ... 3. *T. Rumphii.*

Species of which ♂ flower and fruit are unknown :—
- Stipules triangular, acuminate ... ... 4. *T. laxus.*
- Stipules cupular, the mouth with several unequal linear points ... ... 5. *T. malaccensis.*

1. TIMONIUS JAMBOSELLA, Thwaites Enum. Pl. Ceyl. 153. A small ever-green tree or shrub; young branches thinner than a goose-quill, brown when dry, glabrous or sparingly silky. *Leaves* coriaceous, their margins sometimes recurved, lanceolate, elliptic-lanceolate, or elliptic, acuminate, the base narrowed, cuneate; both surfaces dull-brown when

dry, glabrous; the lower paler, faintly reticulate; main-nerves 5 or 6 pairs, curving upwards, prominent and silky on the lower surface, less prominent and glabrous on the upper; length 2·5 to 4 in.; breadth 1 to 2·5; petioles ·1 to ·3 in.; stipules lanceolate, acuminate, silky, slightly exceeding the petioles. *Male* cymes 3- to 12-flowered, on peduncles ·35 to ·75 in. long. *Female* flowers solitary, on peduncles longer than those of the males: the calyx 4-gonous; suburceolate, the mouth with 4 shallow obscure teeth. *Corolla* hypocrateriform, ·3 to ·5 in. long, the throat valvate. *Anthers* slightly exserted. *Disk* large. *Stigmas* 4, *Fruit* at first ellipsoid, but when peridepressed-globose, 4-gonous, subtruncate, about ·35 in. across, crowned by the calyx-limb and large disk; crustaceous; covered by a smooth pericarp: the placentas 4, cruciate, each bearing about 6 ovules sunk in pits. Bedd. Ic. Pl. Ind. Or. t. 190; Hook. fil. Fl. Br. Ind. III, 127. *T. flavescens*, Baker Fl. Maurit. 144. *Nelitris Jambosella*, Gaertn. Fruct. I. 134, t. 90 (*excl. syn.*). *Helospora flavescens*, Jack in Trans. Linn. Soc. XIV. 127, t. 4, f. 3; DC. Prod. IV. 391; Miq. Fl. Ind. Bat. II. 234. *Eupyrena glabra*, W. & A. Prod. 423. *Bobea glabra*, Korth. in Ned. Kruidk. Arch. II. 211. *Polyphragmon flavescens*, Kurz For. Fl. Burm. II. 38. *Guettarda? peduncularis*, Wall, Cat. 6222; Don. Gen. Syst. III. 551. *G. Brunonis* and *G. missionis* Wall. Cat. 6220, 6221.

In all the provinces: common.—DISTRIB. Andaman Islands Ceylon, Malay Archipelago.

VAR. *Finlaysoniana*; leaves elliptic or elliptic-oblancolate, shortly acuminate or acute, 3 to 5·5 in. long, the petioles ·3 to ·6 in. long, fruit, nearly ·5 in. in diam. *T. Finlaysoniana*, Hook. fil. Fl. Br. Ind. III. 127. *Guettarda Finlaysoniana*, Wall. Cat. 6223. *G. peduncularis*, Wall. Cat. 6222. *Timonius*, Wall. Cat. 8446.

SINGAPORE: *Wallich*, *G. Thomson*, *Ridley* 2762. PENANG: *Curtis* 3388. PERAK: *King's Collector* 1529, 6209. ANDAMAN ISLANDS: *King's Collector.*

2. TIMONIUS WRAYI, King & Gamble, n. sp. A tree 20 to 50 feet high; young branches as thick as a goose-quill, dark-brown when dry, the leaf-cicatrices large, distinct. *Leaves* coriaceous, elliptic or obovate-elliptic, sometimes rhomboidal, the apex acute, the base much narrowed into the long petiole; upper surface olivaceous-brown when dry, glabrous everywhere and shining; the lower paler, dull, the nerves and midrib adpressed rusty-sericeous, otherwise glabrous; main-nerves 6 or 7 pairs, only slightly curved, ascending, very bold on the lower surface like the midrib, somewhat depressed on the upper; length 5·5 to 8 in.; breadth 2·25 to 4·5 in.; petiole ·6 to 1·5 in.; stipules lanceolate, acuminate, sparsely sericeous, about ·5 in. long. *Male cymes* pedunculate, dichotomous, 6- to 8-flowered, the branches bracteate, short, spreading,

everywhere densely rusty-pubescent: the peduncle about ·5 in. long; flowers secund, sessile. *Calyx* ·3 in. long, cylindric, campanulate with 4 broad blunt unequal lobes, densely rusty-pubescent outside. *Corolla* coriaceous with wide short tube and 4 blunt, concave, slightly imbricate lobes nearly as long as the tube, rusty-pubescent outside. *Anthers* 4, included, linear, sessile. *Female flower* not seen. *Fruit* solitary on a peduncle longer than that of the male cyme, ellipsoid or globose, crowned by the large calyx and with a single oblong bract at its base, minutely rusty-pubescent, ·6 in. in diam. when dry. *Seeds* about 12, in pits on the cruciform placentas.

PERAK: *Wray* 3200, *King's Collector* 5168.

This species is very distinct from the others described here. Its nearest ally is one from New Guinea, to which Dr. Scheffer gave the MS. name *Polyphragmon sessile*. But the latter has smaller leaves, more hairy below and with rather more main-nerves; the petioles moreover are shorter, and the fruits have peduncles less than ·1 in. long.

3. TIMONIUS RUMPHII, DC. Prod. IV. 461 A small tree. Young branches twice as thick as a crow-quill, striate, sparsely pubescent at first, finally glabrous. *Leaves* thinly coriaceous or membranous, narrowly elliptic, somewhat oblanceolate, shortly and bluntly acuminate, much narrowed at the base: upper surface dark-brown when dry, usually glabrous except for a few hairs on the midrib; the lower paler, minutely reticulate and with fine white adpressed-sericeous hairs; main-nerves 8 or 9 pairs, slightly curved, ascending, thin and faint on the lower surface, almost obsolete on the upper; length 3·5 to 5·5 in.; breadth, 1·5 to 2 in.; petiole ·25 to ·4 in.; pubescent; stipules lanceolate, caudate-acuminate, shorter than the petioles. *Male cymes* many-flowered pubescent, with many divergent trichotomous branches; the flowers ·3 to ·5 in. long, secund, sessile, pubescent; *calyx* campanulate ·05 in. long *Female cymes* trichotomous, on peduncles 1 to 1·25 in. long, and sometimes bearing small leaves. *Flowers* in threes, the middle one sessile, the two lateral pedicellate, ·4 in. long. *Calyx* with a subulate bracteole at its base, about as long as the pedicel; the tube narrowly campanulate 4-grooved, densely tomentose, somewhat constricted at the base of the less hairy limb; lobes of limb 4, ovate, subacute, spreading. *Corolla* coriaceous, ·3 in. long, twice as long as the calyx, outside adpressed-pubescent, inside glabrous; the tube cylindric; the mouth with 4 blunt lobes. *Anthers* 4, linear-oblong, sessile. *Style* stout, grooved by the pressure of the anthers, stigmatic lobes small. *Fruit* ellipsoid to subglobose, tetragonous, crowned by the erect calyx-lobes, densely covered with short white deciduous pubescence, ·35 in. long: the placentas cruciate bearing many seeds, each enclosed in a woody pyrene. Hook.

fil. Fl. Br. Ind. III. 127: Wall. Cat. 6217. *Bobea Wallichiana*, Korth in Ned. Kruidk. Arch. II. 211.—Rumph. Herb. Amb. III. 216 t. 140.

In all the provinces: common;—DISTRIB. Malay Archipelago.

Near *T. Jambosella*, but with more hairy leaves, more numerous main-nerves and hairier inflorescence. The female flowers are in small cymes instead of being solitary as in that species.

4. TIMONIUS LAXUS, King & Gamble, n. sp. A tree 20 to 30 feet high; young branches thicker than a crow-quill, covered with coarse short rusty-deciduous hairs, the leaf-cicatrices bold. *Leaves* thickly membranous, narrowly elliptic-obovate, shortly acuminate, the base cuneate: upper surface dark-brown when dry, glabrous; the lower paler, minutely rusty-pubescent especially on the nerves and stout midrib; main-nerves 5 or 6 pairs, curved upwards, bold on the lower surface, slightly depressed on the upper; length 3·5 to 5 in.; breadth 1·5 to 2·25 in.: petioles ·1 to ·15 in.; stipules about ·35 in. long, triangular with long apices, the midrib rusty-pubescent. *Male cymes* on slender pubescent peduncles 1 to 2 in. long, with 2 diverging 1- to 2-flowered branches and a sessile flower at the fork. *Flowers* 3·5 in. long, those on the branches on pedicels ·3 in. long. *Calyx* cupular, subentire, less than ·1 in. long. *Corolla* thickly coriaceous, outside with dense yellowish-brown silky tomentum, inside nearly glabrous, the tube cylindric, the mouth with 4 broad blunt lobes one-third of the length of the tube. *Female flowers* and *fruit* unknown.

PERAK: *King's Collector* 10609.

This has been collected only once and its female flowers and fruit are unknown. It appears to be near *T. Jambosella* but differs in its hairy leaves and lax, long-peduncled male cymes.

5. TIMONIUS MALACCENSIS, King & Gamble, n. sp. A small tree? Young branches slender, obtusely 4-angled, clothed in dense pale minute tomentum. *Leaves* membranous, broadly oblanceolate or elliptic, bluntly and shortly acuminate, narrowed to the base; upper surface glabrous, the midrib alone minutely rufous, puberulous when young, pale-brown when dry; the lower paler, reticulate, with sparse slender pale hairs, the midrib and main-nerves cinereous-tomentose; main-nerves 5 or 6 pairs, little curved, ascending; length 3·5 to 4·5 in., breadth 1·5 to 1·75 in.; petioles ·15 to ·2 in.; stipules shortly cupular the mouth with several unequal filiform processes, two being very long. *Cymes* 2 or 3 in the uppermost leaf-axils, about 6-flowered, one quarter of the length of the leaves, tomentose; their peduncles ·35 to ·6 in. long. *Flowers* densely pubescent outside, their pedicels ·05 in. long. *Calyx* tomentose, slightly more than ·1 in. long, campanulate: the mouth with 4 broad, triangular, spreading lobes. *Corolla* nearly twice as long as the

calyx, salver-shaped, pubescent outside, glabrous inside except the villous throat; limb with 4 ovate-lanceolate sub-acute lobes. *Anthers* 4, sub-sessile in the throat, short, elliptic. *Style* stout, elongate, sparsely hairy below, divided into several broad flat truncate stigmatic lobes. *Fruit* unknown.

MALACCA: (on Mount Ophir) *Ridley* 3217.

This differs notably from *T. Rumphii* in its shorter flowers and its stipules. he leaves also differ. It has been only once collected.

Erect herbs or under-shrubs; stems terete or obtusely angled with linear lines of hairs or glabrous. *Leaves* equal, usually narrow, stipules connate with the petiole to form a truncate cup often with bristles on its mouth. *Flowers* white, pink or lilac, small, dimorphous, in corymbose cymes. *Calyx-tube* ovoid or didymous; teeth 4 minute, subequal or 1 or 2 elongate, persistent. *Corolla*-tube long, its throat villous; lobes 4, valvate in bud, with the tips inflexed. *Stamens* 4, inserted on the throat; anthers linear, included or exserted. *Ovary* 2-celled: style filiform: stigma included or exserted, 2-lobed: ovules solitary in each cell, pendulous. *Fruit* globose or oblong, small, of two semi-terete or dorsally compressed indehiscent cocci. *Seeds* with membranous testa and thick funiculus; albumen fleshy; embryo axile, the cotyledons thin and the radicle superior.—DISTRIB. Species about 10: Indian Malayan and Australian.

KNOXIA CORYMBOSA, Willd. Sp. Plant I. 582. Herbaceous, 1 to 4 feet high. *Stem* terete or obscurely 4-angled, little-branched, pubescent, tomentose or villous, never glabrous. *Leaves* membranous, pale-brown and somewhat olivaceous when dry, petiolate or sessile, narrowly elliptic, linear or ovate-lanceolate, tapered to each end, the apex acuminate; both surfaces hairy like the stems: main-nerves 5 to 9 pairs, rather straight, ascending, most prominent on the lower surface; length 1·5 to 5 in.; breadth ·4 to 1 in.; petiole ·2 to ·4 in. or more. *Stipules* narrowly cupular, their edges with bristles ·1 to ·2 in. long. *Corymbs* on the end of the branches, shorter than the leaves, minutely bracteolate, trichotomous; the ultimate branches spicate when in fruit. *Flowers* ·05 in. long, on peduncles shorter than themselves, white or purplish. *Calyx* ovoid, with 4 broad blunt triangular sub-equal teeth. *Corolla*-tube hairy within. *Fruit* less than ·1 in. long, puberulous. W. & A. Prod. 439; Wight Ill. t. 123: Dalz & Gibs. Fl. Bomb. 111. Hook fil. Fl. Br. Ind. III. 128. *K. teres*, DC. Prod. IV. 569; Wall. Cat. 819 *in part.* *K. exserta*, DC. l.c. *K. umbellata*, Banks; Spreng. Syst. I. 406. *K. sumatrensis*, Wall. Cat. 6183. *K. mollis*, Br. in Wall. Cat. 820, *not of W. & A.* *K. stricta*, Thw. Enum. 152. *Spermacoce? teres* and *S. exserta*, Roxb. Hort Beng. 10; Fl. Ind. I. 367, 368: Ed. Carey & Wall. I. 373, 374. *S. sumatrensis*, Retz Obs. IV. 23, ex Cham. & Schl. in

Linnæa, III. 316 (*not of Roxb. Fl. Ind. I. 336 ?*) *Cuncea trifida*, Ham. in Don Prodr. 135.

In all the provinces.—DISTRIB. Malayan Archipelago, British India, tropical Australia.

CANTHIUM, Lam.

Shrubs (sometimes climbing), unarmed or spinous, their stipules of ten connate. *Flowers* small, axillary, fascicled, or in corymbose, often pedunculate, cymes; sometimes polygamous. *Calyx* with short tube and short persistent or deciduous cupular 4- or 5-toothed limb. *Corolla-tube* funnel-shaped, campanulate or urceolate, usually with a ring of deflexed hairs in the throat; limb 4-5-lobed, valvate in bud, finally reflexed. *Anthers* equal in number to the lobes of the limb, inserted in the mouth or throat of the corolla, sessile or on short filaments. *Disk* annular, tumid or depressed. *Ovary* 2-celled; style stout; stigma large, entire or bifid; ovules solitary in the loculi and pendulous. *Drupe* didymous or sub-globose or (when one of the carpels is suppressed) reniform, with 1-2 pyrenes, or a 2-celled putamen. *Seeds* pendulous, oblong, with membranous testa and fleshy albumen; embryo elongate, sub-terete; the cotyledons short and the radicle superior.—DISTRIB. About 80 species; in Asia, Africa, tropical Australia and Polynesia.

Flowers 1 in. long, solitary or in pairs, axillary ... 1. *C. pauciflorum.*
Flowers less than ·5 in. long, in axillary cymes:—
  Spiny straggling or scandent shrubs with more or less hairy leaves:—
    Leaves rarely so much as 1·5 in. long, with 3 pairs of main-nerves, the remains of the calyx on the top of the fruit inconspicuous ... ... 2. *C. parvifolium.*
    Leaves 2 to 3 in. long with 5 pairs of main-nerves: fruit crowned by the large calyx-tube ... ... 3. *C. molle.*
  Unarmed trees or shrubs, glabrous or nearly so:—
    Corolla-tube wide, short:—
      Fruit much compressed, obovate, about ·15 in. long; pyrenes not keeled: whole plant quite glabrous ... ... 4. *C. confertum.*
      Fruit ellipsoid, smooth, obscurely 4-angled, somewhat compressed, 1 in. or more in length: pyrenes prominently keeled on the back, not warted; leaves with a few adpressed hairs on their lower surface ... ... 5. *C. glabrum.*
    Corolla salver-shaped, the tube very narrow. Fruit much compressed, didymous, minutely velvety, ·25 to 6 in. long: pyrenes warted, not keeled: leaves quite glabrous ... ... 6. *C. didymum.*

1. CANTHIUM PAUCIFLORUM, King & Gamble, n. sp. A spiny glabrous shrub 15 to 20 feet high: young branches thicker than a

crowquill, pale, terete; spines few, slender, curved, shorter than the petioles, supra-axillary. *Leaves* membranous, elliptic-ovate, shortly and somewhat obtusely acuminate, the base cuneate; both surfaces pale olivaceous-brown when dry, dull; main-nerves 4 to 5 pairs, spreading, somewhat prominent on the lower surface but evanescing at the tips, almost obsolete on the upper; length 4 or 5 in.; breadth 1·5 to 2·25 in.; petioles ·15 to ·25 in.; stipules small, broadly triangular. *Flowers* about 1 in. long, solitary or in pairs on a short minutely bracteolate axillary branch. *Calyx* ·2 in. long, cupular-campanulate, the mouth with 5 short broad acute teeth. *Corolla* with a wide cylindric tube ·5 in. long, having a ring of hairs inside near the base, otherwise glabrous; the limb with 5 lanceolate erect or spreading lobes half as long as the tube. *Anthers* exserted, narrowly oblong, inserted by short filaments in the glabrous throat. *Ovary* 2-celled; style exserted; stigma mitriform, oblong, 2-partite. *Fruit* nearly 1 in. long, pulpy, smooth, crowned by the large wide calyx-tube. *Plectronia pauciflora*, K. & G. MS.

PERAK: *Scortechini*, 62.

At once distinguishable by its large flowers, solitary or in pairs.

2. CANTHIUM PARVIFOLIUM, Roxb. Hort. Beng. 15: Fl. Br. Ind. I. 534. A rambling spiny shrub often subscandent or scandent; young branches thicker than a crow-quill, angled, at first densely rusty addressed-pilose, ultimately often sub-glabrous; spines supra-axillary, ·05 to ·2 in. in length, straight or curved, pubescent at the base, the tips glabrous and shining. *Leaves* small, subcoriaceous, greenish when dry, ovate or elliptic, acute, the base cuneate; upper surface glabrous; the lower often sparsely hairy; the three pairs of slightly curved ascending main-nerves and the midrib pubescent usually on both surfaces; length ·75 to 1·5 in.; breadth ·5 to ·75 in.: petioles ·05 to ·15 in.; stipules broad and short with an acute abrupt point. *Flowers.* ·2 in. long, in small axillary clusters, on short pedicels. *Calyx* cupular-truncate, entire, or minutely 4- to 5- toothed. *Corolla* several times longer than the calyx: the tube widely tubular in bud and constricted below the limb, when expanded the tube globular, glabrous outside, but with a ring of dense deflexed white hairs inside; the limb with 4 or 5 lanceolate deflexed lobes. *Anthers* partly exserted, ovate, on short filaments. *Stigma* mitriform, sulcate. *Fruit* when ripe the size of a small cherry or black currant, glabrous. DC. Prod. IV, 474. Hook. fil. Fl. Br. Ind. III, 135. *C. scandens*, Blume Bijdr. 966; DC. Prod. IV, 475. *C. horridum*, Blume Bijdr. 966; DC. Prod. IV, 474; Miq. Fl. Ind. Bat. II, 255: Hook. fil. Fl. Br. Ind. III, 135. *Plectronia parvifolia* and *P. horrida*, Kurz. For. Fl. Burm. II, 36. *Gardenia rigida*, Wall. Cat. 8257 *in part*. *C. zizyphinum*, Wall. Cat. 8288 A. C. *Rubiacea*, Wall. Cat. 8288

B. *Hyptianthera rhamnoides*, Zoll. et Mor. in Zoll. Syst. Verzeichn. 60. *Dondisia horrida*, Korth. in Ned. Kruidk. Arch. II, 236.

In all the provinces: not uncommon.

We have here reduced Blume's species *C. horridum* to the older one of Roxburgh; for we can find no character to separate the two, the form of the spines the size of the fruit, and the amount of pubescence hitherto relied upon being as a matter of fact inconstant.

3. CANTHIUM MOLLE, King & Gamble, n. sp. A straggling spiny shrub (? scandent); all parts more or less densely pale rusty-pubescent; the young branches thinner than a goose-quill, dark-brown, more or less 4-angled; spines stout, supra-axillary, much curved downwards, ·2 to ·6 in. long. *Leaves* thickly membranous, ovate to ovate-lanceolate, shortly acuminate, the base cuneate or rounded; main-nerves about 5 pairs, spreading, slightly prominent on the lower surface when dry, obsolete on the upper; length 2 to 3 in.; breadth ·75 to 1·5 in.; petioles ·15 to ·2 in.; stipules broadly triangular, apiculate, very short. *Flowers* ·2 in. long, on pedicels nearly as long, in small axillary cymes or on short, minutely bracteolate, sometimes leaf-bearing, axillary branches. *Calyx* small, cupular, with 5 small acute teeth. *Corolla* with a wide tube glabrous outside, but inside with a ring from the throat of long deflexed white stout hairs: the lobes of the limb about as long as the tube, narrowly oblong, glabrous, deflexed. *Anthers* sessile, shortly oblong, exserted. *Style* exserted; stigma large, ovoid-globose, ridged. *Fruit* unknown.

SINGAPORE: in the Bot. Garden Jungle; *Ridley* 2859.

4. CANTHIUM CONFERTUM, Korth. in Ned. Kruidk. Arch. II, 235. A shrub? everywhere glabrous; young branches rather thicker than a crow-quill, pale brown and striate when dry. *Leaves* coriaceous, olivaceous when dry, elliptic or elliptic-lanceolate, shortly and bluntly acuminate, the base narrowing into the petiole; both surfaces dull, the reticulations obsolete; main-nerves 3 (rarely 4) pairs, oblique, ascending, scrobiculate at the axils, rather faint on both surfaces; length 2·5 to 4 in.; breadth 1·25 to 1·75 in.; petioles about 3 in., winged in the upper half; stipules triangular, acuminate, much shorter than the petioles. *Cymes* sessile, shorter than the petioles, the very short axis bearing a few minute bracts and 6 or 8 flowers on pedicels ·1 in. long. *Flowers* ·25 in. long. *Calyx* very short and cupular, with 5 often minute teeth. *Corolla* coriaceous, rotate, the tube very short: the 5 lobes broadly triangular with thickened edges, reflexed, villous inside and bearing between the lobes 5 ovate exserted anthers on short filaments. *Style* ·1 in. long, bearing a large capitate-peltate corrugated stigma. *Disk* large, thick, cushion-like. *Fruit* solitary, on a thin peduncle ·15 in. long, compressed, obovate, smooth, cushion-like, glabrous. Hook. fil. Fl. Br.

Ind. III, 133. *C. glomerulatum*, Miq. Fl. Ind. Bat. Suppl. 585. *Memecylon pauciflorum*, Wall. Cat. 4114.

MALACCA: *Griffith* (K.D.) 2973; *Maingay* (K. D.) 862, 942. PENANG: *Wallich*, *Curtis* 1119, 694. SINGAPORE: *Ridley* 302, 358, 1895, 4124, 4893, 9421, 9518, 9857. JOHORE: *King and Hullett.* PAHANG: *Ridley* 2245. PERAK: *Scortechini.*

5. CANTHIUM GLABRUM, Blume Bijdr. 967. A small unarmed tree: young branches thinner than a goose-quill, 4-angled, pale-brown when dry, glabrous. *Leaves* thickly membranous or sub-coriaceous, elliptic or ovate-elliptic, olivaceous and dull when dry, shortly and rather abruptly acuminate, the base slightly and abruptly narrowed, or broad and rounded; upper surface glabrous, the lower with some white sub-adpressed hairs, especially by the sides of the stout midrib and larger nerves; main-nerves 6 to 8 pairs, spreading, slightly curved, inconspicuous on the upper and only slightly conspicuous on the lower surface; length 5 to 7 in.; breadth 2 to 3 in.; petiole ·4 to ·6 in. *Stipules* broadly triangular at the base, much acuminate, shorter than the petioles. *Cymes* many-flowered, about 1 in. in diam., on short peduncles, dichotomously branched. *Flowers* pentamerous, ·15 in. long, their pedicels slightly shorter. *Calyx* shortly campanulate or cupular, the mouth undulate and with 5 small triangular teeth. *Corolla* widely tubular, constricted at the throat, the limb with 5 deep valvate broadly lanceolate acute spreading or reflexed lobes. *Anthers* ovate, on short filaments in the throat, with a line of vertically deflexed stout white hairs just below them. *Stigma* large, sub-globular, rather turbinate, corrugated. *Ovary* 5-celled. *Fruit* ellipsoid, pulpy, 4-angled (when dry) often compressed, smooth outside, the two enclosed pyrenes triangular, the inner face of each being flat, the outer faces deeply grooved so as to leave a bold central keel. DC. Prod. IV, 478: Hook. fil. Fl. Br. Ind III, 133. *Plectronia glabra*, Kurz For. Fl. II, 35. *Vangueria? atroviridis*, Wall. Cat. 8412. *Rubiacea*, Wall. Cat. 8303.

In all the provinces: common.

This species is easily distinguished from *C. didymum* by its short widely tubular corolla slightly constricted just below the limb, that of *C. didymum* being hypocrateriform with a narrow tube. The fruit of this is also large and quite glabrous.

6. CANTHIUM DIDYMUM, Gaertn. fil. Fruct. III, 94. A tree: young branches without spines, nearly as thick as a goose-quill, 4-angled, at first brown, but afterwards pale, smooth, the nodes thickened. *Leaves* thinly coriaceous, glabrous, narrowly elliptic or ovate-lanceolate, occasionally sub-orbicular, the apices sub-acute, acute or shortly and bluntly acuminate, usually much narrowed at the base, but sometimes rounded; upper surface dark-brown when dry, shining, the lower paler: main-nerves 3 to 5 pairs, slightly curved, ascending, thin but prominent on

the lower surface as is the midrib, faint on the upper; length 2·5 to 6 in.; breadth 1·5 to 3·5 in.; petioles ·25 to ·3 in.; stipules ·25 in. long, triangular, with broad base and narrowly acuminate apex. *Cymes* sub-sessile or on short peduncles (·25 to 1 in. long) sometimes puberulous; branches longer than the peduncles, spreading, corymbose, crowded, many-flowered. *Flowers* about ·25 in. long, on unequal slender pedicels. *Calyx* less than ·1 in. long, narrowly campanulate; mouth with short acute teeth or truncate. *Corolla* salver-shaped, the throat villous: the mouth with 5 blunt oblong deflexed lobes as long as or longer than the tube. *Anthers* narrowly oblong, on filaments half their length, inserted on the throat, exserted and deflexed. *Style* glabrous; stigma sub-quadrate, notched or bifid. *Fruit* variable, always compressed and more or less didymous, usually somewhat obovoid or obovoid-ellipsoid, ·25 to ·6 in. long, minutely velvety: pyrenes with hard dark warted putamen. Roxb. Fl. Ind. I, 535: W. & A. Prodr. 425; DC. Prod. IV, 473; Wall. Cat. 8413; Hook fil. Fl. Br. Ind. III, 132; Trimen Fl. Ceyl. II, 343. *Plectronia didyma*, Kurz For. Flor. Burma. II, 35. *Psydrax dicoccos*, Gaertn. Fruct. p. 125, t. ·26; DC. Prod. IV, 476. *Vangueria dicocca* Miq. Fl. Ind. Bat., II 250. *Webera cymosa*, Willd. Sp. p. 1224. *Indeterm.* Wall. Cat. 9069.

In all the provinces, very common.

The South Indian species *C. umbellatum*, Wight, Ic. 1034 is, in my opinion, only a form of this species.

Doubtful Species.

7. CANTHIUM GRISEUM, King & Gamble. A shrub? Young branches nearly as thick as a goose-quill, striate and purplish-brown when dry. *Leaves* membranous, narrowly elliptic, tapering to each end; upper surface dark, sparsely strigose when young, afterwards glabrous; lower surface cinereous with pale curved hairs, especially on the midrib and 4 or 5 pairs of rather prominent little-curved ascending main-nerves; length (when young) 2 to 2·5 in.; breadth ·75 to 1·25 in.; petioles ·2 to ·25 in.; stipules broadly triangular, acute, much shorter than the petioles. *Flowers* ·2 in. long, pedicellate, crowded on short multi-bracteolate axillary branches longer than the petioles, the pedicels ·15 to ·2 in. long, pubescent. *Calyx* one-third the length of the corolla, rotate, with 5 long narrow spreading lobes. *Corolla* much pointed in bud, with a short wide tube puberulous outside but densely hairy inside; the 5 lobes about as long as the tube, triangular, acuminate, sub-erect. *Anthers* sub-sessile in the tube, included, elliptic. *Stigma* large, globose, ribbed. *Fruit* unknown.

LANKAWI; *Curtis* 2804.

Only once collected. Has a strong superficial resemblance to *Vangueria spinosa* Roxb.

36. Mesoptera, Hook fil.

A tree with stout terete branches and large, very coriaceous leaves: stipules large, coriaceous, unequal. *Flowers* minute, in dense ebracteolate axillary cymes shorter than the petioles. *Calyx-tube* short, hemispheric, 5-toothed. *Corolla-tube* short; throat hairy; lobes of the limb short, acute, valvate in bud. *Stamens* 5, inserted on the throat; filaments short, subulate; anthers oblong, apiculate. *Ovary* 2-celled: style short, stout; stigma capitate, 10-lobed: ovules 1 in each cell, attached to the septum. *Fruit* small, 2-celled and didymous, or 1-celled and globose, smooth: pericarp coriaceous, with a thin fleshy covering. *Seeds* cup-shaped, embracing a thick horny projection from the inner angle of the cell; testa adnate to the fleshy albumen: embryo slender, cylindric, coiled in the middle of the albumen; cotyledons short, obtuse; radicle long, superior.—A single Malayan species.

Mesoptera Maingayi, Hook fil. in Benth. & Hook. fil. Gen. Plantar. II. 131; Fl. Brit. Ind. III, 137. Young branches as thick as a goose-quill, deciduously rusty-tomentose. *Leaves* elliptic or broadly ovate; shortly acuminate, smooth and shining on the upper surface, rusty-tomentose on the lower; main-nerves 5 to 7 pairs, curved, ascending, depressed on the upper, bold and prominent on the lower surface; length 7 to 9 in.; breadth 4·5 to 5·5 in. *Stipules* very unequal and obtuse, with strong parallel nerves, one obliquely oblong, 1 in. in length, the other shorter and rounded; petiole ·5 in. long, very stout. *Cymes* less than ·5 in. in diam. in flower, but in fruit 2·25 in. in diam. and much branched, pubescent. *Fruit* when didymous ·2 to ·25 in. across; when single-seeded and globular about half as much.

Malacca: *Maingay* (K.D.) 939.

Known only from Maingay's two specimens in Herb. Kew. The above description is mainly copied from Sir Joseph Hooker's.

37. Gardeniopsis, Miq.

Shrubby or sub-arboreous, glabrous, with stout branches. *Leaves* very coriaceous, oblanceolate, many-nerved; stipules lanceolate, caducous. *Flowers* in small somewhat supra-axillary clusters without bracts or bracteoles. *Calyx* small, its tube cylindric; the limb with 5 spreading lobes. *Corolla* much larger than the calyx (1 in. or more in length); its tube widely cylindric, less than half as long as the limb; lobes of limb large, ovate, imbricate. *Stamens* 5, inserted near the base of the corolla-tube; the anthers linear, acuminate, included. *Style* short, stigma fusiform acute; ovary 2-celled with 1 ovule in each cell. *Fruit* broadly ovoid, rugulose, with 10 broad bold ridges, its sub-truncate apex surrounded by the enlarged thickened incurved calyx-lobes, 2-celled, 2-seeded. DISTRIB.—One or perhaps two species, both Malayan.

GARDENIOPSIS LONGIFOLIA, Miq. in Ann. Mus. Lugd. Bat. IV. 250 and 262. A small tree 10 or 12 feet high: young branches as thick as a goose-quill, pale-brown. *Leaves* coriaceous, oblanceolate, gradually narrowed, in their lower three-fourths, to the stout petiole; main-nerves 15 to 20 pairs, slightly curved upwards and interarching ·1 in. from the slightly recurved edges, the intermediate nerves are numerous but fainter, all prominent on the lower surface and depressed on the upper; both surfaces yellowish-brown, the lower paler and reticulate, length 6 to 16 in.; breadth 1·5 to 3·5 in.; petioles ·3 to ·5 in. long; stipules narrowly lanceolate, acuminate, ·4 to ·5 in. long. *Flowers* sessile in clusters of 5 or 6; the calyx-tube about ·1 in. long: the limb about ·15 in. across, its lobes ovate. *Fruit* ·4 to ·6 in. long.

MALACCA: *Derry* 960. PERAK: *Scortechini* 1234; *Wray* 2832, 3693; *King's Collector* 2361, 2850, 6934; *Ridley* 9722. PAHANG: *Ridley* 2661. NEGRI SEMBILAN: *Ridley* 10081. DISTRIB.—Sumatra.

There is what appears to be a distinct species of this in Borneo (*Haviland* 3011) with longer narrower calyx-lobes and fruit 1·25 in. long.

38. WEBERA, Schreber.

Trees or shrubs with thinly coriaceous or membranous leaves drying black. *Flowers* in terminal paniculate cymes, usually on bi-bracteolate pedicels. *Calyx-tube* campanulate or urceolate, the limb 5-toothed or 5-partite. *Corolla* cylindric or narrowly funnel-shaped; its tube shorter, equal to or longer than the lobes of the limb; throat glabrous or with a line of hairs; limb 5-lobed, narrowly oblong, spreading or reflexed, twisted in bud. *Stamens* 5, linear, inserted by short filaments on the throat. *Style* short, usually pubescent; *stigma* long, spindle-shaped or ligulate, grooved, exserted. *Ovary* 2-celled, each cell with a single or at most with 2 ovules. *Fruit* baccate, with little pulp, 2-celled; each cell with a single plano-convex seed often cupped on the plane surface: testa various, albumen fleshy or horny; embryo small, cotyledons leafy. DISTRIB.—About 20 species, all tropical.

The genus *Webera*, as understood in Hooker's Flora of British India, is composed of two sets of plants, one with 2 or more ovules in each cell of the ovary, the other with only a single ovule in each. The former are, in that work, formed into the section *Euwebera*. In these *Materials* the same plants are described under the genus *Stylocoryna* of Cavanilles. By other authors they have been treated as a genus either under the name of *Tarenna*, Gaertner or of *Chomelia*, Linn. (not of Jacquin and Vellosa). The species with single ovules in each cell are, in the Flora of British India, grouped in a section named *Pseudixora*. Here they are treated under the generic name *Webera*. The two sections, *Euwebera* and *Pseuidixora*, are thus, on account of their ovulation, removed to distant positions in the family of of *Rubiaceæ.*

Lobes of the corolla longer than its tube:—
Apices of the corolla-lobes acuminate, reflexed in bud and forming a stem at the apex of the flower-bud: fruit ovoid ... ... 1. *W. stellulata.*
Apices of the corolla-lobes not linear or reflexed in bud; fruit globular:—
Lobes of corolla with ciliate margins; calyx ·25 in. long, its lobes large, oblong-lanceolate, acuminate ... ... 2. *W. Ridleyi.*
Lobes of corolla glabrous; calyx ·15 in. long, its lobes broadly triangular, acute:—
Leaves 5 to 8 in. long, with 8 to 10 pairs of nerves ... ... 3. *W. Wallichii.*
Leaves 2·5 to 3·5 in. long, with 5 or 6 pairs of nerves ... ... 4. *W. Curtisii.*
Lobes of the corolla and its tube of equal length ... 5. *W. odorata.*
Lobes of the corolla shorter than its tube:—
Cymes trichotomously panicled, on peduncles several inches in length:—
Calyx a little over ·1 in. long, the limb with 5 short blunt teeth; leaves glabrous with 8 to 10 pairs of nerves ... ... 6. *W. grandifolia.*
Calyx ·15 in. long, the limb with 5 deeply linear lobes as long as its tube; leaves puberulous beneath, with 8 to 16 pairs of nerves ... 7. *W. longifolia.*
Cymes condensed, with very short peduncles:—
Leaves glabrous and with 16 to 18 pairs of sub-horizontal nerves; lobes of calyx linear-lanceolate, longer than the tube ... ... 8. *W. Wrayi.*
Leaves with scattered adpressed hairs on the under surface, especially on the midrib and 8 to 10 pairs of nerves; lobes of calyx less than half as long as its tube, triangular, sub-acute ... 9. *W. Yappii.*

1. WEBERA STELLULATA, Hook. fil. Fl. Br. Ind. III. 104. A shrub: young branches much thinner than a goose-quill, dark-coloured, sub-terete, glabrous. *Leaves* thinly coriaceous, oblong-elliptic to elliptic, shortly acuminate at the apex, cuneate at the base, upper surface glabrous, shining, very dark when dry, the midrib and nerves depressed; the lower paler and dull, sometimes puberulous when young, but usually glabrous; main-nerves 7 to 10 pairs, rather faint, curved, ascending: length 4·5 to 9 in.; breadth 1·5 to 2·5 in.; petiole ·25 to ·4 in.; stipules ovate, acuminate, ·15 in. long. *Cymes* (including the short peduncle) 1 to 1·5 in. long, terminal, solitary, at first puberulous, afterwards glabrous, trichotomous, rather few-flowered; the bracteoles

linear-lanceolate, persistent. *Flower-pedicels* shorter than the calyx, bracteolate. *Calyx* about ·15 in. long, narrowly campanulate, cut about half-way down into 5 acute triangular lobes. *Corolla* ·4 in. long; the tube cylindric, only ·1 in. long; the limb ·3 in. long, its lobes imbricate, oblong, acuminate with free reflexed linear points; throat slightly hairy. *Anthers* linear, acuminate, on short filaments, included. *Ovary* with two 1-ovuled cells; *style* much shorter than the fusiform hairy included stigma. *Fruit* broadly ovoid or sub-globular, crowned by the calyx-lobes, glabrous, 4 in. long. *Seeds* 2. *Stylocoryne Webera*, Wall. Cat. 840 I (*in part*). *Pavetta aristata*, Wall. Cat. 6169.

PENANG: *Wallich.* MALACCA: *Griffith* (K.D.) 3086; *Maingay* (K.D.) 850. SELANGOR: *Ridley*, 10220. PERAK: *King's Collector*, 973, 4309, 5951, 6169, 10228; *Wray*, 458, 1094, 3745.

Some of the specimens of this have the leaves of a pale olivaceous-brown colour (when dry), contrasting in this respect strongly in colour with the majority which are very dark. The species is well-marked by its corolla, the tube of which is only one-quarter as long as the oblong lobes of the limb, while the five linear points of the latter are reflexed and form a kind of star at the apex of the flower-buds. The lobes do not appear to expand, for in all the specimens I have seen they remain convolute.

2. WEBERA RIDLEYI H.H.W. Pearson MSS. in Herb. Kew. A low glabrous shrub; young branches pale-brown, obtusely 4-angled. *Leaves* thinly coriaceous, narrowly elliptic, acute or shortly acuminate, the base cuneate; both surfaces olivaceous-brown, shining (especially the upper) when dry, main-nerves 10 to 14 pairs, curved, spreading, faint but distinct on both surfaces; length 5·5 to 7 in.; breadth 2 to 3 in.; petioles ·4 to ·7 in.; stipules broadly triangular, acute, about ·2 in. long. *Cymes* several together, terminal, in short pedicels, trichotomous, few-flowered; the branchlets angled and with a few permanent boat-shaped acute bracteoles. *Flower* pedicels about as long as the calyx, bibracteolate near the apex. *Calyx* ·25 to ·3 in. long, campanulate, the limb as long as the tube, deeply divided into 5 oblong-lanceolate acuminate lobes. *Corolla* not much longer than the calyx; the tube short; the limb three times longer and deeply divided into 5 oblong, acute, contorted lobes with ciliate margins. *Anthers* 5, inserted on the throat in a band of hair. *Ovary* with two uni-ovulate cells; *style* very short: stigma fusiform, sulcate, glabrous. *Fruit* fusiform, glabrous, the calyx-scar apiculate.

SINGAPORE: at Chan Chu Kang, *Ridley*, 6147. JOHORE: *King*, 602, PERAK: *King's Collector*, 4585, 4615.

Only once collected and not in fruit; flowers white. A species near *W. Wallichii* but with longer corolla lobes ciliate at the margin.

3. WEBERA WALLICHII, Hook fil. Fl. Br. Ind. III. 105. A shrub 4 to 8 feet high, glabrous except the branches of the inflorescence and the calyx: young branches thinner than a goose-quill, usually dark-coloured, obscurely 4-angled. *Leaves* membranous, oblong-elliptic, oblong, or elliptic, rarely oblanceolate, the apex shortly acuminate, the base cuneate; both surfaces more or less darkly olivaceous when dry, the midrib rather bold; main-nerves 8 to 10 pairs, slightly curved, ascending, thin and only slightly prominent; length 5 to 8 in.; breadth 2 to 2·75 in., petiole ·4 to ·6 in. *Stipules* broadly triangular, acuminate, ·25 in. long. *Panicles* terminal, much branched, shortly pedunculate, about 1·25 to 2·5 in. long including the peduncle, and equally broad branches and their divisions puberulous, cymose; bracteoles triangular acute, about 1 in. long. *Flowers* ·4 to ·6 in. long, on compressed pedicels longer than the calyx. *Calyx* ·15 in. long, bracteolate (often bibracteolate) at the base, shortly campanulate, with 5 broadly triangular acute teeth, puberulous externally. *Corolla* ·45 in. long, glabrous, salver-shaped, the short tube with a belt of hair inside: the lobes linear-lanceolate, longer than the tube, reflexed. *Anthers* 5, exserted, linear-oblong, the apex sub-acute, the base blunt and prolonged beyond the attachment to the short filament. *Style* cylindric, hairy in the middle: stigma as long as the style, compressed, exserted. *Fruit* fusiform, glabrous, reticulate when dry, shining, not ridged, crowned by the small calyx, ·4 in. long and ·3 in. in diam. *Seeds* 2. *Stylocoryne Webera*, Wall. Cat. 840, I (*for the most part*). *Pavetta weberæfolia*, Wall. Cat. 6182 A, in part B.

MALACCA: *Griffith* (K D.) 3084, 3004; *Maingay* (K.D.) 851. PERAK: *Wray*, 3745; *King's Collector*, 1932, 2516, 2921, 2794, 5032, 5957, 10228; *Scortechini*, 429.

4. WEBERA CURTISII, King, n. sp. A small shrub; all parts glabrous except the cinereous-puberulous inflorescence. *Leaves* coriaceous, narrowly elliptic, shortly acuminate, the base cuneate; both surfaces drying dark olivaceous-brown, the lower paler; main-nerves 5 or 6 pairs, rather straight, ascending: length 2·5 to 3·5 in.; breadth ·9 to 1·35 in. petiole ·15 to ·3 in.; stipules ovate or ovate-lanceolate, much acuminate. *Cymes* terminal, sub-sessile, only about 1 in. in diam. each way, trichotomous, few-flowered, the short branches and the flower-pedicels cinereous-puberulous, angled; pedicels slightly longer than the calyx; *Calyx* ·1 in. long, campanulate; the limb with 5 acute triangular erect lobes. *Corolla-tube* widely cylindric, not much exceeding the calyx, and about one-third of the length of the 5 imbricate, oblong, blunt, reflexed lobes of the limb. *Style* shorter than the lobes of the limb, but exserted on account of their reflexion; clavate, grooved. *Ovary* 2-celled: cells each with a single ovule. *Fruit* globular, crowned by the small

calyx-scar, glabrous, ·2 in. in diam. when dry. *Seeds* 2, plano-convex, the plane surface with a large pit.

KEDAH: *Curtis*, 2545, 2546. LANGKAWI: *Curtis*, 2805. PERAK: *Wray*, 3612.

5. WEBBRA ODORATA Roxb., Hort. Beng. 15: Fl. Ind. I, 699. A short shrub 6 to 10 feet high; young branches cinereous, sub-terete, *Leaves* membranous oblong-elliptic (often narrowly so), shortly acuminate, the base much narrowed; both surfaces dull, glabrous, the lower pubescent in *var.*, deep olivaceous when dry: main-nerves 8 or 9 pairs, faint, little curved, ascending or spreading, length 5 to 8 in.; breadth 1·5 to 3 in.; petiole ·4 to ·8 in.; stipules triangular, acuminate, much shorter than the petioles. *Cymes* large terminal, paniculate, trichotomous, lax, 5 or 6 inches wide and equally long, spreading; the peduncles and branches long and slender, 4-angled, cinereous-pubescent: bracteoles linear, persistent. *Flower-pedicels* as long as or longer than the flowers, pubescent. *Calyx* urceolate-campanulate, about ·1 in. long; the teeth shorter than the tube, lanceolate. *Corolla-tube* slender, cylindric, ·25 in. long, the lobes imbricate, clavate in bud, about the same length, narrowly oblong, acute, sub-falcate, reflexed, their upper surfaces glabrous. *Ovary* 2-celled, each cell with 2 ovules; *stigma* exserted, clavate-subulate. *Fruit* the size of a large pea, 2-celled, 2-seeded. Hook fil. Fl. Br. Ind. III, 102. *W. macrophylla*, Roxb. l.c. 697. *Pavetta weberæfolia*, Br. in Wall. Cat. 6182 A, in part. *P. cerberæfolia*, Miq. Fl. Ind. Bat. II, 279. *Stylocoryne Webera* Wall. Cat. 8401. *S. penangensis*, Miq. l.c. 207. *Cupia macrophylla* DC. Prod. IV, 394.

PENANG: *Wallich.* PERAK: *King's Collector* 3121, 3807, 4236; *Wray* 1147.

VAR. *pubescens*, King; lower surfaces of leaves pubescent.

PERAK: at 3400 feet: *Wray*, 474.

6. WEBERA GRANDIFOLIA, Hook. fil. Fl. Br. Ind. III. 105. A shrub or small tree: young panicles obtusely 4-angled, deciduously and minutely rusty-pubescent. *Leaves* thinly coriaceous, elliptic to elliptic-oblong or oblong-oblanceolate, shortly and often abruptly acuminate, much narrowed at the base: both surfaces (when dry) brown, tinged with olivaceous, the lower slightly the paler, quite glabrous; main-nerves 8 to 12 (rarely as many as 16) pairs, thin but distinct on both surfaces, spreading, curved: length 5 to 10 (rarely 12) in.; breadth 2 to 4 in.; petiole ·4 to ·75 in.; stipules broadly ovate, shortly acuminate, ·2 to ·3 in. long. *Cymes* as in *W. longifolia*, but on shorter peduncles and with fewer bracteoles. *Calyx* slightly more than ·1 in. long, flask-shaped, the limb with 5 short blunt teeth. *Flowers* as in *W. longifolia*, but slightly

shorter, and more obovate in bud; *fruit* as in *W. longifolia*. *Ixora grandifolia*, Br. in Wall. Cat. 6134.

Malacca: *Griffith* (K.D.) 2796; *Maingay* (K.D.) 854. Singapore; *Wallich*; *Ridley* 1800, 3764, 10411, 10852. Perak: *Wray* 3001, 3377: *Ridley* 5557; *King's Collector* 763. Johore: *Ridley*, 11167.

7. Webera longifolia, Hook. fil. Fl. Br. Ind. III, 105. A shrub, young branches thinner than a goose-quill, obtusely 4-angled, deciduously rusty-puberulous. *Leaves* thinly coriaceous, oblanceolate, elliptic-oblong or elliptic-lanceolate, shortly acuminate, narrowed from the middle or above it to the short petiole; both surfaces drying olivaceous-brown; the upper glabrous and shining, the lower deciduously cinereous-puberulous, main-nerves 8 to 16 pairs, spreading, slightly prominent on the lower surface, faint on the upper, length 6 to 12 in.: breadth 2 to 3 in.: petiole ·4 to 1 in.; stipules ovate, much acuminate, hairy, about ·3 in. long. *Cymes* erect, terminal, paniculate, trichotomous, on rusty-pubescent obtusely 4-angled peduncles several inches (sometimes 9 or 10) in length: ultimate branchlets crowded: the flower-pedicels each with 2 linear bracteoles at its base. *Calyx* ·15 in. long, narrowly campanulate, divided into 5 deep linear hairy lobes as long as the tube. *Corolla* pubescent, about ·65 in. long; the tube cylindric, more than twice as long as the oblong obtuse lobes. *Style* exserted. *Ovary* 2-celled, each cell with one ovule. *Fruit* globular, glabrous, 4 in. in diam. (when dry), crowned by the long linear calyx-lobes. *Ixora longifolia*, G. Don. Gen. Syst. III, 573. *I. macrophylla* Br. in Wall. Cat. 6165 (not of Bartl.). *Pavetta longifolia*, Miq. Fl. Ind. Bat. II, 275.

Penang: *Wallich, Phillips*; *Ridley*, 9395; *Curtis* 947, 1144. Perak: *King's Collector*, 2737, 3825, 6220, 6632, 10662; *Wray*, 2081, 2864, 2885; *Scortechini*, 228; *Ridley*, 2920. Johore: *Ridley*, 11166.

8. Webera Wrayi King, n. sp. Glabrous, except the inflorescence: young branches 4-angled, thinner than a goose-quill. *Leaves* thinly coriaceous, large, oblong-elliptic, shortly acuminate, cuneate at the base; both surfaces blackish-olivaceous when dry, shining, the midrib conspicuous on both, channelled on the upper; main-nerves 16 to 18 pairs, spreading, sub-horizontal, faintly visible on both surfaces; length 9 to 11 in. long; breadth 2·5 to 3·5 in.; petiole ·5 in. long, narrowly winged above. *Cymes* terminal, umbellately panicled, about 1·25 in. long and broad; the branches few, pubescent, slender, angled, few-flowered, the bracteoles minute: pedicels shorter than the calyx, pubescent, bracteolate. *Calyx* ·15 in. long, narrowly campanulate, the teeth linear-lanceolate, pubescent, erect, longer than the tube. *Corolla* narrowly funnel-shaped, puberulous outside, ·35 in. long: lobes linear-oblong, blunt, about a third of the length of the tube. *Stigma* narrowly clavate, exserted,

glabrous. *Fruit* depressed-globular, smooth, shining, black when dry, crowned by the small calyx-scar, ·4 in. in diam. and ·25 in. long. *Seeds* 2, plano-convex with a depression on the plane side.

PERAK: *Scortechini*; *Wray*, 2477.

9. WEBERA YAPPII, King, n. sp. Young branches thinner than a goose-quill, pale-brown when dry, glabrous. *Leaves* membranous, narrowly oblong-elliptic, acuminate, the base cuneate, both surfaces olivaceous when dry, the upper quite glabrous, the midrib slightly channelled; the lower paler, glabrous but for a few scattered adpressed pale hairs chiefly along the prominent midrib and 9 or 10 pairs of curved ascending distinct nerves: length 5 to 7 in.; breadth 1·5 to 1·75 in.; petioles ·3 to ·5 in.; stipules broadly lanceolate-oblong, blunt, shorter than the petiole. *Cyme* on a short peduncle, terminal, paniculate, condensed, about 2·5 in. in diam., its branches pubescent; bracteoles few, linear. *Flower-pedicels* about as long as the calyx. *Calyx* ·1 in. long, narrowly campanulate, pubescent; its 5 lobes less than half as long as the tube, triangular, sub-acute, rusty-pubescent. *Corolla-tube* narrowly infundibuliform, about ·4 in. long, pubescent; the 5 blunt oblong lobes of the limb imbricate in bud, reflexed where expanded, glabrous. *Style* short; stigma slightly exserted, ligulate. *Fruit* the size of a small pea, glabrous. *Seeds* 2, plano-convex.

PERAK: *Yapp*. 482; *Wray* 10.

39. IXORA, Linn.

Shrubs or small trees with terete branches. *Leaves* opposite, rarely in whorls of three, often coriaceous, rarely sessile. *Stipules* interpetiolar, often with broad bases and acuminate or linear apices, deciduous or persistent. *Flowers* in terminal trichotomously branched, often corymbose *cymes*, each bi-bracteolate, rarely 5-merous. *Calyx-tube* campanulate, often narrowly so; the limb 4-toothed, persistent. *Corolla* salver-shaped: the tube narrowly cylindric much longer than the calyx, rarely widened towards the apex, the throat naked or hairy; the limb with 4, rarely 5 spreading or reflexed lobes, twisted in bud. *Stamens* as many as the corolla-lobes, and inserted on its mouth by short filaments or sessile; anthers linear or oblong usually acuminate, the base bifid, dorsifixed, erect, more or less exerted. *Ovary* 2-celled. *Style* filiform, exserted but never twice as long as the corolla-tube. *Stigma* slender, fusiform before expansion, after expansion its two arms curved and divergent; ovules solitary, peltately attached to the septum of each cell: micropyle inferior. *Fruit* globose or didymous, with 2 plano-convex or ventrally concave coriaceous pyrenes. *Seeds* of the same shape as the pyrenes; testa membranous; albumen cartilaginous;

embryo curved; cotyledons foliaceous; radicle inferior.—DISTRIB. Species about 110; mostly tropical Asiatic and African.

Lobes of the calyx as long as, or longer than, its tube:—
- Leaves hairy beneath:—
  - Calyx-lobes narrowly lanceolate, acuminate ... 1. *I. Brunonis.*
- Leaves everywhere glabrous:—
  - Calyx-lobes broadly lanceolate, acute, unequal ... 2. *I. merguensis.*
  - Calyx-lobes broad, blunt, unequal; bracts not covering the calyces ... ... 3. *I. Kingstoni.*
  - Calyx-lobes ovate, obtuse, puberulous; bracts longer than the calyces and covering them ... 4. *I. multibracteata.*
  - Calyx-lobes narrowly lanceolate, about as long as the tube ... ... 5. *I. arguta.*

Lobes of the calyx shorter than its tube:—
- Lobes acute:—
  - Tube of corolla 1 to 1·25 in. long:—
    - Leaves sessile, cordate at the base, 2 to 3 in. long ... ... 6. *I. coccinea.*
    - Leaves elliptic to oblong-elliptic, not cordate, 6 to 9 in. long; their petioles ·3 to ·5 in. long ... ... 7. *I. congesta.*
  - Tube of the corolla ·25 to ·3 in. long:—
    - Leaves oblong-elliptic, shortly petiolate, 3·5 to 5 in. long; cymes with many divergent branches 8. *I. undulata.*
- Lobes blunt:—
  - Tube of corolla 1 to 1·25 in. long:—
    - Cymes pendulous on long slender peduncles 9. *I. pendula.*
    - Cymes not pendulous; peduncles 1 to 2 in. long:—
      - Main-nerves of leaves 15 to 20 pairs ... 10. *I. opaca.*
      - Main-nerves of leaves 8 to 12 pairs ... 17. *I. grandifolia,* var. *Kurziana.*
  - Tube of corolla 1 to 1·75 in. long:—
    - Cymes lax, spreading, leaves petiolate, acute at the base; branching shrubs (often tall):—
      - Leaves thinly membranous, their main-nerves 15 to 25 pairs ... ... 11. *I. Lobbii.*
      - Leaves coriaceous, their main-nerves 10 to 12 pairs ... ... 12. *I. fulgens.*
    - Cymes not spreading, simple unbranched shrubs 1 or 2 feet high; leaves sessile, oblanceolate, cordate at the base:—
      - Main-nerves of leaves 15 to 18 pairs ... 13. *I. humilis.*
      - Main-nerves of leaves 8 to 10 pairs ... 14. *I. Scortechinii.*
  - Tube of corolla ·8 in. long; cymes dense, 2 to 3 in. in diam. ... ... 15. *I. stricta.*

Tube of corolla ·4 in. long; cymes lax, slightly branched, 1 to 1·5 in. long ... ... 16. *I. concinna.*
Tube of corolla ·2 to ·4 in. long:—
Cymes 2 to 4 in. across, branched, spreading:—
Leaves coriaceous: cymes branched from the base ... ... 17. *I. grandifolia.*
Leaves membranous; cymes on long slender naked peduncles 3 to 4 in. long ... 18. *I. diversifolia.*

1. Ixora Brunonis, Wall. Cat. 6136. A shrub; young branches thicker than a crow-quill, covered with short cinereous-brown tomentum. *Leaves* thinly membranous, sessile, oblanceolate, sometimes sub-panduriform, shortly caudate-acuminate, tapering much to the rounded or minutely cordate base; upper surface with the interspaces shining and glabrous, the depressed midrib and 10 to 12 pairs of rather faint curved ascending main-nerves minutely tomentose; lower surface with minute spreading pubescence especially on the prominent midrib, main-nerves and reticulations, length 5 to 10 in.; breadth 1·5 to 2·25 in.; stipules with broad ovate bases with stout midribs, and long thin linear apical tails, length (including the tails) ·5 in. *Cymes* about 1·5 in. long, 12- to 20-flowered, on short tomentose peduncles, 4 to 6 collected in corymbs on the apices of the branches, their bracteoles filiform and hairy. *Flowers* sessile; calyx ·15 to ·2 in. long, narrowly campanulate, the 4 teeth narrowly lanceolate, acuminate, as long as the tube. *Corolla* 1 to 1·5 in. long, externally with long cinereous spreading deciduous hairs, ultimately nearly glabrous; the tube very narrowly cylindric, glabrous and ridged inside, the throat hairy: limb ·5 in. across, its lobes 4, oblonge-elliptic, acute, spreading or reflexed, quite glabrous on the upper surface, sparsely hairy on the lower. *Anthers* elongate, narrow, acuminate, deflexed, longer than their filaments. *Stigma* slender, slightly exserted. *Fruit* ovoid, puberulous, ·35 in. long, and ·25 in. in diam. when dry. G. Don Gen. Syst. III. 573; Kurz Flora Burm. II. 20; Hook fil. Fl. Br. Ind. III. 139. *Pavetta Brunonis*, Miq. Fl. Ind. Bat. II, 270 (not of Wight Icon.)

Penang: *Wallich*, (6136); *Phillips; Ridley*, 7682. Perak: *Wray*, 3478, 3524; *King's Collector*, 1658. Singapore: *Lobb.* Malacca: *Maingay* (K.D.) 858. Distrib. Burma; *Wall. Cat.* 8447.

2. Ixora merguensis, Hook fil. Fl. Br. Ind. III. 140. A robust shrub only 2 or 3 feet high, glabrous; stem as thick as a swan's-quill, compressed, cinereous. *Leaves* large, coriaceous, elliptic-oblong or obovate, abruptly and shortly acuminate, the base very cuneate: both surfaces olivaceous and dull; when dry the lower paler and reticulate; main-nerves 10 to 14 pairs, slender, slightly curving upwards; length 7 to 12 in.; breadth 2·25 to 4 in.; petioles ·5 to 1 in., stout, channelled. *Cyme*

globose, sub-sessile, terminal, with numerous very short branches, about 3 in. in diam., dense, many-flowered, pedicellate, each flower with a lanceolate small bract. *Calyx* ·15 in. long, campanulate, the 4 lobes of the limb unequal, broadly lanceolate, acute, somewhat longer than the tube. *Corolla-tube* puberulous, ·6 in. long, cylindric, narrow below, somewhat wider above; the limb ·6 in. across; its lobes oblong, broad, blunt, spreading, the throat with a few hairs. *Anthers* sub-sessile, narrow, apiculate. *Fruit* unknown.

MALAY PENINSULA: *Griffith* (K.D.) 3003. PUNGAH: *Curtis*, 2961. PERAK: *Wray*, 3543?

Mr. Curtis has sent from Pungah two specimens bearing the number 2961, one in Herb. Kew and the other in Herb. Calcutta. The one in Herb. Calcutta is typical *I. merguensis*; that in Kew forms the variety described below.

VAR. *Curtisii*, King & Gamble; *leaves* narrowly elliptic-oblong, not at all obovate; nerves about 14 pairs, curving upwards, distinct on both surfaces; length 14 in.; breadth 4·25. *Corolla-tube* about ·8 in. long, cylindric, widening upwards, puberulous; its limb nearly 1 in. across; the lobes ovate-lanceolate, sub-acute, the throat hairy.

PUNGAH: *Curtis*, 2961.

3. IXORA KINGSTONI, Hook. fil. Fl. Br. Ind. III, 140. A shrub or small tree: young branches as thick as a duck's quill, terete, smooth and dark-coloured when dry. *Leaves* thinly membranous, shining and of a pale warm-brown colour when dry; glabrous, oblong or elliptic-oblong, sometimes oblanceolate, the apex with a short usually blunt point, tapered from below the middle to the short petiole; the reticulations slender; main-nerves 15 to 18 pairs, slender, spreading; length 5 to 9 in.; breadth 2 to 3 in.: petiole ·4 to ·5 in. channelled; stipules semilunar, broad but only about ·1 to ·15 in. long, the apex bearing a short bristle. *Cymes* 4 to 6, in a dense terminal corymbose panicle 3 or 4 in. in diam., each on a puberulous bracteate peduncle about ·5 in. long (longer in fruit) and bearing numerous bibracteolate flowers, the bracts and pairs of bracteoles ovate-lanceolate, subcoriaceous, sub-acute, more or less persistent. *Flowers* 4-merous, sessile, crowded. *Calyx* ·2 to ·3 in. long; the tube short, narrow; the limb with 4 large deep broad blunt lobes longer than the tube, one usually longer than the other 3 and resembling the bracts and bracteoles in texture. *Corolla-tube* 1 to 1·25 in. long, slender, cylindric, glabrous; the limb ·5 to ·6 in. across, the lobes broadly obovate, obtuse, spreading. *Anthers* narrow, apiculate, reflexed, longer than their filaments. *Stigma* slightly exserted, small. *Fruit* ovoid, puberulous, crowned by the persistent calyx-lobes; length (including calyx-lobes) ·7 in.: diameter ·3 to ·4 in (when dry).

MALACCA: *Griffith* (K.D.) 2996; *Goodenough*, 1271. PERAK: *Scortechini*, 2030; *Wray*, 626; *King's Collector*, 733, 871, 920, 932, 2540, 3167, 4200, 5972. SELANGOR: *Ridley*, 3674, 7300; *Curtis*, 2346. JOHORE: *Curtis*.—DISTRIB. Andaman Islands.

The corolla, according to Kunstler, is yellowish-red. The Andamanese specimens look slightly different, and may belong to a new species. Fruit of the Andaman plant is wanting.

4. IXORA MULTIBRACTEATA, H. H. W. Pearson in Kew Bull. ed. A bush or small tree, all parts glabrous except the inflorescence; young branches thinner than a goose-quill, somewhat compressed, pale when dry. *Leaves* membranous, pale yellowish-green when dry, oblong-oblanceolate to oblong-elliptic, shortly and bluntly acuminate, much narrowed to the base; both surfaces finely reticulate, main-nerves 10 to 16 pairs, slightly curved, spreading, faint on both surfaces; length 5 to 9 in.; breadth 1·5 to 3 in.; petiole ·3 to ·6 in.; stipules cupular, only about ·1 to ·15 in. long, shortly apiculate. *Cymes* axillary and terminal, from 2·5 to 5 in. in diam. with many spreading ridged glabrous branches, and a peduncle less than 1 in. long; bracts at the bases of the branchlets broad, blunt, from. ·2 to ·3 in. long; ultimate branchlets with numerous imbricate ovate-triangular sub-cordate obtuse puberulous 1-nerved bracts ·2 in. long at their bases, and 3 to 5 flowers nearly 1·5 in. in length; flower bracteoles ovate-obtuse, nerved, about ·15 in. long. *Calyx* sessile, about ·25 in. long, puberulous, its lobes 4, ovate, obtuse. *Corolla-tube* puberulous outside, glabrous within, narrowly cylindric, 1 in. to 1·25 in. long: its limb nearly ·5 in. across: the 4 lobes oblong, blunt, glabrous. *Anthers* longer than the very short filaments, narrowly oblong, short, apiculate, the base sagittate. *Fruit* unknown.

MALACCA: *Maingay* (K. D.) 856. PUNGAH: *Curtis* 2954. LANKAWI; *Curtis* 3408. ANDAMANS: *Helfer* (K. D.) 2997. PERAK: *Scortechini; Wray* 3317. QUEDAH: *Ridley* 5540.

A species allied to *I. Kingstoni*, Hook. fil., but with less membranous leaves. It is readily distinguished by the numerous bracteoles at the bases of the flowers and by the large imbricate bracts at the bases of the ultimate branchlets.

5. IXORA ARGUTA, Br. in Wall Cat. 6157. A tree; all parts except the inflorescence glabrous; young branches much thinner than a goose-quill, obtusely 4-angled, glabrous, dark-coloured. *Leaves* thinly coriaceous, broadly oblanceolate, rarely obovate or elliptic, rather abruptly and shortly acuminate, the base much narrowed, both surfaces drying very dark-brown, almost concolorous, shining; main-nerves 6 or 7 pairs, curved, spreading, faint on both surfaces; length 3·5 to 6 in.; breadth 1.5 to2·25 in.; petiole ·2 to ·4 in.; stipules lanceolate, linear-acuminate,

shorter than the petiole. *Cymes* solitary, terminal on peduncles 1·9 to 3 in. long, spreading, trichotomous, many-flowered, the bracteoles linear, persistent. *Flower-pedicels* shorter than the narrowly campanulate calyx. *Calyx* less than ·1 in. long, narrowly campanulate, its 4 or 5 narrowly lanceolate acute teeth as long as the tube, erect. *Corolla-tube* narrowly cylindric, ·4 or ·5 in. long: the limb with 5 oblong apiculate lobes ·2 in. long. *Stigma* narrowly fusiform (before the expansion of its lobes), slightly exserted. *Fruit* like a small pea if one-seeded; broader and with two vertical groves if two-seeded, crowned by the small scar of the calyx, glabrous, smooth. *I. nigricans*, Hook. fil. Fl. Br. Ind. III. 149, VAR. *arguta*. *I. nigricans*, Wall. Cat. 6154 B. and C. only.

PERAK: *Wray* 2135, *Curtis* 1303, 980; *Kings Collector* 684, 870, 2072, 4286, 4573, 4966, 8718, 10269, 10658, 10901; *Scortechini*. KEDAH: *Ridley* 8299. SELANGOR: *Ridley* 8240. WELLESLEY: *Ridley* 7013; *Curtis*, 2451, 3206. MALACCA: *Maingay* (K.D.) 859.

The type specimens of this in the Wallichian Catalogue consist of two sheets distinguished by the letters A and B. The former was received from Herb. Heyne, and is therefore supposed to have come from Southern India. Sheet B is attributed to Penang. What appears to be the same plant but with somewhat broader leaves also forms B and C of No. 6154 which was distributed under the name *I nigricans*, R. Br. Under this name (*I. nigricans*, R. Br.) there were unfortunately issued by Wallich two other plants lettered respectively 6154 A and D. These two not only differ from B and C, but also from each other. The name has however been adopted in the Flora of British India and the Wallichian No. 6154, without distinction of letters, has been taken as its basis. As the simplest solution of the confusion which has thus arisen, I have ventured to restore the MSS. name *I. arguta*, R. Br. for the plant—a common one in all the provinces—above described.

6. IXORA COCCINEA Linn. Sp. Pl. 159 (excl. syn.) A much branched shrub, the smaller branches of the cymes and the calyces puberulous, otherwise quite glabrous; young branches thinner than a goose-quill, pale. *Leaves* coriaceous, pale when dry, broadly ovate or elliptic, sessile, the base cordate and stem-clasping or slightly narrowed; the apices sub-acute or blunt and mucronate; nervation indistinct when dry; length 2 to 3 in.; breadth 1·25 to 1·75 in.; stipules narrowly semilunar with long straight linear stiff apices. *Cymes* several together, at the apices of the branches, each on a short peduncle, minutely bracteate and bracteolate; *calyx* less than ·1 in. long, puberulous cylindric, with 4 acute teeth shorter than the tube. *Corolla-tube* 1·25 to 1·5 in. long, narrowly cylindric; the 4 lobes of the limb broad, acute, spreading, ·25 in. long. *Fruit* fusiform, sometimes pulpy. Roxb. Fl. Ind. I, 375; W. & A. Prod. Fl. Pen. Ind. 427; Wight Icon. 153; Brand. For. Flora 275; Kurz. For. Flora, Burma II, 26; Hook. fil. Fl. Br. Ind.

III, 145. *I. grandiflora*, Br. in Bot. Reg. t. 154; DC. Prod. IV, 486. Wight in Hook. Bot. Misc. III. Suppl. t. 35. *I. propinqua*, Br. in Wall. Cat. 6119. *I. incarnata*, DC. Prod. l.c. *I. obovata*, Heyne in Roth Nov. Spec. 90. *I. Bandhuca*, Roxb. Hort. Beng. 10; Fl. Ind. I. 376; Wall. Cat. 6120; DC. Prod. l.c.; Wight Ic. 149. *Pavetta coccinea* and *P. incarnata*, Blume Bijdr. 950. *P. Bandhuca*, Miq. Fl. Ind. Bat. II, 266.

In most of the provinces; cultivated on account of its brilliant scarlet flowers.

7. Ixora congesta, Roxb. Fl. Ind. I 387. A shrub, glabrous except the smaller branches of the cymes; young branches half as thick as a goose-quill, dark-coloured. *Leaves* thinly coriaceous, elliptic to oblong, elliptic, sub-acute or shortly and bluntly acuminate, the base rounded or cuneate; both surfaces brown when dry and rather dull, the lower paler; main-nerves 12 to 20 pairs, spreading and interarching at the tips, depressed on the upper and prominent on the lower surface; length 6 to 9 in.; breadth 2·25 to 4 in.; petioles ·3 to ·5 in.; stipules ·15 in long, broad, shortly cuspidate. *Cyme* terminal, corymbiform, trichotomous on a short peduncle, 2·5 to 4 in. long (including the peduncle) and rather more in diam., condensed, the branches many-flowered. *Calyx* sessile or on a short pedicel, less than ·1 in. long, with 4 triangular acute teeth shorter than the tube. *Corolla-tube* 1·25 to 1·5 in. long, narrowly cylindric; its limb ·5 or ·6 in. across, its 4 lobes spreading or reflexed, ovate-lanceolate, blunt or sub-acute, ·25 to ·3 in. long; *stigma* slender, slightly exserted. *Fruit* compressed, fusiform, with 2 vertical grooves, glabrous. DC. Prod. IV, 486; Wall. Cat. 6138. Hook. fil. Fl. Br. Ind. III, 146. *I. Griffithi*, Hook. Bot. Mag. t. 4325. *I. fulgens*, Wall. Cat. 6512 B. *Pavetta congesta*, Miq. Fl. Ind. Bat. II, 269.

Singapore: *Lobb; Anderson* 92; *Ridley* 5674, 6911. Johore: *King*, *Ridley* 4168. Malacca: *Griffith* (K.D.) 2984; *Maingay* (K.D.) 848; 848-2; *Ridley* 5675, 6911; *Derry* 8; *Goodenough* 1967. Penang: *Wallich; King*; *Curtis* 1729, 1730, 2265, 2975. Perak: *Scortechini; King's Collector* 675, 2448 2865, 2867, 3982, 3998; *Wray*. Distrib:—Malayan Archipelago, Burma.

Allied to *I. Lobbii*, Loud. but with more coriaceous broader leaves, with more nerves, shorter flowers in more condensed cymes. The corolla is orange or red.

8. Ixora undulata, Roxb. Hort. Beng. 10: Fl. Ind. I, 385. A glabrous shrub or small tree, the cymes often pubescent; young branches thinner than a goose-quill, pale-brown, shining. *Leaves* coriaceous, oblong-elliptic, sub-acute, the base much narrowed; both surfaces olivaceous-brown when dry, rather dull main-nerves about 12 pairs, thin

but distinct on both surfaces, curved, spreading; length 3·5 to 5 in.; breadth 1·25 to 2 in.; petioles ·3 to ·4 in., stipules triangular, acuminate, ·2 in. long. *Cymes* nearly as long as the leaves, almost sessile, branching from near the base, the branches divergent, trichotomous, many-flowered, the bracteoles few and minute, lanceolate. *Calyx* sessile, less than ·1 in. long, cylindric, with 4 ovate-acute teeth. *Corolla-tube* ·25 to ·3 in. long, narrowly cylindric; the limb ·2 in. across, its 4 lobes narrowly oblong, blunt, reflexed. *Fruit* (in Indian specimens) fusiform, smooth. Roth Nov. Spec. 91; DC. Prod. IV, 488; Wight & Arn. Prod. 428; Wight Icon. 708; Hook. fil. Fl. Br. Ind. III, 147; Wall. Cat. 6129, *excl. Herb. Ham. I. canja,* Wall. Cat. 6130.

PERAK: at elevation of 4000 feet; *Wray* 3934.

Only once collected in our region. A common species at the base of the eastern Himalaya, and in the Khasia Hills.

9. IXORA PENDULA, Jack in Mal. Misc, I, 11. A small shrub, all parts glabrous except the branches of the inflorescence; young branches thinner than a goose-quill. *Leaves* thinly coriaceous, oblong to elliptic-oblong, sometimes slightly oblanceolate, sub-acute, the base more or less cuneate, both surfaces pale-olivaceous when dry, smooth, the upper shining, the reticulations fine, not prominent; main-nerves 12 to 16 pairs, curved, ascending, faint on the upper surface, thin but prominent on the lower; length 9 to 11 in.; breadth 2·5 to 3·5 in.; petiole ·5 to ·75 in., stout, channelled: stipules about ·2 in. long, broadly ovate, abruptly acuminate. *Cymes* terminal, 3-branched, pendulous, often nearly as long as the leaves (half the length being slender peduncle): branches puberulous trichotomous, with subulate bracts at the divisions; ultimate branchlets with about 9 flowers. *Calyx* under ·1 in. in length, with 4 short blunt teeth. *Corolla-tube* slender, cylindric, about 1·25 in. long, the limb about ·4 in. across, the 4 lobes oblong, blunt, reflexed. *Anthers* short, narrow, acute, sagittate at the base, longer than their filaments. *Stigma* slightly exserted. *Fruit* ellipsoid, blunt, smooth, ·3 in. long and ·25 in. in diam. Hook. fil. Fl. Br. Ind. III, 141.

In all the provinces, common.

The flowers of this are rose-coloured. The long slender drooping peduncle of the cyme has often a whorl of lanceolate bracteoles near the base, and the upper leaves of the stem are often much reduced in size. There are specimens in which the peduncle of the cyme is only 2 or 3 inches long, but usually it is twice as long.

10. IXORA OPACA, Br. in Wall. Cat. 6141. A small shrub, glabrous except the puberulous branches of the cyme; young branches thinner than a goose-quill, pale-brown. *Leaves* thickly membranous, oblong to elliptic-oblong, obtusely and shortly acuminate, the base rounded or

cuneate; both surfaces olivaceous when dry; the upper dark and shining; the lower paler, much reticulate, and dull; main-nerves 15 to 20 pairs, spreading, curved, prominent on the lower surface; length 4 to 7 in.; breadth 1·25 to 2·5 in.; petioles ·3 to ·5 in.; stipules triangular with broad bases and long linear points. *Cyme* corymbose, with many short spreading branchlets, sometimes laxly trichotomous, 2·5 to 5 in. across, terminal, on a slender erect peduncle 1 or 2 in. long. *Flowers* as in *I. pendula*, but smaller, the limb of the corolla being only ·3 in. across. *Fruit* as in *I. pendula*, Jack. G. Don, Gen. Syst. Gard. III. 573. Hook. fil. Fl. Br. Ind. III. 147. *Pavetta opaca*, Miq. Fl. Ind. Bat. II. 270.

MALACCA: *Ridley* 966. PENANG: *Curtis* 3385. PERAK: *Wray* 3447: *King's Collector* 2699, 2805, 2829, 2917, 4061; *Ridley* 3071.—DISTRIB. Burma, Sumatra.

A species closely allied to *I. pendula*, Jack, but the cymes have shorter peduncles and the leaves are narrower.

11. IXORA LOBBII, Loudon, Encycl. Supplem. II, 1543. A shrub, everywhere glabrous except the smaller branches of the inflorescence and the calyces; youngest branches as thick as a duck's quill, dark-coloured, shining. *Leaves* thinly membranous, oblong, oblong-lanceolate or elliptic-oblong, rarely oblanceolate, the apex acute or shortly acuminate, the base cuneate; both surfaces rather pale-brown when dry and shining; main-nerves 15 to 25 pairs, rather straight, spreading, inter-arching at the tips, slender but distinct on the lower surface, very faint on the upper; length 5 to 8 in.; breadth 1·25 to 2 in.; petioles ·2 to ·3 in.; stipules triangular, acuminate, about ·15 in. long. *Cymes* terminal, corymbose, shortly pedunculate, 3 to 8 in. across, the bracts and bracteoles minute, lanceolate, deciduous. *Calyx* cylindric-campanulate, less than ·1 in. long, its 4 broad blunt lobes shorter than the tube. *Corolla-tube* slender, cylindric; 1 to 1·75 in. long; the limb ·4 to ·5 in. across; its 4 lobes narrowly oblong, blunt or sub-acute, spreading; stigma slender, slightly exserted. *Fruit* ellipsoid, blunt, ·25 to ·3 in. long and ·25 to ·3 in. in diam. (when dry), smooth. *I. fulgens*, Hook. fil. Fl. Br. Ind. (not of Roxb.) *in part.* *Pavetta Lobbii*, Teysm. & Binn. in Miq. Ann. Mus. Lugd. Bat. IV. 194.

MALAYAN ARCHIPELAGO; *Helfer* (K.D.) 2998. MALACCA: *Griffith* (K.D.) 2985; *Maingay* (K.D.) 845; *Derry* 10, 966; *Cuming* 2396 PENANG: *Curtis* 479; *Lobb.* WELLESLEY: *Ridley* 6991. PERAK: *Wray* 476, 952, 2891, 3449; *King's Collector* 407, 2374, 2908, 3828, 4196, 5626, 5968; *Scortechini* 96, 349. SINGAPORE: *Lobb*; *King*; *Ridley*; *Anderson* 94. KEDAH: *Curtis* 2659.—DISTRIB. Malay Archipelago.

VAR. *angustifolia*, King & Gamble; *leaves* narrowly oblong-lanceolate about 1 in. in width.

SINGAPORE: *King*. PERAK: *Wray* 519; *Scortechini* 1893; *King's Collector* 2718. PAHANG: *Ridley* 2215.

This variety comes near to *Pavetta salicifolia*, Blume, but its leaves have more numerous main-nerves, and its corolla lobes are much shorter.

12. IXORA FULGENS, Roxb. Hort. Beng. 10: Fl. Ind. I. 378. A shrub, all parts glabrous: young branches thicker than a crow-quill, dark, shining. *Leaves* coriaceous, oblong-lanceolate or oblanceolate, shortly acuminate, the base cuneate; both surfaces shining when dry, the upper dark-brown, the lower paler; main-nerves 10 to 12 pairs, curved, spreading, interarching, slender; length 3·5 to 5·5 in., breadth 1·25 to 1·5; petiole ·2 to ·3 in.; stipules ·2 in. long, triangular, the base broad, with a long linear point. *Cymes* terminal, corymbose, rather lax, spreading, ·3 to ·5 in. in diam., many-flowered; bracteoles triangular, minute. *Calyx* less than ·1 in. long, cylindric-campanulate, with 4 shallow broad teeth. *Corolla-tube* 1·25 to 1·5 in. long, narrowly cylindric; its limb ·8 in. across; the 4 lobes broadly ovate or lanceolate, acute, spreading. *Anthers* narrow, on short filaments. *Fruit* fusiform, somewhat 2-lobed, smooth, purple when ripe. DC. Prod. IV, 486: Wight Icon. 451: Wall. Cat. 6152; Hook. fil. Fl. Br. Ind. III. 146, *not of Roxb.*

SINGAPORE: *Lobb* 102. PERAK: *Scortechini; Wray* 3024; *King's Collector* 2949, 5075, 5522.

This species is not common. It has been confused with the much more common *I. Lobbii*, Loud. from which it differs in having about half as many leaf-nerves. It is to *I. Lobbii* that the description of *I. fulgens* given in the Flora of British India really refers.

13. IXORA HUMILIS, King & Gamble, n. sp. A small unbranched glabrous shrub little more than a foot high. *Leaves* large, coriaceous, sessile, elliptic to sub-panduriform, the apex sub-acute, narrowed below the middle to the broadly cordate auriculate base; both surfaces brown when dry, the lower paler and with the reticulations distinct; main-nerves 15 to 18 pairs, curved, slender but distinct, spreading and only slightly curved length 9 to 12 in.; breadth 3·5 to 4 in.; stipules of opposite sides united into a short tube with a cusp on each side. *Cyme* terminal, 2·5 to 3 in. long (including the short peduncle), and as much across; branches few and short, bracteoles minute. *Calyx* under ·1 in. long, its lobes shorter than the tube, blunt. *Corolla-tube* about 1·5 in. long, narrowly cylindric; the limb about ·7 in. across; its 4 lobes subrotund, spreading. *Anthers* linear, apiculate, on short filaments inserted in the throat. *Fruit* unknown.

PENANG: *Curtis* 400. SELANGOR: *Ridley* 7422a. PERAK: *Wray* 4157; *Ridley* 7186; *Yapp* 204; *Scortechini.*

A distinct species distinguished by its short bushy habit, and its large leaves tapered to a broad cordate-auriculate base.

14. IXORA SCORTECHINI, King & Gamble, n. sp. An unbranched shrub about a foot in height: the stem as thick as a goose-quill, pale-brown, rather rough. *Leaves* large, almost sessile, coriaceous, broadly oblanceolate, sub-acute or blunt, narrowed from about the middle to the rounded or cordate base; upper surface brown when dry and somewhat shining; the lower pale, reticulate and dull; main-nerves 8 to 12 pairs, slightly prominent on both surfaces, curving upwards, interarching length 5·5 to 9 in.; breadth 2 to 3 in.; petioles about ·1 in. long or absent; stipules very short, broadly triangular and with an abrupt linear point. *Cymes* terminal, about 2 in. long (including the short peduncle), the branches short, puberulous. *Calyx* nearly ·1 in. long, cylindric, with 4 very broad short blunt teeth. *Corolla-tube* 1 to 1·25 in. long, narrowly cylindric, glabrous; the limb ·5 in. across with 4 blunt broad oblong spreading lobes. *Fruit* fusiform, deeply 2-grooved, smooth.

PENANG: *Curtis* 400. PROVINCE WELLESLEY: *Ridley* 6992. PERAK: *Scortichini* 1277; *Wray* 4157; *King's Collector* 3120.

15. IXORA STRICTA, Roxb. Hort. Beng. 10: Fl. Ind. 1, 379. A large shrub, everywhere glabrous: young branches thicker than a crow-quill, dark-brown, shining. *Leaves* thinly coriaceous, lanceolate or elliptic-lanceolate, rarely elliptic, acute or acuminate, the base cuneate; upper surface olivaceous when dry, the lower brown; main-nerves 7 or 8 pairs: obsolete on the upper surface, faint and interarching on the lower; length 2·5 to 5 in.; breadth 1·25 to 2 in.; petiole ·15 to ·2 in.; stipules ·2 in. long, triangular, with broad bases and long linear points. *Cymes* almost sessile, terminal, corymbose, dense, 2 or 3 in. in diam., bracteoles minute. *Calyx* under ·1 in. long, cylindric, broadly 4-lobed or sub-entire. *Corolla-tube* narrow, cylindric, ·8 in. long; the limb ·4 in. across, its 4 lobes oblong, sub-acute or obtuse, spreading or reflexed. *Fruit* broadly fusiform, smooth. DC. Prod. IV. 486; W. & A. Prod. 427; Wight Ic. 184; Kurz For. Fl. Burma, II. 26; Wall. Cat. 6123; Hook. fil. fil. Br. Ind. III. 145. *I. coccinea*, Bot. Mag. 169. *I. alba*, Roxb. ll. cc.; Wight Ic. 707. Wall Cat. 6122. *I. blanda*, Ker in Bot. Reg. t. 100; DC. l. c., 487. *I. incarnata*, Roxb. Fl. Ind. I. 379: DC. l.c. 486. *I. crocata*, Lindl. in Bot. Reg. t. 782; DC. l.c. 486. *I. rosea*, Wall. Cat. 6124; Bot. Mag. t. 2428, (not of Wall. in Roxb. Fl. Ind. I. 398). *I. amoena*, Wall. Cat. 6121 D.E.F.G.; Don, Gen. Syst. III. 571; Hook. fil. Fl. Br. Ind. III. 146. *I. densa*, Wall. Cat. 6150, *in part.*

MALACCA: *Griffith* (K.D.) 2986; *Maingay* (K.D.) 846, 846½, 849; *Goodenough* 1753; *Derry* 257. PERAK: *Wray* 3293, 3448; *King's Collector* 2247, 3978; *Scortechini.* PAHANG: *Ridley* 2227. SINGAPORE: *Ridley* 5004; *Lobb.* PENANG: *Wallich*; *Curtis* 1122; *Deschamps.* KEDAH: *Ridley* 7092. DINDINGS: *Ridley* 7187.—DISTRIB. British India, Burmah.

Owing to the beauty of its flowers this species is much cultivated in gardens. But it also occurs in a wild state. The corolla is usually scarlet, but individuals with white, rosy, or yellowish corollas are frequent. As regards leaves the species varies somewhat. I can find nothing except the slightly different reticulation of the leaves to distinguish *I. amoena*, Wall., and I have therefore reduced it here. In the Flora of British India, Sir Joseph Hooker, without actually making the reduction, expresses himself in favour of it.

16. IXORA CONCINNA, Br. in Wall. Cat. 6149. A shrub, all parts glabrous: young branches slightly thicker than a crow-quill, pale-brown. *Leaves* thinly coriaceous, elliptic-oblong or elliptic-oblanceolate, very shortly and rather bluntly acuminate, the base cuneate: both surfaces slightly shining when dry, olivaceous-brown, the lower the paler; main-nerves 8 or 9 pairs, slender, slightly depressed on the upper and prominent on the lower surface; length 2·5 to 5 in.; breadth 1 to 1·75 in.; petioles ·15 to ·25 in.; stipules triangular, ·2 in. long with broad bases and long stiff linear apices; a few of the upper leaves much reduced in size. *Cymes* (including their peduncles) from 1 to 1·5 in. long, three or four collected at the apex of a branch, each 5- or 6-flowered; bracteoles minute *Calyx* under ·1 in. long, campanulate, with 4 broad teeth shorter than the tube. *Corolla-tube* about ·4 in. long, narrowly cylindric; the limb about ·3 in. across, its 4 lobes oblong, spreading, blunt. *Fruit* about as large as a small pea, broader than long, deeply 2-grooved, glabrous. Hook. fil. Fl. Br. Ind. III. 647. *Rubiacea,* Wall. Cat. 8449.

SINGAPORE: *Wallich*; *Ridley* 8451. MALACCA: *Griffith*; *Lobb* 189; *Maingay* (K.D.) 847; *Derry* 962. PERAK: *Scortechini* 174; *Wray* 1817; *King's Collector* 3068, 3978, 3530, 4639, 5648.

17. IXORA GRANDIFOLIA, Zoll. & Mor. Syst. Verz. 65. A bush or small tree, quite glabrous or with the cymes puberulous; young branches pale-brown when dry, not so thick as a goose-quill (paler and thinner in some vars.). *Leaves* large in the typical form, sub-coriaceous, elliptic, ovate (oblong or lanceolate in vars.), obtuse or acute, the base cuneate or broadly rounded, sometimes (in vars.) minutely cordate, both surfaces brown when dry, shining, obscurely reticulate; main-nerves 8 to 12 pairs, not usually very prominent on either surface: length 8 to 10 in. (less in var. 3), breadth 3 to 5 in. (less in var. 3), petiole ·5 to ·75 in. stout (shorter in some vars.); stipules broad, ·35 in. long, cuspidate

or sometimes bifid. *Cymes* varying, always pedunculate, laxly trichotomous, or in var. 2 densely crowded, 3 or 4 in. across (much less in var. 2) the branches cinereous-puberulous. *Flowers* crowded, shortly pedicellate, glabrous, about ·5 in. long, (longer in vars.). *Calyx* under ·1 in. long, with 4 blunt teeth shorter than the tube. *Corolla-tube* cylindric, slender, ·35 in. long. (longer in vars. 2 and 4), the limb with 4 broad blunt oblong reflexed lobes ·15 in. long: stigma narrowly clavate in bud. *Fruit* broadly fusiform, smooth. Hook. fil. Fl. Br. Ind. III. 143. *I. elliptica*, Br. in Wall. Cat. 6153.

MALACCA: *Griffith; Maingay* (K.D.) 843. PENANG: *Wallich* 6153. PERAK: *King's Collector* 410, 4083, 4756; *Scortechini* 1368.—DISTRIB. Nicobars, *Kurz*.

A very variable species of which the following forms may be distinguished. The corolla is white.

VAR. 1 *gigantea*, King & Gamble. A tall tree, leaves very coriaceous, elliptic, obtuse at base and apex, 7 to 10 in. long and 3 to 5 in. broad; cymes (including their peduncles) 3 to 7 in. long, with spreading puberulous branches; corolla about ·5 in. long.

PENANG: *Curtis*, 3384. SINGAPORE: *Ridley*, 4120. PERAK: *Wray* 2973, 3678, 3971; *King's Collector* 5609, 5466, 10294. ANDAMANS: *Heinig* 22.

This may be separable as a species. More specimens (in flower) are wanted.

VAR. 2 *coriacea*, Hook. fil. Fl. Br. Ind. III. 143 (excl. syn. *I. macrosiphon*); *leaves* very coriaceous, oblong-lanceolate or oblong-elliptic, sub-acute, the base cuneate; length 8 to 10 in.; breadth 2·5 to 3 in.; cymes (including their peduncles) 3 in. long or less. *Corolla* about ·6 in. long. *I. coriacea*, Br. in Wall. Cat. 6151.

PENANG AND SINGAPORE: *Wallich*; *Curtis* 2486. MALACCA: *Griffith* in Herb. Wight, (K.D.) 2999; *Maingay* (K.D) 844. PERAK: *Wray* 2140, 2626; *King's Collector* 5935. PAHANG: *Ridley* 2213.—DISTRIB. Andaman Islands.

There is in Herb. Calcutta a single specimen (in flower only) collected by Ridley in Pahang (Herb. Ridley 2213) which in most of its characters resembles this. The texture of the leaves and their nervation are however slightly different, and the flowers are somewhat longer and in less spreading cymes.

VAR 3 *arborescens*, Hook. fil. l.c.; branches thinner than a goose-quill, the bark very pale; *leaves* sub-coriaceous, only 4 to 6 in. long, and from 2 to 2·5 in. broad; sub-obtuse at the apex and broadly rounded at the base, the petiole only ·3 to ·4 in. long; *cymes* (including peduncle) ~~3 to 7 in~~. long, the branches long and spreading: *corolla* little more than ·5 in. long. *I arborescens*, Hassk. in Retzia I. 22.

MALACCA: *Griffith* Herb. Wight, (K.D.) 2987; *Derry*, 310, 571;

Cumming 2332. PERAK: *King's Collector* 4686. JOHORE: *Ridley* 4165. —DISTRIB. Andaman Inlands.

VAR. 4 *Kurzeana*, Hook. fil. l.c.; *leaves* sub-coriaceous, elliptic to elliptic-oblong, the apex acute; the base rounded or cuneate; *corolla* 1·25 in. long. *I. Kurzeana*, Teysm. & Binn. in Nat. Tijds. Ned. Ind. 100. *I. macrosiphon*, Kurz in Trimen Journ. Bot. 1875, 327; For. Flora Burm. II. 24.

ANDAMAN ISLANDS: *Kurz, Prain's Collector.* SUMATRA, JAVA, &c.

18. IXORA DIVERSIFOLIA, Wall. Cat. 6146. A shrub or small tree, the branches of the inflorescence slightly puberulous, otherwise glabrous; young branches thinner than a goose-quill, pale when dry. *Leaves* membranous, oblong to broadly elliptic, acute or sub-acute, the base rounded or cuneate; the upper pair sometimes sessile and sub-cordate, often reduced in size, the majority with stout petioles ·3 or ·4 in. long; both surfaces smooth, shining, brown when dry; main-nerves 10 to 12 pairs, curved, spreading, prominent as the lower surface; length of blade 4 to 10 in.; breadth 2 to 4 in.; stipules elongated-triangular, ·25 in. long (sometimes longer and sometimes blunt). *Cyme* 3 to 4 in. in diam. (its slender peduncle included) 3 to 6 in. long, trichotomous; the ultimate branchlets minutely bracteolate at the divisions, 2- to 3-flowered. *Flowers* ·4 to ·6 in. long, mostly on short puberulous pedicels, some sessile, glabrous. *Calyx* less than ·05 in. long, the 4 teeth shorter than the tube, blunt. *Corolla-tube* narrowly cylindric, very short in the bud, afterwards lengthening to ·2 to ·4 in.; sometimes longer, lobes of the limb 4, narrowly oblong, sub-acute, much reflexed, ·2 in. long. *Stigma* exserted, clavate at first, the arms afterwards divergent. *Fruit* ellipsoid, blunt, ·3 in. long and ·2 in. diam. (when dry) glabrous. Kurz. For.; Flora Burm. II. 22; Hook. fil. Fl. Br. Ind. III. 141.

PENANG: *Curtis*, 2486. PERAK: *King's Collector* 5691, 5737, 5896; (*Wray* 3491?); *Scortechini* 168.—DISTRIB. Burma; *Griffith* (K.D.) 2992.

The corolla of this is much shorter than those of *I. pendula*, and it is white and the leaves are often broader. The two species are closely allied. A form collected in Perak by *Wray* (No. 3491) connects the two, combining the longer corollas and peduncles which are characteristic of *I. pendula* with the general facies of *I. diversifolia.*

40. PAVETTA, Linn.

Characters of *Ixora*, but the style very slender and much longer than (often twice as long as) the corolla-tube; the stigma not thicker and sometimes even thinner than the style and usually entire; the stipules larger and sheathing, especially those of the lower part of the inflorescence; leaves membranous.—Species about 70, in the tropics of the old world.

Large much branched shrubs; cymes corymbose pedunculate, 2 to 4 in. in diam., often in panicles:—
- Leaves pubescent to tomentose beneath, ovate-elliptic, elliptic or elliptic-rotund ... ... 1 *P. indica.*
- Leaves slightly pubescent to glabrous beneath, elliptic lanceolate or oblanceolate ... ... 1 *P. indica* var. *glabra.*

Small little branched or unbranched shrubs; cymes sessile or nearly so, 1 to 2 in. in diam., never in panicles: leaves pubescent beneath:—
- Calyx woolly; leaves densely and softly pubescent beneath 2 *P. naucleiflora.*
- Calyx glabrous or nearly so; leaves hispidulous beneath... 3 *P. humilis.*

1. PAVETTA INDICA, Linn. sp. Pl. 110. A shrub or small tree, young branches slender, glabrous, pubescent, or tomentose like the leaves. *Leaves* membranous, variable in form, in the Malayan specimens (VAR. *polyantha*) elliptic-lanceolate or oblanceolate, in the British Indian ovate-elliptic, elliptic, or elliptic-rotund; in all, except some of the latter, acute or acuminate at the apex, pubescent tomentose or glabrous beneath, the base always much narrowed; main-nerves 5 to 7 pairs, usually faint, curved; length (in Malayan specimens) 4 to 7 in.; breadth 1 to 2 in.; petiole ·35 to 5 in.; stipules triangular, acuminate, shorter than the petioles, deciduous. *Cymes* terminal, shorter than the leaves, on peduncles 1·5 to 4 in. in length, corymbose, many-flowered, 2 to 4 in. in diam., often in panicles; the stipules at the bifurcations rather large and persistent. *Flowers* on pedicels about ·2 in. long. *Calyx* from ·05 to ·1 in. long, narrowly campanulate, with 4 short triangular teeth or sub-truncate. *Corolla* ·5 to ·75 in. long; the tube very slender, cylindric; the limb ·3 to ·4 in. across, with 4 oblong blunt lobes. *Style* much exserted, slender like the stigma. *Fruit* globular-oblong, glabrous, about the size of a pea. Wall. Cat. 6175; Blume Bijdr. 951; W. & A. Prod. 431; Wight Ic. t. 148; Miq. Fl. Ind. Bat. II. 276; Hook. fil. Fl. Br. Ind. III. 150; Trim. Fl. Ceyl. II. 349. *P. Finlaysoniana*, Wall. Cat. 6177. *P. alba*, Vahl. Symb. III. 11. *P. petiolaris*, Wall. Cat. 6786; Hook. fil. Fl. Br. Ind. III. 150. *Ixora paniculata*, Lam. Dict. III. 344. *I. Pavetta*, Roxb. Fl. Ind. I. 385: Kurz Fl. Burm. II. 18.

In all the provinces, but not common.

VAR. *polyantha*, Hook fil. l.c. 150. *Flowers* numerous, crowded in puberulous or pubescent cymes; leaves thinly membranous, oblanceolate or elliptic-lanceolate, glabrous or puberulous beneath. *P. polyantha*, Wall. Cat. 6176; Bot. Regist. t. 198. *P. graciliflora* Wall. Cat. 6178. *P. petiolaris*, Wall. Cat. 6180. *P. Rothiana*, DC. Prod. IV. 491:

W. & A. Prod. 431. *P. villosa*, Heyne in Roth. Nov. Sp. 88 (not of Napl.) *Ixora tomentosa* VAR. *glabrescens*, Kurz. Fl. Burm. II. 19.

In all the provinces: common.

The variety *tomentosa*, Hook. fil. l.c. characterised by ovate or rotund elliptic often subacute thickly membranous leaves more or less pubescent or tomentose, and with the inflorescence also pubescent or tomentose occurs chiefly in British India. The synonymy of it is as follows: *P. tomentosa*, Wall. Cat. 6173 all the sheets except E.: *P velutina* 6174: *P. mollis* 6179; *P. canescens* 6181.

2. PAVETTA NAUCLEIFLORA, Wall. Cat. 6171. A shrub or small tree, young branches thicker than a crow-quill, tawny-tomentose. *Leaves* oblanceolate, shortly acuminate, narrowed from above the middle to the petiole; both surfaces olivaceous when dry; the upper at first pubescent, afterwards becoming less so, but even when adult the midrib always pubescent; the lower densely and persistently pale-pubescent, especially on the midrib and 9 or 10 pairs of oblique prominent main-nerves; length 4·5 to 7 in.; breadth 1·35 to 2·75 in.; petiole ·3 to ·75 in., pubescent. *Stipules* broadly triangular, acuminate. *Cymes* terminal, solitary, densely compound-umbellate, 1·75 in. broad and not quite so long, the branches and pedicels densely pubescent; branches divaricate with a few ovate-lanceolate bracteoles near the flowers. *Flowers* ·75 in. long, excluding the style, on unequal pedicels always longer than the calyx. *Calyx* tubular ·1 in. long, ribbed, densely pubescent, the mouth with 5 short triangular erect teeth. *Corolla-tube* narrowly cylindric, sub-glabrous; limb pubescent and with 4 oblong blunt lobes. *Fruit* globular not ridged, sparsely hairy, crowned by the small calyx, ·25 in. in diam. two-celled by abortion. *Seed* single fleshy, convex on the back; G. Don, Gen. Syst. III. 575: Hook. fil. Fl. Br. Ind. III. 152. *Ixora naucleiflora*, Kurz, For. Flora. II. 19.

PENANG: *Curtis* 1060, 2217, 2646, 3382. PERAK: *Scortechini*; *Wray* 3619.—DISTRIB. Base of Eastern Himalaya, Burma.

3. PAVETTA HUMILIS, Hook. fil. Fl. Br. Ind. III. 151. A small shrub with unbranched pale rough stem 6 to 12 in. long, densely pubescent at first but afterwards sub-glabrous. *Leaves* membranous, close together, oblong-oblanceolate, shortly acuminate, much narrowed at the base; upper surface minutely rugulose when dry, glabrous, the midrib sparsely adpressed-hispid; lower surface sub-adpressed hispidulous: main-nerves 6 or 7 pairs, faint, little curved, ascending; length 3·5 to 6 in.; breadth 1·25 to 1·75 in.; petiole ·3 to ·5 in., swollen at the base, hispid; *stipules* broadly triangular, acuminate, hispid. *Cymes* solitary, terminal, sessile or sub-sessile, usually 1 to 1·5 in. in diam., dense. *Flowers* shortly pedicellate, glabrous, ·75 in. long. *Calyx* funnel-shaped, the mouth with 4 short acute teeth. *Corolla-tube* about ·6 in. long,

narrowly cylindric, the limb with 4 blunt oblong lobes. *Fruit* globular, glabrous, ·25 in. in diam.

MALACCA: *Griffith* (K.D.) 3007; *Maingay* (K.D.) 855; *Hullett*, 763.

41. MORINDA, Linn.

Shrubby, somtimes scandent; rarely arboreous. *Leaves* membranous, rarely in whorls of three: stipules connate, sheathing. *Flowers* connate by their calyces, axillary or terminal, simple panicled or umbellate pedunculate heads. *Calyx-tube* short, the limb short or absent. *Corolla* salver- or funnel-shaped, coriaceous, the tube short; the limb usually 5- (rarely 4- to 7-) lobed, valvate in bud. *Stamens* equal in number to the corolla-lobes, on short filaments; anthers linear or oblong, dorsi-fixed. *Ovary* 2- or spuriously 4-celled; style included or exerted, 2-branched: ovules solitary in the ovarian cells, ascending. *Fruit* formed of the succulent enlarged calyces; the contained pyrenes 1-seeded, horny or cartilaginous, usually free but 2 or 4 of them sometimes cohering together. *Seeds* obovoid or reniform, with membranous testa and fleshy or horny albumen; the embryo terete, radicle inferior.—DISTRIB. Species about 40, all tropical.

Erect shrubs or trees, with pulpy infrutescences ... 1. *M. citrifolia.*
Large woody climbers:—
Infrutescence dry, more than 1 to 2 in. in diam., externally marked with many large deeply pitted hardened calyces ... ... 2. *M. lacunosa.*
Infrutescence about 1 in. in diam., pulpy, smooth, bearing externally a few long narrow soft tubular calyces ... ... 3. *M. rigida.*
Infrutescence about ·25 in. in diam., without large protruding calyces ... ... 4. *M. umbellata.*

1. MORINDA CITRIFOLIA, Linn. Sp. Pl. 176. A glabrous small tree or large shrub; young brances thinner than a goose-quill, obtusely 4-angled, pale-brown. *Leaves* broadly elliptic, occasionally obovate-elliptic, shortly acuminate, the base cuneate, one of the pair opposite the peduncle often suppressed; both surfaces pale-brown when dry: main-nerves 6 or 7 pairs, curved upwards, thin but slightly prominent on both surfaces; length 5 to 10 in.; breadth 2·25 to 4·5 in.; petioles ·2 to ·4 in.; stipules transversely oblong or sub-orbicular, entire or 2- to 3-fid., ·3 to ·5 in. long. *Peduncles* axillary, solitary, about ·5 in. long, each bearing a many-flowered capitulum 1 to 1.75 in. in diam. *Calyx* truncate. *Corolla* fusiform in bud: the tube ·3 to ·5 in. long, pubescent in the throat, otherwise glabrous: limb ·5 or ·6 in. across, with 5 lanceolate lobes. *Anthers* with their tips exserted, filaments woolly. *Infrutescence* when

ripe ovoid or globose, 1 to 1·75 in. long, yellow, fleshy: each pyrene 2-seeded. Roxb. Fl. Ind. I. 541; Hunter in As. Resear. IV. 35; DC. Prod. IV. 446: Ham. in Trans. Linn. Soc. XIII. 533; W. & A. Prod. 419; Wall. Cat. 8418: Brand. For. Flora, 277; Kurz, For. Fl. Burm. II. 60; Hook. fil. Fl. Br. Ind. III. 155; Trimen Fl. Ceyl. III. 354; Gaertn. Fruct. I. 29. *M. bracteata*, Roxb. Hort. Beng. 15; Fl. Br. Ind. I. 544; Ham. l.c. 534; DC. l.c. 447; W. & A. l.c.; Wight Ill. t. 126; Wall. Cat. 8419; Brandis l.c. 277.

In all the provinces: in or near cultivation, but probably in many cases not wild.—Distrib. Brit. India, Ceylon, Malay Archipelago.

Var. *elliptica*, Hook. fil. l.c. *Leaves* narrowly elliptic-oblong, tapering to each end, shining: peduncles slender, 1 to 1·5 in. long: fruiting heads ·5 to ·75 in. diam. Wall. Cat. 8434.

In all the provinces: more frequent than the typical form.

2. Morinda lacunosa, King & Gamble, n. sp. A powerful climber 30 to 60 feet long: young branches thinner than a goose-quill, angled, sparsely and minutely pubescent. *Leaves* thickly membranous, elliptic, sharply and shortly acuminate, the base cuneate; upper surfaces dark-brown when dry, glabrous except the puberulous midrib; lower paler, the reticulations very distinct; main-nerves about 8 pairs, curving upwards, very bold on the lower surface, slightly depressed and faint on the upper; length 4·5 to 6 in.; breadth 2 to 2·75 in.; petioles ·5 to 1·25 in.; stipules apiculate, only ·15 in. long. *Heads* about ·5 in. in diam. (when in flower) with one or two linear coriaceous bracts at their bases, solitary, on puberulous peduncles about 1 in. long, collected in twos or threes at the apices of the branches. *Calyces* completely confluent by their sides, irregularly cupular, the limb coriaceous, produced into a large oblique triangular lobe at one side, otherwise sub-truncate. *Disk* large, cushion-like, convex. *Corolla* unknown. *Infrutescence* (when ripe) globular, 1·5 in. in diam.; the surface covered with the protruding irregularly 4-sided conical enlarged calyces, each with a wide pit on its apex; individual fruits 2-celled, 2-seeded.

Perak: *King's Collector*, 4320, 6030, 8254; *Scortechini.*

This is easily distinguished by its large deeply pitted infrutescence which is dry, not at all pulpy.

3. Morinda rigida, Miq. Fl. Ind. Bat. II. 246. A woody climber 20 to 30 feet long; young branches thinner than a goose-quill, at first minutely rusty-tomentose, afterwards with glabrescent pale spongy bark. *Leaves* dark-coloured when dry, the edges recurved, thickly coriaceous, narrowly elliptic, shortly and bluntly acuminate or blunt, the base cuneate; upper surface shining, glabrous except the pubescent

base of the midrib; the lower uniformly pale-pubescent; midrib distinct; main-nerves (18 to 12 pairs) very indistinct on both surfaces; length 2 to 4 in.; breadth 1 to 1·6 in.; petiole ·3 or ·4 in., pubescent. *Stipules* broadly oblong, blunt, scaly, ·2 in. long. *Capitula* on puberulous peduncles ·2 to ·3 in. long, in fascicles of 3 or 4 at the apices of the branches. *Flowers* ·4 in. long, confluent by their calyces into globular capitula ·2 in. in diam. *Calyx* very short, cupular. *Corolla* salver-shaped, ·35 in. long, the tube narrow, the limb with deflexed oblong blunt lobes ·1 in. long, densely hairy on the upper surface. *Infrutescence* when ripe pulpy, elliptic (often transversely so) with one or two elongate very protruding enlarged calyx-tubes.

PERAK: *King's Collector* 4004; *Wray* 2284; *Ridley* 7204, 10258; *Hullett* 5665. SINGAPORE: *Ridley* 3818, 4126. MALACCA: *Griffith* (K. D.) 2947; *Maingay* (K.D.) 874.—DISTRIB. Borneo.

4. MORINDA UMBELLATA, Linn. Sp. Pl. 176. A powerful glabrous climber; young branches thinner than a goose-quill, pale-brown, angled, shining. *Leaves* thinly coriaceous, narrowly oblong or elliptic-lanceolate, the apex shortly acuminate, the base much narrowed; both surfaces pale olivaceous-brown when dry, transversely reticulate; main-nerves 5 or 6 pairs, curved, ascending, faint; length 3·5 to 5 in.; breadth 1 to 1·35; petioles ·2 to ·3 in.; stipules sheathing, entire, truncate, or slightly toothed, ·15 in. long. *Heads* sub-globular, about ·25 in. in diam., on slender peduncles varying from ·35 to 1 in. in length (lengthening in fruit to nearly 2 in.) from 5 to 8 collected in an ebracteate umbel at the end of a branch. *Calyx* sessile, truncate. *Corolla* almost rotate, longer than the calyx, its tube about 1· in. long, slightly constricted at the mouth, throat densely villous; limb ·2 in. across, its lobes oblong, obtuse, glabrous on the outer surface, densely woolly on the inner. Ripe infrutescences about ·25 in. in diam. DC. Prod. IV. 449; W. & A. Prod. 420; Wall. Cat. 8431; Kurz For. Flora, Burma, II. 62; Hook fil. Fl. Br. Ind. III. 157. *M. scandens*, Roxb. Fl. Ind. I. 548; DC. Prod. IV. 449. *M. tetrandra*, Jack in Mal. Misc. I. 13; Wall. Cat. 8432; Roxb. Fl. Ind. ed. Carey & Wall. II. 203; DC. l.c. *M. Padavora*, Juss. Gen. 206. *Morinda*, Wall. Cat. 8429.

In all the provinces; common.—DISTRIB. Burma, Southern India and Ceylon, Malay Archipelago, China, Japan, Australia.

VAR. *Scortechinii*, King & Gamble. Young branches, under surfaces of the leaves, and peduncles rusty-pubescent; *leaves* elliptic-obovate, shortly and abruptly acuminate; pedicels 1·5 to 2 in. long.

PERAK: *Scortechini* 2015. Collected only once.

VAR. *Ridleyi*, King & Gamble. Young branches and under surfaces of the leaves softly pubescent; *leaves* oblanceolate or oblong-lanceolate, shortly acuminate: peduncles less than 1 in. long.

SINGAPORE: in Botanic Garden Jungle, *Ridley* 5668, 6470, 6471, 6916.

42. RENNELLIA, Korthals.

Characters of *Morinda* but the heads few-flowered and in terminal panicles, the ovules peltate; the seeds thin, orbicular.—DISTRIB. 5 or 6 Malayan species.

NOTE.—In this we include the genus *Tribrachya*, Korthals, which, as described by its author, differs from *Rennellia* only in having the flowers in each head limited to three.

Inflorescence paniculate	...	...	...	1 *R. paniculata.*
„ spicate	...	...	...	2 *R. speciosa.*

1. RENNELLIA PANICULATA, King & Gamble, n. sp. A small glabrous tree or shrub; young branches at first dark-brown, afterwards becoming pale, striate, thickened at the nodes. *Leaves* sub-coriaceous, elliptic, acute or shortly acuminate, the base much narrowed; upper surface dark-brown when dry; the lower paler-brown, finely reticulate; main-nerves 10 to 12 pairs, slightly curved, spreading, prominent like the midrib on the lower surface, indistinct on the upper; length 6 to 9 in.; breadth 2·25 to 3·75 in.; petioles ·8 to 1·25 in.; stipules oblong, obtuse, ·4 in. long. *Inflorescence* paniculate, erect, terminal; the branches opposite, or sometimes whorled, ·6 to ·9 in. long, each bearing at its apex 3 or more sessile flowers. *Calyx* a very shallow entire cup. *Corolla* coriaceous; the tube cylindric, ·5 in. long; the limb nearly as long as the tube with 5 recurved lobes. *Anthers* included, attached near the throat, versatile, on short filaments. *Style* short; stigmas lanceolate. *Infrutescence* globular, ·5 in. in diam., glabrous, with several orbicular calyces protruding on the surface.

PERAK: *Scortechini* 316; *King's Collector* 2164, 2592, 5432. PENANG: *Curtis.*

2. RENNELLIA SPECIOSA, Hook. fil. Fl. Br. Ind. III. 158. A small glabrous shrub; young branches about as thick as a goose-quill, pale, striate, thickened at the nodes. *Leaves* thinly coriaceous, oblanceolate or elliptic-lanceolate, shortly acuminate, the base much narrowed; upper surface olivaceous-brown, the lower olivaceous, reticulate; main-nerves 7 to 9 pairs, curved, ascending, slightly prominent; length 5 to 9 in.; breadth 1·5 to 3·5 in.; petioles ·5 to 1 in.; stipules coriaceous, often 2-lobed, oblong, sub-acute, breaking off about the middle. *Inflorescence* 1 to 2 in. long, terminal, erect, on a short petiole; flowers from 3 to 6 on very short branches. *Calyx* sessile, cupular, truncate. *Corolla* coriaceous, ·75 in. long, salver-shaped; limb with 5 short oblong

blunt sub-erect lobes. *Infrutescence* the size of a large pea. *Morinda speciosa*, Wall. Cat. 8436; Kurz For. Fl. Burma, II. 62.

MALACCA: *Griffith* (K.D.) 3046; *Maingay* (K.D.) 918/2. PERAK: *Scortechini* 668; *Ridley* 7197; *Wray* 2897, 4008; *King's Collector* 495, 5967.—DISTRIB. Burma.

VAR. *elongata* King & Gamble: *inflorescence* 2 to 6 in. long; flowers mostly in threes.

WELLESLEY PROVINCE: *Ridley* 7010. PAHANG: *Ridley* 2193, 5834. PERAK: *King's Collector* 3926; *Ridley* 9710; *Scortechini* 106.—DISTRIB. Sumatra.

43. PRISMATOMERIS, Thwaites.

Shrubs with compressed 4-angled branches. *Leaves* sub-coriaceous; stipules 1- or 2-cuspidate. *Flowers* unisexual, usually on slender pedicels, in sub-umbellate axillary and terminal, sometimes pedunculate fascicles. *Calyx-tube* in the male flowers small, turbinate; in the female longer, obovoid, persistent; limb cupular. *Corolla-tube* cylindric, with glabrous throat; lobes of the limb 4 or 5, spreading, valvate in bud. *Stamens* included in the corolla-tube and equal in number with the lobes of the limb; dorsifixed near their bases by short filaments. *Ovary* 2-celled; style filiform, with 2 linear or lanceolate arms; ovules solitary in each cell, attached above the middle of the septum. *Berry* small, 1-celled, 1-2-seeded. *Seed* sub-globose, peltate, deeply concave in the ventral surface; testa membranous; embryo small; cotyledons reniform; radicle inferior.—DISTRIB. 3 or 4 species, in tropical India, Ceylon and Malaya.

Flowers on rather long slender pedicels ... ... 1 *P. albidiflora.*
Flowers sub-sessile or sessile ... ... 2 *P. subsessilis.*

1. PRISMATOMERIS ALBIDIFLORA, Thw. in Hook. Kew Journ. VIII. 268, t. VII. f. A. An evergreen shrub or small tree, glabrous; young branches thicker than a crow-quill, pale. *Leaves* narrowly elliptic or elliptic-lanceolate, sometimes oblanceolate, the apex much acuminate, the base much narrowed; both surfaces pale-greenish or yellowish-brown, and rather dull when dry; the lower reticulate; main-nerves 5 to 7 pairs, curved, spreading and interarching about a line from the edge; length 2·5 to 4·5 in.; breadth ·75 to 1·5 in.; petioles ·1 to ·2 in.; stipules small, fugacious. *Flowers* usually in sessile fascicles, rarely in pedunculate umbels; pedicels ·3 to ·75 in. long, ebracteolate, filiform. *Calyx* ·05 to ·1 in. long. *Corolla* white; the tube ·5 to ·75 in. long, narrowly funnel-shaped, the lobes of the limb narrowly oblong, blunt, nearly as long as the tube, spreading. *Fruit* globose or ovoid, smooth, ·25 in. in diam. Thwaites Enum. Pl. Ceyl. 154, 421; Bedd. Ic. Pl. Ind. Or. t. 93; Hook. fil. Fl. Br. Ind. III. 159; Trimen Fl. Ceylon, II. 355.

Coffea tetrandra, Roxb. Fl. Ind. I. 538; Wall. Cat. 6242; DC. Prod. IV. 499; Kurz For. Fl. Burma. II. 28. *Rubiae*, Wall. Cat. 8470.

In all the Provinces: common.—DISTRIB. Burma, Khasia Hills, Malay Archipelago, Ceylon.

Besides the foregoing there is in Herb. Calcutta a single specimen (*Ridley* 2196) with flowers only in bud and no fruit. This is distinguished by ovate-elliptic leaves with 4 or 5 pairs of slightly curved ascending nerves, and few-flowered lax panicles on filiform axillary peduncles about 1·5 in. long.

2. PRISMATOMERIS SUBSESSILIS, King & Gamble. A glabrous shrub: young branches thinner than a goose-quill, pale, polished. *Leaves* narrowly elliptic, the apex and base acuminate; both sides pale-brown when dry, dull, the midrib prominent, the reticulations obsolete; main-nerves 5 to 7 pairs, slender, spreading, interarching ·1 in. from the edge; length 2·25 to 4·5 in.; breadth ·75 to 1·35 in.; petiole ·15 to ·4 in.; stipules under ·1 in. in length, broad, connate into a ring, each 2-toothed. *Flowers* 2 or 3, on very short pedicels, or sessile, in a terminal fascicle. *Calyx* about ·2 in. long, funnel-shaped, the limb wide, about as long as the tube, truncate with minute acute teeth. *Corolla* 1·25 in. long, salver-shaped, the tube narrow; the limb nearly as long as the tube, divided to its base into 5 narrowly lanceolate, deflexed, coriaceous lobes. *Fruit* a broad smooth didymous berry, about ·6 in. in diam. and ·5 in. long.

PERAK: *Scortechini* 355; *Wray* 289; *King's Collector* 8071: at elevations of 3000 to 4500 feet.

Differs from *P. albidiflora* in its nearly sessile flowers and larger calyx, corolla and fruit.

44. GYNOCHTHODES, Blume.

Climbing glabrous shrubs with slender terete branches. *Leaves* opposite, coriaceous or sub-coriaceous; the stipules broad, acute, deciduous. *Flowers* small, on short pedicels, unisexual, in axillary fascicles or pedunculate heads; bracts deciduous. *Calyx* with a small short tube, the limb annular, truncate or 5-toothed, persistent. *Corolla* coriaceous with a short tube and woolly throat; the limb with 4 or 5 oblong-lanceolate lobes, valvate in bud, the apices inflexed. *Disk* broad, depressed. *Stamens* equal in number to the corolla lobes, on short filaments, dorsi-fixed, in the corolla tube, linear-oblong, exserted. *Ovary* 4-celled; style of male flower entire; of female stout, bifid. *Ovules* 1 in each cell, broad-based, attached to the inner angle of the cell. *Drupe* globose, fleshy, with 2 to 4 dorsally compressed pyrenes. *Seeds* compressed, ascending; testa membranous; embryo small, basal, radicle inferior.—DISTRIB. 3 or 4 species, all Malayan.

Leaves broad and rounded at the apex, sometimes with a short broad blunt point, 2·25 to 4 in. long and 1·25 to 2·25 in. broad; fruit ·5 in. in diam.	1. *G. coriacea.*
Leaves acuminate at the apex, elliptic-lanceolate (often narrowly so) 2·25 to 3·25 in. long and ·5 to 1·1 in. broad; fruit the size of a pea	2. *G. sublanceolata.*
Leaves shortly and abruptly acuminate, rarely sub-acute, 3·5 to 5 in. long and 1·35 to 2·5 in. broad; fruit globose, ·5 to ·6 in. in diam.	3. *G. macrophylla.*

1. GYNOCHTHODES CORIACEA, Blume Bijdr. 993. Young branches thinner than a goose-quill, nearly black. *Leaves* thinly coriaceous, elliptic, elliptic-rotund or elliptic-obovate, obtuse or shortly bluntly and abruptly apiculate, much narrowed to the base; main-nerves 4 to 6 pairs, spreading, only slightly curved, faint; both surfaces alike, nearly black, slightly shining; length 2·25 to 4 in.; breadth 1·2 to 2·25 in.; petioles ·4 or ·5 in.; *Flowers* ·3 in. long, few, on short axillary peduncles. *Corolla-tube* very narrow, about as long as the limb; lobes of limb linear-oblong, densely hirsute on the upper surface, spreading. *Fruit* globose, pulpy, 4-celled; pyrenes 1-seeded. Miq. Fl. Ind. Bat. II. 313; DC. Prod. IV. 467.

SINGAPORE: (Bot. Garden Jungle), *Ridley* 6410, 10393, 2871.—DISTRIB. Java, Borneo, Timor.

2. GYNOCHTHODES SUBLANCEOLATA, Miq. Fl. Ind. Bat. Suppl. 548. Branches thinner than a goose-quill, dark-coloured when dry. *Leaves* thinly coriaceous, elliptic lanceolate, often narrowly so, acuminate, the base much narrowed; both surfaces dull and blackish when dry; main-nerves indistinct, 5 or 6 pairs, ascending, little curved; length 2·25 to 3·25 in.; breadth ·5 to 1·1 in.; petioles ·2 to ·4 in.; stipules triangular. *Flowers* few, about ·35 in. long, sub-sessile on very short axillary branches. *Calyx-limb* truncate but with 5 distant minute teeth. *Corolla-tube* short, rather wide, hairy inside; limb with 5 broadly lanceolate sub-acute lobes longer than the tube. *Anthers* slightly exserted. *Stigma* with 2 elongate plano-convex lobes. *Fruit* pisiform, smooth, on a short pedicel. Hook. fil. Fl. Br. Ind. III, 160. *G. coriacea*, var.—, Miq. in Ann. Mus. Lugd. Bat. IV. 244. *Paederia tetrandra*, Wall. Cat. 6249. ? *Psychotria*, Wall. Cat. 8385. *Rubiacea ?* Wall. Cat. 8297.

SINGAPORE: *G. Thomson; Ridley; King's Collector* 319. MALACCA: *Maingay* (K.D.) 919; *Griffith*. PENANG: *Wallich*.—DISTRIB. Borneo, Sumatra.

3. GYNOCHTHODES MACROPHYLLA, Kurz in Journ. As. Soc. Beng. 1872, Pt. II, 314. Young branches angled, nearly as thick as a goose-quill, the bark pale. *Leaves* coriaceous, elliptic or elliptic-oblong, shortly

and abruptly acuminate or sub-acute, the base cuneate; upper surface very dark-brown and shining when dry, the lower paler and dull; main-nerves 6 or 7 pairs, spreading, slightly prominent on the lower surface scarcely visible on the upper; length 3·5 to 5·5 in.; breadth 1·35 to 2·5 in.; petioles ·3 to ·5 in.; stipules short, broad. *Flowers* ·25 in. long, on thick short axillary pedicels. *Calyx*-tube almost globular; the limb cupular, as long as the tube, truncate. *Fruit* ·5 or ·6 in. in diam., pulpy, globose or broadly depressed-pyriform with 4 pyrenes (one often abortive). Kurz For. Flora Burm. II. 33: Hook. fil. Fl. Br. Ind. III. 160.

MALACCA: *Maingay* (K.D.) 934.

PERAK: *Ridley; Wray* 1156; *King's Collector* 5807.—DISTRIB. Andamans, Nicobars.

The Andaman specimens have darker narrower leaves than those from the Malay Peninsula.

45. SPERMACOCE, Linn.

Herbs or small under-shrubs, usually with 4-angled branches. *Leaves* membranous or coriaceous, penni-nerved or longitudinally nerved; the stipules connate into a campanulate tube with a truncate bristly mouth. *Flowers* usually red or blueish, small or minute, solitary and axillary, or in axillary or terminal fascicles, heads or cymes, sometimes densely crowded. *Calyx* obovoid, or ovoid, the mouth with 2 or 4 persistent teeth often with interposed bristles or processes. *Corolla* funnel- or salver-shaped; the mouth with 4 valvate lobes. *Stamens* 4, inserted on the throat or tube of the corolla, filaments short or long. *Anthers* linear or oblong, included or excluded. *Disc* tumid or absent. *Ovary* 2-celled; each cell with a single ovule attached to the middle of the septum, amphitropous. *Style* filiform; stigma capitate or with 2 oblong arms. *Fruit* coriaceous or crustaceous, mericarps dehiscing variously. *Seeds* oblong or ovoid, grooved ventrally, the testa thin, embryo axile, cotyledons thin and broad.—DISTRIB. Species about 150, tropical and subtropical.

Leaves spathulate, obovate or bluntly oblong, the base narrowed, main-nerves 3 pairs, faint, hispid ... ... 1. *S. hispida.*
Leaves narrowly elliptic, tapering acutely to each end, main-nerves 3 or 4 pairs, very bold and prominent beneath 2. *S. scaberrima.*
Leaves narrowly oblong-lanceolate, acute, pale beneath, main-nerves sub-obsolete ... ... 3. *S. stricta.*

1. SPERMACOCE HISPIDA, Linn. Sp. Pl. 102. Herbaceous, diffuse, spreading or sub-erect; stems half as thick as a goose-quill, acutely 4-angled and somewhat grooved when dry, sparsely and minutely

hispid, especially on the angles. *Leaves* sub-coriaceous, obovate, spathulate or oblong, sometimes elliptic, always blunt at the apex and tapering more or less to the base, continuous with the short, wide-cupular, pubescent bristle-bearing persistent stipules; upper surface reticulate (when dry), scaberulous, olivaceous, strigose; the lower pale, with spreading hispid hairs on the nerves; main-nerves about 3 pairs, rather straight, faint, oblique; length ·35 to ·75 in.; breadth ·15 to ·4 in. *Cymes* small, axillary, hardly longer than the stipules, 4- to 6-flowered. *Flowers* ·4 in long, sessile, with a few small membranous toothed bracteoles between them. *Calyx* small, densely silky, urceolate-campanulate, with 4 long narrow acute spreading lobes. *Corolla* three times as long as the calyx, salver-shaped, glabrous, the 4 broadly ovate teeth silky at their apices. *Stamens* about as long as the corolla-lobes; anthers oblong, filaments and style equal. *Stigma* large, transversely oblong. *Capsule* ovoid or sub-globular, sparsely hispid, crowned by the narrow, reflexed calyx-lobes, 2-celled with a single brown seed in each cell. DC. Prod. IV. 555; Roxb. Fl. Ind. I. 373; Wall. Cat. 825; W. & A. Prod. Fl. Penins. Ind. 438; Hook. fil. Fl. Br. Ind. III. 201; Trimen Fl. Ceyl. II. 371. *S. articularis*, Linn. fil. Suppl. 119; Roxb. Fl. Ind. l.c.; Wall. Cat. 827; W. & A. Prod. l.c.; Kurz Journ. As. Soc. Beng. 1877 II. 137. *S. scabra*, Willd. Sp. Pl. I. 572; Roxb. l.c. 371; Wall. Cat. 824. *S. hirta*, Rottb. in Nov. Ac. Berol. 1803, 95. *S. longicaulis*, Wall. Cat. 826. *S. avana*, Wall. Cat. 828. *S. ramosissima*, Wall. Cat. 829. *S. tubularis* Br. in Wall. Cat. 836.

In all the provinces: common.—Distrib. British India, Ceylon, S. China, Malaya Archipelago.

2. Spermacoce scaberrima, Blume Bijdr. 946. Herbaceous, woody near the base; stems procumbent, much branched, thinner than a goose-quill, 4-angled, the angles with stiff reflexed small white hairs, otherwise glabrous and shining, dark-brown. *Leaves* olivaceous, coriaceous, narrowly elliptic, tapering acutely to each end, sessile, upper surface scaberulous, with a very few short white hairs; the lower paler, pilose on the midrib and nerves; main-nerves 3 or rarely 4 pairs, ascending obliquely, little curved, depressed on the upper surface and very prominent in the lower; length ·5 to 1 in.; breadth ·2 to ·4 in. *Stipules* cupular, the mouth with 3 to 7 erect stiff bristles, glabrous. *Cymes* small, axillary, sessile, 4- to 8-flowered, condensed, ·15 to ·2 in. in diam. *Flowers* about ·15 in. long, sessile or on very short pedicels, with short filiform bracteoles between them. *Calyx* oblong, constricted below the mouth, glabrous, the lobes lanceolate, slightly ciliate on the edges, spreading. *Corolla* not much exceeding the calyx, funnel-shaped, glabrous except for a few ciliae on the edges near the

base of the narrowly-lanceolate spreading lobes. *Stamens* exserted from the throat of the corolla but shorter than its lobes. *Anthers* oblong, the filaments rather long. *Style* about as long as the filaments; stigma large, thick, transversely oblong. *Capsule* slightly more than ·1 in. long, oblong, crowned by the large spreading calyx-lobes, smooth, membranous, dehiscent, each cell containing a single oblong blunt black seed. DC. Prod. IV. 555; Miq. Fl. Ind. Bat. II. 331; Hook. fil. Fl. Br. Ind. III. 201. *S. longicaulis,* Br. in Wall. Cat. 826.

MALACCA: *Griffith.* SINGAPORE: *Ridley* 5897, 8954. PERAK: *Scortechini* 12, 64, 78, 602.—DISTRIB. Malay Archipelago.

3. SPERMACOCE STRICTA, Linn. fil. Suppl. 120. Herbaceous, erect, little-branched, pale-olivaceous when dry; branches as thick as a crow-quill, 4-angled and with 2 broad deep grooves, minutely hispid or sub-glabrous. *Leaves* sessile, coriaceous, oblong-lanceolate, acute, the base narrowed to the stipule; upper surface shining, glabrous or minutely hispid; the lower paler, dull, the midrib prominent and sometimes minutely hispid, nerves obsolete on both surfaces; length ·75 to 1·25 in. *Stipules* conjoined to form a deep campanulate cup, the mouth acuminate or truncate but always with 6 to 8 long spreading bristles. *Flowers* ·3 in. long, in clusters of 2 or 3, axillary, sessile subtended by a few pectinate bracteolates. *Calyx* campanulate, hispid outside, the mouth with 4 deep, lanceolate, acuminate, spreading lobes. *Corolla* much exserted beyond the calyx, tubular, with 4 deep, bolong, sub-erect lobes inflexed and sometimes hispid at the apex. *Stamens* slightly exserted; anthers sagittate, on long filaments. *Stigma* large, 2-lobed, as long as the stamens; style long filiform. *Capsule* oblong-obovoid, smooth, membranous, 2-celled, dehiscent, with a single black oblong seed in each cell. Roxb. Hort. Beng. 83; Fl. Ind. I. 370; DC. Prod. IV. 554; Kurz in Journ. As. Soc. Beng. 1877 II. 137. *S. lasiocarpa* Br. in Wall. Cat. 832. *S. pusilla,* Wall. in Roxb. Fl. Ind. ed. Carey & Wall. I. 379; Cat. 823; Don. Prod. 134. *S. filina, Gardneri* and *angustifolia,* Wall. Cat. 830, 834, 835. *S. triandra,* Ham. in Don. Prodr. 134. *Bigelovia stricta,* Blume Bijdr. 945. *B. lasiocarpa. Roxburghiana & Kleinii,* W. & A. Prod. 437. *B. myriantha,* Miq. Fl. Ind. Bat. II. 334. *Borreria pusilla,* DC., Prod. l.c. 543.

PENANG: *Curtis* 1936. MALACCA: *Goodenough* 1490. PAHANG: *Ridley* 1624.—DISTRIB. British India.

46. PAEDERIA, Linn.

Twining, slender, fœtid shrubs, glabrous or pubescent; the branches thin. *Leaves* opposite, rarely in whorls of three, membranous petiolate, stipules broad, acuminate, deciduous. *Flowers* in axillary and terminal 2-3-chotomously branched cymose panicles, with or without bracteoles. *Calyx tube* campanulate or turbinate; the limb 4 or 5 toothed, persistent. *Corolla* funnel-shaped, its throat glabrous or villous; 4 or 5 lobes of the limb with inflexed crenulate margins, their apices sometimes 3-lobed, spreading. *Stamens* 4 or 5, linear-oblong, inserted in the tube of the corolla by very short filaments. *Ovary* 2-celled; stigmas 2, slender, twisted. *Ovules* one in each cell, basal, erect. *Fruit* compressed or globose, with thin shining fragile epicarp, separating early from the 2 pyrenes; pyrenes orbicular or ovoid, dorsally compressed, with or without wings, each containing a single compressed seed with membranous testa adherent to the pyrene; cotyledons large, thin, cordate; radicle small, inferior.—DISTRIB. Species 10 to 12 mostly in tropical Asia, one in Brazil.

Fruit compressed, orbicular; pyrenes flat, winged, with radiating ridges on the dorsal surface:—
  Leaves and the branches of the panicles always opposite ... ... 1. *P. foetida.*
  Leaves and the branches of the panicles often in verticels of three ... ... 2. *P. verticellata.*
Fruit globular; pyrenes cupped, with neither marginal wings or dorsal ridges ... ... 3. *P. tomentosa.*

1. PAEDERIA FOETIDA, Linn. Mant. I. 52. Glabrous or puberulous; branches thinner than a goose-quill, dark-coloured and compressed when dry. *Leaves* ovate to lanceolate, the apex acute or apiculate, the base usually rounded or slightly cordate but sometimes cuneate; both surfaces cinereous or olivaceous-brown when dry, and finely reticulate, glabrous except for the occasional pubescence on the leaf nerves beneath and the tufts in their axils; main-nerves 4 or 5 pairs, oblique, faint; length 2 to 3·5 in.; breadth 1 to 1·5 in.; petioles ·5 to 1·5 in.; stipules broadly ovate-lanceolate, acuminate, often bifid, under ·1 in. in length. *Flowers* pink, ·35 in. long, shortly pedicellate, in lax spreading trichotomous (often scorpioid) cymes arranged in divergent axillary and terminal panicles from 3 to 15 in. long and usually bearing leaves like those of the stem but smaller; bracteoles minute, linear. *Calyx* less than ·1 in. long, campanulate, its mouth acutely 4- to 5-toothed. *Corolla* funnel-shaped, three times as long as the calyx, usually pubescent; the lobes of the limb crenulate, short, spreading only slightly. *Fruit* ·4 to ·5 in. across, orbicular; epicarp with 5 curved vertical veins in each side, thin, shining; pyrenes orbicular, with pale marginal wings, the centre with many bold radiating ridges on the dorsal surface, nearly smooth on the ventral. Wall. Cat. 6247, excl. E.; Roxb. Fl. Ind. I. 683; id. ed.

Wall. & Carey II. 517; W. & A. Prod. Fl. Pen. Ind. 424; Blume Bijdr. 968; DC. Prod. IV. 471; Griff. Notul. IV. 267; Ic. Pl. Asiat., t. 479, f. 3; Miq. Fl. Ind. Bat. II. 258; Miq. in Ann. Mus. Lugd. Bat. IV. 254; Hook. fil. Fl. Br. Ind. III. 195.

PERAK: *King's Collector* 1125, 4916, 7560; *Scortechini* 263. PAHANG: *Ridley* 1256. PENANG: *Curtis* 24. MALACCA: *Griffith.*—DISTRIB. British India, Malay Archipelago, Andaman Islands.

2. PAEDERIA VERTICELLATA, Blume Bijdr. 968. Glabrous except the lower surfaces of the leaves; branches thinner than a goose-quill, dark and slightly and bluntly 4-angled when dry. *Leaves* coriaceous, usually opposite but sometimes in whorls of three, lanceolate, ovate-lanceolate or elliptic, shortly acuminate, the base cuneate; both surfaces brown when dry, dull, the upper always glabrous, the lower often pubescent, the reticulations on the lower side rather distinct and transverse; main-nerves 6 or 7 pairs, curving, oblique, rather prominent on the lower surface; length 2·5 to 4 in.; breadth 1 to 1·75 in.; petioles 1 to 1·75 in.; stipules broadly triangular, short, very deciduous. *Flowers* ·6 in long, funnel-shaped, shortly pedicellate in lax pedunculate branching cymes arranged in pairs or whorls of three in long narrow panicles, bracteoles minute. *Panicles* from 3 to 18 in. long, often bearing petiolate narrowly oblong leaf-like bracts ·5 in. long; branches from ·75 to 3 in. long, diverging, opposite or in whorls of three. *Calyx* less than ·1 in. long, glabrous or puberulous, narrowly funnel-shaped, the mouth dilated and with 4 small triangular teeth or sub-truncate. *Corolla* tubular, constricted at the base, ·6 in. long; the teeth less than ·1 in. long, acute, erect. *Anthers* linear-oblong, apiculate, included in the corolla; their filaments nearly as long as themselves, dorsi-fixed. *Fruit* much compressed, orbicular, ·4 to ·5 in. across, with 5 curved vertical veins on each side; pyrenes as in *P. foetida*. DC. Prod. IV. 471; Miq. Fl. Ind. Bat. II. 259; Hook. fil. Fl. Br. Ind. III. 195; Ann. Mus. Lugd. Bat. IV. 255.

SELANGOR: *Ridley* 7416. MALACCA: *Maingay* (K.D.) 885. PERAK: *Scortechini* 446, 1573; *Wray* 3042; *King's Collector* 3177, 3736, 4457, 4780, 5316, 5410, 10613; *Curtis* 3182, 3340. SINGAPORE: *Ridley* 2835, 3647, 6469.—DISTRIB. Borneo.

3. PAEDERIA TOMENTOSA, Blume Bijdr. *var.* GLABRA, Kurz. Glabrous or sparsely pubescent; branches slightly thicker than a crow-quill, compressed and brown when dry. *Leaves* membranous, ovate to lanceolate; apex acute, base rounded or cuneate: both surfaces brown when dry, the lower paler and minutely reticulate, pubescent in the nerve axils; length 2·25 to 4 in.; breadth ·85 to 1·5 in.; petioles ·25 to 1 in.; stipules not connate, triangular, acuminate, less than ·1 in. long. *Panicles* as

in *P. foetida* but shorter and less branched; the branches long (often 2·5 in.), diverging, markedly scorpoid. *Flowers* ·5 in. long, secund, sessile or pedicellate on the same branch. *Calyx* ·1 in. long, narrowly campanulate, with 5 sharp teeth, glabrous. *Corolla* ·5 in. long, cylindric, the mouth with 5 short erect acute teeth, pubescent outside. *Fruit* ·2 to ·3 in. in diam., globular, shining, without veins, crowned by the small calyx; pericarp brittle, pale-brown when dry. *Pyrenes* cupular, without wings or ridges. DC. Prod. IV. 471; Miq. Fl. Ind. Bat. II. 258; Miq. in Ann. Mus. Lugd. Bat. II. 254; Hook. fil. Fl. Br. Ind. III. 197. *P. barbulata* Miq. in Ann. Mus. Lugd. Bat. IV. 255.

MALACCA: *Maingay* (K.D.) 886. PERAK; *Scortechini* 1376; *King's Collector* 6048.—DISTRIB. Malayan Archipelago.

The typical form of this has pubescence on the stems, under surfaces of the leaves and on the panicles. It is the form found in Burma and Assam. In our region only this variety *glabra* has as yet been collected. Except in the shape of its fruit and seeds this species differs little from *P. foetida*, Linn.

47. SAPROSMA, Blume.

Shrubs, foetid when bruised, usually glabrous, often with subulate bristles at the apices of the branches and the bases of the peduncles. *Leaves* membranous, sometimes in whorls of 3 or 4; stipules usually connate into a 1- to 3-pointed sheath. *Flowers* small, white, axillary or terminal, solitary or in fascicles of about 3, sessile or pedicelled, or in pedunculate cymes; the bracteoles minute, often connate. *Calyx-tube* funnel-shaped; the limb dilated, 4- to 6-lobed or toothed; persistent. *Corolla* funnel-shaped or campanulate, the throat villous; the limb with 4 or 5 broad blunt lobes valvate in bud and with inflexed margins. *Stamens* 4, inserted on the throat, sessile or on short filaments; anthers more or less narrowly oblong. *Ovary* 2-celled; style filiform, with 2 short branches; ovules 1 in each cell, erect, basal. *Fruit* small, oblong or globose, containing 2 or (by abortion) 1 pyrene. *Seeds* elliptic and solitary, or two and plano-convex the plane surface not grooved; cotyledons small and leafy; radicle small, inferior.—DISTRIB. About 10 species, tropical Asiatic.

Flowers sessile in dense glomeruli ... ... 1. *S. glomerulatum.*
Flowers pedicelled, in cymes:—
  Glabrous:—
    Cymes about 1 in. long, laxly 3-flowered ... ... 2. *S. Scortechinii.*
    Cymes from 1·5 to 3·5 in. long, more than 3-flowered,
      the branches lax, spreading ... ... 3. *S. ternatum.*
  More or less pubescent... ... ... 4. *S. Ridleyi.*

1. SAPROSMA GLOMERULATUM, King & Gamble, n. sp. A shrub, very foetid when bruised; young branches thicker than a crow-quill,

compressed, brown when dry. *Leaves* thinly coriaceous, elliptic or ovate-elliptic, shortly and sharply acuminate, the base more or less cuneate, both surfaces brown when dry; the lower paler, dull, and with sparse transverse reticulations; main-nerves 6 to 9 pairs, pale and prominent on the lower surface like the midrib, depressed on the upper; length 3·5 to 7 in.; breadth 1·75 to 3 in.; petioles ·25 to ·4 in.; stipules cartilaginous, united into a short more or less persistent ring with some short bristly processes inside it. *Flowers* crowded, to the number of 4 or 5, in a multibracteate solitary glomerulus borne at the apex of a short branch between two leaves; the branch bearing in its lower third a pair of lanceolate bracts about ·5 in. long. *Female* glomerulus quite sessile, about ·3 in. long and ·4 in. broad; the male glomerulus somewhat larger than the female, borne on a short compressed peduncle ·4 to ·75 in. long and enveloped for the lower two-thirds of its length in a loose sheath formed of two acuminate partly conjoined bracts. The outer bracteoles of each glomerulus longer and thicker than the inner, broad, very concave, and forming a persistent involucre; the middle bracteoles broadly ovate-rotund with terminal caudate appendages; the inner ones narrower and embracing the flowers by pairs, appendiculate. *Flowers* sessile, about ·25 in. long. *Calyx* ·1 in. long, coriaceous, campanulate, the mouth truncate and with 4 or 5 minute distant acute teeth. *Corolla* salver-shaped, about ·2 in. long; the tube short and wide; the limb longer than the tube, with 4 broad blunt spreading lobes; anthers 4 to 6, linear-oblong. *Fruit* sessile, sub-globular, smooth, crowned by the small annular calyx, ·3 to ·35 in. in diam.; pericarp thick; seed solitary, sub-globular, hard.

PERAK: *Scortechini; Ridley* 9835; *King's Collector* 783, 6031, 8166. SINGAPORE: *Ridley* 10931. JOHORE: *Ridley* 4213.

The fruit when ripe is said to be blue, and the flowers variously pale-green or white.

VAR. *angustifolia*, King & Gamble: leaves rather more coriaceous than in the typical form, ovate-lanceolate, acuminate, 3 to 4 in. long and 1·25 to 1·4 in. broad.

MALACCA: *Goodenough* 1856. NEGRI SEMBILAN: *Ridley* 1856.

Flowers are absent in both the specimens cited here. When these are obtained, they may afford characters to separate this as a good species.

2. SAPROSMA SCORTECHINII, King & Gamble, n. sp. A shrub, glabrous except the midrib and nerves of the leaves on the lower surface; young branches thicker than a crow-quill, with pale-brown spongy bark. *Leaves* thinly coriaceous, elliptic, shortly and bluntly acuminate, the base cuneate; both surfaces brown when dry; the upper glabrous; the

lower puberulous on the midrib, otherwise g is, laxly reticulate; midrib bold on both surfaces; main-nerves 6 pairs, oblique, bold on the lower surface, faint on the upper; length 3·5 to 5·5 in.; breadth 1·5 to 2·5 in.; petiole ·2 to ·25 in. *Stipules* very short, connate into a sheath; mouth with short bristles. *Cymes* one to three at the apices of the branches, about 1 in. long (longer in fruit), laxly 3-flowered, the peduncle angled, puberulous, with small lanceolate bracteoles in whorls. *Flowers* ·5 in. long; their pedicels about the same. *Calyx* funnel-shaped; the mouth with 4 deep linear-lanceolate spreading lobes. *Corolla* twice as long as the calyx, tubular, expanding at the mouth; lobes 4, oblong, blunt; throat with a ring of hairs. *Stamens* 4, included. *Anthers* curved, oblong; their filaments attached to the tube. *Disk* conical. *Ovary* 2-celled, 2-ovuled. *Fruit* ellipsoid, smooth, ·65 in. long; the remains of the calyx ·2 in. long, blue when ripe. *Seed* solitary.

PERAK: *Scortechini* 511, 670; *Kings Collector* 4138, 5020.

3. SAPROSMA TERNATUM, Hook. fil. in Bth. & Hook. fil. Gen. Plant. II. 131; Fl. Br. Ind. III. 193. A glabrous shrub; young branches rather thinner than a goose-quill, pale when dry, compressed. *Leaves* often in whorls of three, thickly membranous, elliptic or elliptic-lanceolate, rarely oblanceolate-elliptic, shortly and rather abruptly acuminate, the base cuneate; both surfaces pale-brown when dry, the upper shining; the lower dull and paler; main-nerves 7 to 9 pairs, oblique, little curved, pale and prominent on the lower surface, the reticulations transverse and rather distinct on the lower surface only; length 4 to 8 in.; breadth 1·5 to 3·25 in.; petioles ·4 to ·6 in. long, with many short unequal bristles at their bases and inside the connate setosely-toothed stipules. *Cymes* solitary or fascicled, from 1·5 to 3·5 in. long, (longer in fruit) axillary, pedunculate, or branching from the base; the branches lax, spreading, sparsely flowered; the bracteoles few, linear. *Flowers* ·4 in. long, on pedicels varying from ·2 to ·6 in. long. *Calyx* ·1 in. long, shortly campanulate, the mouth wide and with 4 broad blunt teeth. *Corolla* ·3 in. long, salver-shaped, puberulous; the tube wide; the limb ·35 in. across with 4 or 5 broad reflexed lobes. *Fruit* ovoid or subglobular, crowned by the rather large calyx-teeth, ·35 in. in diam.; 1-seeded; seeds ellipsoid. Kurz. For. Fl. Burma II. 29. *Paederia ternata*, Wall. Cat. 6248 Roxb. Fl Ind., ed. Carey & Wall., II. 520; DC. Prod. IV. 471. *Mephitidea* sp., Griff. Notul. IV. 267; Ic. Pl. Asiat. t. 476.

PERAK: *Scortechini* 1163; *Wray* 2262, 2907, 2929, 3943; *King's Collector* 1975, 2764, 3052, 4006, 4069, 6760, 8491. PAHANG: *Ridley* 2225. SELANGOR: *Ridley* 8236.—DISTRIB. Andaman Islands, Burma, Khasia Hills, Sumatra, Java.

4. SAPROSMA RIDLEYI, King & Gamble. A shrub? Young branches

compressed, thicker than a crow-quill, pale, glabrous below, pubescent or tomentose towards the apices. *Leaves* membranous, oblanceolate to elliptic, shortly and rather bluntly acuminate, the base much narrowed; both surfaces pale-brown when dry and minutely pitted; the upper glabrous and with the midrib channelled; the lower sparsely pubescent, the midrib densely so and prominent; main-nerves 7 to 10 pairs, spreading but curving upwards at their apices, thin but prominent below; length 3 to 3·75 in.; breadth 1 to 1·5 in.; petiole ·1 to ·15 in. *Stipules* connate, pale, coriaceous, forming a narrow cup pubescent outside at first, but ultimately glabrous, from less than ·1 to ·15 in. deep, irregularly toothed, persistent. *Cymes* axillary and terminal, less than half as long as the leaves, trichotomous, the branches 3- or more-flowered, often with 2 elliptic acute involucral bracts at the base. *Flowers* ·25 in. long, their pedicels ·1 in. *Calyx* salver-shaped, ·15 in. long; the tube narrow, tomentose externally; the limb with 5 deep oblong blunt spreading or deflexed lobes; disk large. *Ovary* 2-celled, 2-seeded. *Corolla* and *Fruit* unknown.

SINGAPORE: *Ridley* 6474, only one specimen seen.

48. HYDNOPHYTUM, Jack.

Glabrous epiphytic shrubs, with a dilated tuberous fleshy stem, simple or lobed and perforated by ants. *Leaves* coriaceous, elliptic, obtuse. *Flowers* small, sessile, axillary, solitary or in fascicles, white. *Calyx-tube* ovoid-cylindric, the limb truncate. *Corolla* salver or funnel-shaped; tube short, hairy inside; limb 4-lobed, valvate. *Anthers* 4, oblong, subsessile on the corolla-throat. *Ovary* 2-celled; stigma 2-lobed; ovules one in each cell, basal, erect. *Fruit* containing two coriaceous pyrenes surrounded by pulp. *Seeds* oblong, plano-convex, testa thin with dark lines, embryo in the centre of the fleshy albumen.—DISTRIB. 3 or 4 species in Malaya, N. Australia, Fiji.

HYDNOPHYTUM FORMICARIUM, Jack in Trans. Linn. Soc. XIV. 124. All parts glabrous. *Stem* tuber-like, smooth, several inches to a foot in diameter, bearing roots from its base and from its apex a few short branches as thick as a goose-quill and compressed near the nodes, pale and striate when dry. *Leaves* elliptic or elliptic-oblong, sometimes obovate, the apex obtuse, the base cuneate; both surfaces pale-brown when dry; the midrib distinct on both; the 6 or 7 pairs of ascending little-curved main-nerves slender on both surfaces and the reticulations obsolete; length 2·5 to 3·5 in.; breadth 1 to 2·5, petioles ·1 to ·2 in. *Flowers* few, ·25 in. long, sessile in axillary fascicles. *Calyx* widely campanulate with rounded base and truncate apex. *Corolla-tube* nearly twice as long as the calyx, wide, with 4 tufts of hair in the throat; limb about half as long as the tube, with 4 broad oblong acute lobes, thickened at the apex. *Anthers* elliptic, on very short filaments inserted at the base of the tube. *Fruit* broadly ovoid, crowned by the cup-like remains of the calyx, glossy orange-red when ripe, about ·2 in. long. Blume Bijdr. 956: DC. Prod. IV. 451; Kurz For. Flora Burma, II. 8; Hook. fil. Fl. Br. Ind. III. 194; Beccari Malesia II. t. XLVII. f. 1 to 11; XLVIII. f. 1 to 8. *H. montanum*, Blume and DC. ll. cc. *Lasiostoma formicarium*, Spreng. Syst. I. 423; Wall. Cat. 9055.

MALACCA: *Griffith* (K.D.) 2975; *Maingay* (K.D.) 864. PENANG: *Curtis* 2164. PERAK: *Scortechini* 934; *Wray* 2673; *King's Collector* 4994. JOHORE: *Ridley* 335, 2840. SINGAPORE: *Ridley* 1617.—DISTRIB. Cochin-China, Sumatra, Borneo.

49. GEOPHILA, Don.

Small, slender, usually perennial, creeping herbs, glabrous or pubescent, the stems rooting. *Leaves* orbicular, reniform, ovate, often cordate, on long petioles. *Stipules* ovate, entire. *Flowers* small, solitary and subsessile or in pedunculate, bracteate, axillary or terminal umbels. *Calyx-tube* obovoid; its segments from 5 to 7, slender, persistent, spreading or reflexed. *Corolla* rather long, funnel-shaped, the throat hairy; lobes 4 to 7, valvate in bud. *Stamens* equal in number to the lobes. *Anthers* dorsifixed, linear; filaments thin. *Ovary* 2-celled; style slender, with 2 long or short branches: ovules erect, one in each cell. *Fruit* fleshy, with two plano-convex pyrenes. *Seeds* plano-convex, without any ventral groove; embryo minute, basal; radicle inferior.—DISTRIB. about 16 species, all tropical.

Leaves with broad, usually cordate bases:—
 Flowers solitary, axillary:—
  Leaves glabrous, ·5 in. long ... ... 1. *G. humifusa.*
  Leaves hairy, ·6 to 1 in. long ... ... 2. *G. pilosa.*
 Peduncles with 1 to 3 flowers; leaves reniform to ovate-cordate, glabrous, ·5 to 1·75 in. in length and breadth 3. *G. reniformis.*
 Peduncles with 6 to 9 flowers in an umbel; leaves glabrous, 1·75 to 3 in. long ... ... 4. *G. melanocarpa.*
Leaves with narrow bases never cordate, sparsely and minutely adpressed hairy, 1 to 1·5 in. long, peduncles few-flowered ... ... 5. *G. Scortechinii.*

1. GEOPHILA HUMIFUSA, King & Gamble, n. sp. Stems very slender, glabrous, rooting at the nodes, often several feet long. *Leaves* thickly membranous, glabrous, in distant pairs, ovate-cordate, acute, the edges undulate when dry, ·4 in. long and ·25 in. broad, the petiole as long as the blade, main-nerves about 3 pairs, one pair basal; stipules

broad-ovate, ·1 in. long. *Flowers* solitary, axilary, sub-sessile. *Fruit* as large as a currant, fleshly, bright-red.

PERAK: *Scortechini* 412.—DISTRIB. JAVA: on the Gedeh Volcano, *King*. SUMATRA: *Beccari* 44; *Forbes* 2059.

2. GEOPHILA PILOSA, H. H. W. Pearson in Hook. Ic. Plant., t. 2691. More slender than *G. reniformis*, the stem, leaves, peduncles and calyx with much stiff pubescence. *Leaves* broadly ovate-cordate, with sub-acute apices and slightly waved edges, both surfaces and petioles with pale stout curved hairs, the upper olivaceous, the lower paler green; main-nerves 3 pairs, much curved, spreading and ascending, rather distinct (when dry) on the lower; length ·6 to 1 in.; breadth ·35 to ·65 in.; petioles ·5 to 2 in. *Stipules* ovate, ·1 in. long. *Peduncles* terminal, ·5 to ·8 in. long, tomentose. *Flowers* solitary, or 2 to 3 in an umbel with 2 lanceolate hairy bracts at its base. *Flowers* ·25 in. long, sub-sessile. *Calyx*-tube cylindric, densely hairy, its lobes linear. *Corolla* tubular, with 5 deep ovate-acute teeth, pilose externally. *Fruit* sub-globular, black, crowned by the sub-coherent calyx-lobes, ·3 in. in diam.

SINGAPORE: *Ridley* 9516.—DISTRIB. BORNEO: *Barber* 249.

3. GEOPHILA RENIFORMIS, Don. Prodr. 136. *Stem* as thick as a crow-quill, 6 to 18 in. long, glabrous, the branches short. *Leaves* broadly ovate-cordate to reniform, the apex sub-acute or obtuse; upper surface brown when dry, the lower paler, both glabrous, the main-nerves mostly radiating from the base of the midrib, 3 or 4 pairs, not prominent; length ·5 to 1·5 in.; breadth ·5 to 1·75 in.; petioles ·35 to 2 in., often puberulous. *Stipules* small, semilunar, the apex reflexed. *Peduncles* slender, ·5 to 2 in. long, slender, 1- to 3-flowered. *Flowers* ·6 in. long, without pedicels, with lanceolate bracts at their bases. *Calyx*-lobes deep, narrowly lanceolate. *Corolla* much exceeding the calyx, its lobes lanceolate, glabrous or pubescent externally. *Berry* red, crowned by the calyx-lobes, sub-globular, ·35 in. in diam. DC. Prod. IV. 537; W. & A. Prod., 436; Wight Icon. t. 54; Dalz. & Gibs. Fl. Bomb. 111; Miq. Fl. Ind. Bat. II. 311; Hook. fil. Fl. Br. Ind. III. 178. *G. diversifolia*, DC. l.c., Wall. Cat. 8325. *Psychotria herbacea*, Linn. Sp. Pl. 245; Roxb. Fl. Ind. I. 533. *Cephaelis herbacea*, Kurz in Journ. As. Soc. Beng. 1877, II. 140. *C. diversifolia*, Bl. Bijdr. 1004.

MALACCA: *Maingay* (K.D.) 927; *Goodenough* 1526. PERAK: *Scortechini* 130, 2183; *Wray* 3368; *King's Collector* 265, 905. PENANG: *Curtis* 1930; *Deschamps*. POONGAH: *Curtis* 3235. KEDAH: *Curtis*.—DISTRIB. Malayan Archipelago, Ceylon, British India, Andaman Islands, Polynesia, S. China, tropical America and Africa.

4. GEOPHILA MELANOCARPA, Ridley in Trans. Linn. Soc. (2) III. 313, t. 62. *Stems* 6 to 18 in. long, compressed, as thick as or thicker

than a crow-quill, glabrous. *Leaves* thickly membranous, oblong-ovate; slightly cordate at the base, the apex sub-acute, the edges slightly waved; both surfaces glabrous, pale olivaceous-brown, the reticulations, midrib, and 3 to 5 pairs of ascending main-nerves prominent; length 1·75 to 3 in.; breadth ·75 to 1·5 in.; petiole 1 to 2·5 in.; puberulous. *Stipules* lanceolate, 1 in. long. *Peduncle* terminal, slender, ·75 to 3 in. long, compressed, bearing an umbel of 6 to 9 flowers with an involucre of linear blunt bracts at its base. *Flowers* ·6 in. long, on glabrous pedicels much shorter than themselves. *Calyx-tube* ·25 in. long; its lobes longer, oblong, obtuse. *Corolla-tube* about ·25 in. long, its lobes shorter, oblong, blunt. *Stamens* included. *Fruit* fleshy, broadly ovoid, black when ripe, shining, ·35 in. in diam. and (including the persistent calyx-teeth) slightly longer; pyrenes ·25 in. long, plano-concave with a ridge on each side.

PERAK: *Scortechini* 129; *King's Collector* 10134. MALACCA: *Ridley* 1608. SELANGOR: *Ridley* 8569.

5. GEOPHILA SCORTECHINII, King, n. sp. *Stem* prostrate, rather thicker than a crow-quill, obscurely 4-angled, 1 or 2 feet long; the branches short, erect. *Leaves* sub-fleshy, ovate or ovate-elliptic, base narrowed or rounded; both surfaces with sparse very minute white adpressed hairs; upper (when dry) pale-brown, the nerves indistinct; lower yellowish, the midrib and the 3 or 4 pairs of much curved ascending nerves slightly prominent; length 1 to 1·5 in.; breadth ·6 to ·9 in.; petioles ·35 to ·75 in. *Peduncles* terminal, about as long as the leaves, slender, compressed, bracteote, dichotomous near the apex and bearing two small linear bracts at each bifurcation. *Flowers* few, on short bracteolate pedicels, ·6 in. long (to the end of the long style). *Calyx* with a long narrow tube, and 5 long linear acuminate lobes puberulous outside. *Style* very long, filiform.

PERAK: *Scortechini.*

CEPHAELIS, *Swartz.*

Undershrubs or perennial herbs, usually erect. *Leaves* oblanceolate, obovate or oblong; stipules usually solitary, connate at the base (in the Malayan species) *Flowers* in involucrate heads. *Calyx* with a funnel-shaped tube and (in the Malayan species) an entire persistent limb. *Corolla* funnel-shaped or salver-shaped, its throat naked or hairy; lobes of the limb 4 or 5, erect or spreading, valvate. *Stamens* 4 or 5, inserted in the mouth of the corolla-tube, usually shortly exserted. *Anthers* oblong or linear, dorsifixed. *Ovary* 2-celled (rarely 3- or 4-celled. *Style* long or short. *Ovules* 1 in each cell, basal, erect. *Fruit* dry or fleshy, of two plano-convex pyrenes. *Seeds* plano-convex, their testa membranous, albumen horny. *Embryo* small, basal, the cotyledons leafy.—DISTRIB. Species about 70, all tropical.

Stipules coriaceous, their bases coriaceous and leaving bold scars on the stem:—
Capitula sessile, 1 to 3 in. across; leaves 3 to 5 in. broad; stipules broadly ovate, ·8 in. long ... ... 1. *C. Griffithii.*
Capitula pedunculate, ·75 to 1 in. across; leaves ·5 to 3·5 in. broad; stipules coriaceous, broadly ovate with discoloured edges, ·1 to ·5 in. long ... ... 2. *C. cuneata.*
Stipules not coriaceous, leaving no scars on the stem ... 3. *C. Ridleyi.*

1. CEPHAELIS GRIFFITHII, Hook. fil. Fl. Br. Ind. III. 178. Young branches thicker than a swan-quill, lenticellate. *Leaves* membranous, oblong-oblanceolate, shortly and rather abruptly acuminate, gradually narrowed from above the middle into the long slightly winged petiole, both surfaces glabrous, brown when dry, the lower the paler; main-nerves 12 to 20 pairs, curving upwards, prominent like the midrib on the lower surface, rather faint on the upper surface when dry; length 10 to 16 in.; breadth 3 to 5 in.; petioles 2·5 to 3 in. *Stipules* coriaceous, sub-orbicular, their apices sub-acute, ·8 in. long, the margins entire, thin, and discoloured. *Capitulum* sub-globular, from 1 to 2 in. in diam., sessile or shortly stalked, bearing numerous orbicular bratcs like the stipules, but smaller. *Flowers* ·75 in. long, on short pedicels. *Calyx* ·15 in. long, the tube narrow-cylindric; the mouth abruptly campanulate, entire, truncate. *Corolla* funnel-shaped, ·65 in. long, mouth with 5 ovate-acute reflexed lobes. *Fruit* ·35 in. long, compressed, slightly grooved along the edges, with a broad dorsal rib on each side, crowned by the calyx-limb. *Seed* thin.

MALACCA: *Griffith* (K.D.) 3032; *Maingay* (K.D.) 928. NEGRI SEMBILAN: *Ridley* 10109. PERAK: *King's Collector* 746, 2534, 6251, 6399, 10782; *Wray* 1197, 1338, 3027; *Ridley* 9755; *Scortechini.*—DISTRIB. SUMATRA: *Forbes*, 2511.

Differs from *C. cuneata* in the longer and sessile capitulum and somewhat larger leaves and stipules.

2. CEPHAELIS CUNEATA, Korth. in Ned. Kruidk. Arch. II. 248. A shrub; young branches thinner than a goose-quill, glabrous, the nodes sometimes close together and always marked by the pale coriaceous bases of the deciduous stipules. *Leaves* thickly membranous, oblanceolate or elliptic-oblanceolate, gradually narrowed from above the middle into the slightly winged petiole; both surfaces glabrous, olivaceous when dry, the lower the paler; main-nerves 10 to 18 pairs, curved, spreading and ascending, indistinct on the upper surface when dry but distinct on the lower, the midrib broad; length from 5 to 10 in.; breadth 1 to 2·5 in.; petioles narrowly winged, ·5 to 1·5 in. long. *Stipules*

coriaceous, broadly ovate and about ·5 in. long or forming small shallow, cups ·1 in. deep always with more or less broad discoloured edges *Capitulum* pedunculate, from ·8 to about 1·25 in. in diam. enveloped in thickly membranous, veined, involucral bracts, the inner being mostly orbicular-oblong but the two or three lower (external) elongate-oblong and connate; the peduncle from 1 to 3 in. long, ebracteate. *Flowers* ·75 in. long. *Calyx* only ·15 in. long, cylindric but widening slightly at the truncate apex. *Corolla* ·65 in. long, infundibiliform, the mouth with 5 short triangular reflexed lobes. *Anthers* linear-oblong, their apices slightly exerted. *Disk* large and deep. *Style* longer than the anthers; stigma fleshy, 2-lobed, exserted. *Fruit* ·4 in. long, compressed, deeply grooved on the edges and with a stout dorsal ridge on each side, crowned by the calyx.

MALACCA: *Griffith* (K.D.) 3085; *Goodenough* 1979; *Derry* 609; *Maingay* (K.D.) 929; *Hullett* 790. SINGAPORE: *Ridley* 4966. JOHORE, *King; Ridley* 3733, 6405. PAHANG: *Ridley* 2198. PERAK: *Scortechini* 343; *Ridley* 2924; *King's Collector* 1104, 6218; *Wray* 1497, 1977.

Sir Joseph Hooker considers *C. cuneata*, Korth. to be a species, and in deference to his opinion we have kept it up. The two chief characters, on which he relies to separate it from *C. Griffithii* are the pedunculate inflorescence and the narrower leaves. But, in a large suite of specimens, these break down, for there are specimens in which distinct peduncles are associated with the broadly oblanceolate leaves of *C. Griffithii.* A third and minor character used to separate the two is the size of the stipules,—those of *C. Griffithii* being 1 in. in diam., and those of *C. cuneata* only ·25 in. But, here again, there are numerous variations which do not fit in as distinctive marks with the other two characters. I think it might be better to treat *C. cuneata* as a variety of *C. Griffithii*, referring to it (amongst the specimens cited above) only *Griffith* 3085, *Maingay* 929 and *Hullett* 796.

3. CEPHAELIS RIDLEYI, King, n. sp. Like *C. Griffithii*, but with rather narrowly elliptic leaves, tapering to each end, the main-nerves faint and only 8 to 10 pairs, 8 or 9 inches in length and from 2·5 to 3 in. in breadth; stipules lanceolate not coriaceous, the capitules shortly trichotomous, 2·5 to 3 in. in diam. on thick peduncles 1 in. long, subtended by two boat-shaped bracts 1·35 in. long, flowers shorter than the tanceolate inner bracteoles.

SINGAPORE: *Ridley* 9515; *Yapp* 433. PENANG: *Curtis.* SELANGOR: *Ridley* 7417.

51. LASIANTHUS, Jack.

Shrubs or small trees, often fœtid, with terete branches often compressed at the nodes. *Leaves* distichous, more or less acuminate (often very much so), the veins transverse and often distinct; stipules usually broad. *Flowers* small, in axillary, often bracteate, sessile (rarely peduncled), fascicles on condensed cymes. *Calyx-tube* short; the limb with 3 to 5 long or short persistent teeth, sometimes truncate. *Corolla* funnel- or salver-shaped, its throat villous; the limb with 3 to 7 valvate lobes. *Stamens* 4 to 6, inserted by short filaments on the throat, often apiculate, included. *Style* long or short, stigmas 3 to 9, short, blunt; ovules 1 in each cell, basal, erect, usually linear. *Drupe* small, containing 3 to 9 triquetrous 1-seeded pyrenes. *Seeds* narrow, with membranous testa; embryo terete; radicle slender, inferior.—DISTRIB. About 50 species, mostly tropical Asiatic.

A genus resembling in facies *Urophyllum*; but distinguished from that by its 1-seeded pyrenes and deeply-lobed, not truncate, calyx-limb; also by its larger stipules, and shorter corolla-tube.

Flowers 4-5-merous:—

Glomeruli hemispheric, sessile, not longer than the petioles; bracts and flowers numerous:—

Glomeruli partially or entirely covered (at least when young) by the persistent, often coriaceous, stipules; leaves usually more than 8 in. long; bracts longer than the flowers (except in No. 43, VAR.):—

Leaves elliptic-oblong, hispidulous on both surfaces 1. *L. scabridus.*

Leaves oblanceolate, glabrous on the upper surface, pubescent (usually minutely so) on the lower ... 2. *L. Griffithii.*

Leaves oblong-lanceolate, glabrous on both surfaces 3. *L. stipularis.*

Glomeruli not covered by the more or less deciduous stipules, bracts longer than the flowers:—

Bracts unequal, diminishing in size inwards; the outer ovate-lanceolate often 1 in. long; the inner lanceolate or linear; pubescence of leaves rusty ... 4. *L. cyanocarpus.*

Bracts uniform, all linear and densely hispid; leaves oblong-lanceolate, thickly coriaceous, rugulose and glabrous on the upper surface; the lower softly pubescent ... ... 5. *L. rhinocerotis.*

Bracts uniform, all broad; leaves membranous; pubescence of leaves yellowish... ... ... 6. *L. inæqualis.*

Cymes twice as long as the petioles with few flowers and few linear hirsute bracts shorter than the flowers; leaves coriaceous, elliptic-lanceolate acute, glabrous above (except the midrib), softly hairy and reticulate below, main-nerves 11 to 13 pairs; pyrenes 5 to 7 ... ... 7. *L. pilosus.*

Cymes not much longer than the petioles with few flowers but many linear softly hairy bracts longer than the flowers; leaves membranous, narrowly elliptic, somewhat oblanceolate, quite glabrous above; main-nerves 8 or 9 pairs ... ... 8. *L. Ridleyi.*

Cymes about as long as the petioles with few flowers and many linear pubescent bracts shorter than the flowers; leaves thinly membranous, narrowly elliptic acuminate, glabrous above and minutely pubescent beneath; main-nerves 5 or 6 pairs; pyrenes 4 ... ... 9. *L. flavicans.*

Cymes shorter than the petioles, few-flowered, bracts few:—

Leaves 8 to 10 in. long:—

All parts quite glabrous; bracts small, fimbriate leaves 4·5 to 6 in. long ... ... 10. *L. longifolius.*

Leaves pubescent at least below, more or less oblanceolate, bracts linear:—

Main-nerves of leaves 4 pairs ... ... 11. *L. constrictus.*

Main-nerves of leaves 6 to 8 pairs—

Stipules linear, hirsute, as long as the petioles; calyx ·1 in. long; corolla ·3 in. long, its lobes narrow ... ... 12. *L. singaporensis.*

Stipules triangular, sub-acute or bifid; calyx ·25 in. long; corolla shorter than the calyx, its lobes oblong, blunt ... ... 13. *L. ellipticus.*

Leaves elliptic-ovate, tapering to each end, nearly glabrous; main-nerves 4 to 6 pairs, faint like the reticulations; bracts linear; flowers under ·1 in. long 14. *L. subspicatus.*

Leaves oblong-lanceolate; main-nerves 5 pairs, ascending, the reticulations horizontal, strong, puberulous on the under surface; bracts broad; flowers ·15 in. long ... ... 15. *L. Wrayi.*

Leaves oblong, acute at both ends, under surface pubescent everywhere; main-nerves 6 or 7 pairs, ascending; bracts oblong, acuminate, flowers ·3 in. long. 16. *L. Kurzii.*

Leaves 2 to 4 in. long, much narrower than long:—

Bracts of cymes large, broadly ovate to elliptic ... 17. *L. sub-inæqualis.*

Bracts of cymes linear:—

Upper surfaces of leaves quite glabrous; calyx-lobes crowning the fruit, ·25 in. long; pyrenes 5 ... 18. *L. coronatus.*

Upper surfaces of leaves glabrous except for a few hairs on the midrib; calyx teeth on the fruit short: pyrenes 8 ... ... 19. *L. appressus.*

Upper surfaces of leaves glabrous except the cinereous-tomentose midrib; under surfaces minutely pilose; bracts of cyme lanceolate or oblanceolate, tapering to each end; flowers 4-merous ... ... 20. *L. attenuatus.*

Both surfaces of the leaves and all parts of the plant with coarse flexuose hairs with bulbous bases; bracts of cyme linear, hispid; flowers 5-merous ... 21. *L. densifolius.*

Cymes ebracteate, sessile, shorter or rarely a little longer than the leaf-petioles:—

Leaves-quite glabrous on both surfaces:—

Leaves 7 to 12 in. long and 2·5 to 3·5 in. broad:—

Lower surfaces of leaves at first puberulous, afterwards quite glabrous, their main-nerves 16 to 20 pairs: stipules ·4 in. long, coriaceous, sagittate; calyx shortly campanulate, ·1 in. long, obscurely 4- or 5-toothed; fruit sub-globular, glabrous, 6-ridged; pyrenes 5 or 6 ... ... 22. *L. robustus.*

Lower surfaces of leaves always quite glabrous; main-nerves of leaves 10 to 12 pairs; stipules ·2 in. long, triangular, acuminate; calyx ·15 in. long, widely tubular, the mouth truncate, fruit hairy; pyrenes 4 ... ... 23. *L. coriaceus.*

Main-nerves of leaves 10 pairs; stipules ·15 in. long, broadly triangular with abrupt oblong apices: calyx ·25 in. long, tubular, the mouth truncate but obscurely 4-toothed ... ... 24. *L. pergamaceus.*

Leaves 3·5 to 6 in. long:—

Leaves elliptic or oblanceolate-elliptic, 1·35 to 2·5 in. broad; main-nerves 5 pairs; fruit ellipsoid, 4-ridged, ·45 in. long; pyrenes 4, rugulose ... ... 11. *L. constrictus.*

Leaves oblong-lanceolate, 1 to 1·4 in. broad; main-nerves 8 or 9 pairs; fruit sub-globose, ·2 in. in diam.; pyrenes 4, smooth ... ... 25. *L. malaccensis.*

Leaves quite glabrous on both surfaces except for a few adpressed hairs on the lower part of the midrib on each, elliptic-oblong, sharply acuminate, 5 to 6·5 in. long and 1·5 to 2 in. broad; main-nerves 8 or 9 pairs... 26. *L. chinensis.*

Leaves glabrous on both surfaces except the midribs and 10 to 13 pairs of main-nerves, adpressed-puberulous on both, elliptic-oblong, 3 to 4·25 in. long and 1·25 to 1·5 in. broad ... ... 27. *L. Wightianus.*

Leaves quite glabrous above, minutely sub-strigose below, elliptic or oblong-elliptic, bluntly acuminate or sub-acute:—

Leaves with 10 or 12 pairs of main-nerves ... 28. *L. pterospermus.*

Leaves with 3 or 4 pairs of main-nerves... ... 11. *L. constrictus.*

Leaves glabrous on the upper surface, the lower sparsely pilose everywhere ... ... 7. *L. pilosus* VAR. *angustifolius*

Leaves glabrous on the upper surface, the lower hairy on the midrib and main-nerves:—

Leaves 6 to 10 in. long, elliptic or obovate-elliptic; main-nerves 7 or 10 pairs ... ... 29. *L. perakensis.*

Leaves 3 to 7 in. long:—

Leaves narrowly oblong-lanceolate, five or six times longer than broad, their apices caudate-acuminate:—

Neither surface of leaves scaly; main-nerves 12 to 14 pairs; cymes 2-to 3-flowered; mouth of calyx with 5 triangular acuminate lobes; corolla tubular, its lobes pubescent; pyrenes 4 or 5 ... 30. *L. angustifolius.*

Both surfaces of leaves minutely scaly; main-nerves about 7 pairs; cymes 5-to 7-flowered; mouth of calyx truncate, entire; corolla salver-shaped, the lobes densely hirsute; pyrenes 7 or 8 31. *L. oblongus*

Leaves 5 or 6 in. long, oblong, sub-acute or shortly and bluntly acuminate; under surfaces sub-glabrous between the 9 to 11 pairs of adpressed-tomentose main-nerves and veins; calyx cupular-campanulate with 5 triangular teeth ... ... 7. *L. pilosus.*

Leaves 3 to 4·5 in. long, ovate-lanceolate, shortly acuminate; under surface glabrous except the pubescent midrib and 5 or 6 pairs of pubescent main-nerves; calyx with 5 long unequal linear-lanceolate lobes ... ... 32. *L. montanus.*

Leaves 2·5 to 3·5 in. long, lanceolate or elliptic-lanceolate, long-acuminate; under surface softly pubescent on the 4 to 6 pairs of main-nerves; calyx with 5 sub-equal linear-lanceolate lobes; fruit sub-globular, sparsely pilose; pyrenes 5 ... ... 33. *L. Curtisii.*

Leaves never more than 3 in. long, elliptic-lanceolate, acuminate, glabrous above, reticulate beneath and adpressed-puberulous on the 6 or 7 pairs of bold main-nerves; calyx-lobes 5, linear-lanceolate, unequal ... ... 34. *L. pseudo-lucidus.*

Leaves never more than 1·5 in. long, oblong-lanceolate, acute or sub-acute, glabrous except the lower surfaces of the 6 to 8 pairs of minutely adpressed-puberulous main-nerves; calyx-teeth short triangular; pyrenes 4 ... ... 35. *L. nervosus.*

Leaves scaberulous on the upper surface, the lower scabrid-puberulous between the softly puberulous 4 to 6 pairs of main-nerves, elliptic or ovate-elliptic, 4 to 5 in. long; calyx narrowly campanulate ... 36. *L. Harveyanus.*

Leaves sparsely clothed with stiff bulbous hairs on the upper surface, the lower with more numerous shorter hairs, oblong-lanceolate, much acuminate; main-nerves 16 to 18 pairs; calyx with 5 deep lanceolate lobes ... ... 37. *L. ferrugineus.*

Leaves sparsely and minutely strigose on the upper surface, pilose on the lower, but the 7 to 10 pairs of main-nerves and the midrib tomentose on the latter surface; length 2·5 to 3·5 in.; calyx campanulate with sub-truncate obsoletely toothed mouth ... 38. *L. tomentosus.*

Inflorescence solitary, on peduncles much exceeding the petioles in length:—

Peduncles rather short, 3- to 5-flowered; leaves

narrowly elliptic-oblong, coriaceous, 4 to 5 in. long; almost glabrous, the reticulations bold and horizontal ... 39. *L. scalariformis.*
Peduncles filiform, 1- to 2-flowered; leaves 2 to 3 in. long, sessile or nearly so, broad and unequal at the base; both surfaces more or less hispidulous-pubescent ... 40. *L. filiformis.*
Peduncles filiform, 1-to 3-flowered, leaves under 1 in. long, petiolate, sub-rhomboidal or ovate; glabrous except sometimes the midrib at its base on the lower surface ... ... 41. *L. gracilis.*

Flowers 3-merous:—
Calyx and corolla 3-cleft; anthers and pyrenes each 3:—
Leaves 5·5 to 8·5 in. long, narrowly elliptic or sub-obovate-elliptic, usually glabrous; reticulations distinct, especially below, as are the 5 or 6 pairs of main-nerves; flowers puberulous; fruit obliquely elliptic ... 42. *L. Maingayi.*
Leaves 3·5 to 6 in. long, oblong-elliptic or lanceolate, everywhere glabrous; reticulations and 7 to 10 pairs of main-nerves faint; fruit depressed-trigonous or sub-didymous; pyrenes with a transverse partition and thus falsely 2-celled ... ... 43. *L. lucidus.*

1. LASIANTHUS SCABRIDUS, King & Gamble, n. sp. Young branches about as thick as a goose-quill, glabrous, black when dry. *Leaves* coriaceous, oblong or oblong-elliptic, shortly acuminate, the base narrowed and usually slightly unequal; both surfaces pale-brown when dry, rugulosely reticulate, scaberulous from numerous short stiff hairs with large bulbous bases, the midrib prominent and hirsute, the main-nerves and veins depressed, under surface with non-bulbous hairs longer and softer than those of the upper; the midrib and 10 to 13 pairs of curved spreading main-nerves hirsute like the midrib; length 4·5 to 8 in.; breadth 1·35 to 2·35 in.; petiole ·5 to ·7 in.; hirsute; stipules broadly triangular-acute or obtuse, thickly coriaceous, glabrous, ·4 or ·5 in. long, and nearly as broad, persistent. *Glomeruli* somewhat shorter than the petioles, sessile, dense, many-flowered, partly covered by the stipules when young, bearing very numerous linear obtuse bracts, black, glabrous and shining on their posterior surface, but on the edges and in part covered with coarse bristly hairs. *Flowers* few, sessile, much shorter than and concealed amongst the bracts. *Calyx* narrowly campanulate with a glabrous tube, and 5 lanceolate pubescent lobes. *Fruit* glabrous, except the persistent calyx-lobes, about ·2 in. long; pyrenes 5, rugulose.

JOHORE: *Ridley* 6463, 11170, 7112.

2. LASIANTHUS GRIFFITHII, Wight in Calc. Journ. Nat. Hist. VI, 505. Young branches as thick as a swan's-quill, terete below but compressed in the very young parts, sparsely and deciduously pubescent, ultimately sub-glabrous, dark-coloured when dry. *Leaves* large, thickly

coriaceous, oblanceolate-elliptic, shortly acuminate, the base acute; both surfaces pale-brown tinged with olivaceous; the upper quite glabrous, often rugulose from the depression of the nerves and reticulations; the midrib not depressed but channelled near the base; under-surface paler, the bold midrib, nerves and veins, and their interspaces in a less degree pubescent; length 8 to 12 inches; breadth 3 to 4 in.; petioles ·3 to ·5 in., winged above; stipules broadly triangular, obtuse or acute, coriaceous, partly covering the inflorescence when young, more or less persistent. *Glomeruli* somewhat longer than the petioles, hemispheric, condensed, many-flowered; flowers sessile, ·2 in. long, imbedded amongst numerous linear densely hirsute bracts somewhat longer than themselves. *Calyx* tubular-campanulate or campanulate, narrowed to the base, glabrous except the hirsute ovate or lanceolate lobes. *Corolla* in the perfect flowers ·3 in. long, salver-shaped, the tube narrow, glabrous except the villous throat; the limb with 5 narrowly lanceolate hirsute reflexed lobes. *Anthers* 5, exserted beyond the dense villous hairs of the throat, linear-oblong; filaments short. In *cleistogamic flowers* (which are numerous) the corolla smaller than the calyx but resembling it, 5 or 6 lobed. *Fruit* glabrous, ovoid, crowned by the slightly accrescent calyx-lobes, about ·2 in. long; pyrenes 5. Hook. fil. Fl. Br. Ind. III. 179.

MALACCA: *Griffith* (K.D.) 2935. JOHORE: *Ridley* 11177, 11179. SINGAPORE: *Ridley* 4121. PERAK: *King's Collector* 496.—DISTRIB. Borneo; *Haviland* 84.

VAR. *latibracteata*, King & Gamble; bracts of inflorescence broad, obtuse, glabrous outside, hirsute inside, shorter than the flowers, often becoming thick, white and polished when old, persistent.

SELANGOR: *Ridley* 10196. PERAK: *Ridley* 9528; *Scortechini* 612.

3. LASIANTHUS STIPULARIS, Blume Bijdr. 997. A slender shrub 3 to 6 feet high; all parts except the bracts and lobes of corolla inside glabrous: young branches half as thick as a goose-quill, dark-coloured when dry, smooth. *Leaves* membranous, oblong-lanceolate, shortly and rather abruptly cordate-acuminate, narrowed from below the middle to the short petiole; both surfaces pale-brown when dry, glabrous, the upper shining; main-nerves 9 to 12 pairs, curved, rather distinct on both surfaces, the midrib grooved on the upper, prominent on the lower surface; the main-nerves distinct on both; length 5 to 7 in.; breadth 1·5 to 2 in.; petioles ·25 to ·35 in. long. *Stipules* broadly ovate-cordate, sub-acute, ·5 to ·6 in. long, completely covering the inflorescence. *Flowers* nearly ·3 in. long, on very short flat pedicels, surrounded by numerous unequal narrowly lanceolate densely hirsute bracts longer than themselves. *Calyx* campanulate, ridged; the mouth with 4 or 5 broadly triangular acute teeth. *Corolla* thrice as long as the calyx; the tube

cylindric; the lobes 4 or 5, oblong, blunt, villous inside. *Stamens* 4 or 5, on short compressed filaments; anthers oblong, their tips exserted. *Fruit* ovoid-globose, sub-ligneous, glabrous, with 8 to 10 vertical ridges, crowned by the calyx-lobes, ·25 in. long, and ·2 in. in diam., 4- or 5-celled, with a single compressed erect seed in each cell. Kurz Fl. Burm. II. 32. Hook. fil. Fl. Br. Ind. III. 179. *Mephitidia stipularis*, DC. Prod. IV. 453.

SINGAPORE: *Ridley* 4903, 6559, 10419; *King*. SELANGOR: *Ridley* 8230, 8575. PERAK: *Scortechini* 213; *Wray* 2019; *Ridley* 9743; *King's Collector* 340.—DISTRIB. Malay and Andaman Archipelagos.

4. LASIANTHUS CYANOCARPUS, Jack in Trans. Linn. Soc. XIV. 125. A shrub 6 to 8 feet high; all parts more or less tawny- or rusty-hirsute, the hairs shining and often flexuose; young branches half as thick as a goose-quill. *Leaves* coriaceous, oblong, oblong-elliptic or oblanceolate-oblong, shortly acuminate, the base somewhat narrowed, unequal-sided; upper surface dark olivaceous-brown when dry, the lower paler with the transverse veins distinct; main-nerves 7 to 10 pairs, curved, spreading and ascending, bold on the lower surface, depressed on the upper when dry; length 4·5 to 6·5 in.; breadth 1·65 to 2·25 in.; petioles ·15 to ·25 in. *Stipules* narrowly triangular, acuminate, ·2 in. long. *Cymes* sessile, shorter than the petioles, enveloped by a number of densely hirsute bracts diminishing in size inward; the outer ovate-lanceolate acuminate and often 1 in. or more in length; the inner much smaller, lanceolate or linear. *Flowers* only 3 or 4, sessile, concealed amongst the numerous bracts, only about ·25 in. long and shorter than even the innermost bracts. *Calyx* longer than or about as long as the corolla, campanulate, with 4 or 5 long narrow hirsute lobes. *Corolla* tubular, glabrous inside; its lobes oblong, blunt. *Anthers* oblong, blunt, almost sessile. *Fruit* ovoid-globular, glabrous, but crowned by the long hirsute calyx-lobes, ·2 to ·25 in. long, separating into 4 or 5 three-sided, one-seeded pyrenes. Kurz For. Fl. Burma, II. 32; Hook. fil. Fl. Br. Ind. III. 179. *L. bracteatus* and *L. Roxburghii*, Wight in Calc. Journ. Nat. Hist. VI. 501, 502. *L. oculus-Cati*; Miq. Fl. Ind. Bat. II. 315. *L. laevicaulis*, Kurz in Trimen's Journ. Bot. 1875, p. 327. *Lasianthus?* Wall. Cat. 8440. *Mephitidia cyanocarpa*, DC. Prod. IV. 452. *M. rhinozerotis*, Kurz in Andaman Report, Append. A. 40; (not of Blume?). *Triosteum hirsutum* Roxb. Fl. Ind. I. 538. *Rubiacea*, Wall. Cat. 8305.

In all the Provinces, common.—DISTRIB. British India, Malay Archipelago.

VAR. *subsessilis*; petioles only about ·1 in. long, bases of leaves oblique.

PERAK: *Ridley* 9730; *King's Collector* 472; *Scortechini* 1207.

Wall. Cat. 8440 belongs here.

5. LASIANTHUS RHINOCEROTIS Blume Bijdr. 996. A shrub or small tree; young branches rather thinner than a goose-quill, covered like the petioles with dense short rusty-tomentum. *Leaves* coriaceous, narrowly oblong-lanceolate, acute, the base rounded; upper surface glabrous, the midrib depressed when dry, the nerves depressed, the veins inconspicuous; lower surface everywhere hairy, the 10 to 12 bold oblique ascending little-curved main-nerves and the stout midrib tomentose; the prominent transverse veins pubescent and the interspaces puberulous; length 4 to 7 in.; breadth 1·5 to 2·25 in.; petioles ·25 in. long; stipules broadly triangular acute, pilose, ·1 to ·2 in. long. *Glomeruli* sessile or on short pedicels, axillary, bearing very numerous narrow bracts, the outer linear, the inner subulate, all softy rusty-pilose, mostly ·5 or ·6 in. long, the inner sometimes shorter. *Flowers* much shorter than the bracts and concealed by them, few, sessile or subsessile. *Corolla* with 5 deep concave lobes, pilose outside. *Fruit* ovoid, pointed, blue, about ·15 in. long, separating into 5 three-cornered pyrenes. Miq. Fl. Ind. Bat. II. 315. *Mephitidia rhinocerotis* DC. Prod. 453; Korthals in Ned. Kruidk. Arch. II. 220.

PERAK: at elevations of 4500 feet and upwards. *Scortechini* 532, 537; *Wray* 237; *King's Collector* 3209, 3809. SELANGOR: *Kelsall* 1993. —DISTRIB. Java.

Closely allied to *L. crinitus* Jack, but differing in the characters of the hairs and bracts. In that species the outer bracts are much longer than the inner; in this the outer bracts are not longer and only slightly broader than the inner.

6. LASIANTHUS INAEQUALIS, Blume Bijdr. 996. A shrub; young branches twice as thick as a crow-quill, densely tawny-pilose like the petioles. *Leaves* membranous, olivaceous-green when dry, elliptic, oblanceolate-elliptic or oblong, shortly acuminate, more or less narrowed to the rounded, sometimes slightly oblique, base; upper surface shining, glabrous, except the bold pilose midrib and puberulous nerves, minutely reticulate; lower surface softly and sparsely pilose; length 3 to 5·5 in.; breadth 1 to 2 in.; petiole ·2 to ·25 in.; stipules linear, pilose, ·6 or ·7 in. long, deciduous. *Glomeruli* axillary, twice as long as the petioles, few-flowered, the bracts broadly ovate, abruptly acuminate, bearing much yellow hair, especially externally, ·7 in. in length. *Flowers* ·35 in. long, sessile. *Calyx* campanulate, with 4 deep unequal lanceolate spreading lobes. *Corolla* shorter than the calyx, with a short tube and 4 oblong lobes, glabrous inside, but outside covered like the calyx with long yellow hair. *Anthers* ovate, almost sessile. *Fruit* narrowly ovoid, sparsely hairy, crowned by the accrescent connivent calyx-lobes; length ·35 in. (of which nearly half is calyx); pyrenes 4, three-sided, rugose.

PENANG: at 1500 feet; *Curtis* 760. PERAK: *Ridley* 9726.

A very distinct species and not resembling *L. cyanocarpus* Jack, to which some authors have reduced it. It is much more nearly allied to *L. subinæqualis*, King & Gamble.

7. LASIANTHUS PILOSUS, Wight in Calc. Journ. Nat. Hist. VI. 506. A shrub or small tree; young branches about as thick as a goose-quill; covered like the petioles and undersurfaces of the leaves (and often the stipules and inflorescence) with very dark short rusty tomentum, sometimes tinged with green. *Leaves* coriaceous, dark olivaceous-brown when dry, oblong or elliptic-lanceolate, the apex sub-acute or shortly and abruptly acuminate, the base sub-cuneate or rather rounded; both surfaces boldly and transversely reticulate when dry; the upper sparsely pilose or glabrous except sometimes the depressed faint midrib, hirsute; the lower sub-glabrous or sparsely hairy between the prominent adpressed-tomentose main-nerves, the midrib bold on the lower surface, depressed and glabrous on the upper; main-nerves 9 to 13 pairs, curved, ascending; length 4·5 to 6 in.; breadth 1·25 to 2·5 in.; petiole ·1 to ·3 in.; stipules triangular-lanceolate, acute, hairy, about ·1 in. long. *Cymes* glomerulate, sessile, few-flowered, longer (sometimes shorter) than the petioles. *Flowers* sessile; bracts shorter than the calyx, hirsute. *Calyx* about ·2 in. long, cupular-campanulate, hirsute outside, with about 5 triangular teeth. *Corolla* 5- to 7-cleft, dirty purple, shortly campanulate. *Fruit* blueish-black and ultimately glabrous, sub-globular, not longer than the persistent calyx-lobes; pyrenes 5 to 7. Hook. fil. Fl. Br. Ind. III. 182. *L. setosus*, Wight in Calc. Journ. Nat. Hist. VI. 506; Hook. fil. Fl. Br. Ind. l.c. 181.

MALACCA: *Griffith* (K.D.) 2918; *Maingay* (K.D.) 869; *Cuming* 239; *Hervey*. PERAK: at elevations of about 5000 feet; *Wray* 876. JOHORE: *Ridley* 11180. SELANGOR: *Ridley* 8231.

VAR. *angustifolia*, King & Gamble; branches more hirsute and with greenish-brown tomentum; leaves rather membranous, their lower surfaces sparsely and shortly pilose between the nerves, 4 or 5 in. long and 1 to 1·15 in. broad; stipules lanceolate.

MALACCA: *Griffith*; *Maingay*. PERAK: *Scortechini* 374?—DISTRIB. Burma.

VAR. *glabra*, King and Gamble; *leaves* with only 9 to 11 pairs of nerves, their upper surfaces quite glabrous even on the midrib, the reticulations not depressed and not very distinct.

SELANGOR: *Ridley* 7424.

8. LASIANTHUS RIDLEYI, King & Gamble, n. sp. A shrub; young branches, petioles and under surfaces of the midribs of the leaves densely and softly pubescent. *Leaves* membranous, narrowly elliptic, somewhat

oblanceolate, sub-acute, tapering in the lower third to the slightly rounded base; both surfaces olivaceous when dry; the upper glabrous, shining, with the midrib and nerves slightly prominent; the lower paler with prominent transverse reticulations, downy between the veins; main-nerves 8 or 9 pairs, slightly curved, ascending, thin but distinct on the lower surface like the midrib; length 7 to 8 in.; breadth about 2·5 in.; petiole about ·2 in.; stipules linear, hirsute. *Glomeruli* shorter than the petioles, bearing a few flowers hidden amongst numerous linear bracts with many pale spreading hairs. *Calyx* sessile, ·15 in. long, narrowly campanulate; the tube glabrous; the lobes 5, acuminate, erect, covered outside with long stiff white hairs. *Corolla* and fruit unknown.

SINGAPORE: *Ridley* 3620*a*.

9. LASIANTHUS FLAVICANS, King & Gamble, n. sp. Young branches thinner than a goose-quill, clothed with dense short yellowish-brown deciduous tomentum like the petioles. *Leaves* thickly membranous, narrowly elliptic, the apex acuminate, the base cuneate; upper surface olivaceous-green, glabrous except the lower part of the midrib, the nerves indistinct, shining; lower surface darker and with much short minute pubescence, especially on the 5 or 6 pairs of sharply ascending bold main-nerves and conspicuous transverse veins; length 5 to 7 in.; breadth 1·25 to 2 in.; petiole ·3 to ·35 in. short; stipules shorter than the petioles while in flower (longer in fruit), oblong, blunt or acute, adpressed to the stem, pubescent. *Glomeruli* about as long as the petioles, few-flowered, bearing numerons linear very pubescent bracts shorter than the flowers. *Flowers* few, sessile or nearly so, ·3 in. long. *Calyx* narrowly campanulate, glabrous, constricted below the 4 large triangular, spreading sparsely hirsute teeth. *Corolla* twice as long as the calyx and exceeding the bracts, clavate in bud, glabrous outside except for a few hairs on the back of the lobes, villous inside, salver-shaped, the limb with 4 broad triangular teeth. *Anthers* 4, broadly ovate, on short filaments; style as long as the corolla. *Fruit* elliptic, pointed towards each end, the apex crowned by the small calyx-teeth, glabrous, ·45 in. long, and ·25 in. diam.; pyrenes 4, rugulose.

SINGAPORE: in the Botanical Garden jungle; *Ridley* 4394, 6927. PERAK: *Scortechini*. PAHANG: *Ridley* 2223; *King's Collector* 10974.

VAR. *subglabra*, King, hairs short, often deciduous.

PERAK: *Curtis* 1334. SELANGOR: *Ridley* 4895.

10. LASIANTHUS LONGIFOLIUS, Wight in Calc. Journ. Nat. Hist. VI. 514. Shrub or small, tree? All parts quite glabrous; young branches as thick as a goose-quill, black when dry. *Leaves* coriaceous, broadly or narrowly elliptic, sometimes oblong or oblanceolate-elliptic, sub-acute or shortly and bluntly acuminate, much narrowed to the petiole,

both surfaces shining, boldly and transversely reticulate, the lower scaberulous; main-nerves 11 to 13 pairs, curved, spreading and like the midrib very prominent and minutely hispid on the lower, less prominent and glabrous on the upper; length 8 to 10 in.; breadth 2 to 3·5 in.; petioles ·3 to ·4 in.; stipules nearly as long as the petioles, coriaceous, triangular, sub-acute or blunt, partly covering the inflorescence, deciduous. *Cymes* shorter than the petioles, sessile. *Flowers* 4 to 6, sessile, surrounded at their bases by small rufescent fimbriate bracts much shorter than themselves. *Calyx* ·2 in. long, sessile, coriaceous, tubular, with 4 small blunt teeth, slightly puberulous outside. *Corolla* not seen. *Ovary* 4-celled, 4-seeded. Hook. fil. Fl. Brit. Ind. III. 187.

MALACCA: *Griffith* (K.D.) 2936; *Maingay* (K.D.) 867. PERAK: *Wray; Ridley* 7190. SELANGOR: *Ridley* 4904.

11. LASIANTHUS CONSTRICTUS, Wight in Calc. Journ. Nat. Hist. VI. 515. A shrub; young branches twice as thick as a crow-quill, compressed or sub-terete, like the petioles sparsely and deciduously strigose. *Leaves* membranous or thinly coriaceous, narrowly elliptic or elliptic-oblong, sometimes oblanceolate-elliptic, the apex rather bluntly acuminate, the base cuneate or rounded; both surfaces pale-olivaceous, minutely reticulate, and more or less shining when dry; the midrib on the lower surface minutely and sparsely strigose, otherwise both glabrous; main-nerves only 3 to 5 pairs, ascending and little curved, thin but distinct; length 3·5 to 5·5 in.; breadth 1·25 to 2·5 in.; petioles ·15 to ·2 in., corrugated, sparsely pubescent; stipules shorter than the petioles, lanceolate, adpressed-hairy, deciduous. *Cymes* sessile, shorter than the petioles (sometimes slightly longer) condensed, 4- to 6-, rarely 10-flowered; bracts minute or more usually absent, *Flowers* small, sessile or sub-sessile. *Calyx* ·1 to ·15 in. long, thick. narrowly campanulate, constricted below the 4- (rarely 3- to 5-) toothed mouth; teeth triangular, spreading, sparsely hairy. *Corolla* longer than the calyx, funnel-shaped, glabrous outside, the tube ·25 in. long, villous inside, the limb as long as the tube and with 5 sub-acute lobes. *Fruit* obliquely ellipsoid, tapering to each end, somewhat compressed, 4-ridged, rugulose, crowned by the small calyx, glabrous, ·35 in. long; and ·3 in. in diam.; pyrenes 4, sub-cylindric. Hook. fil. Fl. Br. Ind. III. 188 (excl. syn. Kurz Fl. Burm.) *Mephitidea* sp. Griff. Notul. IV. 267 t. 474, fig. 4.

SINGAPORE: *Ridley* 4902. SELANGOR: *Ridley.* BURMA: *Griffith.* PERAK: *King's Collector* 2564, 2780, 3591, 6065; *Scortechini.* PAHANG: *Ridley* 2222. JOHORE: *Ridley* 11183, 11189.—DISTRIB. Sumatra, *Beccari* P.S. 952; Borneo, *Haviland.*

12. LASIANTHUS SINGAPORENSIS, King & Gamble n. sp. A shrub?

Young branches, petioles and under surfaces of the leaf-midribs cinereous-pilose. *Leaves* thinly coriaceous, narrowly elliptic, more or less oblanceolate, tapering to each end, the apex obtusely acuminate; upper surface olivaceous when dry, glabrous, shining, the midrib distinct and channelled, the nerves rather faint; under surface pale-cinereous, minutely and softly pubescent, the 6 or 7 pairs of spreading ascending main-nerves bold like the transverse veins; length 5 or 6 in.; breadth 1·75 in.; petiole ·2 in.; stipules linear, hirsute, about as long as the petioles. *Cymes* sessile, shorter than the petioles, 4- to 6-flowered; bracts 2 or 3 at the base of each flower, linear-hirsute, about as long as the calyx. *Flowers* ·4 in. long, sessile. *Calyx* ·1 in. long, campanulate, the tube narrow, the limb wide with 5 deep triangular acute spreading teeth. *Corolla* funnel-shaped, ·3 in. long, outside glabrous except for a few hairs near the mouth, inside villous; lobes of the mouth 5, narrow. *Anthers* 5, narrowly oblong. *Fruit* unknown.

SINGAPORE: *Ridley* 9095.

13. LASIANTHUS ELLIPTICUS Wight in Calc. Journ. Nat. Hist. VI. 507. A tall shrub; young branches half as thick as a goose-quill, cinereous or sub-rusty adpressed-pilose like the petioles and under surfaces of the leaves. *Leaves* thinly coriaceous, olivaceous-brown when dry, narrowly elliptic or oblanceolate-elliptic, shortly acuminate, much narrowed to the base; upper surface glabrous, shining, the midrib, nerves and transverse veins rather distinct; main-nerves 7 or 8 pairs, slightly curved, ascending, bold on the under surface like the midrib; length 4·5 to 6·5 in.; breadth 1·5 to 2 in.; petioles ·15 to ·25 in.; stipules broadly triangular-lanceolate, sub-acute or sometimes bifid, almost glabrous, shorter than the petioles. *Glomeruli* shorter than the petioles, few-flowered, sessile, bearing (mostly on the outside) a few hirsute lanceolate bracts. *Calyx* ·25 in. long, widely campanulate, tapering much to the base, deeply divided into 5 triangular acuminate spreading lobes, densely hirsute externally, sparsely so internally. *Corolla* half as long as the calyx, divided almost to the base into 5 oblong blunt lobes, hirsute outside and glabrous inside. *Anthers* 5, short, sessile. *Fruit* unknown. Hook. fil. Fl. Br. Ind. III. 182.

PENANG: at an elevation of 2000 feet; *Curtis* 1594.

14. LASIANTHUS SUBSPICATUS, King & Gamble, n. sp. A small tree; young branches rather thinner than a goose-quill, 2-grooved like the petioles, under surfaces of the leaves and the inflorescence with minute, usually pale, flocculent deciduous pubescence. *Leaves* membranous, ovate-elliptic, much acuminate, the base cuneate; both surfaces brown when dry, the upper quite glabrous, the nerves and reticulations faint; the lower glabrous, except the midrib and nerves, the reticulations

distinct; main-nerves 4 to 6 pairs, oblique rather straight; length 3·5 to 5 in.; breadth 1·25 to 1·85 in.; petioles ·25 in.; stipules elongated triangular, acute, about as long as the petioles, the midrib keeled. *Cymes* spiciform, usually about as long as the petioles, their axes somewhat elongated, bearing a few broadly lanceolate, acute or acuminate bracts much shorter than the 6 to 12 flowers, all parts except the inside of the calyx and the corolla-tube on both surfaces covered with short rather thick hair. *Flowers* sessile, broadly clavate in bud, under ·1 in. long. *Calyx* as long as the corolla-tube, campanulate, with 5 small, spreading, triangular teeth. *Corolla*-tube much shorter than the sub-globular bluntly 5-lobed limb. *Anthers* 5, linear, embedded in the dense white hair which lines the inside of the lobes. *Fruit* unknown.

PENANG: *Curtis* 2476. PERAK: *Wray* 863.

15. LASIANTHUS WRAYI, King & Gamble, n. sp. A small tree; young branches twice as thick as a crow-quill, slightly compressed, densely adpressed-pubescent. *Leaves* thinly coriaceous, oblong-lanceolate, tapering much and about equally to each end; upper surface quite glabrous, shining, faintly reticulate, olivaceous-brown; lower surface darker, adpressed-pubescent on the midrib and 5 pairs of rather bold ascending little-curved nerves, the connecting veins bold, horizontal, puberulous, the areolæ glabrous; length 3·5 to 5 in.; breadth ·75 to 1 in.; petioles about ·3 in.; stipules triangular, acuminate, much shorter than the petioles. *Flowers* ·15 in. long, two or three on a very short axillary tubercle having a few short broad pubescent bracts at its base. *Calyx* ·05 in. long; sessile, campanulate, with 4 small acute teeth, adpressed-hirsute like the tubular corolla; teeth of corolla blunt. *Anthers* 4, linear-oblong, inserted by short filaments in the villous ring in the throat. *Fruit* unknown.

PERAK: at an elevation of 4500 feet; *Wray* 257.

16. LASIANTHUS KURZII, Hook. fil. Fl. Br. Ind. III. 183. A shrub? Young branches twice as thick as a crow-quill, densely olivaceous-tomentose like the petioles, stipules, and under surfaces of the midribs and main-nerves of the leaves. *Leaves* thinly coriaceous, oblong, acute at both ends: upper surface dark olivaceous-brown, glabrous, shining, the midrib somewhat depressed (when dry); lower surface dark-olivaceous, pubescent on the distinct horizontal veins and on the 6 or 7 pairs of ascending main-nerves, also on the veins and on the interspaces; length 3·5 to 4·5 in.; breadth ·75 to 1·25 in.; petioles ·15 to ·2 in.; stipules lanceolate with broad bases, shorter than the petioles. *Cymes* sessile, condensed, few-flowered, without the corolla shorter than the petioles, with the corolla longer; bracts oblong, acuminate, few. *Flowers* ·3 in.

long, sessile. *Calyx* sparsely pilose, ovoid, tapering to the small 4-toothed mouth. *Corolla* pilose outside, white, longer than the calyx, salver-shaped, the tube narrowly funnel-shaped; its limb with 4 broad blunt hairy teeth each bearing near its base an oblong anther on a short filament. *Fruit* (*fide* Curtis) blue, ·5 in. long.

PENANG: at an elevation of 2000 feet; *Curtis.* SINGAPORE: *Ridley* 140.

We refer this to *L. Kurzii* with some hesitation, for it does not absolutely agree with specimens from the Andamans so named by Sir Joseph Hooker.

17. LASIANTHUS SUB-INAEQUALIS, King & Gamble, n. sp. A shrub 3 to 5 feet high: young branches rather thicker than a crow-quill, densely rusty-tomentose like the short petioles. *Leaves* membranous, oblong-lanceolate, shortly acuminate, very little or not at all narrowed to the rounded sub-cordate, slightly oblique base; both surfaces pale, olivaceous-brown when dry; the upper sparsely pilose, densely so on the midrib; lower surface more or less pilose everywhere, densely so on the prominent midrib and 8 to 10 pairs of spreading curved main-nerves; length 2 to 3·5 in.; breadth ·75 to 1 in.; petiole under ·1 in.; stipules ovate to elliptic, sometimes tapering to each end, pilose, ·35 to ·5 in. long. *Glomeruli* few-flowered, axillary, not so long as the stipules, their bracts like the stipules but smaller. *Flowers* few, about ·3 in. long, sessile. *Calyx* deeply divided into 4 unequal lanceolate lobes. *Corolla* about ·15 in. long, divided into 4 short lobes, hairy outside like the calyx, concave and glabrous inside. *Anthers* 4, oblong, sessile. *Fruit* ·35 in. long, of which half is formed by the persistent calyx-lobes, globular, blue, sparsely hirsute; pyrenes 4, three-sided, smooth.

PERAK: *King's Collector* 157, 3358; *Wray* 2588, 3451; *Ridley* 9715; *Scortechini* 189.—DISTRIB. Sumatra: *Forbes* 2457: Java; on Mounts Salak and Pangerango.

Allied closely to *Lasianthus inaequalis* Bl.; King & Gamble, but with narrower subsessile leaves and much more conspicuous stipules, which are ovate or elliptic not linear.

18. LASIANTHUS CORONATUS, King & Gamble, n. sp. Young branches rather thicker than a crow-quill, covered like the petioles, stipules and lower surfaces of the leaf-midribs and main-nerves with soft brown tomentum. *Leaves* coriaceous, oblong-lanceolate, much acuminate, the base cuneate; both surfaces pale-brown when dry; the upper quite glabrous, except the tomentose lower fourth of the midrib, finely reticulate, the midrib and main-nerves depressed; lower surface darker than the upper, the reticulating veins transverse, bold and pubescent the enclosed spaces almost glabrous; main-nerves 5 or 6 pairs, bold,

spreading, tomentose; length 3 to 3·5 in.; breadth ·75 to 1 in.; petioles about ·1 in.; stipules linear, twice as long as the petioles. *Cymes* longer than the petioles, few-flowered, bearing a few linear tomentose bracts as long as the stipules and resembling them. *Calyx & corolla* unknown. *Fruit* sub-globular, somewhat narrowed at the base, the apex truncate, the sides deeply 5-grooved, the interspaces pubescent and rugulose, about ·25 in. long, crowned by the equally long or longer erect linear pubescent calyx-lobes; pyrenes 5, bony.

PERAK: *Scortechini* 329.

A plant known only from *Scortichini's* imperfect specimens; named from the long conspicuous calyx-lobes on the apex of the fruit.

19. LASIANTHUS APPRESSUS, Hook. fil. Fl. Br. Ind. III. 181. A shrub; young branches thinner than a goose-quill, softly and densely hirsute like the petioles, stipules and bracts. *Leaves* sub-coriaceous, oblong-lanceolate, shortly acuminate, the base cuneate (often rather abruptly so); upper surface pale olivaceous-brown, glabrous, shining, the main-nerves and midrib depressed, the latter with 1 or 2 lines of adpressed hairs; lower surface paler and bearing many sub-adpressed yellowish hairs; especially on the main-nerves and rather prominent transverse veins; main-nerves 6 or 7 pairs, curved, ascending, bold and prominent on the lower surface; length 2 to 3 in.; breadth ·5 to ·75 in.; petiole ·1 to ·15 in. long; stipules oblong, blunt, adpressed to the stem, rather shorter than the outer flower-bracts. *Flowers* about ·15 in. long, sessile, sub-solitary, surrounded by linear-lanceolate, acuminate, hirsute bracts, the outer of which are ·25 in. long, the inner being smaller. *Calyx* campanulate, sparsely pilose, the limb with 4 short triangular rather blunt teeth. *Corolla* minute. *Fruit* depressed-globular, crowned by the short calyx-lobes, ·15 in. in diam., sparsely pilose; pyrenes 8, three-sided, smooth. *Lasianthus*, Wall. Cat. 8443 and 8442 partly.

MALACCA (on Mount Ophir) *Griffith* (K.D.) 2927. PENANG: *Wallich*; *King*; *Deschamps*. JOHORE: *Ridley* 2925, 11183 and 4. PERAK: *Scortechini*.

20. LASIANTHUS ATTENUATUS, Jack in Trans. Linn. Soc. XIV. 126. A shrub; young branches not much thicker than a crow-quill, covered like the petioles, and upper surfaces of the leaf-midribs with dense short cinereous-olivaceous tomentum. *Leaves* membranous, oblong, lanceolate, shortly acuminate, the base rounded and somewhat oblique upper surface (except the midrib) glabrous, dark-olivaceous; the lower paler, minutely pilose, especially on the midrib and 7 or 8 pairs of spreading ascending rather bold main-nerves; the reticulations faint; length 2 to 3·5 in.; breadth ·75 to 1 in.; petioles about ·1 in.; stipules

lanceolate, closely adpressed to the stem, as long as the flower-bracts and hirsute like them. *Flower-bracts* lanceolate or oblanceolate, tapering to each end, ·25 to ·3 in. long. *Flowers* 1 to 3, sessile. *Calyx* ·2 in. long, cleft to the base into 4 lanceolate acuminate hirsute lobes. *Corolla* shorter than the calyx, narrowly campanulate, with 4 short lobes, densely hirsute outside, but glabrous within. *Anthers* 4, oblong, sessile. *Fruit* (fide *Jack*) "ovoid, hairy, dark-blue, pyrenes 4." Wight in Calc. Journ. Nat. Hist. VI. 504; Hook. fil. Fl. Br. Ind. III. 181. *Mephitidia attenuata*, DC. Prod. IV. 452.

MALACCA: *Griffith* (K.D.) 2926. PERAK: *King's Collector* 237, SINGAPORE: *Ridley* 6517, 6830, 9224.

Allied to *L. appressus*, Hook. fil., but with different pubescence and bracts and rather more nerves in the leaves.

21. LASIANTHUS DENSIFOLIUS, Miq. Fl. Ind. Bat. II. 321. A shrub; all parts more or less clothed with coarse flexuose pale-olivaceous hairs with bulbous bases. Young branches slightly thicker than a crow-quill. *Leaves* membranous, nearly sessile, narrowly oblong-lanceolate, somewhat oblique and emarginate, but not narrowed at the base, the apex shortly acuminate; both surfaces olivaceous-brown when dry; main-nerves 8 to 10 pairs, ascending, slightly curved, thin but prominent on the lower surface, faint on the upper; length 1·75 to 2·75 in.; breadth ·6 to ·8 in.; petioles under ·1 in.; stipules lanceolate, densely hirsute, ·25 to ·3 in. long. *Cymes* axillary, sessile, few-flowered, rather more than twice as long as the petioles; bracts linear, hispid. *Flowers* few, sessile. *Calyx* ·2 in. long, with 4 or 5 deep very unequal, lanceolate hispid lobes. *Corolla* much smaller than the calyx with oblong and less hairy lobes. *Anthers* 5, sessile, oblong, opposite the lobes. *Fruit* blue, sub-globular, sparsely hispid, surmounted by the calyx-lobes, ·2 or ·25 in. in diam.; pyrenes 4. Hook. fil. Fl. Br. Ind. III. 182. *Lasianthus?* Wall. Cat. 8441 in part.

This is very closely allied to the Indian species *L. Wallichii*, Wight.

MALACCA: *Maingay* (K.D.) 868. JOHORE: *King*. SINGAPORE: *Wallich*; *Anderson* 88; *Morton* 142; *Ridley* 4898, 5679. SELANGOR: *Ridley* 7421.

VAR. *latifolia*, King. *Leaves* broadly oblong with a short broad abrupt acumen, the base broad, oblique, sub-cordate, and more than 1 in. broad; young branches and inflorescence densely covered with coarse hair, 2·25 in. long.

JOHORE: *Ridley* 10948. SELANGOR: *Ridley* 7423.

VAR. *calycina*, King. *Leaves* glabrous on the upper surface except for a very few scattered adpressed hairs and for the strigose midrib; main-nerves not more than 8 pairs; *fruit* crowned by calyx-lobes as long as itself.

SINGAPORE: *Ridley* 5679.

22. LASIANTHUS ROBUSTUS, King & Gamble, n. sp. Young branches terete, sub-glabrous, about as thick as a goose-quill. *Leaves* large, coriaceous, pale-olivaceous on both surfaces (when dry) and glabrous, oblanceolate, much narrowed but not acute at the base; upper surface corrugated from the depression of the nerves and veins, the midrib thin but prominent; under surface with bold large reticulations and stout midrib, the 16 to 20 pairs of curved ascending main-nerves thin but prominent length 8 to 12 in.; breadth 2·5 to 3·25 in.; petioles ·4 in., stout, channelled; stipules coriaceous, sagittate, pale, about ·4 in. long (measured to the end of the basal lobes). *Cymes* shorter than the petioles, condensed, ebracteate, few-flowered. *Calyx* shortly campanulate, glabrous, about ·1 in. long, the mouth with 5 or 6 obscure teeth. *Corolla* unknown. *Fruit* sub-globular, 6-ridged, glabrous, crowned by the short calyx-tube, ·15 in. in diam., pyrenes 5 or 6.

MALACCA: (at Ayar Pannas) *Ridley* (without number).

Only a single specimen seen by me, and that a poor one.

23. LASIANTHUS CORIACEUS, King & Gamble, n. sp. A small fœtid shrub; young branches terete or somewhat compressed, minutely puberulous, the bark thick, pale and rugulose when dry. *Leaves* very coriaceous, oblong-elliptic, gradually and bluntly acuminate, the base cuneate; upper surface pale-brown when dry, everywhere glabrous, shining, the stout midrib and the main-nerves depressed; lower surface pale cinereous-brown, glabrous, dull; the midrib very stout and prominent; main-nerves 10 to 12 pairs, spreading but also ascending, ultimately glabrous, but like the midrib at first minutely adpressed, puberulous; intermediate nerves none, reticulations wide and indistinct; length 7 to 11 in.; breadth 2·5 to 3·5 in.; petiole about ·4 in. stout, channelled; stipules triangular acuminate, half as long as the petioles. *Cymes* axillary, rather longer than the petioles, on short peduncles, ebracteate, bearing 3 to 5 sessile flowers. *Calyx* ·15 in. long, widely tubular, truncate. *Corolla* unknown. *Fruit* (fide *Scortechini*) deep purple, ·25 in. in diam., minutely hairy, crowned by the truncate, entire or faintly 4-toothed calyx-limb; pyrenes 4.

PERAK: *Scortechini* 332. SELANGOR: *Ridley* 10217, 8540 *in part.*

This is very like *L. pergamaceus* K. & G., which however is a tree with very thick leaves indistinctly veined.

24. LASIANTHUS PERGAMACEUS, King & Gamble, n. sp. A tree; young

branches, under surfaces of leaves, and outside of calyx and corolla minutely but deciduously puberulous; all other parts except the corolla quite glabrous. *Leaves* thinly coriaceous, oblong-elliptic, shortly and rather bluntly acuminate, the base cuneate; both surfaces pale hepatic-brown when dry and reticulate, the upper in all stages quite glabrous, the lower ultimately becoming so; the midrib very bold on the lower, less so in the upper surface; main-nerves 10 pairs, thin but distinct, spreading and ascending, many of the intermediate nerves prominent and spreading like the main ones, the reticulating veins delicate and forming square or rhomboidal areolae; length 8 to 10 in.; breadth 2 to 2·75 in.; petiole ·3 to ·4 in.; stipules ·15 in. long with broad bases and abrupt oblong points. *Cymes* not much exceeding the petioles, ebracteate, 4-or 5-flowered, shortly pedunculate. *Flowers* ·5 in. long, sessile. *Calyx* ·25 in. long, tubular, the mouth truncate but obscurely toothed. *Corolla* much longer than the calyx, tubular, sub-inflated below the broadly 4-toothed limb, thick (almost fleshy), coarsely pubescent on one side externally, more or less villous everywhere internally. *Anthers* 4, narrowly oblong, on short thick filaments. *Fruit* unknown.

PERAK: at an elevation of 4500 feet on Gunong Batu Pateh, *Wray* 270.

Mr. Wray describes the whole plant as very foetid when bruised.

25. LASIANTHUS MALACCENSIS, King & Gamble, n. sp. A small tree; young branches twice as thick as a crow-quill, terete, puberulous, very dark in colour when dry. *Leaves* coriaceous, oblong-lanceolate, bluntly acuminate, the base rounded but slightly contracted just above its junction with the petiole; the edges somewhat wavy; both surfaces glabrous except for a few minute adpressed hairs on the midrib and nerves, dark olivaceous-brown, reticulate when dry; main-nerves 8 or 9 pairs, curved, ascending abruptly, thin and inconspicuous; length 4 to 5 in.; breadth 1 to 1·4 in.; petiole ·3 in. *Stipules* much shorter than the petioles, the base broad, abruptly narrowed into the triangular apex. *Flowers* two or three together in the leaf-axils. *Calyx* sessile, campanulate, tapering to the base, less than ·1 in. long, puberulous outside the mouth, wide and minutely 5-toothed. *Fruit* sub-globular, pulpy, surmounted by the 5 or 6 blunt short calyx-teeth, ·2 in. in diam.; pyrenes 4, narrow, smooth.

MALACCA: *Ridley* 3219.

26. LASIANTHUS CHINENSIS, Benth. Fl. Hongkong 160. A shrub 8 to 12 feet high; young branches rather thinner than a goose-quill, angled, the bark dark-brown when dry, sparsely and minutely adpressed-pubescent. *Leaves* dark olivaceous-brown when dry, thinly coriaceous, elliptic-

oblong, shortly acuminate, narrowed to the base; surface reticulate, glabrous, except for a few adpressed hairs near the base, and on the midrib and longer nerves; main-nerves 8 or 9 pairs, thin, prominent on the lower surface, slightly curved, ascending; length 5 to 6·5 in., breadth 1·5 to 2 in.; petiole stout, adpressed rusty-pubescent, about ·15 in. long; stipules triangular, shorter than the petioles. *Cyme*, ebracteate, axillary, few-flowered, sessile, about twice as long as the petioles. *Flowers* ·4 in. long, on pedicels much shorter than themselves. *Calyx* adpressed-pubescent, campanulate, deeply divided into 4 or 5 somewhat spreading, lanceolate, acuminate lobes. *Corolla* glabrous outside, longer than the calyx, salver-shaped; the tube densely pilose inside; the lobes oblong, thickened at their apices, reflexed. *Filaments* about as long as the 5 or 6 linear anthers. *Fruit* unknown. Hook. fil. Fl. Br. Ind. III. 187.

PERAK: *King's Collector* 2582, 10100.

The collector, in his field-note, describes the corolla as white and the calyx as blue.

27. LASIANTHUS WIGHTIANUS, Hook. fil. Fl. Br. Ind. III. 188. A shrub? Young branches compressed, varying in thickness, some as thick as a goose-quill, all as well as the petioles, the backs of the stipules, the under-surfaces of the main-nerves, and both sides of the midrib of the leaves minutely rusty adpressed-pubescent. *Leaves* dark-brown when dry, elliptic-oblong, the apex shortly acuminate, the base rounded, rarely sub-acute; upper-surface finely reticulate, the veins and nerves sparsely strigose; under-surface strongly reticulate, the veins and nerves pubescent; main-nerves 10 to 13 pairs, very prominent, curved, spreading; length 3·5 to 4·25 in.; breadth 1·25 to 1·5 in., petioles ·1 to ·15 in.; stipules triangular, acuminate, as long as the petioles. *Cymes* slightly longer than the petioles, few-flowered, ebracteate. *Flowers* clustered, sub-sessile. *Calyx* pubescent, ·1 in. long, narrowly campanulate, with 5 small triangular spreading teeth. *Corolla* and *fruit* unknown. *Mephitidea venosa*, Wight in Calc. Journ. Nat. Hist. VI. 514, *not of Blume.*

MALACCA: on Mount Ophir, *Griffith* (K.D.) 2922.

28. LASIANTHUS PTEROSPERMUS, Wight in Calc. Journ. Nat. Hist. VI. 510. A shrub; young branches half as thick as a goose-quill, compressed especially at the nodes, strigose-puberulous, becoming subglabrous. *Leaves* coriaceous, elliptic or oblong-elliptic, shortly and bluntly acuminate or sub-acute, narrowed to the slightly oblique, rarely sub-acute, base; both surfaces when dry reticulate, pale-brown, tinged with olivaceous, the upper glabrous, the lower minutely substrigose

the midrib and main-nerves depressed on the upper surface (when dry); main-nerves 10 to 12 pairs, spreading, ascending, prominent on the lower surface; length 5 to 7 in.; breadth 1·25 to 2·25 in.; petioles ·2 to ·25 in.; stipules oblong-lanceolate, blunt, strigose, ·35 in. long. *Cymes* only slightly longer than the petioles, 3- to 4-flowered. *Flowers* sessile, with a few minute bracts or without any. *Calyx* sessile, ·15 in. long, strigose, the limb with 5 short obtuse triangular teeth. *Corolla*, globose, glabrous. *Drupe* sub-globose, ·5 in. in diam. when fresh, only ·3 in. when dry, glabrous, black, crowned by the shortly tubular calyx-limb; pyrenes 4 to 5, trigonous, bisulcate on the back and with 3 vertical processes, the middle one thick and rugulose, the two lateral thin and wing-like.

MALACCA: *Griffith* (K.D.) 2929; *Maingay* (K.D.) 866.

29. LASIANTHUS PERAKENSIS, King & Gamble, n. sp. A shrub or small tree; young branches half as thick as a goose-quill, deciduously and minutely rusty-puberulous like the petioles, stipules and under surfaces of the midrib and main-nerves. *Leaves* thinly coriaceous, narrowly elliptic or obovate-elliptic, abruptly and shortly acuminate, narrowed in the lower third to the short petiole; upper surface dark-olivaceous, quite glabrous, shining, the midrib and nerves not prominent; under surface paler olivaceous, glabrous except the puberulous midrib and 7 or 8 pairs of prominent ascending, little-curved main-nerves; the veins very bold, transverse; length 6 to 10 in.; breadth 1·75 to 3·25 in, petiole ·2 to ·25 in.; stipules triangular, acute, shorter than the petioles, adpressed to the stem. *Glomeruli* about as long as the petioles, condensed, ebracteate or with a few small linear hairy bracts shorter than the calyx. *Flowers* sessile, crowded. *Calyx* campanulate, much tapered to the base, the mouth wide and with 5 indistinct blunt, spreading lobes, pubescent. *Corolla* not seen; ovary 5-celled. *Fruit* hemispheric, sub-glabrous, ribbed, crowned by the calyx; pyrenes 5.

PERAK: *King's Collector* 682, 2438, 2838, 10210; *Wray* 4128.

Resembling *L. Maingayi* in leaves but with 5-merous flowers.

30. LASIANTHUS ANGUSTIFOLIUS, King & Gamble, n. sp. Small tree; young branches covered with a thin dense layer of adpressed minute pale-brown tomentum. *Leaves* thickly membranous, narrowly oblong-lanceolate, caudate-acuminate, the base cuneate; both surfaces brown when dry; the upper the darker, glabrous except the tomentose midrib; the lower glabrous except the pubescent midrib and nerves; the reticulations transverse strong on the lower surface, faint on the upper; main-nerves 12 to 14 pairs, slightly curved, ascending, thin but distinct on the lower, indistinct on the upper surface; length 5 or 6 in.; breadth

·6 to 75 in.; petiole ·15 in.; stipules lanceolate, much shorter than the petioles, their edges ciliate. *Cymes* axillary, 2- to 3-flowered, ebracteate, sessile, shorter than the petioles. *Flowers* about ·2 in. long, sessile. *Calyx* adpressed pubescent on both surfaces, tubular-campanulate, with 5 triangular-acuminate, slightly spreading teeth. *Corolla* slightly longer than the calyx, tubular, slightly inflated below the mouth; lobes 5, lanceolate, acuminate, sub-erect; the tube glabrous on both surfaces and the teeth adpressed-pubescent on both. *Anthers* small, narrowly oblong. *Fruit* ovoid-globular, crowned by the spreading calyx-lobes, about ·2 in. long; pyrenes 4 or 5, rugulose.

PERAK: on Gunong Batu Pateh at 4500 feet, *Wray* 413.

31. LASIANTHUS OBLONGUS, King & Gamble, n. sp. Young branches slightly thicker than a crow-quill, somewhat angled, densely but very minutely adpressed-pubescent. *Leaves* membranous, narrowly oblong-lanceolate, gradually tapering into the caudate-acuminate apex, the base much narrowed; both surfaces dark dull-brown when dry, minutely scaly, puberulous on the nerves and midribs, obscurely transverse-reticulate; main-nerves about 7 pairs, curved upwards, not conspicuous; length 3 to 5 in.; breadth ·6 to 1 in.; petiole ·15 to ·2 in.; adpressed-puberulous. *Stipules* lanceolate-acuminate, about ·1 in. long. *Cymes* ebracteate, axillary, sessile, 5- to 7-flowered, twice as long as the petioles. *Flowers* ·35 in. long, on very short pedicels, adpressed-puberulous or glabrous. *Calyx* campanulate, shallow, the mouth wide, truncate, entire. *Corolla* more than twice as long as the calyx, salver-shaped; the tube slightly widened near the mouth; the limb densely hirsute on its upper surface, the lobes 5, oblong, obtuse. *Anthers* 5, oblong, subacute, on short filaments. *Fruit* depressed-globular, about ·2 in. in diam. when dry, glabrous, 7- or 8-ridged, somewhat corrugated, crowned by the small calyx; pyrenes 7 or 8, each with a transverse septum dividing it into two cells, the outer of which is 1-seeded, the inner empty.

PERAK: *Scortechini* 265; *Ridley* 4935, 9702, 9729; *Wray* 2590; *King's Collector* 402, 4128, 4462, 10082; *Curtis* 2018. SELANGOR: *Ridley* 7438.

This closely resembles a specimen in Herb. Kew (Horsfield Rub. 52) doubtfully named *Lasianthus sylvestris* Miq., but in that the calyx has 5 distinct triangular acute teeth.

32. LASIANTHUS MONTANUS, King & Gamble, n. sp. A bush 4 to 8 feet high; young branches slightly thicker than a crow-quill, rather minutely adpressed-pilose like the stipules. *Leaves* thickly sub-coriaceous, ovate-lanceolate, shortly acuminate, the base cuneate; both

surfaces olivaceous, somewhat shining, reticulate, the upper quite glabrous, the lower pubescent on the bold midrib and thin but prominent 5 or 6 pairs of curved ascending main-nerves, sometimes also on the transverse veins; length 3 to 4·5 in.; breadth 1 to 1·5 in.; petioles ·1 to ·15 in., stout, stipules about ·15 in. long, pubescent, adpressed to the stem, triangular-acuminate. *Flowers* solitary or in pairs, about ·5 in. long, ebracteate. *Calyx* nearly as long as the corolla with a short tube and 5 long unequal linear-lanceolate pubescent lobes. *Corolla* white, salver-shaped; the tube long and narrow, pubescent on both surfaces, but especially inside near the base; lobes broad, spreading, somewhat irregular, with tufts of long hair near their apices. *Anthers* 5, short, sub-sessile near the base of the tube. *Fruit* unknown.

PERAK: at elevations of 3000 to 4000 feet, *Wray* 3932; *King's Collector* 2156.

33. LASIANTHUS CURTISII, King & Gamble, n. sp. A shrub; young branches somewhat thicker than a crow-quill, sparsely and deciduously pubescent, ultimately glabrous. *Leaves* thickly membranous, olivaceous-brown when dry, lanceolate or elliptic-lanceolate, much acuminate, the base slightly cuneate; upper surface quite glabrous; lower minutely and softly pubescent on the midrib, bold transverse veins and 4 to 6 pairs of stout spreading ascending curved main-nerves; length 2·5 to 3·5 in.; breadth ·35 to, 1·25 in.; petioles ·15 to ·2 in., very pubescent; stipules triangular, adpressed to the stem, hirsute, under ·1 in. long. *Cymes* not much longer than the petioles, axillary, sessile, 6- to 8-flowered, ebracteate. *Flowers* sessile, ·15 to ·2 in. long. *Calyx* cleft to nearly the base into 5 sub-equal, linear-lanceolate sub-erect lobes, hirsute externally. *Corolla* much shorter than the calyx, its upper part with dense long yellow hair; lobes 5, short, blunt. *Anthers* 5, sessile, oblong, blunt. *Fruit* ovoid-globular, sparsely pilose, ·1 in. long but crowned by the equally long, persistent calyx-lobes; pyrenes 5, broad, 3-angled.

PENANG: *Curtis* 284, 9355.

34. LASIANTHUS PSEUDO-LUCIDUS, King, n. sp. A bush; young branches slender, densely and minutely tawny-tomentose. *Leaves* thinly coriaceous, narrowly elliptic-lanceolate, acuminate, the base cuneate, both surfaces pale olivaceous-brown when dry, the upper glabrous; the lower darker, reticulate, puberulous on the midrib and nerves; main-nerves 6 or 7 pairs curved, ascending, distinct on the lower surface; length 2 to 2·5 in.; breadth ·6 to ·75 in.; petiole about ·1, in., pubescent; stipules narrowly oblong-lanceolate, tomentose, ·4 in. long. *Cymes* twice as long as the petioles, on short tomentose peduncles, 3- to 4-flowered. *Flowers* sessile. *Calyx* campanulate, ·25 in. long, deeply

divided into 5 slightly unequal, linear-lanceolate lobes, hirsute on both surfaces. *Corolla* and fruit not seen.

PERAK: at 5000 feet, *Wray* 4109.

A species near *L. lucidus*, Blume (not of Hook. fil. in Fl. Br. Ind.), but differing from that species in its thicker, less acuminate and rather fewer-nerved leaves, and thicker twigs which are moreover tomentose instead of glabrous. The calyx of this is moreover hirsute instead of glabrous.

35. LASIANTHUS NERVOSUS, King & Gamble, n. sp. A small dense shrub 2 to 3 feet high; young branches and petioles covered with dense short olivaceous tomentum. *Leaves* coriaceous, deep olivaceous-brown when dry, shining and minutely reticulate, oblong-lanceolate, the apex acute or sub-acute and mucronate, the base sub-cuneate; upper surface glabrous, the midrib depressed; lower slightly paler, the stout midrib and 6 to 8 pairs of prominent curved ascending nerves minutely adpressed-pubescent; length 1 to 1·5 in.; breadth ·4 to ·6 in.; petioles ·1 to ·15 in. long; stipules triangular, much shorter than the petioles, pubescent, caducous. *Cymes* sessile, while in flower shorter than the petioles, 3-flowered. *Flowers* sessile, about ·15 in. long. *Calyx* cupular, very short, with 4 triangular teeth. *Corolla* longer than the calyx (about ·1 in. long), the tube cylindric, hairy, white; the lobes 4, short, with moniliform hairs inside. *Anthers* attached to the middle of the tube. *Style* shortly bifid. *Berry* bluish, sparsely hairy, globular, ·15 in. in diam., crowned by the calyx-teeth; pyrenes 4.

PERAK: *Scortechini* 342.

36. LASIANTHUS HARVEYANUS, King & Gamble, n. sp. A shrub; young branches rather thicker than a crow-quill, minutely rusty-tomentose like the petioles and midribs of the leaves on both surfaces. *Leaves* membranous, elliptic or ovate-elliptic, (oblong-elliptic in VAR.); narrowed to the rather blunt (acuminate in VAR.) apex, the base rounded; both surfaces pale-brown when dry; the upper scaberulous and with a few scattered adpressed hairs near the edges; lower surface scabrid-puberulous between the 4- to 6 (8 to 10 in. VAR.) pairs of slender little-curved ascending minutely pubescent main-nerves; length 4 to 5 in. (up to 7·5 in VAR.) breadth 1·65 to 2 in.; petioles ·15 to ·2 in.; stipules triangular, acute, one-third or one-half as long as the petioles. *Cymes* longer than the petioles, ebracteate, 3- to 5-flowered. *Flowers* ·3 in. long, sessile. *Calyx* under ·1 in. in length, narrowly campanulate, densely pubescent, the mouth 4-toothed. *Corolla* both outside and inside less pubescent than the calyx, funnel-shaped; the mouth with 4 ovate and acute spreading lobes. *Anthers* 4, narrowly oblong, shortly apiculate, exserted, attached by short filaments to the densely villous throat; style elongate; stigmas 2 or 3, hairy. *Fruit* unknown.

PERAK: at an elevation of 3400 feet, *Wray* 444.

VAR. *longifolia. Leaves* elliptic-oblong, shortly acuminate, as much as 7·5 in. long, with 8 to 10 pairs of nerves.

MALACCA: *Harvey.*

37. LASIANTHUS FERRUGINEUS, King & Gamble, n. sp. A bush; young branches about half as thick as a goose-quill, rusty-lanate like the outside of the stipules, the petioles and both sides of the leaf-midribs. *Leaves* dark-brown when dry, thinly coriaceous, oblong-lanceolate, much acuminate, the base rounded or sub-cuneate; upper surface reticulate, sparsely covered with stiff flexuose hairs with conspicuous black bulbs at their bases, shining, the nerves thin but distinct; lower surface more densely hairy (the hairs with smaller bulbs), especially dense on the 16 to 18 pairs of bold curved spreading main-nerves; length 5 or 6 in.; breadth 1·25 to 1·5 in.; petioles ·15 to ·2 in.; stipules triangular, sub-acute, longer than the petioles, deciduous. *Cymes* small, not so long as the petioles, few-flowered, ebracteate. *Flowers* on short hirsute pedicels. *Calyx* ·25 in. long, tubular-campanulate, densely hirsute like the corolla, deeply divided into 5 lanceolate acuminate sub-equal lobes. *Corolla* like the calyx but only half as long, white. *Disk* smooth, glabrous, orbicular. *Style* short, glabrous. *Fruit* unknown.

PERAK: at an elevation of 4500 feet; *Wray* 3911.

38. LASIANTHUS TOMENTOSUS, Blume Bijdr. 997. A shrub? Young branches varying in thickness, the longer nearly as thick as a goose-quill, densely clothed like the petioles and stipules with dense short rusty tomentum *Leaves* thickly membranous, oblong-lanceolate, acuminate, the base cuneate or rounded; upper surface blackish-olivaceous when dry, sparsely and minutely strigose; the lower paler, shortly olivaceous-pilose except the 7 to 10 pairs of curved ascending nerves on their lower surfaces, and the bold midrib on both, which are tomentose; length 2·5 to 3·5 in.; breadth ·5 to 1 in.; petiole ·1 to ·2 in.; stipules about as long as the petioles, triangular. *Cymes* when in flower twice as long as the petioles, when not in flower shorter, condensed, few-flowered, ebracteate, sessile. *Flowers* ·2 in. long, sessile. *Calyx* under ·1 in. long, widely campanulate, hirsute, the mouth sub-truncate, obscurely toothed. *Corolla* salver-shaped; the tube wide, glabrous outside and inside but with a band of stout hairs at the throat; lobes of the limb ovate, sub-acute, sub-erect, sparsely hirsute. *Anthers* 5, ovate-oblong, on short filaments, curving inward, and cohering by their margins and tips. *Style* as long as the tube of the corolla, cylindric, divided into 2 compressed arms. *Ovary* 5-celled, with a single ovule in each.

PERAK: *Yapp* 525. JOHORE: *Ridley* 11181, 11182, 4083.

This resembles No. 17, but has its leaves hairy on the upper surface, thicker young branches and a much wider corolla-tube.

39. Lasianthus scalariformis, King & Gamble, n. sp. A shrub 5 or 6 feet high; young branches thinner than a goose-quill, minutely rusty-puberulous, faintly ridged, dark-coloured when dry. *Leaves* coriaceous, narrowly elliptic-oblong, the apex very shortly acuminate or acute, much narrowed to the base; both surfaces dark olivaceous-brown when dry, glabrous, shining, the veins scalariform, horizontal, close together, very distinct especially on the lower surface, the midrib thin on the upper surface, stout, convex and often faintly puberulous on the lower surface; main-nerves 7 or 8 pairs, little curved, ascending, broad, bold, and when young, minutely puberulous on the lower surface, always faint and glabrous on the upper; length 4 to 5 in.; breadth 1·25 to 1·5 in.; petioles ·25 to ·3 in.; stipules minute (about ·05 in. long) triangular, with broad bases. *Peduncle* solitary, ebracteate, glabrous, about ·5 in. long, bearing at its apex a 3- to 5-flowered cyme. *Flowers* sessile. *Calyx* ·2 in. long, campanulate, deeply divided into 5 narrowly oblong acute lobes very minutely puberulous. *Corolla* not seen. *Fruit* glabrous, obovoid, 5-ridged; pyrenes 5.

Perak: *Scortechini* 411; *Wray*, at an elevation of 6700 feet, 332.

40. Lasianthus filiformis, King & Gamble, n. sp. A slender shrub 2 to 4 feet high; young branches rather thicker than a crow-quill, clothed like the other parts of the plant with long spreading rather slender hairs. *Leaves* membranous, subsessile, oblong-lanceolate, shortly acuminate; the base rounded, slightly unequal and minutely caudate, both surfaces olivaceous-brown when dry (sometimes pale), dull, more or less hispidulous-pubescent especially on the midrib and main-nerves; the upper when old sometimes almost glabrous; main-nerves 7 to 9 pairs, thin, but pale and rather conspicuous on the lower surface (when dry), inconspicuous on the upper; length 2 to 2·75 in.; breadth ·65 to 1 in.; petiole under ·1 in. or almost absent; stipules linear-lanceolate, pubescent, ·2 or ·25 in. long. *Inflorescence* a slender solitary filiform, sparsely pubescent peduncle ·75 to 1 in. long, bearing at its apex one or at most two, flowers subtended by a single or double linear bracteole (by two large leaf-like bracts in var. *bracteata*). *Calyx* with a campanulate tube ·1 in. long, and 4 linear-lanceolate erect lobes longer than itself. *Corolla* tubular, exceeding the calyx-lobes, white hairy, deeply 4-lobed *Ovary* 8-celled. *Fruit* baccate, blue, ·25 in. in diam., crowned by the long persistent calyx-lobes.

Perak: *Scortechini* 29; *King's Collector* 851.

Var. *bracteata.* Flowers subtended by two ovate acute leaf-like bracts from ·3 to ·5 in. long.

PERAK: *Scortechini* 180, 190; *Ridley* 8578.

41. LASIANTHUS GRACILIS, King & Gamble, n. sp. A slender shrub 2 to 3 feet high, young branches as thick as or thinner than a crow-quill, like the petioles and sometimes the under-surfaces of the midribs densely adpressed-pubescent. *Leaves* stiffly membranous, ovate or sub-rhomboidal, the apex acute and minutely apiculate; the base cuneate, sometimes slightly unequal; both surfaces usually glabrous; the 7 to 9 pairs of main-nerves spreading, little curved, pale and conspicuous beneath; length ·6 to ·75 in.; breadth ·35 to ·5 in.; petiole under ·1 in.; stipules as long as the petioles, caducous. *Inflorescence* a filiform hairy peduncle shorter than the leaves, bearing at its apex 1 or 2 minute bracteoles and (*fide* Scortechini) 1 to 3 flowers. *Fruit* depressed-globular, glabrous, shining, ·15 in. in diam. with 4 vertical ridges; pyrenes 4.

PERAK: *Scortechini* 39, 617. *Ridley* (in tea gardens) 2904.

42. LASIANTHUS MAINGAYI, Hook. fil. Fl. Br. Ind. III. 188. A large shrub or small tree; young branches much thinner than a goose-quill, somewhat compressed, covered with deciduous minute rather stiff rusty hairs or sub glabrous. *Leaves* thickly membranous, large, sub-coriaceous, pale-brown, often tinged with olivaceous when dry, narrowly elliptic or sub-obovate-elliptic, shortly and abruptly acuminate; upper surface quite glabrous, shining, the midrib and main-nerves and also the reticulations rather prominent when dry; lower surface rather rough from the bold pale transverse veins; main-nerves 5 or 6 pairs, slightly curved, ascending, thin but prominent; the midrib stout, glabrous or with a few minute hairs; length 5·5 to 8·5 in.; breadth 1·75 to 3 in.; petiole ·2 to ·3 in.; stipules, lanceolate, acuminate, the base broad, shorter than the petioles, pubescent, deciduous. *Glomeruli* lobulate, shorter than the petioles, sessile ebracteate, the flowers crowded on 2 or 3 short thick branches. *Flowers* about ·15 in. long, on very short pedicels, puberulous. *Calyx* about as long as the corolla, campanulate, constricted somewhat below the three blunt or acute triangular teeth. *Corolla* tubular with 3 sub-acute triangular teeth. *Anthers* 3, broadly oblong, emarginate at the apex. *Ovary* 3-celled, style cylindric. *Fruit* obliquely elliptic, crowned by the small calyx; pyrenes 3, rugulose.

MALACCA: *Maingay* (K.D.) 871. SINGAPORE: *Ridley* 10737; *King* 89; *Hullett* 528. JOHORE: *Ridley* 6516, 11185, 11186, 11187. SELANGOR: *Ridley* 4895. PERAK: *Scortechini*, 678; *King's Collector* 2964.

This resembles No. 13, but is trimerous, its cymes have thick branches and are ebracteate, and its young stems and leaves are glabrous or nearly so.

43. LASIANTHUS LUCIDUS, King & Gamble, n. sp. A glabrous fœtid shrub; young branches rather thicker than a crow-quill, somewhat compressed, especially at the nodes. *Leaves* thinly coriaceous, oblong-

elliptic or lanceolate, the apex caudate-acuminate, the base much narrowed, both surfaces pale-brown when dry, shining, reticulate; main-nerves 7 to 10 pairs, thin, spreading, interarching ·15 in. from the edges, the secondary nerves almost as prominent; length 3·5 to 6 in ; breadth 1·15 to 1·8 in.; petiole ·15 to ·2 in. or ·25 in., slender; stipules minute triangular, much shorter than the petioles. *Cymes* sessile, 4- to 8-flowered, ebracteate. *Flowers* ·25 in. long, on short pedicels, narrow, erect. *Calyx* tubular, with 3 broad teeth much shorter than the corolla, glabrous. *Corolla* narrowly tubular, with 3 long narrow-ovate lobes, hairy inside except at the tip. *Anthers* 3, erect, narrowly oblong, not quite so long as their filaments. Ovary 3-celled; style long, slender, clavate. *Fruit* sub-trigonous, or sub-didymous, depressed, ·2 to ·35 in. in diam., shining, blue; pyrenes 2 or 3, oblique sub-pyriform, smooth, each divided into 2 cells by a transverse septum, the anterior cell empty. *Seeds* concave, cupped, fleshy.

PERAK: *Scortechini* 264, 463; *King's Collector* 788, 2797, 2840, 5051; *Ridley* 2928, 5549, 7437, 8574; *Wray* 426, 973, 2807, 3931.

52. CHASALIA, Commers.

Characters of *Psychotria* except that the corolla-tube is slender and in one species is usually curved, and the seeds are orbicular plano-concave, the dorsal surface being flat and the anterior deeply concave; almost cupped, albumen uniform.—DISTRIB. About 10 species, tropical Asiatic and African.

In our opinion this genus might with advantage be reduced to *Psychotria*.

Flowers sessile, from ·5 to 1 in. long; corolla-tube slender,
curved ... ... 1. *C. curviflora.*
Flowers pedicelled, ·15 in. long; corolla-tube wide, straight 2. *C. rostrata.*

1. CHASALIA CURVIFLORA, Thwaites Enum. Pl. Ceyl. 150, 421. A shrub 2 to 4 feet high; everywhere glabrous. Young branches woody, terete, glabrous, dark-coloured when dry. *Leaves* membranous, elliptic, oblong-elliptic, oblong or oblanceolate, shortly and somewhat abruptly and often bluntly acuminate, narrowed at the base; (narrowly elliptic or linear in VARS.) upper surface olivaceous-brown when dry, the lower paler; main-nerves 5 or 6 pairs, much curved, spreading and ascending, thin but distinct on the lower surface like the wide reticulations; length 6 to 8 in.; breadth 1 to 2·75 in.; petioles ·3 to ·75 in. *Stipules* coriaceous, campanulate-cupular, blunt, ·15 to ·35 in. deep, the upper edge truncate, entire or 2- or 3- cleft. *Cymes* solitary, terminal, from 1 to 2 in. long, and the same in diam., sometimes on naked peduncles ·5 to 1·25 in. or even more in length; branches divergent,

trichotomous, often short, few-flowered. *Flowers* sessile, from ·5 to 1 in. long. *Calyx* only ·15 in. long, campanulate, the mouth irregularly and shortly toothed. *Corolla* about four times as long as the calyx, the tube long and narrow; its 4 lobes not a quarter of its length, lanceolate, spreading. *Anthers* 4, linear-oblong, deeply cordate at the base, the filaments varying in length. *Style* also varying in length. *Fruit* pisiform, globose sometimes didymous, crowned by the small remains of the calyx, glabrous, pyrenes thin, each with one plano-convex seed. Kurz For. Flora Burma, II. 14; Miq. in Ann. Mus. Lugd. Bat. IV. 202; Hook fil. Fl. Br. Ind. III. 176; Trimen Flora Ceylon III. 363. *C. lurida*, *C. tetrandra*, Miq. Fl. Ind. Bat. 281, 282. *C. Sangiana*, Miq Fl. Ind. Bat. Suppl. 546. *Psychotria lurida*, Bl. Bijdr. 959; DC. Prod. IV. 521. *P. curvifolia* and *P. ophioxyloides*, Wall. in Roxb. Fl. Ind. ed. Carey & Wall. II. 167, 168; Cat. 8360, 8364; DC. Prod. l.c. 520. *P. ambigna*, W. & A. Prod. 433; Wt. Ic. t. 127. *P. tetrandra*, BC. Bijdr. 961; DC. l.c. 521. *Zwaardekronia lurida*, Korth. in Ned. Kruidk. Arch. II. 252. *Ixora attenuata*, Wall. Cat. 6164. *Psychotria*, Wall. Cat. 8361, 8362, 8363, 8364, 8375; (*in part*) 8386, 8390. *Rubiaceae*, Wall. Cat. 8461.

In all the provinces, common.

The corolla varies in length and is moreover dimorphous as régards the respective length of the stamens and pistils. As regards leaves the plant varies greatly. It seems necessary, however, to separate one Malayan variety.

VAR. *linearis* King & Gamble; leaves linear-oblong from 3·25 to 8·5 in. long, and from ·35 to ·65 in. in breadth.

MALACCA: *Ridley* 1359: *Goodenough* 1606.

2. CHASALIA ROSTRATA, Miq. in Ann. Mus. Lugd. Bat. IV. 203 excl. syn. *Psychotria tetrandra*. A slender glabrous shrub; young branches thicker than a crow-quill, compressed, pale. *Leaves* membranous, greenish when dry, elliptic or elliptic-oblong, the apex acuminate, the base usually much narrowed but sometimes rounded and oblique; both surfaces more or less distinctly fine-reticulate; main-nerves 5 or 6 pairs, curved, spreading, conspicuous beneath when dry; length 3 to 6 in.; breadth 1·5 to 2 in.; petiole ·25 to ·4 in.; stipules less than ·1 in. long, connate into a short tube, the mouth with a few bristles. *Cymes* solitary, terminal, slender, from ·75 to 2 in. long (including the peduncle); bracteoles few, broad, coriaceous; branches divergent trichotomous, few-flowered. *Flowers* ·15 in. long, on short pedicels. *Calyx* campanulate; the mouth oblique, irregularly 4- or 5-toothed. *Corolla*-tube wide, only slightly longer than the calyx; the limb about as long as the tube with 4 broad blunt spreading lobes. *Anthers* 3 or 4, ovate, as long as the filaments, included in the corolla-tube. *Fruit* ovoid, smooth, ·25 in. long. Hook.

fil. Fl. Br. Ind. III. 177; Miq. Fl. Ind. Bat. II. 281. *Psychotria rostrata* Blume Bijdr. 961. *Polyozus latifolia* (fide *Miquel*) Bl. Bijdr., 948; DC. Prod. IV. 521, 494.

MALACCA: *Griffith* (K.D.) 3045; *Maingay* (K.D.) 937. JOHORE: *Ridley* 4092. SINGAPOPE: *Ridley* 4890. SELANGOR: *Ridley* 7376. DINDINGS, *Ridley* 7992. PERAK: *Scortechini* 1482. *King's Collector* 2190.

We follow previous writers in putting this plant in the same genus as *Chasalia urviflora*, from which it differs in having a corolla with a short wide perfectly straight tube.

INDEX SLIPS.

BOTANY.

DRUMMOND, J. R.—On a new Scirpus from Beluchistan and certain of its allies. Journ. As. Soc. Bengal, LXXIII, pt. ii, 1904, pp. 137-148.

CYPERACEAE.

Scirpus Wardianus (n. sp.) from Beluchistan ...	p.	147.
S. litoralis and its allies reviewed	pp.	137–145.
Key to *S. litoralis* group	,,	146–147.

METEOROLOGY.

LITTLE, C.—The Himalayan summer storm of September 24th, 1903, and the weather immediately subsequent to that date in Northern India. Journ. As. Soc. Bengal, LXXIII, pt. ii, 1904, pp. 148–176. Discussion of weather conditions at the time of the storm, pp. 148–165.

PHYSIOLOGY.

(PHARMACOLOGY.)

HOOPER, D.—*Rusot*: an ancient Eastern Medicine. Journ. As. Soc. Bengal, LXXIII, pt. ii, 1904, pp. 177-182.

Lycium or *Lykion*, the drug as known to the ancients, p. 177.
its identity with Rusot, the Indian Lycium ... p. 178.

Berberis aristata, D.C.
,, *Lycium*, Royle } used in preparing Rusot ... p. 180.
,, *asiatica*, Roxb.

Rusot, process of extraction, properties and analysis pp. 180–182.

BOTANY.

PRAIN, D. and BURKILL, I. H.—On Dioscorea birmanica—a new species from Burma—and two allied species. Journ. As. Soc. Bengal, LXXIII, pt. ii, 1904, pp. 183-187.

DIOSCOREACEAE.

Dioscorea birmanica (n. sp.) from Burma, p. 185; distribution, pp. 183–184.

D. yunnanensis (n. sp.) from Yunnan, p. 186.

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On a new Scirpus from Beluchistan and certain of its allies.—By J. R. Drummond, I.C.S., B.A., F.L.S., etc.

[Read July 6th, 1904.]

A small consignment of Cyperaceæ and other aquatic plants lately received in the Royal Herbarium at Sibpur from the Seistan Arbitration Mission, and made over to the writer for examination, included a Scirpus which does not appear to have been described hitherto. The hypogynous bristles are plumose, and the stigma bifid, so that it would fall, as the species are arranged in Fl. Br. Ind. V. 653—663, under *Scirpus proper* near *Scirpus litoralis*, but study of the material in the Calcutta Herbarium has suggested that a short review of *S. litoralis* and its nearer allies may be useful.

In the Fl. Br. Ind. (V. 659) Schrader's *litoralis* is given priority over Vahl's "*subulatus*," the two being taken as equivalent; but it will be convenient in this paper to commence with "*subulatus*," which Vahl

(En. II. 268, 1805) gives as an inhabitant of the Nicobars (collector not stated) and describes it as follows:—

Aphyllus spicis oblongis, squamis carina pubescentibus stylo trifido, involucri foliolum longius rigidum læve, squamis emarginatis * * * *setae apice plumosae* * * *

He distinguishes his plant from *S. lacustris* by the setae being plumose, not retrorsely echinate.

Who collected Vahl's plant and where specimens are to be seen, I have so far failed to discover.

In 1806 Schrader's Flora Germanica appeared, in which he distinguished *Scirpus litoralis* as an undescribed species resembling *S. triqueter* of *Willd.*, between which and *S. maritimus* he inserted it.

His figure shews a *Scirpus* of the *triqueter* stamp with two styles and what may have been two plumose setae, also a membranous ligulate body which looks like a filament wanting its anther or a 3rd (glabrous) segment of the perigonium; the nut is shown as obovate and acuminate, without any trace of a style base; the stigma is bifid: glumes faintly carinate, hardly acute, entire, and not ciliate; spikelets less than ½ an inch in length.

His description is not strictly in accord with his figure, more particularly as regards the glumes; these he says are very blunt and tipped with a long mucro, which is more or less reflexed.

Bentham (Fl. Austr. VII 334) remarks that the essential character derived from the bristles of *S. littoralis* was overlooked both by Linnæus and Schrader, but it must be noted that the plant was not taken up by Linnæus. Schrader records that he had not seen ripe fruit, but his figure shews the plumose bristles as to which the text is silent.

His plant was found by Wulfenius in marshes near Duino and Monfalcone on the Adriatic (Gulf of Trieste); I have not seen specimens.

In 1812 *Scirpus fimbrisetus* was published by Delile as an Egyptian species. The figure and description suggest that his plant differs from that of the northern shores of the Mediterranean if at all, as follows:—

(*a*) main involucral bract hardly exceeding the inflorescence;

(*b*) inflorescence more compact, peduncles stiffer;

(*c*) achene obcordate, rounded at the apex, hardly acuminate, style-base manifest;

(*d*) sheaths producing laminæ which attain 3 inches in length by $\frac{1}{8}$ of an inch in breadth at the base and are flaccid, narrowly triangular-acuminate in outline, acute at the tip, and spreading.

Note.—The rootlets are scanty and feeble (in the figure).

In 1820 Carey's Edition of Roxburgh's Flora Indica appeared in which *Scirpus pectinatus* is described, as a native chiefly of "marshy places where the soil is sandy." There is a picture of this among the unpublished drawings in Herb. H.B.C. which differs from *S. fimbrisetus* Delile in the sheaths bearing no laminæ, in the shape of the glumes which are acute, not at all emarginate, and by the lax and drooping panicle.

There are specimens in the Calcutta Herbarium gathered in salt marshes near Sealdah in November 1860 and December 1866, by Kurz, which appear to be the plant of Roxburgh and have been so named by the finder.

Wall. 3506 which is from Herb. Heyne, and was therefore probably collected on the coast of the Peninsula, agrees fairly well with *S. pectinatus* also.

There are also two Ceylon examples (C. P. 831) which have been named *S. pectinatus* Roxb. in Thwaites' handwriting.

In Wight's "Contributions," (1834) the Indian *Cyperaceæ* were reviewed,—chiefly on material in the Herbaria of Wight himself, of Wallich, Royle, and Lindley,—by Prof. Nees von Esenbeck, who divided off sundry types from *Scirpus* and created, among other new genera, *Malachochæte*, which in his Tribe III (*Scirpeæ*) is referred to a subtribe B. with the glumes (squamæ) arranged spirally (plurifariæ), and to that particular group of the same which has a perigonium (of bristles).

In its group *Malacochæte* is distinguished by the "setæ" which constitute the perigonium being linear, membranaceous, and ciliate.

He enumerates a single Indian species only, *viz.*, *Malacochæte pectinata*, of which the synonymy is given as follows:—

Scirpus pectinatus, Roxb. Fl. Ind. I. p. 218 (Ed. Wall.) I. 210.
S. campestroides, Roxb. in Co. Merc. I. Or. Mus. tab. 744 (fide Arnott)
S. plumosus, R. Br.? Fl. Nov. Holl.

As localities are mentioned sandy marshes of the *E. I. Peninsula* (Roxburgh, Wight), *Nepal* (Royle).

I have not traced *S. campestroides* of Roxburgh's unpublished drawing, but it seems likely that the Nepal habitat is an error, and that *S. pectinatus* was collected on the coast or in tidal rivers exclusively.

Wight's plant was doubtless that which is represented from Ceylon in Herb. H.B.C., named *S. pectinatus* Roxb. and S. *subulatus*, Vahl by Mr. C. B. Clarke subsequently.

Royle's specimens may have been from the Dehra Dun or Kumaon, and to whatever plant they belonged were presumably distinct (as a sub-species at least) from the estuarial *Scirpus pectinatus.*

In the Flora Germanica (VIII p. 42 Ic. CCCIX) Reichenbach has described and figured Schrader's Istrian species, giving as additional localities the Venetian Islands, and the synonymy as

=*S. mucronatus*, Scopoli
=*S. fimbrisetus*, Delile
=*Fimbristylis mucronatum* (sic), Vahl
=*Malacochæte littoralis* N. von E.
=*S. balearicus*, Willd. ined.

From the last synonym it appears that a similar or identical species had been collected in the Balearic Islands also. Reichenbach's figure represents a plant agreeing fairly as regards the sheaths and inflorescence with *S. pectinatus* of Roxburgh, but differing from that widely as regards the shape of the glumes.

From Delile's plate of *S. fimbrisetus* the Fl. Germ. Icon differs as regards the length of the stigma and in shewing the glumes as ciliate on the margins. It adds a detail which may have escaped previous observers as regards the anthers, which are shown as adnate to a strap-shaped filament, broadened upwards, and produced above the cells into a short semicircular crest or expansion, which is bristly or minutely plumose on the margin.

The achene is depicted as plano-convex, shortly stalked, and obcordate, with a manifest style base. The culm for the most part of its length is triquetrous, or to speak quite correctly plano-convex, the section of the convexity giving a curve which is nearly a parabola.

Nyman's Conspectus gives the range of Schrader's *S. litoralis* as the whole N. shore of the Mediterranean and its European islands from Crete westwards, and it may be taken that the plant of Delile is a sub-species of *S. litoralis* or a very closely allied form.

In 1855 Steudel (Synopsis Pl. Cyper.) described the following species of *Scirpus* belonging to the same group as *S. litoralis* Schrad, *viz.*—

SCIRPUS.

No.	Species.	Habitat.	Character.
40	*Philippi*, Tineo ...	Sicily ...	Stigmas 3.
41	*plumosus*, R. Br. ...	N. Holland ...	Culm terete, glume-margins naked.
42	*Meyenii*, Nees ...	N. Holland and Sandwich Islands	Style trifid, achenes lead-coloured, punctate gibbous.
43	*Brayii*, Hoppe ...	Baltic ...	Style trifid, glumes ciliate above.
44	*subulatus*, Vahl ...	India ...	Style deeply bifid, achenes rust-coloured, compressed, smooth.
45	*litoralis*, Schrad ...	Mediterranean, etc.	Style bifid, glumes blood-red to rust-coloured, achenes plano-convex, punctulate.
46	*Despraussii*, Steud. ...	Cuba ...	Style bifid, glumes not mucronate.
50	*Jatora, Kunth* (? Tatora) ...	Peru ...	Culm triangular, style bifid, glumes not aristate.
51	*Pterolepis*, Kunth	Cape G. Hope ...	Culm terete, style bifid, glumes strongly ciliated.

It appears that Schrader in a memoir that is scarcely accessible had referred his *S. litoralis* to a new genus *Pterolepis* as *P. scirpoides*, including in it the Cape plant which is No. 51 of Steudel, but Nees demolished *Pterolepis*, at the same time erecting *Malacochæte* for the reception of the Roxburghian species having a bifid style and plumose setæ and certain extra-Indian forms, in which the Australian plant of Brown was doubtfully included.

Steudel gives *S. pectinatus* of Roxburgh as *S. subulatus* of Vahl, and reduces *fimbrisetus* of Delile to *S. litoralis* of Schrader, but under these he says nothing of the Neesian "Malacochæte."

S. Philippi is a doubtful plant reduced by some authorities to *S. litoralis* though the style is described as trifid. It is only found in Sicily and may be a good species, but the writer has no means of placing it at present. *S. Brayii* of Hoppe is referred to *S. lacustris*, and is therefore not a *Malacochæte*; so that if for the purposes of this note we put the American species on one side we have left the following, *viz* :—

S. plumosus,—R. Brown
S. Meyenii,—Nees.
S. subulatus,—Vahl
S. litoralis,—Schrad.

S. Meyenii differs from the other plumosæ by the trifid style, and the same applies to the true *S. subulatus* of Vahl, so that of "Malacochæte" with a bifid stigma there remain but two out of the above, *viz* :—

S. plumosus,—R. Br.; and
S. litoralis,—Schrad.

To these we must add, however, *S. pectinatus* Roxb., because Nees (in Linnæa, IX. 2921) has kept Roxburgh's species distinct from Schrader's *litoralis.*

[*Note.*—In the Prod. Fl. Nov. Hollandiæ *S. plumosus* is contrasted with the "Caribean" *S. validus* of Vahl's Enumeratio, but *S. subulatus* is not mentioned.]

Miquel's Flora of the Dutch Indies (1855) contains only one *Scirpus* of the "*Malacochæte*" type, which is given as *Scirpus subulatus* Vahl, Roxburgh's *Scirpus pectinatus* being cited as a synonym, also Nees' *Malacochæte.*

Nothing is said about *S. litoralis* or *plumosus*, although Steudel is referred to. "Further India" is given as the Batavo—Indian habitat (apparently) along with the Nicobars (as the external distribution presumably).

Miquel's description follows Steudel exactly although not *verbatim ;* but Steudel's does not fit with Vahl's whose *S. subulatus* had a trifid style, while Steudel's description brings his species near *S. litoralis* by the style being *bifid.* Steudel does not give the solitary habitat from which Vahl's plant had been gathered when the "*Enumeratio*" was published, and as he cites Roxburgh, and his description tallies with Roxburgh's sufficiently, the probability is that he had *S. pectinatus* in his eye exclusively.

There are no specimens of Vahl's *S. subulatus* in Hb. H. B. C. nor in fact of any *Scirpus* of the "*Malacochæte*" group from the Nicobars or regions adjoining: and it seems likely that none of the subsequent authors who have quoted or described what they understood to be his plant had a specimen from the Nicobars before them.

Boeckeler in the XXXVIth issue of Linnæa (1869—70) described the *Cyperaceæ* of the Royal Hb. Berlin, and has given a key to the species of *Scirpus* taken up by him. This has a group under the first main section (A. squamæ apice rectæ) which is distinguished by the segments of the perigonium being fimbriate-ciliate: this group includes three species, *viz*:—

S. subulatus,—Vahl
S. triqueter,—Linn.
S. riparius,—Presl.

It may be noted that these are referred to a sub-section having glumes entire (squamæ integræ) which is inapplicable to several of the forms which he has assigned to *S. triqueter*.

Moreover he has reduced *S. fimbrisetus* Del. (or as he gives it, following a misprint in the Index to Steudel, "*fimbriatus*") and *S. litoralis* of Schrader to *S. triqueter* of Linnæus, which is certainly erroneous.

His *S. riparius* of Presl. is made up of several species of Steudel's plus some others subsequently edited, all American, of which most appear to be referable to the sub-genus "*Malacochæte*"; but for the purpose of this note the American forms may be neglected.

Under "*S. subulatus*" he cites:—

(i) *S. subulatus* Vahl (but had apparently not seen authentic specimens),
(ii) *Malacochæte pectinata* Nees, in whose Hb. he seems to have seen a specimen (from Wight probably);
(iii) Wallich Hb.—No. 3506 B;
(iv) *S. arabicus* Nees et Ehrenb in Hb. Berol;
(v) Thwaites No. 831 from Ceylon; and
(vi) Boivin No. 3051 from *Mayotte*, which is no doubt the island of *Mayotta*, one of the Oceanic group of the *Comoro* Isles, half-way between the *Mozambique Coast and Madagascar.*

As observed above, Thwaites No. 831 is in Hb. H.B.C. and is marked as *S. pectinatus* Roxb.

S. Pterolepis Kunth (=*Pterolepis scirpoides* of Schrader's Analecta Fl. Cap.) he makes var. B of *S. subulatus* without discussing the strongly marked diognosis which is given for the Cape plant by its author. The Mascarene plant is not improbably the same as Schrader's *Pterolepis* or closely allied to it; but for want of specimens the writer is unable to suggest a place for either form.

In the Flora Austral. (l.c.) it is pointed out that Boeckeler was wrong in identifying *S. litoralis* with *S. triqueter* of Linnæus and of Schrader. From the remark that the areas of *S. litoralis* (Mediterranean region) and *S. plumosus* R. Br. (Australian continent) are distant, it appears that Bentham either had not seen Vahl's *subulatus* and Roxburgh's *pectinatus* or was not prepared to unite them summarily with *litoralis.*

In the *Flora Orientalis S. litoralis* is the only Malacochæte dealt with.

It is noted as—

= *S. fimbrisetus*, Del.
= *S. triqueter*, Gren. & Godr. and of Boeck. (l.c.) [not of Linn.]
= *S. pectinatus*, Roxb.
= *Malacochæte litoralis*, and *pectinatus* } of Nees.

The distribution given is S. France, Italy, Greece, Corsica, Crete Cyprus, Anatolia, Syria,—Alexandria, the Fayum and the Great Oasis in Egypt,—N. Africa, Caspian region, and Afghanistan (Griffith.)

A variety (oligostachys) is added as found in what is probably a marsh (from the name) in Eastern Persia (Coll. Bunge).

Trimen (Fl. of Ceylon V. 77) gives *S. pectinatus* Roxb. as a synonym of *S. litoralis*, and notes that it inhabits tidal waters in Ceylon, occurring rarely.

In the Fl. Br. Ind. VII. 659 *S. litoralis* is noted as the only Indian species with the bristles plumose, and the synonymy is—

= *S. subulatus*, Vahl, also Miquel
= *S. fimbrisetus*, Del.
= *S. pectinatus*, Roxb.
= *S. triqueter*, Gren. and Godr. and of Boeck; (l.c.) not of Linn.
= *Malacochæte litoralis*, = *M. pectinatus* } Nees.

It is also observed that it is part of Wall. No. 3506 C.

The weakness of the rhizome is noted, and the anthers are described as red-crested (Cf. Reichenbach's figure of *S. litoralis.*)

In the Genera Plantarum *Malacochæte* has not been accepted as a separate genus or even as a sub-division of *Scirpus.* It would be convenient in some ways to retain it as a sub-genus, but in *Scirpus Kysoor* of Roxburgh (placed as a variety under *S. grossus* Linn. in Fl. Br. Ind.) the "setæ" are minutely plumose, and this species would logically be included in *Malacochæte*, while its natural affinities seem to be with *S. grossus* of Vahl, and with Mr. C. B. Clarke's series "*Sylvaticæ.*"

The importance of the characters derived from the "setæ" cannot be correctly estimated until more is known of the morphology of the flower in *Scirpus* and its allies, and of the part played by the hypogynous bristles in the life of the individual. Where these are "plumose," all the floral whorls appear to be unsymmetrical, the actually anterior segments of the perigonium being more in number than the posterior and declinate. The flower of such a *Scirpus* would in fact be somewhat on the plan of a minature *Gladiolus*. In *Scirpus pectinatus* and *S. litoralis* the anterior "setæ" seem to be pretty constantly four in number, of which one pair is opposite the axis, the others being pushed to the right and left of it by the ripening achene, which, as noted by Roxburgh, they embrace laterally. The plano-convexity of the caryopsis itself may be due to the same tendency. In the ripe floret of certain *Malacochætes*, there are two flattened scarious white ligules corresponding to the anterior setæ, and arising in some species apparently with them from a ring that surrounds the base of the caryopsis. Whether these have carried anthers,—or at all events produced pollen,—may be doubted, but they are, in all likelihood, modified filaments, and the whole of the "setæ" therefore in "*Malacochæte*" (also in *S. Kysoor* and S. *eriophorum* presumably) would thus be regarded as belonging to the staminary whorl, while the plumose setæ of the *litoralis* group, of which the hairs are certainly gland-tipped, and have been observed to be moniliform, would be comparable with the staminodes of *Palisota* (see fig. 31 in Engler and Prantl. II. 4, p. 62). Roxburgh says of *S. Kysoor* that it has the setæ always five in number, and examination of fresh specimens would no doubt confirm his observation. In the *S. litoralis* group the writer finds the plumose segments of the perigonium to be always four in dried specimens, but living material is wanted to clear up the variability in the development of setæ in this genus.

A key is appended to those forms of *Scirpus* found in Europe, Asia and Australia, which, on the above view, have three or more of the perigonial "setæ" (in the fertile florets) developed as penicillate staminodes.

+ Nut plano-convex

* Style bifid

O Culms rooting separately

△ Sheaths without laminæ.

1. Main involucral bract longer than the effuse panicle ... ... *pectinatus, Roxb.*
   Hab. Sea coasts and estuaries of Ceylon and India, Sundriban (Kurz !) Coromandel (Heyne !) Ceylon (Thwaites)
   Dist:—(Not known.)

2. Main involucral bract shorter than the rather compact panicle...*plumosus, R.Br.*
   Hab. Coasts of Australia (!)
   Dist:—(uncertain)

△ △ 3. Sheaths with distinct (sometimes submerged) laminæ ... *litoralis, Schrader*
   Hab. Rivers and lagoons (in brackish water only ?) Affghanistan (Griffith ex Boiss.) Waziristan (Stewart !) Punjab (Stewart and others !) Kathiawar (Mehta in Herb. R. E. P. !) Ahmedabad (Burkill !) Rajputana (King !) Central India (Vicary ! Duthie !)
   Dist:—Persia, Central Asia, Egypt, Mediterranean to S. Portugal.

O O 4. Culms and barren shoots (phyllodes) several from a common rhizome ... ... *sp. adhuc non descripta*
   Hab. Lakes and marshes Kashmir (C. B. Clarke !) Baluchistan (Duke !) (Col. C. A. MacMahon !)
   Dist:—(Punjab Salt Range ?)

* * Style 3-fid

5. .... *subulatus, Vahl*
   Hab. Nicobar Isl.
   Dist:—(unknown).

++ Nut trigonous

6. .... *Kysoor, Roxb.*

Hab. Ponds and marshes. S. Bengal (Burkill!) Chota Nagpur (C. B. Clarke!)

Dist:—(endemic).

The above (as well as the subjoined additional species of *Scirpus*) is altogether provisional, but put forward in the hope that it may draw the attention of local botanists to the group, and lead to the collection of further material.

Descriptio sp. No. 4, antecedentis.

SCIRPUS WARDIANUS.

3-5pedalis, erectus, culmis pluribus, ex rhizomate rotundo sæpe incrassato, radicillis fibrosis undulatis nigris circumdato, exorientibus, floriferis lævibus rigidis obtuse triquetris, foliis (phyllodiis) planoconvexis spongiosis culmis floriferis elatioribus, involucro universali erecto paniculam aequante vel supereminente, paniculæ ramulis parum effusis, spiculis oblongis uncialibus albescentibus, squamis inferioribus acuminatis sterilibus deciduis, mediis nuciferis apice retuso subpersistentibus, omnibus scariosis pellucidis margine integerrimo spinulis microscopicis ornato carina flavida in brevissimum mucronem excurrente, perigonii setis anterioribus quatuor, duobus caryopsidis plano-convexæ obcordatæ breviter stipulatae ad apicem styli frustulo minuto armatæ duo latera amplectentibus.

A tall clubrush with several plano-convex barren shoots or leaves, which are very spongy, from the same rhizome as the flowering stem, which is rather slender for the group, but rigid, terete below, in the upper two-thirds bluntly triangular, sides slightly convex;—spikelets fully an inch long, larger and more tapering than in *S. litoralis*; branches of the panicle rather stiff ascending; glumes without rust-coloured markings, those of the fertile florets very thin, wings almost transparent, keel pale-golden, gibbous near the base; the lower empty glumes acuminate falling away from the rather stout notched rachis before the fruit ripens, when the spikelet bleaches. Nutlet narrowed at the base,—at the tip rounded, (under a high power) finely reticulated, colour olive turning to a chestnut-brown.

From *S. litoralis* Schrader, this should be easily distinguished by the presence of distinct "leaves"; the strong rhizome and much larger silvery, not chestnut, spikelets.

It is nearer *S. pectinatus* and *S. plumosus* which may not improbably be found to form a single species, but the panicle is more effuse in *pectinatus*, and in neither is there any rhizome; the Seistan plant manifestly survives over one or more winters, while the other species, to judge from their weak attachments, may be annual.

Vern. *Tuzg.*—Sent by Col. C. A. MacMahon from the Helmund lagoons where it is gregarious and abundant, with *Arundo Donax* Linn., *Scirpus maritimus* Linn., and other fen plants of the temperate and sub-tropical zones of the northern hemisphere.

Named after the writer's friend, Mr. T. J. R. Ward of the Punjab Irrigation Department, who has supplied full and interesting notes on this collection of aquatic species from the Helmund.

The Himalayan summer storm of September 24th, 1903, *and the weather immediately subsequent to that date in Northern India.*[1]—*By* C. LITTLE, M.A. (With Plate VI.)

[Read March 2nd, 1904.]

Although in this paper some reference is made to the past two rainy seasons, the discussion in the main deals with occurrences towards the close of the monsoon season of 1903. My reason for making this arrangement is the belief that these later events bring into stronger relief the importance of considering to what these events are due. It will, I am sure, be obvious to all that until such occurrences can be fully accounted for afterwards, there is no prospect of their being foreseen with even a semblance of accuracy.

In the *Englishman* of September 15th, 1903, there appeared the usual weekly report of Meteorological observations at St. Xavier's College. To that report a note was added giving expression to the idea that the monsoon season had practically come to an end in Northern India. The note closed with the following sentence: "This year, 1903, there seems therefore to be greater fear for a speedy termination of the rainy period."

1 In the Monthly Weather Review for September 1903, published in February 1904, the following is the summary of the weather in the former month:—

"During September 1903, the weather was more disturbed than usual over the Bay area and surrounding regions, occasioned by a series of small storms which was developed over the Bay, and thence progressed through the central parts of the country into Upper India. Over Western India, on the contrary, the weather was fairly quiet. The south-west monsoon was, on the whole, weaker than usual over the Arabian Sea, and the rains ceased at about the normal date over North-west India."

In the *Pioneer* of September 28th, the following remark appeared: "The sky is becoming clear all over Upper India, and fine weather is now promised by the Meteorological Department."

Ten days later the *Pioneer* wrote as follows: "On the 26th or 27th September the Meteorological Bureau seems to have arrived at the conclusion that fine weather conditions were becoming established over Upper India just on the eve of one of the most heavy and prolonged bursts of rainfall that can ever have been recorded so late in the year. Even now the daily telegrams seem to show no appreciation of the extraordinary character of the season in which October seems to have changed places with July. Down to the end of the former month there was every reason to apprehend in these Provinces that the autumn crops would be a failure from the want of rain. The danger now is that they may be ruined by too much of it. Already serious damage must have been done in places, and the telegrams to-day give a lively picture of the state of things in the Deccan and especially at the capital. Railway communication has been severed between Madras and Secunderabad. There are even fears that the great Hussain Saugor Tank may burst its bounds, and already thousands of people belonging to the villages along its banks are said to have been rendered homeless."

My object in quoting the above remarks from the daily press I will give presently. But before going on to the subject of the paper I may perhaps be permitted to point out, that it is not apparent, whether the criticism of the writer in the *Pioneer* is directed against the system on which weather forecasting is done in this part of the world, or whether it is against the subordinates, I might almost say the rank and file of the Weather Bureau who, in no way responsible for the system, still have a responsibility as regards the application of that system to daily occurrences. I have not been able to verify the accuracy of the statement in the *Pioneer* that the Weather Bureau had come to the conclusion that fine weather conditions were becoming established, but there is not much doubt that such was the case, because on the present system of weather forecasting there was no other alternative. The chief feature of the present system, at times other than when weather is controlled by a well-marked cyclonic storm, is in the estimate of the strength of what is called the Arabian Sea monsoon current and the Bay of Bengal monsoon current. If these currents are both weak, then diminished rainfall is considered inevitable in Northern India; and when this weakening of the monsoon current on both sides of the peninsula is accompanied by the commencement of the change of season in Upper India, about the usual time, the chances of more rainfall in that region are greatly diminished. Now, in September of the past year, there was practically no monsoon either in the Arabian Sea or in the Bay of Bengal, if it be understood that a smooth sea and comparatively light winds indicate the absence of monsoon; and, as the *Pioneer* states, the skies had become cloudless in Upper India. We have also the evidence of the meteorologists of St. Xavier's College, Calcutta, that in their opinion the rains would terminate early—an opinion given quite independently of the Weather Bureau. Assuming that the chances were 10 to 1 against a disturbance developing in the Bay of Bengal or the Arabian Sea during the latter half of September or first week of October, and 10 to 1 against that storm moving north-westward, if it happened to form, the chances were 100 to 1 against rainfall in the United Provinces or the Punjaub. The above chances are not at all unlikely if we remember that the monsoon had become exceedingly weak in the Indian sea area, and that the sky had become cloudless in Upper India: or, in other words, that atmospheric conditions in the north of India and the Bay of Bengal were such as in ordinary years are experienced in the early part of October. Experience has shown that under such circumstances no cyclonic storm has ever advanced from the Bay of Bengal or the Arabian Sea in the direction of North-west India.

The conclusion therefore is that the subordinates of the Weather Bureau had two alternatives. They had either to stand by the system and come to the conclusion that rainfall had ceased for the year in North-West India, or they had to put aside the system and strike out a new course for themselves. That the former course was adopted is in my opinion not only natural; the adoption of any other was impossible.

One of my reasons for making the above newspaper quotations is to emphasise, as strongly as it is possible to do, the fact that weather in Northern India just after the middle of September was of a kind to suggest an early termination of the rains in Northern India, and that before the end of the first week of October rainy weather of an intense character had become established over a great part of Northern India.

A change so noticeable, as that most undoubtedly was, must have been due to well-marked local causes, which ought to become apparent on subsequent enquiry. Now whether these causes can be brought to the surface from the meteorological records or not, there can be no question that the events of the early days of October were not foreseen, and in my opinion could not, under the present system, have been foreseen, for reasons which I have been trying to make clear in previous papers read before this Society. Until the atmospheric processes are better understood than they are at present, it is a mere truism to state that even approximately accurate forecasting is impossible.

The criticism of the *Pioneer* if just, makes it obligatory on some one to revise present-day methods of meteorologists in India, and cannot be entirely overlooked by even the most humble worker or writer. I have given my opinion that any fault, there may have been, cannot be laid at the door of the subordinates who were carrying on the daily routine of weather reporting and forecasting. It must, therefore, have been the system that failed, and as that system is intimately connected with the subject of this and other papers which have been read by me before this Society, I will pause for a brief reference to that system. I may be permitted to point out that atmospheric problems, whether simple of their kind or complex, are of such unusual difficulty, that their treatment must of necessity, in any department such as a Weather Bureau, be the special responsibility of the head of the department; and that the success or failure of a system, whether in its bearing on past events, or as the basis of weather forecasting, is a matter, from the point of view of science, of strictly personal reckoning. On that ground I may be excused somewhat repeated reference in the few general remarks that follow to Mr. Blanford and Sir J. Eliot, who have controlled meteorological work in India during the past thirty to forty years.

It requires only a cursory examination of the meteorological history of the early years of the department to realize, even in the light of the accumulated experience of the intervening years, how sound was the instinct displayed, and practical the view that was taken of the possibilities of meteorological work in India by its founder, Mr. H. F. Blanford of immortal memory. Nothing affords a more striking illustration of his power of separating what may be called casual occurrences, or from those indicating important or controlling causes, than his method of estimating the strength of the coming monsoon, and theory has received more encouraging confirmation than his is receiving at the present time, twenty years after it was formulated. That theory has been given in published reports and in the Proceedings of the Royal Society, and its distinctive feature is the connection between the condition of the upper atmospheric strata as indicated by snowfall in the Himalayas, and the character of the coming monsoon. The following extracts are taken from his report on the Meteorology of India in 1882:—

> "In Europe and America, the attention of the leading Meteorological Physicists would seem to have been concentrated of late years mainly on the physics of the vortical movements of the atmosphere of cyclones and anticyclones, the importance of which is keenly felt, owing to the prominence given to storm

warnings and forecasts, of impending weather among the objects of the national systems of weather report."

"In India storm warnings also have an importance, but it is chiefly local and restricted to certain seasons of the year: and other and more comprehensive problems force themselves on our attention and await their solution at our hands. Foremost among these are all questions bearing on the vicissitudes of the rainfall."

After pointing out that seasons of drought are due to the persistence of certain winds, the report continues:—

"The experience of recent years indicates that a season in which the pressure of the higher atmospheric strata is excessive is one in which the land winds are unduly prevalent; and by a process of exhaustive reasoning, supported by occasional observation, I have been led to infer that, except at certain times in the cold season, the higher strata of the atmosphere lying over the mountain zone around North-Western and Western India, are the principal and immediate source of these winds."

"It would be out of place to enter here on an exposition of the reasons which have led me to this view; and it is my intention to give them in another place. Moreover, systematic observation of a kind which we can hardly expect from the class of men, who furnish the registers of our observatories, is yet required to confirm its accuracy. What is more especially required now, is a knowledge of the prevailing movements of the higher atmospheric strata, as indicated by those of the clouds characteristic of great elevations; and this requires watchfulness and judgment only to be expected of educated observers who take an intelligent interest in the conduct of the observations. Such persons are at present extremely rare in India."

Later at page 69 of the same report the following important opinion is recorded: "The main fact which is thus becoming more and more firmly established, as each successive year furnishes its additional mead of evidence, is that the character of the Indian weather is in a large measure determined by the barometric condition of the higher atmospheric strata."

In the annual report for 1883 (a year of crop failure) Mr. Blanford says:—

"It has been shown in former reports, more especially that for 1878, that years of severe and prolonged drought have been those in which the pressure of the atmosphere has been unduly high, and there is in all probability a direct connection between this condition and the persistence of the dry winds in those years. But there is evidently some other condition which operates in producing these winds, and in retarding or interrupting the rainfall in years such as 1883, when the atmospheric pressure does not exceed the average and may even be below it. The dry winds in such seasons are less lasting, but for a time they are as strongly marked as in famine years. I have given elsewhere my reasons for believing that in such cases they are due to an unusual extent to the thickness of snow on the North-Western Himalayas.

* * * * * *

But there were indications that throughout this rainy interval the influence of the snows was operative. On the North-Western Himalayas, the rain of the first half of July was accompanied with frequent thunderstorms and hail storms (always a sign of an unsteady monsoon), and in clear intervals, the upper clouds could be seen drifting steadily from the North-West, proving the existence, at no great height, of the dry current which about the 19th descended and replaced the monsoon, prevailing over the whole of Northern India and Rajputana, and influencing the winds down to the Deccan on the south and Bihar on the east."

Further reference is made in the report for 1884, to the connection between the North-Westerly winds, the snowfall in the Himalayas and the rainfall distribution in Northern India; and in the report for 1885, the last which Mr. Blanford wrote before retirement, the following remark occurs:—

"The year under review affords a very striking instance, in confirmation of the hypothesis, on which these latter forecasts have been principally based, *viz.*, that the persistence of dry North-Westerly winds in Western India and Westerly winds in Northern India is greatly influenced by the depth and extent of the snow accumulation on the North-West Himalayas."

It will, I think, be clear from the above extracts that an important factor, in Mr. Blanford's opinion, in estimating the character of the Weather in Northern India, not only for the monsoon season as a whole, but for brief periods ahead, was connected with the upper atmospheric strata.

He repeatedly expresses his conviction of the need of some influence from the North, "some condition which operates in retarding or interrupting the rainfall," and shows that the pressure variations or pressure anomalies fail to account for rainfall failure or distribution. What that condition is he merely indicates as an important subject for investigation, with an expression of the opinion that the confirmation requires watchfulness and judgment not to be expected from the "class of men who furnish the registers of our observatories." I understand him to take the snowfall in the North-Western Himalayas as the best, and in fact at that time the only available indication of different states of the upper atmosphere (of great elevations he observes).

At the time when the head of the Meteorological Department in India was evolving the above hypothesis or theory, that is in the early eighties, Mr. Eliot, then a subordinate in Bengal, was publishing (see Monthly Weather Reviews) rival forecasts based upon the principle which Mr. Blanford was declaring to be an insufficient guide. After he became in turn head of the Department, that principle became to the exclusion of all others the working guide in estimating the character of the rainfall, and in fact of all weather changes.

It is not easy to give chapter and verse for what I may select as the guiding principle, theory or hypothesis used by Mr. Eliot in weather forecasting, for owing to the immense amount of printed matter published since 1888 and the difficulty of finding what I may call incriminating statements, the search reminds one of a recent process which has been attracting much attention lately—the extraction of radium from pitchblende.

Perhaps the most explicit statement issued previous to the letter published in the *Pioneer* in 1899, is to be found in an extract from the papers of the Chicago Meteorological Congress, August 1893. The following extracts give, as Mr. Eliot then states, some of the conditions determining the character of the coming monsoon :—

(1) "Unusually heavy and prolonged snowfall in the Himalayan Mountain area has been shown by Mr. Blanford to exercise a very powerful influence."

(2) "The abnormal pressure conditions established during the hot weather, more especially if they are marked, exercise a great influence in modifying the set of the monsoon currents."

"A consideration of the snowfall data of the cold weather, of the meteorological conditions prevailing during the hot weather, and more especially the character and persistency of the pressure variations, usually enables a rough estimate of the general strength of the monsoon currents and the distribution of the rainfall to be made. .... This is what is now attempted to be done in the forecasts issued annually in June by the Department and which have had a fair measure of success. For example, a full warning was given in June 1891, of the drought in Rajputana during the monsoon rains of that year."

The paper closes with the following paragraph :—

"It is hardly necessary to point out that the methods employed and sketched above are practically identical with those employed in giving warning of the approach of storms, and I may again point out that these long period forecasts in India are rendered possible by the peculiar features of the South-West Monsoon air motion over India, and by the remarkable persistency of many of the abnormal conditions of the meteorology of that current."

The meaning of the statement regarding the full warning in June 1891 of the drought in Rajputana is shown by the following extract from a paper by Mr. Eliot on oscillatory changes of pressure published in 1895. Met. Mem. Vol. VI, page 92 :—

"The abnormal pressure conditions which enabled the Department to foretell accurately the last serious drought in India, *viz.*, that of 1891, in Rajputana, were small in amount, depending on pressure variations and anomalies not exceeding ·05″——————."

The above extracts make it, in my opinion, sufficiently evident that the theory or hypothesis on which weather forecasting in India for long or short periods was conducted from 1888 to 1895, was the pressure anomalies or variations as disclosed by the barometric observations in the plains of India. A study of monsoon forecasts and other publications will, I believe, complete the proof (notwithstanding the statement in the Chicago paper) that Mr. Blanford's theory had ceased to be a living theory, but any such troublesome investigation is rendered quite unnecessary because the last annual summary to which Sir J. Eliot contributed, that of 1902, contains at his hands the complete *quietus* of that hypothesis. In page 708 of that summary the following occurs :—

"In the year 1902, the deficiency in the total rainfall due to the Arabian Sea was due solely to the weakness of the whole circulation of the South-East trades and South-West monsoon during more than half of its normal period. In some years of similar periods, as in 1885, the delay and weakness of the monsoon was associated with heavy prolonged and continuous snowfall during the cold and hot weather periods in the Western Himalayas. This was not the case in 1902, as the snowfall of the cold weather or winter of 1902 was one of the lightest on record. It is hence probable that actions and conditions in the Indian Ocean are primary, and conditions in India such as snowfall in the Himalayas subsidiary, and are of small importance relatively to the former except when the conditions in the Indian Ocean and Seas are approximately normal."

It is unnecessary to follow the progress of weather forecasting through the years between 1895, and 1903, when the above opinion was written, or to consider the influence of American meteorologists in directing the development of Sir J. Eliot's opinions; or to show that the abnormal years, such as 1899, convinced even him that Mr. Blanford was right in the opinion that pressure anomalies form an unreliable guide in forecasting the weather in Northern India. All that is necessary is to show that in 1903, so far as hypothesis or theory went, the slate had practically been wiped clean, the snowfall theory had failed, the pressure anomalies had failed, the comparison with previous years had failed; and all that remained was to transfer the seat of cause and effect to the Indian Ocean or Seas, an area over which an active imagination may roam with but little restraint.

The following extracts from the report referred to, the Annual Summary for 1902, appear to support the opinion which I have given, that Sir J. Eliot believes the character of the monsoon to be determined in the Southern Seas:—

Page 688.

"The conditions in India itself hence fail to give any clue to the delay in the advent of the monsoon currents in June and July, and more especially of the Bombay or Arabian Sea current."

Page 705.

"The discussion of the Meteorology of India in the preceding pages has shown clearly:—

(1) That the conditions in India in the latter part of May and the commencement of June were such as are usually associated with an early and strong monsoon, more especially as judged by the data of the period 1875–1892, antecedent to the period of anomalous and remarkable conditions obtaining from 1892 to 1902.

(2) That there was no large or rapid change of meteorological conditions in India prior to the remarkable change in the character of the Arabian Sea Monsoon in the third week of August. The conditions then prevailing were such as invariably accompany a prolonged break in the rains, and are rather effects and not causes of the breaks. It hence follows that the causes, actions or conditions determining the weakness of the Arabian Sea current in the first half of the period, and its strength during the second half, are not to be sought for in India or the Indian monsoon land area, but most probably in

the remaining portion of the area of the complete monsoon air circulation, *viz.*, the South-East trades region of the Indian Ocean."

Later in the same page:—

"The preceding data show that the abnormal monsoon of 1902, accompanied abnormal conditions in the Indian Ocean unfavourable to a strong monsoon, although in India the conditions are favourable. This fact is almost sufficient to establish that the abnormal features of the monsoon of 1902 were due primarily, if not entirely, to abnormal features in the Indian Ocean."

Page 707.

"It is not necessary to give further data, as the previous have been sufficient to establish fully that the variations in the strength of the Arabian Sea current in India were primarily and directly related to variations in the strength of the whole air movement over the Indian Ocean and Seas, and more especially to the movement in the Indian Ocean."

I have attempted to show by the above brief extracts what the controlling principle in weather forecasting has been from time to time, and these may, I think, be still more briefly summarised as follows:—

Mr. Blanford at first relied on pressure anomalies or variations, but afterwards found that method to be untrustworthy. His own observation showed that there was some other condition on which rainfall in Northern India depended, connected as he thought with the upper strata of the atmosphere and requiring careful investigation in the future. Taking the snowfall in the Himalayas as a tangible representation of that condition, he claimed to have repeatedly and successfully shown beforehand the character of the coming monsoon.

Sir J. Eliot was guided entirely by the pressure anomalies in India, as is shown by the claim to have foretold the nature of the famine in Rajputana in 1891. He was subsequently induced by the criticism of American meteorologists to extend the sphere of observation over a wider area, and when the pressure anomalies in India failed conspicuously in the later nineties, as Mr. Blanford had found them to fail nearly twenty years before, the discussion of the character of the coming monsoon resolved itself into a consideration of conditions over the Southern Sea area, and a comparison of what had happened in India in years said to be similar.

Still later the sunspot cycle has been put forward under an impetus from Sir Norman Lockyer.

During all these years nothing has been done towards investigating that other condition on which, according to Mr. Blanford, the rainfall in Northern India appeared to depend, connected with the upper strata of the atmosphere.

It has appeared to me that since 1897 the evidence has been becoming conclusive, not to say overwhelming, that without more information, such as Mr. Blanford required regarding the upper strata of the atmosphere, it is impossible to say even a few hours ahead what the character of the weather will be in Northern India. With the object of showing how important the changes are that appear to originate in the north, I have been collecting and publishing in the Journal of the Society all information available regarding what I have called Summer Himalayan storms and their influence on weather in Northern India.

These storms were unusually well-marked in 1902, the year which Sir J. Eliot states was sufficient in itself to show that the character of the monsoon in Northern India was determined by conditions in the Southern Indian Seas. In the two cases which I have discussed in some detail in the paper on two remarkable rainbursts in Bengal,—one on June 30th, 1902, the other on August 12th,—I showed that there was no evidence of any kind that the general change then in operation came from the south, whereas there was very strong evidence of a disturbance crossing the Himalayan range from the north.

Similar well-marked occurrences are on record for 1903, and the unusual weather in the United Provinces in the early part of October, can, I believe, be traced to the disturbance which entered Northern India from Central Asia in the closing days of September. As that weather called forth the criticism of the *Pioneer*, which I have quoted above, it may now be seen more clearly why I have quoted their remarks. In the first place the press extracts show that weather was settled over the southern seas, because it was anticipated on all hands that the monsoon was on the wane. In the second place the remarks of the *Pioneer* afford strong corroborative evidence that on that particular occasion something very unusual and unexpected had happened in Northern India. Also I may point out, as further justification for introducing these extracts, that similar occurrences in 1902 were passed over by Sir J. Eliot without comment, showing that an examination of registers only is not sufficient to account for passing events or, to quote Mr. Blanford again, there is certain information which we cannot expect from the men who furnish our registers.

Even Mr. Murray supports my contention that weather in 1902 was not entirely controlled from the south. In the Weather Review for

June 1902, among conclusions suggested by a discussion of the atmospheric conditions in Europe, Asia, Africa, Australia and the adjoining seas, the following occur :—

"That conditions in India may be sometimes largely conditioned by actions taking place in the Central Asian areas, and that occasionally these actions extend over the greater part of Europe and Asia."

"That these actions are largely modified by the barrier of the Himalayas, and seem to spread more readily southward through the gaps in the range."

I think the above remarks have made it clear how the subordinates of the Meteorological Department, entrusted with the duty of issuing forecasts in the first half of October, 1903, had no alternative but to estimate coming weather changes on the supposition that they originated in the southern sea area and approached Northern India from the south, and that an attempt by them to introduce any consideration of other conditions such as were thought to be necessary by Messrs. Blanford and Murray, would have been without sanction so long as Sir J. Eliot controlled meteorological work in India. Before proceeding to consider the striking changes which passed over Bengal from the north previous to the unexpected burst of rainfall in Northern India in October, I will give an illustration which appears to me to show in a simple way the great need there is for investigating the condition which Mr. Blanford, by observation and reasoning, found to be indispensable to an accurate estimate of coming weather.

The atmosphere is, on a large scale, nothing more than a condensing engine, the lower part constituting the boiler, the upper part the condenser. In settled weather there appears to be little or no passage of air from the lower to the upper sections of the atmosphere, and in an area of settled weather the air currents move on steadily and independently, and frequently, if not always, in opposite directions. Through some action which is never absent from some part of the atmosphere these currents interfere, cyclonic motion begins, ascensional motion follows, and the moisture laden air passes from the boiler to the condenser. Rainfall will then begin *provided that conditions in the upper strata of the atmosphere are favourable to condensation.* It is as regards this requirement that marked cleavage of opinion exists between Mr. Blanford and Sir J. Eliot. The former early saw that in any discussion of rainfall the condition of the condenser or upper strata of the atmosphere cannot be overlooked, and he has put on record his opinion that information on that head cannot be expected from the observers who furnish our registers of observations. The latter has relied entirely on these registers. When they failed he has said that the conditions were not determined over India, and that the causes must be looked for in the southern seas. In other, words we have the case of an engineer who knows that the boiler of his engine is in perfect working order and fails to account for a break-down because he has never even looked at the condensing arrangements.

Towards the end of September, my attention was attracted to a change of weather which commenced in Assam and North Bengal. The first sign of the change was a fall of pressure, but that fall was of no value as an indication of important events pending, because we have similar and much larger changes occurring in the midst of the finest and most settled weather. The fall began on the 23rd September and continued on the 24th and was, in North Bengal, ·05 inch on an average, as may be seen from a table given below. Table IX below will show that rain began to increase in Assam on the 23rd, in North Bengal on the 24th, and in Lower Bengal on the 25th. Tables III and VII show that temperature began to fall in Assam on the 23rd, in North Bengal on the 24th, in Southwest Bengal on the 25th, and in Orissa on the 26th. Southerly winds strengthened in Lower Bengal, and in these early days there were all the signs of the occurrence of a Himalayan storm of the kind that I have, on previous occasions, written about. From Thursday, September 24th, I not only scrutinised carefully the daily weather report, but I almost continuously watched the appearance of the change so far as it came within my range of vision. I give below brief notes made at the time. Before doing so I may state that I was watching carefully for the passage northwards from the Bay into Bengal of an area of disturbed weather. I saw no indication of any such occurrence, and all I saw clearly indicated a sequence of change commencing in the north and progressing in a general southerly direction.

My notes were as follows :—

Thursday, September 24th.

Moderate fall of pressure general, wind S.W. at Darjeeling, temperature falling rapidly in North Bengal and Assam, rainfall general in the north and heavy in places (Daily Weather Report). I began watching the upper cloud movements. Characteristic cirrus visible, appeared to be moving from a southerly or south-easterly direction. Towards evening the cirrus thickened into what I should call stratus, and after dark distant and almost continuous lightning was visible in several directions, chiefly in the north but also in the north-west. There was no sign of disturbance towards the south.

Friday 25th.

Sky clear in the early part of the day with some low cumulus and cirrus much the same as the day before. Strongish southerly winds continued below, but as far as I could make out, the direction of movement of the cirrus appeared to be from the north. In the afternoon I watched, for an hour between 3 and 4 P.M., a dark cloud creeping up from the north-west: it appeared to be at a great height, probably the same as the cirrus. Below that cloud the air was evidently in commotion, because there was at times a great deal of fracto-cumulus, and in places high cumuli unbroken. About 5-30 low cloud covered the sky and a thunderstorm broke over Calcutta from the north or north-west. Very heavy rainfall for a short time.

Saturday 26th.

Weather again fine during the day.

In the evening two thunderstorms developed near Calcutta; one passed eastward with a slight southerly element in its movement. The second was then visible in the west and moved slowly eastward, but by the time it reached Calcutta, about 9 P.M., the cloud was much diffused Ordinary rainfall began about 9 P.M., and continued for several hours.

Sunday 27th.

A depression has begun to form over Lower Bengal and the north of the Bay, but it is diffused, and changes being of a local character, it is difficult to account for what is going on. A thunderstorm was over Calcutta about noon.

Monday 28th.

The depression is somewhat better defined and is moving slowly westward. The most noticeable occurrences were as follows: In the early morning between 7 and 8 A.M., thick stratus overhead and a cumulus underneath towards the east. This cumulus moved slowly westward and was over this place about 9 A.M., with moderately heavy rainfall. In the forenoon a black cloud came up over Calcutta from the South-west, and heavy rain fell all the afternoon. The cloud was high when I noticed it and when the weather cleared up the clearing began from the north-east.

Tuesday 29th.

The depression was more to the west. Centre at 8 A.M., about equally distant from Saugor Island, Balasore and Midnapore.

Wednesday 30th.

The westerly movement has continued.

The above notes made at the time show what the main features of the weather were in Bengal at the end of September. These may be summarised as follows:—

(1) While weather was still fine and almost cloudless in Lower

Bengal and over the Bay a change began in the north of the Province and in Assam.

(2) This change shown by the occurrence of thunderstorms advanced southward over the Province.

(3) It had not reached Calcutta on Thursday, but knowing, as I believe I did, what was happening, the distant continuous lightning visible towards the north was to me a most impressive sight.

(4) The change passed over Calcutta on the 25th, and thereafter a depression almost immediately began to form over Lower Bengal and the north of the Bay.

Puja holiday people from Calcutta will remember that they left this place in fine weather, and that the Darjeeling and Himalayan Railway was most unexpectedly breached, further evidence that the disturbing influence was not from the south.

I have already referred to the fall of temperature which passed over Bengal on the 24th and 25th. Expecting some such change at Calcutta I borrowed, from the Presidency College, a thermograph and exposed it about noon on Friday the 25th. The thermograph trace here given extends for a week from the 25th. The weather in Calcutta at that time was fine and almost cloudless. In the place of exposure of the instrument, temperature, during the afternoon, rose to nearly 94°. The trace shows the sudden fall with the thunderstorm which occurred about 5 P.M. The temperature on Saturday was even higher during the day, and again there was the fall due to a thunderstorm about 5 P.M. Sunday, Monday and Tuesday show a steady fall of day temperatures as the depression formed and cloud increased. Wednesday and Thursday, the recovery after the depression moved westward. It is not my intention to give this temperature tracing as indicating the correct shade temperature for Calcutta. The thermograph was in a verandah with a free exposure to all directions except the north, and the high temperature at times indicated, as on Saturday the 26th, was due to the sun's rays falling on the instrument towards evening. I took no precaution to prevent high temperatures because my object was to show low temperatures.

The depression, which began over Lower Bengal on Sunday the 27th, moved westward into Central India, and then recurving towards the United Provinces gave the commencement of the "heavy and prolonged burst of rainfall" referred to in the *Pioneer*. It is unnecessary to follow the storm in its course; a reference to the Indian Daily Weather Report of those days will show the main features of the disturbance.

I have pointed out in previous papers that a striking feature of these Himalayan storms and their after-effects, has been the subsequent formation at brief intervals of depressions over the north of the Bay. It has been seen that on this occasion a depression formed over Lower Bengal on the 27th to 29th September and then moved westward. A second depression appeared over the north of the Bay a few days later about the 3rd October. This storm also moved westward, but in a direction more northerly than its predecessor, and after recurving in the southern parts of the United Provinces filled up over those Provinces about the 11th. The exceptional character of the weather in the United Provinces during the period October 1st to 10th was due to these two depressions, but the main cause of the rainfall was the recurving, or the causes thereof.

We have had the "remarkable series" of three cyclonic storms which saved the agricultural situation in Guzerat in 1902, following immediately after the Himalayan storm of August 12th. These cyclonic storms developed at intervals of seven days. Again this year we had the remarkable series of four cyclonic storms following the Himalayan storm of July 9th. These developed over the north of the Bay at intervals of five days. Their influence on the rainfall distribution in Northern India was very striking, but need not be referred to here.

Now we have a "remarkable series" of two cyclonic storms forming over the same area at an interval of seven days, at a time when such storms not unfrequently develop over the Bay, but on this occasion following an unexpected, I might say, an unprecedented course and causing what the *Pioneer* calls "one of the most heavy and prolonged bursts of rainfall that can have ever been recorded so late in the year."

Not only do these Himalayan storms appear to indicate an important cause in the formation of cyclonic storms in the Bay of Bengal, but they have, on all the occasions I have referred to, been followed by a marked alteration in the course or track of the cyclonic storms over Central and Northern India. That is, the recurving on which the rainfall distribution so largely depends, was materially affected.

That recurving, as I have pointed out, is not dependent on the lower strata of the atmosphere, and my reason for thinking so is that there is no occasion on record when recurving has been indicated beforehand by the ground-level observations.

It is in this connection that Mr. Blanford's insight receives such striking confirmation. Take for comparison the year 1882, and its monsoon experience. The extracts I have given show that at that time Mr. Blanford was giving form to the theory that there is an important connection between the condition of the upper strata of the atmosphere and the rainfall distribution, and was taking careful note of all available information. Mr. Eliot in Bengal was at the same time explaining all changes by the ground-level observations, in fact by pressure variations. The year 1882 was in many of its features similar to 1903. There was the same remarkable series of cyclonic storms in July causing serious misgiving to the authorities in Bengal; there was in both years a change of the same kind early in August, and subsequently sufficient rainfall; there was a similar cyclonic storm at the end of the season, though not quite so late in 1882 as the first week of October. That is, all the more striking features of the monsoon season of 1882 have been repeated in 1903 (after an interval which, it may be noted, is suspiciously like two sunspot cycles). It is hardly necessary to repeat that these past few years have shown that the system on which weather forecasting has lately been worked has failed: but what cannot be too frequently repeated is that these past two years have supplied valuable evidence as to the reason for the failure, and that that evidence is in its more important aspects similar to what was before students of Meteorology in India in the early eighties. The failure has been due to the exclusive reliance placed on ground-level observations. If the line of investigation suggested by Mr. Blanford twenty years ago had been followed up, we would probably now have been able to take full advantage of the information to be extracted from the varied conditions of the series of years between 1897 and the present year.

In 1882, Mr. Blanford was pointing out that other information than what is supplied in the registers of the observatories is necessary to solve the weather problem in India. In 1903, Sir J. Eliot after twenty years more study of registers and without any assistance from an investigation of the upper strata, records his opinion that the character of the weather in India is determined in the southern seas.

The inference appears to me to be obvious. If we are to make headway with the problem of weather forecasting the lines must be taken up where they were laid down 16 years ago by Mr. Blanford.

It may be asked what means have been available for following out the investigation of the upper strata outlined twenty years ago. The answer may be, that meteorologists in Europe and America have been steadily developing and improving such methods, and that a considerable amount of information has been collected regarding the upper strata over those regions. That being so, the next question is what success in weather forecasting has followed this extension of the field of observation—a question to which a negative answer must be given for a very good reason. Neither the United States of America, nor at least the British Isles, afford favourable conditions for the early steps in settling the part played by the different currents or strata of the atmosphere. In the United States the "highs" and "lows" on which weather variation largely depends, cross the west coast from the Pacific and usually follow an easterly course towards the Atlantic. There is but little of that variation which is indispensable for successful analysis. In Britain the actions are more variable but their beginnings and their endings are both unknown. It was only at the last meeting of the British Association that Dr Shaw, Secretary to the Meteorológical Committee of the Royal Society, told his audience how unreliable the depression is as guide to weather changes, and his difficulty appeared to me to be as regards the origin of the depression.

In India, and more especially in Lower Bengal and over the north of the Bay, circumstances are much more favourable. We have clearly defined currents, which undergo considerable variation from season to season, and even from year to year; we have depressions forming over the north of the Bay during the monsoon and pre-monsoon months, with a great variety of subsequent occurrences as regards recurvature and rainfall distribution; in fact all that variety which may fairly be expected, on analysis, to yield the orderly sequence of cause and effect. But until the upper currents are made the subject of systematic observation any satisfactory solution is unlikely.

To take a simile from well-sinking, they appear to be boring for water in the United States where there is no water, and probably also in Europe; while here, where water exists and is much needed, the boring has not been begun. As soon as observation, such as was outlined by Mr. Blanford, is begun in Lower Bengal and adjacent tracts, results of the utmost value to meteorology may be confidently expected.

In my previous papers on these Himalayan storms I gave brief tables—one set arranged to show the progress of the disturbance southward from the part of the Himalayas where it first affected the weather, and the other set to show the progress westward. I give similar tables for the Himalayan storm now under discussion, and I will call it the storm of date September 24th, because that was the date on which it appeared, although the heaviest rainfall in North Bengal appears under date 25th, having been measured at 8 A.M. of the 25th.

(*For table see next page*).

TABLE I.

Giving the pressure change daily from September 22nd to September 30th, 1903, arranged to show the southward progress of the disturbance.

	September 22 Tuesday.	September 23 Wednesday.	September 24 Thursday.	September 25 Friday.
Assam	+·044″	−·008″	−·041″	+·040″
North Bengal ...	+·048	−·013	−·049	+·032
East Bengal	+·067	−·006	−·031	+·018
South-West Bengal ...	+·064	−·023	−·040	+·021
Orissa	+·061	−·009	−·037	+·011
Circars	+·044	+·011	−·012	+·009
Akyab	+·083	+·032	−·045	−·001
Diamond Island ...	+·073	+·011	−·024	+·030

	September 26 Saturday.	September 27 Sunday.	September 28 Monday.	September 29 Tuesday.	September 30 Wednesday.
Assam	−·026″	−·069″	−·028″	+·050″	+·048″
North Bengal ...	−·009	−·076	−·024	+·083	+·051
East Bengal ...	−·031	−·068	−·033	+·036	+·058
South-West Bengal ...	−·017	−·089	−·028	+·004	+·079
Orissa	−·009	−·088	−·021	−·024	+·027
Circars	+·009	−·092	−·027	−·022	−·009
Akyab	−·002	−·095	+·021	−·010	+·027
Diamond Island ...	−·007	−·085	−·040	−·014	−·003

TABLE II.

Giving the pressure variation from the normal from September 22nd to September 30th, 1903, arranged to show the progress of the disturbance southward.

	September 22.	September 23.	September 24.	September 25.
Assam	+·073″	+·062″	+·018″	+·042″
North Bengal ...	+·095	+·071	+·018	+·033
East Bengal	+·087	+·075	+·041	+·049
South-West Bengal ...	+·108	+·077	+·029	+·038
Orissa	+·111	+·094	+·049	+·050
Circars	+·077	+·083	+·065	+·066
Akyab	+·077	+·105	+·056	+·051
Diamond Island ...	+·054	+·062	+·036	+·063

	September 26.	September 27.	September 28.	September 29.	September 30.
Assam	+·005″	−·071″	−·100″	−·056″	−·015″
North Bengal ...	+·019	−·064	−·095	−·068	−·025
East Bengal ...	+·011	−·064	−·101	−·074	−·020
South-West Bengal ...	+·012	−·084	−·121	−·123	−·050
Orissa	+·032	−· 65	−·093	−·126	−·105
Circars	+·067	−·034	−·070	−·100	−·115
Akyab	+·044	−·057	−·041	−·056	−·034
Diamond Island ...	+·053	+·014	−·031	−·050	−·057

These tables give the daily pressure change and variation from the normal between September 22nd and 30th. As on previous occasions, these figures are averages for the observatories in each division, and my reason for giving averages instead of the reports supplied by each observatory is, as before, because of the peculiar character of the change then in progress. Thunderstorms were numerous in the front line of the advancing disturbance, and anyone who has watched meteorological reports in such circumstances will be aware that there are irregularities due to local storms. I have given the averages to eliminate these irregularities as far as possible, and to show the advance of the general disturbance.

As on previous occasions, pressure changes are not of much assistance in showing the importance of the general change then in progress. There was a slow fall of pressure on the 23rd in Assam, Bengal and Orissa. It continued somewhat more rapidly on the 24th and extended to the Circars, Akyab and Diamond Island, which had not been affected on the 23rd. The recovery is general on the 25th, and the brisk fall on the 27th shows the development of the cyclonic storm over Lower Bengal and the north of the Bay.

In Table II the variations from the normal are given. It will be seen that pressure was in excess, considerable excess as it is usually measured in these parts, on the 22nd and 23rd; and that deficient pressure was not noticeably present until the 28th and 29th, when the shallow depression had formed over Lower Bengal and the north of the Bay.

Table III.

Giving the temperature change daily from September 22nd to September 30th, 1903, arranged to show the southward progress of the disturbance.

	September 22.	September 23.	September 24.	September 25.
Assam	+0·8°	−1·0°	−1·9°	−2·0°
North Bengal	+3·0	+1·2	−2·8	−2·0
East Bengal	+0·3	−0·6	−0·7	−2·1
South-West Bengal ...	−0·8	+0·6	+0·8	−1·6
Orissa	+0·4	−0·2	+0·3	+0·6
Circars	−0·9	−0·1	−0·7	+1·4
Akyab	+1·5	−2·0	−1·0	+1·5
Diamond Island ...	+0·8	+0·2	+0·5	+0·5

	September 26.	September 27.	September 28.	September 29.	September 30.
Assam	+0·5°	−0·1°	+2·8°	+0·6°	+0·2°
North Bengal ...	−1·4	+2·9	+0·8	+0·9	−0·3
East Bengal ...	−0·2	+0·9	−1·0	0	+0·6
South-West Bengal ...	−1·3	+0·8	−1·3	−1·8	−0·1
Orissa	−1·3	−0·2	−0·6	−2·3	−1·9
Circars	+1·1	+0·2	−0·8	−0·2	−3·1
Akyab	−0·5	−1·0	−3·3	+0·3	+3·5
Diamond Island ...	−1·2	−1·8	0	+2·0	0

TABLE IV.

Giving the temperature variation from the normal from September 22nd to September 30th, 1903, arranged to show the southward progress of the disturbance.

	September 22.	September 23.	September 24.	September 25.
Assam	+1·7°	+1·5°	−1·5°	−2·9°
North Bengal ...	+0·8	+2·4	+0·5	−1·6
East Bengal	+1·7	+1·2	+0·6	−1·4
South-West Bengal ...	+0·8	+1·5	+2·7	+1·2
Orissa	+1·5	+1·3	+1·6	+2·4
Circars	−0·4	−0·5	−1·3	+0·1
Akyab	+1·6	−0·5	−1·5	0
Diamond Island ...	+2·5	+2·6	+3·1	+3·5

	September 26.	September 27.	September 28.	September 29.	September 30.
Assam	−2·8°	−2·8°	+0·2°	+0·5°	+1·2°
North Bengal ...	−2·8	−0·8	−0·5	+0·3	−0·2
East Bengal ...	−1·7	−0·9	−1·9	−2·0	−1·5
South-West Bengal ...	−0·2	+0·6	−0·8	−2·6	−2·8
Orissa	+1·4	+1·3	0	−2·2	−4·3
Circars	+1·3	+1·4	+0·6	+0·3	−2·8
Akyab	−0·5	−1·5	−4·9	−4·7	−1·2
Diamond Island ...	+2·2	+0·3	+0·	+2.1	+2·0

These changes and variations of temperature are not large, but they show, at least as regards Bengal and Assam, that a change began in the north-east on the 23rd, was well-marked in North Bengal on the 24th, in South-West Bengal on the 25th, and in Orissa on the 26th. They also show that the period of greatest departure from the normal was between the 24th and 27th September in Assam, the 25th and 26th in North Bengal, and on the 26th in East Bengal. These indicate the progress of the change which passed over Bengal. The larger defect of the 30th in Lower Bengal, Orissa and the Circars is due to the cloudy weather which became general with the formation of the depression over Lower Bengal and the north of the Bay.

TABLE V.

Giving the pressure change daily from 22nd to 30th September 1903, arranged to show the Westward movement of the disturbance.

	September 22.	September 23.	September 24.	September 25.
Assam	+·044″	−·008″	−·041″	+·040″
North Bengal ...	+·048	−·013	−·049	+·032
Bihar	+·060	−·036	−·047	+·016
United Provinces ...	+·118	−·035	−·054	−·027
Punjab	+·097	−·009	−·052	−·034
Srinagar, &c.	+·055	−·015	−·022	+·008

	September 26.	September 27.	September 28.	September 29.	September 30.
Assam	−·026″	−·069″	−·028″	+·050″	+·048″
North Bengal ...	−·009	·076	−·024	+·033	+·051
Bihar	+·004	−·069	−·012	+·014	+·050
United Provinces ...	+·015	−·059	+·021	+·001	+·060
Punjab	+·005	−·050	+·038	+·015	+·049
Srinagar, &c. ...	+·009	−·052	+·016	+·020	−·002

TABLE VI.

Giving the pressure variation from the normal from 22nd to 30th September 1903, arranged to show the westward movement of the disturbance.

	September 22.	September 23.	September 24.	September 25.
Assam	+·073″	+·062″	+·018″	+·042″
North Bengal	+·095	+·071	+·013	+·033
Bihar	+·108	+·065	+·010	+·016
United Provinces ...	+·099	+·061	+·002	−·029
Punjab	+·047	+·030	−·026	−·067
Srinagar	+·034	0	−·030	−·044
Leh	+·082	+·069	+·048	+·064

	September 26.	September 27.	September 28.	September 29.	September 30.
Assam	+·005″	−·071″	−·100″	−·056″	−·015
North Bengal ...	+·019	−·064	−·095	−·068	−·025
Bihar	+·011	−·064	−·086	−·078	−·035
United Provinces ...	−·023	−·089	−·076	−·081	−·031
Punjab	−·070	−·126	−·096	−·C91	−·048
Srinagar	−·050	−·127	−·109	−·046	−·064
Leh	+·081	+·005	+·004	+·018	−·009

These tables show a general fall of pressure along the Himalayan range on the 23rd and 24th. The only indication of any westward movement is the recovery of pressure on the 25th in Assam, North Bengal and Bihar, and on the 26th in the United Provinces and the Punjab.

One matter which may deserve special comment is the rather large defect on the 27th in the Punjab and at Srinagar. It has been pointed out in a previous paper that there appears to be the same tendency to the formation of a cyclonic arrangement of winds in the Punjab after one of these disturbances as in Lower Bengal and the north of the Bay. The deficiency noticed above may be the indication of that tendency in the present case. If so, it was of very brief duration and almost immediately disappeared.

Table VII.

Giving the temperature change daily from 22nd to 30th September 1903, arranged to show the westward movement of the disturbance.

	September 22.	September 23.	September 24.	September 25.
Assam	+0·8°	−1·0°	−1.9°	−2·0°
North Bengal	+3·0	+1·2	−2·8	−2·0
Bihar	+2·2	+1·5	−0 3	−2.1
United Provinces ...	−2·0	−0·1	+1·2	+0·5
Punjab	+0·5	−0·8	+0·6	+0·5
Srinagar, etc. ...	−0·2	+0·2	−1·0	+1·2

	September 26.	September 27.	September 28.	September 29.	September 30.
As am	+0·5°	−0·1°	+2·8°	+0·6°	+0·2°
North Bengal ...	−1·4	+2·9	+0·3	+0·9	−0·3
Bihar	−2·1	+1·6	+0·4	+0·7	−0·7
United Provinces ...	+0·7	−1·0	−0·6	+1·0	+0·8
Punjab	+0·3	−0·6	−0·7	−0·3	+0·3
Srinagar, etc. ...	+0·6	+0·1	−0·2	+0·1	−0·1

TABLE VIII.

Giving the temperature variation from the normal from 22nd to 30th September 1903, arranged to show the westward movement of the disturbance.

	September 22.	September 23.	September 24.	September 25.
Assam	+1·7°	+1·5°	−1·5°	−2·9°
North Bengal ...	+0·8	+2·4	+0·5	−1·6
Bihar	+0·6	+2·5	+2·5	+0·9
United Provinces ...	−0·4	−0·4	+0·9	+1·6
Punjab	+3·4	+2·9	+3·7	+4·4
Srinagar	+7·1	+6·1	+7.1	+7·4
Leh	+1·7	+3·1	+2·3	+3·0

	September 26.	September 27.	September 28.	September 29.	September 30.
Assam	−2·8°	−2·8°	+0·2°	+0·5°	+1·2°
North Bengal ...	−2·8	−0·3	−0·5	+0·3	−0·2
Bihar	−1·4	+0·5	+0·7	+1·3	+0·5
United Provinces ...	+2·4	+1·5	+1·0	+2·1	+3·1
Punjab	+4·9	+4·5	+4·1	+4·1	+4·3
Srinagar ...	+9·1	+9·6	+11·0	+9·9	+9·5
Leh	+4·4	+5·8	+4·5	+5·4	+5·9

Table VII shows that temperature began to fall in Assam on the 23rd, and that the change appeared in Bihar on the 24th. A rapid fall was general in Assam, North Bengal and Bihar on the 25th, but it did not extend to the United Provinces. There was practically no fall of temperature in the United Provinces until later, when the depressions moved northwestward from the north of the Bay in the first week of October.

TABLE IX.

Rainfall (22nd to 30th September, 1903.)

	No. of Stations.	September 22.	September 23.	September 24.	September 25.
Assam	6	0·56	3·94	5·95	4·83
North Bengal ...	7	1·35	1·52	4·77	14·07
East Bengal ...	7	3·98	0·78	2·05	5·02
South-West Bengal ...	9	5·64	0·33	*Nil*	3·73
Bihar	13	5·03	0·03	2·35	6·92
United Provinces ...	11	4·93	1·50	2·22	1·12
Punjab	12	*Nil*	*Nil*	*Nil*	0·35
Simla Hills	5	0·91	0·67	0·07	0·53
Kashmir	6	*Nil*	*Nil*	*Nil*	*Nil*
Darjeeling	...	*Nil*	0·82	0·29	1·86
Cherrapunjee ...	...	*Nil*	0·25	0·75	1·36
Orissa	4	0·02	0·24	*Nil*	0·06
Circars	4	0·90	1·74	1·49	*Nil*

	September 26.	September 27.	September 28.	September 29.	September 30.
Assam	8·13	0.35	2·14	0·80	0·15
North Bengal ...	11·12	3·46	1·05	1·00	0·84
East Bengal ...	3·81	11·66	3·77	3·14	0·98
South-West Bengal ...	6·59	2·46	8·59	10·97	4·05
Bihar	6·08	3·37	1·57	0·19	0·55
United Provinces ...	5·29	0·85	0·62	*Nil*	0·28
Punjab	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*
Simla Hills ...	0·04	*Nil*	0·69	*Nil*	0·19
Kashmir ...	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*
Darjeeling ...	0·77	0·46	0·02	0·16	1·04
Cherrapunjee ...	0·87	0·07	*Nil*	0·56	0·30
Orissa	0·88	0·67	5·29	6·72	5·16
Circars ...	0·02	*Nil*	0·46	1·68	0·61

The rainfall statistics in the above table have been prepared in the same way as in previous papers. As I have said before, thunderstorms with irregular changes of pressure and temperature and variable rainfall are the chief features of the passage of these disturbances over Bengal, and that it is advisable on that account to give averages instead of individual observations. To obtain the rainfall in North Bengal, for example, on the 25th September, the rainfall reported from the various Observatories in that division, 7 in number, has been added together. The average fall in North Bengal for the 24 hours preceding 8 A.M. on the 25th was 2·01 inches. I have retained the totals as they serve to magnify the comparison which the table is intended to indicate.

It will be seen that rainfall in some quantity began in Assam on the 23rd and continued until the 26th. In North Bengal the days of heaviest rainfall were the 25th and 26th; in South-west Bengal the 26th; and there was very little rain in Orissa until the 28th. Considerable increase of rainfall is shown for Bihar on the 25th, and in the United Provinces on the 26th—an increase which occasional remarks in the Daily Weather Report show to have been associated with thunderstorms along the Himalayan range. It may be noticed that a considerable proportion of the rainfall in the above table fell before the 26th or 27th, the dates on which, according to the *Pioneer*, the Meteorological Bureau arrived at the conclusion that fine weather conditions were becoming established over Upper India.

It may be noticed that the rainfall was heavy on this occasion at neither Darjeeling nor Cherrapunjee. But some increase is shown at both places, and the reason why there is so much variation in rainfall with disturbances, otherwise similar in character, probably arises from the irregular distribution of thunderstorms. If a thunderstorm occurred near Cherrapoonjee the rainfall is likely to be much more heavy than if the storm were distant. Another cause, which on this occasion may have influenced the fall at Cherrapunjee, is that there was little or no indraught up the Brahmaputra Valley towards the east end of the Himalayan range. The indraught towards the hills was confined more to part of the range north from Bengal and Bihar, and the heaviest falls appear to have been on the southern slopes of that part of the range.

I have pointed out that the disturbance, as it passed over Bengal, was similar, in its main features, to the disturbances which occurred on the 30th June and 12th August 1902, and the 9th July 1903; and it has been seen from the remarks of the *Pioneer* that it was followed by exceptional weather in part of Northern India. It has also been seen that over the southern seas, and in fact over the whole of the Bay of

Bengal and the Arabian Sea exceptionally settled weather for the season prevailed for some time previous to the disturbance in Bengal, and that there was no appearance of any disturbance having passed northwards from either of the sea areas. In the previous papers I have pointed out that similar settled weather had been a prominent feature of the occasions referred to, that on all these occasions striking developments followed as regards rainfall in Northern India. I have also pointed out that there is a fair amount of evidence that the changes were initiated from the north, and were propagated in the first instance through the upper strata lying over Northern India.

When it is remembered that Sir J. Eliot in his system of weather discussion and forecasting relies entirely on the registers furnished by observers, and that series of changes affecting Northern India through the medium of the upper strata of the atmosphere appear not to enter into his calculations, it becomes intelligible how such remarkable occurrences as those of 1902 are overlooked by him, even at a time when similar occurrences are in progress in 1903. It also becomes intelligible how he arrived at the inferences for 1902, already quoted, and here repeated, that—"It hence follows that, the causes, actions or conditions determining the weakness of the Arabian Sea current in the first half of the period, and its strength during the second half, are not to be sought for in India or the Indian monsoon land area, but most probably in the remaining portion of the area of the complete monsoon air circulation, *viz.*, the south-east trades region of the Indian Ocean."

It also becomes intelligible how it is possible that on such a system forecasts show "no appreciation of the extraordinary character of the season"; but therewith must be placed the verdict that it is the system which is at fault and not those on whom the responsibility has been placed of carrying out the system.

Rusot: *an ancient Eastern Medicine.*—*By* DAVID HOOPER.

[Read 3rd August, 1904.]

Among some collections of Grecian antiquities exhibited in the British Museum and at Paris are certain small vases bearing the legend LYKION. That in the British Museum is a small vase made of lead, of a sub-ovoid form, about one inch in height, and about three-quarters of an inch in breadth. The inscription is in Greek letters and may be rendered the *Lycium of Museus.* In Paris there is a similar small vessel made of pottery-ware bearing on its side in Greek an inscription which may be translated *Lycium of Heracleus.* In 1814 M. Millin of Paris, published an account of a similar vase found at Tarentum, formerly a well-known Greek settlement. This vase is slightly larger than either of the others; it is made of clay, and has an inscription, *Lycium of Jason.* Two years later M. Tochon of Paris, gave an account of another vase not improbably from Tarentum, of the same material and size, and presenting the same inscription.

Figures of these four vessels were published by Dr. J. Y. Simpson, of Edinburgh, in an interesting paper entitled "Notes on some Ancient Greek Vases containing Lycium" [See *Monthly Journal of Medical Society* (*Edin.*). XVI. (1853), 24; also *Pharm. Journ.* XIII. (1854), 413.]

These vases are intended to contain one and the same substance as shown by the indelible labels which they bear. The medicinal substance called Lycium or Lykion was a drug, which enjoyed much favour among the ancients and was supposed to be possessed of great virtue as a collyrium. The early Greek and Arabian writers describe its properties. Dioscorides recommends it as an astringent for the cure of various complaints affecting the eye. Galen, Oribasius, Paulus Ægineta, Scribonius Largus and Avicenna dilate upon the medicinal uses of Lycium as of value in many diseases besides ophthalmia.

Two varieties of Lycium were in use among the Greeks, one obtained from Lycia and Cappadocia, and the other from India. In the opinion of Paulus Aegineta (Adam's Translation, vol. III., p. 234) and

Galen (*De Simp. Medicam.* lib. VII., 64) the latter was regarded as by far the most valuable and powerful for all purposes. Avicenna (*Canon Medicinæ*, lib. II. cap. 398) gives a long account of the medical uses of Lykion and remarks, "Magis vincens, secundum existimationem, est quod Indicum est," and he compares its properties with a specimen from Mecca. Scribonius Largus, the reputed house-physician of the Emperor Claudius, and Marcellus laud its powers, the former declared that he attributed to no collyrium whatever, such great efficacy as to the genuine Indian Lycium used by itself.

Dr. J. Forbes Royle in a paper read before the Linnean Society of London in 1833[1] was the first to prove that the Indian Lycium is the same as Rusot, an inspissated extract prepared from the wood and roots of several species of Berberis. Dr. Royle, on inquiring in the shops of druggists in the bazars of India, learned that both the wood (*dar-huld*) and the extract, Rusot, were imported from the hills into the plains and that large quantities continued to be brought from Naggarkot as well as other places. He found that Rusot was procurable in every bazar in India, and was used by native practitioners who are fond of applying it both in incipient and chronic inflammation of the eye, it was used both simply and in combination with opium and alum.

It should be understood that in early times everything to which the adjective *Indicum* appertained was not necessarily derived from Hindustan; but with regard to Lycium or Rusot it is clear that the drug was a product of the peninsula. The authors of the *Pharmacographia* say, "The author of the Periplus of the Erythrean Sea who probably lived in the 1st century, enumerates λύκιον as one of the exports of Barbarike at the mouth of the Indus, and also names it along with Bdellium and Costus among the commodities brought to Barygaza: and further, lycium is mentioned among the Indian drugs on which duty was levied at the Roman custom house of Alexandria about A.D. 176–180.[2]

The nomenclature of the drug further confirms its Indian origin as it is interesting to find that two of the names for *Lycium* given by Ibn Baytar in the 13th century are precisely those under which Rusot is met with in the Indian bazars at the present day.

The names by which the extract of Barberry is known in the trade and profession in the country are Rusot, Rusivat, Raswanti, Rusvat, Rusout, from the Sanskrit Rasanjana; in Sinde it is Ruswal; in Persia,

1 *Trans. Lin. Soc.*, XVII., p. 87.

2 *Vincent, Commerce and Navigation of the Ancients in the Indian Ocean*, ii. (1807) 390, 410, 734.

Fil-zabrah or Pil-zabrah; in Arabic, Huziz or Hooshish; and in West Afghanistan, Ibrán.

In Hindu Materia Medica the root and extract are regarded as alterative and deobstruent, and are used in skin diseases, menorrhagia, diarrhœa and jaundice, but above all they have the greatest reputation in affections of the eye, mixed with opium, alum or rock-salt.

Dr. Wise, the author of "Commentaries on the Hindu System of Medicine," and Dr. Walker, of the Edinburgh Eye Dispensary, tried the preparation of Rusot with some measure of success in ophthalmia, but the opinion of Europeans is best summed up by Sir W. B. O' Shaughnessy in the following words:—"Rusout is best given as a febrifuge in half drachm doses, diffused through water, and repeated thrice daily or even more frequently. It occasions a feeling of agreeable warmth at the epigastrium, increases appetite, promotes digestion and acts as a very gentle but certain aperient. The skin is invariably moist during its operation."

Surgeon General W. R. Cornish reported that the Nilgiri Barberry had been used in the treatment of ague with good results, and coffee planters in the Wynaad, among others, have used it as a febrifuge. Preparations of barberry are still favourably employed by the medical profession in India, and a tincture of the root bark is often recommended in the treatment of fever.

The dried stem of *Berberis aristata* has recently been introduced into the Indian and Colonial Addendum to the British Pharmacopœia, and a liquid extract and tincture have been prescribed as desirable preparations for administering the drug.

Barberry wood and root were formerly used as a dye and pigment and among the Paharis or hill-tribes the powdered wood is still smeared on the face to form caste-marks. According to the vernacular names employed in India these products were sometimes confounded with turmeric, and in some works it is stated that the properties of Barberry are similar to those of turmeric. It is known that the tree was formerly in use in Astrachan and Poland in Russia as a dye for leather, and in Germany it was used for staining wood. Dr. Royle in a letter addressed to the Agri-Horticultural Society of India, in 1838, informed the Secretary that the wood and root were in great demand in Europe and the supply in the South of Europe had failed. Samples from Ceylon had been tried and they were pronounced to be superior to any in the market. He finally suggested that the extract made in the hills of India and sold in the bazars as Rusot might be tried as a dye. It was said that it could readily be obtained for *4d.* to *6d.* the pound by proper arrangements in the district where the bushes are found

In Bombay the price is Rs. 8 to 9 per maund of 37½ lb. In Madras the wholesale price is Rs. 35 per maund, and retails in the bazar at Rs. 2-4 per pound.

Dr. E. Solly further contributed a paper on "The Yellow Colour of Barberry and its use in the Arts" (*Journ. Roy. As. Soc.*, XIII (1844), also *Journ. Agri.-Horti. Soc. Ind.*, iii., 272). He reported that 17 per cent. of yellow colouring matter was obtainable from the roots, and suggested experiments being made in India to determine which part of the plant was richest in extract. According to Aitchison the extract is still used in West Afghanistan as a dyeing material.

Lest any hope should be entertained that Rusot might possess some commercial value as a dye-stuff, I would quote the opinion of an expert in the person of Mr. A. G. Perkin, of the Clothworkers Research Department, Leeds. In 1897, Mr. Perkin had occasion to examine the root of *Berberis Oetnensis* from Cyprus. He reported (*Journ. Chem. Soc.* LXXI. 1198), that the colouring matter was due to berberine of which he separated nearly one per cent. of the hydrochloride. Silk was dyed a yellow shade without the use of a mordant, but ordinary mordanted calico was not dyed owing to the basic nature of the colouring principle. He adds, "As a colouring matter, the use of berberine has been practically discontinued, so that the tinctorial properties of the root have but little commercial value."

The three species of Indian Barberry that are used in preparing the extract called Rusot are—

1. The Nepal Barberry (*Berberis aristata*, DC.), a variable species occurring in the temperate regions of the Himalaya at 6,000 to 10,000 feet elevation, also found in the Nilgiri Hills and Ceylon.

2. The Ophthalmic Barberry (*B. Lycium*, Royle,) an erect, rigid shrub found in dry hot situations of the western part of the Himalaya range at 3,000 feet above the sea level.

3. The Indian Barberry (*B. asiatica*, Roxb.). This species has a wider distribution than the last, being found in the dry valleys of Bhutan and Nepal whence it stretches westward along the Himalaya to Gharwhal, and occurs again in Afghanistan.

The extract is obtained by digesting in water slices of the bark, root and twigs for a few hours, then boiling, straining and evaporating to a soft consistence. Capt. H. W. Lowther describes in Journal Agri-Horticultural Society of India,[1] the preparation of the inspissated juice of *Berberis aristata* at Hawalbagh in Kumaon. The fresh roots of the Barberry were chopped into small pieces with a hatchet. About ten

[1] Vol. IX., (1857) p. 358.

pounds were placed in a large *gurrah* which was filled up to the neck with water. It was boiled over a slow fire until one fourth of the liquid was evaporated, the liquor was again boiled with some fresh chips, and the process was repeated three times. The liquid was strained through a coarse cloth and the chips squeezed. The juice, on further heating, became concentrated to a thick fluid, which was poured out into trays and exposed to the full heat of the sun until it was sufficiently solid. The latter part of the process must be conducted carefully and thoroughly so as to prevent any tendency to mouldiness or fermentation in the finished extract. In the "Materia Medica of the Hindus," by U. C. Dutt, *Rasanjana*, as it is called in Sanskrit, is directed to be prepared by boiling together equal parts of a decoction of Indian Barberry and milk, till reduced to the consistence of an extract.

Rusot is a dark-brown extract of the consistence of opium having a bitter and astringent taste. It dissolves almost entirely in distilled water and partly in rectified spirit, forming a rich yellowish-brown solution which becomes bright yellow when diluted. The intense bitterness is due to the alkaloid berberine which pervades the root, bark, blossoms, berries and leaves of the plant.

Four samples of this preparation are exhibited in the Indian Museum —one from United Provinces, one from Bushahr, one from Hazara and the other from Lahore in the Panjab. These were examined as regards the amount of moisture, extractive matter, ash and alkaloid, berberine, they contained.

The sample from the United Provinces was prepared in 1893, and was a dark-brown extract with a shining fracture.

The second sample was forwarded to the Indian Museum by the Forest Ranger, of the Nogli and Pahor Ranges, Bushahr Division, Punjab, in April 1901. It was a soft extract prepared by boiling the chips of the root of *Berberis Lycium*, a shrub locally called "Chochar." In this division an extract is also made from the roots of *B. aristata*, a plant known in this district as "Kashmal."

The third sample was from the Deputy Conservator of Forests, Hazara Division, Panjab, who forwarded it to the Indian Museum in January 1902. This was a blackish brittle extract having the odour of liquorice. It occurred in square packets enveloped in leaves.

The fourth sample was from Lahore. It consisted of triangular cakes about one inch thick and three inches along the side, and each enveloped in the green leaves of *Bauhinia Vahlii*. The extract was of the consistence of opium, dark-brown in colour, and not always homogeneous in the interior.

The berberine was estimated by making an alcoholic extract of the rusot, evaporating to a low bulk with an excess of hydrochloric acid, and separating and drying the crystals of berberine hydrochloride. A more accurate method was tried with the last sample. This is the process of A. M. Gordin (*Proc. Amer. Pharm. Ass.*, vol. 50, (1902), 1051), which consists in separating the alkaloid in the form of crystalline berberine-acetone, drying and weighing the compound, and calculating 85·24 per cent of these crystals as pure berberine.

The following are the results of the examination:—

	1 United Provinces.	2 Bushahr.	3 Hazara.	4 Lahore.
Water	6·70	40·31	4·00	20·98
Spirit extract ...	25·85	27·15	38·25	40·16
Water extract ...	36·25	17·43	29·32	20·85
Fibre	15·50	10·00	19·23	7·65
Ash	15·70	5·11	9·20	10·36
	100·00	100·00	100·00	100·00
Berberine	7·75	2·9	3·46	4·22

The results indicate a variable amount of berberine in the samples of rusot manufactured in different districts, the amount ranging from 7·75 per cent. in that from the United Provinces to 2·90 per cent. in that from Bushahr. There is likewise little uniformity in the amount of extracts, insoluble material and ash, and the composition is found to differ very considerably in various portions of the same cake.

The alcoholic extract is the most valuable part of the drug, as it contains all the alkaloidal active principles; the aqueous extract, insoluble matter and ash may be regarded as impurities. Instead of the watery extract at present made in the jungles, and which varies so considerably in composition, a preparation made with alcohol would have many advantages, as it would be more concentrated and uniform, and could be readily standardized in regard to the alkaloidal strength measured as berberine.

On Dioscorea birmanica—*a new species from Burma—and two allied species.—By* D. PRAIN & I. H. BURKILL.

[Read 3rd August, 1904.]

We find to be undescribed a yam which is in Burma, through the moister parts of that province, almost the commonest of all, so that its very abundance entitles it to attention. It is a climber in the open forests, where the rainfall is 50 inches and more, and in the 10—15 feet high scrub which often covers waste lands. It seems to avoid the densest forests; and it is quite absent from dry central Burma where the rainfall is small.

Its distribution makes the letter Q round the dry focus of Burma, as it is common in the northern forests, common in the southern forests, is found down a connecting strip on the west in the Arakan Yomas and down another on the east in the Shan States; the tail of the letter lies in Tenasserim.

In the northern forests it grows both over bushes in the chequered shade under the tall Dipterocarps, and also climbs over bamboos and bushes getting a considerable amount of sun where the Dipterocarps no longer exist. About Katha, where red-soil forests and black-soil forests meet, it is more prevalent perhaps on the red-soil; at Bhamo it is quite common on black-soil. On the east, in the northern Shan States, it is very common about Hsipaw (Thibaw), and thence to Lashio, on red soil and black soil. Southwards we know it to occur in the state of Möngkung (Maingkaing), and about Taunggyi and Fort Stedman. On the west we know it to occur in the Gangaw valley and again near Kan on the Arakan Yomas, in the latitude of Minbu. In the south we know it to be very plentiful all along the railway line from a little south of Taungu to Nyaunglebin in the Pyinmana forests, on a yellowish-grey soil; and we know it to grow quite abundantly on the hills close to Prome. Southwards again it may be seen in the bamboo jungle which clothes any slight elevation rising above the otherwise uninterrupted stretches of rice-fields. It is readily found close to Pegu, and as near to Rangoon as Hmanwi. Towards Taungu it grows in savannah land, in the

Pyinmana forests it grows over the bushes that are mixed with teak; at Prome it grows in deciduous forest of *Ægle Marmelos*, bamboos, etc., and, as already said, it grows about Pegu in bamboo thickets.

In Tenasserim, near Moulmein, it is excessively common on laterite in 10 feet jungle of *Combretum*. To the east of Moulmein it is absent from the high evergreen forests of the Dawna range, but re-appears beyond them in the thinner forest of Thingan-nyi-naung, and continues right up to the Siamese frontier at Myawadi on a clayey grey soil.

The tuber of the plant is very woody, and has a hard skin cracking rather rectangularly like the carapace of a tortoise; in shape it is very irregular, with blunt processes lying just under the surface of the soil. Wiry roots arise from the surface, which bear low warty thorns, and dying may themselves almost constitute thorns. The flesh is yellowish-purple and unpleasant to the taste. Even the wild boars seem to leave the root altogether alone. One stem arises from each tuber, and usually bears strong prickles; at the base of each leaf in the position of stipules are two or four downwardly directed small thorns. When young the stem is pubescent; when old, with the hairs rubbed off, it becomes shining and has dark blotches on it. The leaves are very like those of *Dioscorea fasciculata*, but are larger; and the rows of prickles which generally line the main-nerves serve to distinguish them. When young they are pubescent; when old they are glabrescent, especially above. The inflorescence, which is produced in the month of May, is a long drooping spike: in the male the flowers are arranged on it in small scorpioid cymes; in the female they are solitary. This type of secondary inflorescence has hitherto never been described in any Asiatic *Dioscorea*, though there are at least two others which share the character. The young cymes are recurved; but after flowering they are found to be quite straight. The young ovaries, after flowering is over, begin to turn upwards, and long before the fruit reaches maturity have come to be parallel to the rhachis, their tips looking upwards. At maturity the fruits are imbricated, all directed away from the earth: dehiscing, they hold the seeds until some sudden puff of wind blows them away. It is when in fruit that the plant is most easily recognised; for the long spikes, sometimes over 40 cm. long, and with 40 capsules, are very conspicuous and distinctive.

The root is too woody to be fit for use as food, but we have heard of a very quaint use of it in southern Burma as a reputed antifecundative taken by the male before coition.

The plant is widely known in Burma as Hkadhkyo, pronounced Khatcho, or at Prome as Ginbeekpya; it is called Katak in the Northern Shan States.

We proceed to give a diagnosis of the plant and a list of localities.

DIOSCOREA BIRMANICA. *Rhizoma* informe, horizontale hypogæum, carne luteo-livida lignosum amarum, corticis rimis testæ testitudinis similius. *Caulis* armatus, e radice singulus, in dumetis sinistrorsum ita volubilis ut sarculos ultimos tangere pedite non licet; sarculi sæpissime pubescentes, sed sarculi (præcipue vetustiores) glabri tamen nonnunquam occurruntur: caulis vetustus semper glaber. *Folia* membranacea, alterna, cordata vel late cordata sinu aperto, caudato-acuminata, vel modo caulium primo pubescentia dein supra glabrescentia vel glabra, infra ad nervos primarios spiculis recurvis armata, 11–15 cm. longa, 7·5–16 cm. lata, nervis primariis 7–11 (extremis bifurcatis) infra prominentibus supra distinctis, nervis secundariis supra infraque distinctis, reti anastomotico indistincto: petiolus pubescens vel puberulus vel glaber, armatus, 4·5–9 cm. longus. *Spicæ* dependentes, ad axillas foliorum singulæ vel binæ, 35–45 cm. longæ. *Spicæ masculæ* rhachi præter basin sterilem 1–3 cm. longam flores in cymis scorpioideis 5–10 mm. distantibus gerentes: cymæ 5–6-floræ, 1 cm. longæ, apicem spicæ versus spectantes: bracteæ bifariæ, alternæ, fere glabræ, 1–5 mm. longæ, brunneo-lineolatæ; bracteolæ 0. *Perianthii masculi* campanulati lobi marginibus exceptis externe villosi, brunneo-lineolati, exteriores lanceolati acuti cymbiformes, interiores ovati acuti marginibus retrorsi. *Stamina* 6, æqualia, perianthii lobis breviora, filamentis quam antheris longioribus. *Spicæ femineæ* flores 20–40 sessiles alternatim gerentes: bracteæ et bracteolæ adsunt. *Perianthii feminei* lobi iis floris masculi similes. *Ovarium* densissime pubescens. *Fructus* stipitatæ, stipite 4–5 mm. longo, imbricatæ, mox ad cælum versus spectantes, glabrescentes, maturæ tamen semper glabræ : alæ regulariter semiorbiculares vel irregulariter oblongæ, 2–3 cm. longæ, 10–15 mm. latæ, apice retusæ, basi truncatæ vel cuneatæ. *Semina* ala membranacea inæqualiter circumcincta.—*Dioscorea spinosa* Wall. Cat. 5103, pro parte; Hook. fil. Fl. Brit. Ind. VI. 291 pro parte; Collett and Hemsley in Journ. Linn. Soc. xxviii. (1890) p. 137.

BURMA. Hukung Valley near the Assam border, *Griffith*, 5545, K.D. Bhamo District; Bhamo, on land above flood level, *Burkill* in Herb. R. E. P. 22770; hills east of Bhamo beyond Momouk, *Burkill* in Herb. R. E. P. 21520, 21546. Katha District; Katha, *Burkill* in Herb. R. E. P. 22499, 22640, 22657, 22659. Northern Shan States; Lashio, *Burkill* in Herb. R. E. P. 22534, 22578; Manpwe, *Burkill* in Herb. R. E. P. 22504; Hsipaw, *Burkill* in Herb. R. E. P. 24059, 24137; between Hsipaw and Mankang, *Burkill* in Herb. R. E. P. 24140. Southern Shan States; without precise locality, *Abdul Huq;*

Möng-Kung, 2500–4000 ft., *Craddock*, 27; Fort Stedman, *Collett*, 704; Taunggyi, *Abdul Khalil.* Pakokku District; Gangaw Valley, *Millar* in Mus. R. E. P. 20634. Minbu District; below Kan on the Yomas, *Aubert and Gage.* Prome District; hills South of Prome, *Burkill* in Herb. R. E. P. 23824. Pegu District; Kyauktaga, *Burkill* in Herb. R. E. P. 21978, 22119; Sittang side, *Kurz*, 2629; Bank of Sittang, *Kurz* 483; Pegu town, in bamboo thickets, *Burkill* in Herb. R. E. P. 21960. Myaungmya District; Hmanwi, *Burkill.* Amherst District; Moulmein, *Wallich*, 5103 C; on the south-east of Moulmein, *Burkill* in Herb. R. E. P. 23917; Thingan-nyi-naung on the east of the Dawna range, *Burkill* in Herb. R. E. P. 24385; Myawadi on the Siamese frontier, *Burkill* in Herb. R. E. P. 24448. Tenasserim, without exact locality, *Helfer*, 5544.

A very closely allied species is found in south-west China, which we here describe.

Dioscorea yunnanensis. *Rhizoma* deest. *Caulis* sinistrorsum volubilis, dense pubescens, teres, inarmatus (saltem quoad surculi). *Folia* membranacea, alterna, subreniformi-cordata vel cordata, sinu angustiore, apice parum acuminata, supra glabrescentia viridia, infra dense albo-pubescentia, inermia, 7–9 cm. longa, 11–12 cm. lata, nervis primariis 9–11 (extremis bifurcatis) infra distinctis supra vix distinctis, nervis secundariis supra infraque indistinctis, reti anastomotico vix visibile: petiolus dense pubescens, inermis, 3–8 cm. longus. *Spicæ* dependentes, ad axillas foliorum singulæ vel binæ, masculæ 18–20 cm. longæ, femineæ 5–20 cm. longæ. *Spicæ masculæ* rhachis præter basin sterilem 1–3 cm. longam flores in cymis scorpioidiis 4–10 mm. distantibus gerentes: cymæ 3–5-floræ, 5 mm. longæ, apicem spicæ versus spectantes; bracteæ bifariæ, alternæ, extus dense glabrescentes, intus glabræ, 1–5 mm. longæ, brunneo-lineolatæ: bracteolæ 0. *Perianthii masculi* campanulati lobi brunneo-lineolati, subæquales, ovato-acuti. *Stamina* 6, æqualia, perianthii lobis breviora; filamenta antheras subæquantia. *Spicæ femineæ* flores 6–12 sessiles alternatim gerentes; bracteæ extus dense pubescentes: bracteolas non vidimus. *Perianthii feminei* lobi iis floris masculi similes. *Ovarium* densissime pubescens, 3–6-costatum. *Fructus* maturæ ignotæ, post anthesin teste ovario gravido ad cælum versus respicientes.

China: Yunnan; Mengtze, in woods at 4,600 and 5,000 feet, *A. Henry*, 9288 and 9288 A.

This species differs from *D. birmanica* in the more pubescent leaves, in the equal perianth-segments and in the filaments.

Dioscorea sp. Another apparently nearly related plant has been once collected by Scortechini in Perak, who gives no precise locality.

It is distinguished, as far as the sterile plant is concerned, by the main stem being densely beset with very large compound prickles which have two to six cusps. The smaller stems have simple prickles fewer and smaller than those on the main stems, but even the prickles on these are larger than the prickles usually met with in corresponding situations on *D. birmanica*. The petioles are prickly as in the Burmese plant and have the same basal stipular thorns; but the leaves themselves are rather differently shaped, being ovate-cordate, 20 cm. long by 11 cm. broad, and having no thorns on the veins: the younger leaves have hairs beneath towards the base. The plant, which is probably an undescribed species, deserves to be looked for.

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Noviciæ Indicæ XXIII. *Four Orchids new to the Indian Flora.—By* D. Prain.

In this paper are given descriptions, after the style adopted in Sir J. D. Hooker's *Flora of British India*, of four species of orchids discovered to be Indian since Sir Joseph's masterly account of the *Orchidaceæ* was written. Two of them are novel forms of well-known Indian genera; the other two are members of a very interesting genus which extends from Japan to Java, but which was not till quite recently known to occur in any intervening area. One of the two, which appears to be not uncommon in the Eastern Himalaya and the Khasia Hills, is identical with the Japanese plant. The other, which externally resembles a formerly known Java species and which comes from the Malay Peninsula, in floral structure really more closely agrees with its Japanese than with its Javanese congener.

Tribe I. Malaxideæ.

2. MICROSTYLIS Nutt.

2*b*. Microstylis Cardoni *Prain*; *Beng. Pl.* ii., 1004; leaves 2, sessile, opposite, ovate; bracts spreading, shorter than the ovary; sepals ovate, the posterior slightly narrower than the lateral; petals narrow oblong, about equal to the sepals in length; auricles of the lip obtuse, blade with bifid tip.

CHOTA NAGPUR: Rengarih, *Cardon*!

Stem 0. *Leaves* green, 3 in. by 1·5 in., sub-opposite, explanate and adpressed to the soil. *Scape* 6—8 in., pinkish below. *Flowers* ·2 in. across, sessile, pure white or greenish; auricles of lip considerably shorter than the blade. *Capsule* ·35 in. long.

The nearest allies of this species are *M. khasiana* which has flowers of about the same size, but differs in having a distinct above-ground stem with more numerous and scattered leaves and has a different lip; and *M. Wallichii* which also differs in having an above-ground stem with large leaves and much larger flowers. In structure, however, the flowers of *M. Wallichii* and *M. Cardoni* are very similar.

Before the scape appears the present species has all the habit of a *Habenaria* allied to *H. diphylla*; its two leaves, and it appears never to have more, lie closely applied to the surface of the ground as in that plant.

TRIBE II. VANDEÆ.

39. EULOPHIA R. BR.

Sect. I. EULOPHIA proper; column not produced into a foot.

* Leaves beginning to appear at flowering time.

†† Pseudobulb tuberous hypogæal; leaves elliptic-lanceolate; scape simple.

§ *Lip longer than broad, side-lobes short.*

3*b*. EULOPHIA CAMPBELLII *Prain*; leaves elliptic-acuminate, scape with narrow loose ochreate sheaths, bracts lanceolate shorter than the ovary, sepals linear-oblong, petals broadly elliptic-acute, lip narrowly ovate-oblong, tip shortly 2-lobed, lobes crenate, disc with three yellow callose ridges fimbriate anteriorly.

CHOTA NAGPUR: Manbhum; Pokhuria, *Campbell* 7560! Singbhum; Gidung, near Manharpur, *Burkill's Collector* 19734!

Stem slender. *Leaves* 3-5, many-nerved. *Scape* 10–12 in., slender throughout; raceme laxly 6–8-flowered; bracts ·25 in.; sepals ·5 in. long, ·15 in. wide, green, brownish towards the apex; petals as long as sepals, ·25 in. wide, in colour the same; lip ·5 in. long, ·25 in. wide, greenish white with numerous spreading and recurved lilac purple veins; disk with three strong yellow ridges, the central becoming obsolete towards base of lip; the central throughout and the lateral for their anterior two-thirds covered with projecting papillæ; spur obsolete.

The tuberous roots of this plant are eaten after being boiled in the Singbhum district; it is there known as *Jadu Sanga*.

TRIBE III.—NEOTTIEÆ.

94*b*. LECANORCHIS BL.

Terrestrial leafless herbs; scapes erect, simple or branched from a branching rootstock; sheaths of scapes remote, of rhizome more approximated thicker persistent. *Flowers* racemose or spicate. *Sepals* subequal, free, suberect, their bases surrounded by a small urceolate toothed epicalyx. *Petals* like sepals. *Lip* erect, shortly adnate to the base of the column, or free but embracing the column below, above somewhat wider, concave with two subacute side lobes and a rounded central lobe, pubescent within. *Column* rather long, straight, dilated above; stigma short rounded; anther adnate to margin of clinandrium, cells distinct; pollinia granular, ovate or oblong. *Capsule* narrow-oblong, dehiscing from base to apex, tipped by the toothed or entire cupular persistent epicalyx.—Species 3, in Malaya, Indo-China, E. Himalaya and Japan.

1. LECANORCHIS JAPONICA *Bl. Mus. Bot. Lugd. Bat.* ii., 188; flowers racemose, sepals and petals narrowly obovate obtuse; lip oblong, with subacute wide triangular side lobes, softly hairy at the base and densely pubescent with strong reflexed hairs towards the margin of the rounded cucullate mid-lobe within. *Bl. Orch. Arch. Ind.* 176, t. 62.

EASTERN HIMALAYA: Sikkim; above Rungbee, 6,500—7,000 ft., *Prain*! *Prain's Collectors*! ASSAM: Jaintia Hills; Darrung and Mongot, *King's Collectors*! Khasia; Mamloo, *Pantling*!

Stems rather soft, 1·5–2 ft. high, dark-green, tinged with purple, with 6–8 purplish membranous sheaths rather close below, more distinct above, ·5 in. long, embracing the stem. *Racemes* 3–4 in. long, 6–9-flowered, lax; bracts ·3 in. long, triangular; pedicel with ovary 1 in. long; epicalyx 18–20-toothed, teeth acute; sepals and petals ·6 in. long, dull purple externally; lip as long but much broader, dull purple externally as are the side lobes within, interior of mid-lobe pale-yellow within.

Flowers self-fertile. A careful examination of the Sikkim plant in the living state reveals nothing that can distinguish it from the Japanese.

2. LECANORCHIS MALACCENSIS *Ridl. Trans. Linn. Soc.* Ser. II., Bot. iii., 377, t. 65; flowers racemose or panicled, sepals and petals lanceolate spathulate; lip oblong not lobed, wide-spathulate and densely hairy within. *Journ. Linn. Soc.* xxxii., 409.

MALAY PENINSULA: Singapore; Penang, Malacca; Kedah; Pahang; *Ridley*. Perak; *Wray* 4021!

Stems slender, wiry, often branching, 1–1·5 ft. high, black, with 6-8 small ovate-acute sheaths, ·2 in. long. *Racemes* 1–2 in. long, 3–6-flowered, lax; bracts ·1-·15 in. long, ovate acute; pedicel with ovary ·5 in. long; epicalyx entire; sepals and petals ·6 in. long, pale flesh-coloured or yellowish-white; lip as long but much broader, pale flesh-coloured externally, inside of lip anteriorly yellow.

Flowers self-fertile. In general facies this species considerably resembles *L. javanica* Bl., but differs from that plant in having an entire epicalyx and in having the base of the lip adnate to the column below, in which respect the present plant is, as Mr. Ridley has pointed out, allied rather to *L. japonica* than to *L. javanica*.

Noviciæ Indicæ XXIV. *Some new Indian Plants.*—*By* D. Prain.
(With Plates VII—VIII).

In this paper are given descriptions of a few plants new to the *Flora of British India* either in the sense that they are new to science or that they have been ascertained to be Indian since the portions of the *Flora of British India* containing accounts of their respective natural families have appeared. References are also occasionally given to interesting new localities for species already fully described there.

IV. Anonaceæ.

9. UNONA Linn.

11. Unona praecox *H. f. & T.*
Add to localities of F. B. I.:—
Sikkim: Ryang Valley, 4,000—5,000 ft., *Cave*!

15. GONIOTHALAMUS Bl.

3. Goniothalamus Griffithii *H. f. & T.*
Add to localities of F. B. I.:—
Andamans: Port Blair, common.

20. SACCOPETALUM Benn.

1. Saccopetalum longiflorum *H. f. & T.*
Add to localities of F. B. I.:—
Sikkim: Ryang Valley, 4,000—5,000 ft., *Cave*!

XXVII. Sterculiaceæ.

1. STERCULIA Linn.

Leaves simple not lobed; calyx lobes medium spreading.

13*b*. Sterculia Kingii *Prain;* leaves ovate-lanceolate, long acuminate, base round, glabrous above, glabrescent beneath; panicles or racemes drooping much shorter than the leaves; calyx lobes lanceolate-acuminate.

Sikkim: Darjeeling District *T. Thomson*! at Ranyak, *T. Anderson* n. 388! Kootom, below Mungpoo, 3,000 ft., *King*! Rungbee, 3,000 ft., *King*! Lopchoo, 6,000 ft., *Osmaston*!

A tree about 30 feet high, wood soft, bark greyish, branches with prominent cicatrices. *Leaves* alternate, ovate-lanceolate, apex long acuminate, base rounded, glabrous above, when young sparingly pubescent with stellate hairs on the nerves, but soon glabrous beneath, 9-12 in. long, 4-6 in. wide, main-nerves 10-12 pairs spreading, secondary nervation wider-meshed distinct; petioles 2-2·5 in. long, flattened above; stipules linear-ovate, coloured, rusty-hairy. *Flowers* near ends of branches below the leaves, in the axils of cicatrices; in drooping few-flowered racemes or panicles 2·5-4 in. long; peduncles glabrous as are the slender pedicels ·5-·7 in. long, bracts very minute and fugacious. *Calyx* brownish-red, campanulate, tube very short ·1 in. long, lobes 5, lanceolate acute ·5 in. long; finely puberulous. *Stamens* about 5, united in an erect crenate column, about ·2 in. long; anthers 2-celled. *Ovary* 4-5-celled, ovules many. *Fruit* of 4-5 purplish red or scarlet follicles, 4-5 in. long, 1·5 in. wide. *Seeds* ovoid, ·8 in. long ·5 in. across, testa blue.

Osmaston gives the vernacular name as *Chiuri pat.* The species is nearly related to *S. coccinea* which is however easily distinguished by its narrower pilose calyx-segments. It is also closely related to *S. laevis* Wall., but is again very distinct because the calyx-lobes are not bearded within. It has been sometimes confused with *S. Roxburghii* which has however much smaller flowers.

XLI. Celastrineæ.

1. EUONYMUS Linn.

6*b*. Euonymus macrocarpus *Gamble, List. Darjeel.*, ed. II, 18 (1896); leaves 2·5-5 in. long, 1-1·75 in. wide, ovate-lanceolate, acuminate, thickly papery, margins finely serrate; peduncles 3-flowered axillary; petals ovate, margins entire.

Eastern Himalaya: Bootan, at Khumpung, 7,500 ft., *Gamble*!

A large climber; branches cylindric. *Leaves* pale-green, nerves 6-7 pairs, distinct above and prominent beneath, much curved forward and forming a series of intramarginal loops particularly in the apical half. *Peduncles* short, ·35 in. long, stout; pedicels ·2 in. long, rather stout. *Flowers* ·2 in. across; sepals rotund, concave, 5; petals 5, ovate; style long. *Fruit* oblong, sharp-pointed, valves 5, spreading stellately when ripe, hard and thickly leathery or almost woody, 1·25 in. long, ·75 in. wide.

A very distinct species.

7. Enonymus grandiflorus *Wall.*

Add to localities of F. B. I.:—

E. Himalaya: Chumbi; Paroo, *Dungboo*! Bootan; *Griffith*! Burma: Shan Hills, at Moungtaya, 4,000 ft., *Collett*!

8. Enonymus calocarpus Kurz.

To be deleted: is a *Glyptopetalum.*

8*b*. Enonymus kachinfnsis *Prain;* peduncles 2-2·5 in. slender, fruit broadly pyriform, strongly 4-angled.

Upper Burma: Kachin Hills, at Sima, 6,500 ft., *Shaik Muquim*!

A shrub, branches slightly 4-angled under the leaves, terete below, smooth. *Leaves* lanceolate-acuminate tapering from below the middle to the narrowly cuneate base with entire margins, elsewhere finely serrate, thinly but firmly papery, 4 in. long, 1·25 in. wide; nerves slender acute 8-9 pairs, prominent beneath.

Peduncles 1·5 in. long, pedicels usually one to each peduncle, ·5 in. long. *Fruit* deeply 4-lobed, the calyx persistent at its contracted base; length ·75 in., width at apex ·6 in.

A very distinct species of which the petals are not yet known. The sepals are rounded, spreading, forming a calyx ·25 in. in diam.

8*c*. ENONYMUS SUBSULCATUS *Prain;* peduncles ·75-1 in. very slender, fruit subpyriform, distinctly 4-angled.

BURMA : Tenassarim; Moolyet, 5,000 ft., *Gallatly*!

A shrub, branches distinctly 4-angled throughout, somewhat 4-grooved in upper parts of internodes, smooth. *Leaves* ovate-lanceolate acuminate, base wide-cuneate, margin entire, thickly membranous, 3·5-4 in. long, 1·75-2·25 in. wide, nerves 5-6 pairs not prominent below, hardly visible above. *Peduncles* ·75-1 in., pedicels usually 1, sometimes 2 to each peduncle, ·25 in. long. *Fruit* deeply 4-lobed, the calyx persistent at its contracted base; length ·5 in., width at apex ·45 in.

12*b*. ENONYMUS WRAYI *King, Journ. As. Soc. Beng.* lxiv., 2, 344; leaves 4·5 in. long, 2·25 in wide, ovate acuminate, remotely and obscurely serrate, peduncles very long slender, cymes lax 3-4 in. across, flowers nearly ·25 in. across.

MALAYA: Perak; Gunong Batu Pateh, *Wray*! Pahang; Kota Glanggi, *Ridley*!

A small tree; branches cylindric, smooth, dark-brownish when dry. *Flowers* 5-merous, sepals large rotund spreading concave, glabrescent, margins membranous. *Petals* not much exceeding sepals, rotund, clawed; edges incurved undulate, minutely puberulous, green with dull crimson veins. *Fruit* shortly and broadly pyriform, deeply 5-lobed, the calyx persistent at the contracted base; length ·75 in., width at apex ·6 in.

A very distinct species; in general appearance approaching most closely to *E. glaber*, but with laxer cymes and widely different fruit.

17*b*. ENONYMUS VIBURNOIDES *Prain;* leaves 3-5 in. long, 1·25-2·25 in. wide, oblong acute base rounded or truncate less often cuneate, fruit very slightly 4-ridged.

EASTERN HIMALAYA: Sikkim; Sureil, 5,500 to 6,500 feet; *King*! Near Darjeeling, *Gage*! Rungyroon, *King*! Pasheting, *Grieve*!

A shrub; young branches faintly quadrangular under the leaves. *Leaves* thickly herbaceous, margins finely serrate and slightly revolute with a tendency for those of alternate pairs to be smaller and larger; nerves about 6 pairs, distinct on both surfaces, especially beneath. *Peduncles* axillary rather slender, 1-1·5 in. long, cymes very many-flowered up to 4 in. across. *Sepals* 4, wide reniform, spreading. *Petals* 4, much exceeding the sepals, orbicular, minutely puberulous. *Style* 0. *Fruit* somewhat depressed, very slightly 4-ridged, ·3 in. long, ·4 in. across.

A distinct species nearest *E. bullatus*, but with larger and more numerously flowered cymes, smaller fruit, and the veins on the leaves beneath less prominent.

18. EUONYMUS BULLATUS *Wall.*

Add to localities of F.B.I.:—

EASTERN HIMALAYA: Bootan; *King's Collector*! INDO-CHINA: Naga Hills; Kohima, *Clarke*! Manipur; Lingli, *Watt*!

19. EUONYMUS FIMBRIATUS *Wall.*

Add to localities of F.B.I.:—

AFGHANISTAN: Kurram Valley; *Aitchison*! WESTERN HIMALAYA: Hazara; at 7,000 ft., *Stewart*! Chitral; Ziarat, 7,800 ft., *Harriss*! Kashmir; Sonamurg, 8,500 ft., *Clarke*! Barzil Valley, *Duthie*! Kishengunga Valley, *Duthie*!

20*b*. EUONYMUS LAWSONII *C. B. Clarke* Mss. *in Herb. Calc.*; leaves lanceolate-acuminate, 3-5 in. long, 1 in. wide, sharply serrate except at the entire cuneate base, fruit with 4 prominent angles but not winged.

KHASIA: Normai, Mansmai, Sohra, etc., *Clarke*! *Mann*! *Simons*! *Prain*!

A small tree; branches slender, cylindric. *Leaves* membranous or thinly chartaceous, nerves 5-6 pairs, rather distinct, especially beneath. *Inflorescence* laxly cymose; cymes 2 in. across, peduncles very slender, 1·5 in. long; pedicels almost filiform ·25 in. long. *Flowers* ·2 in. across. *Sepals* 4 rounded, *Petals* 4 orbicular, shortly clawed, much exceeding sepals, margin faintly undulate but not fringed or toothed, finely veined. *Fruit* thinly coriaceous, ·3 in. long, ·5 in. across.

Very like and very nearly related to *E. frigidus*, but with rather larger petals and very different fruit.

7. CELASTRUS LINN.

1. CELASTRUS PANICULATA *Willd.*

This species, as defined in the *Flora of British India*, includes three species as recognised by Roxburgh, *viz.*:—*C. paniculata*, *C. multiflora* and *C. nutans*. Of these the two former are certainly quite distinct, and the third, which approaches *C. multiflora* is also possibly distinct. The three may be diagnosed, with much ease, as follows:—

Leaves rounded	*C. paniculata.*
Leaves oblong	*C. multiflora.*
Leaves obovate	*C. nutans.*

The geographical areas of the three, which may be looked upon as representative species, is as follows:—

C. PANICULATA *Willd.*

N. W. HIMALAYA and SUB-HIMALAYA: Kalidungi, *Thomson* 740! Pattludop, *Brandis* 2032! Chamba, at Raipur, 3,000 ft., *Clarke* 23681! Dehra Dun, *Vicary* 175! Submontane forests of Pilibhit, *Duthie* 21400/*a*! Kheri in Oudh, *Duthie* 21402! Bettiah, near the Nepal Frontier, *Hieronymus* 443! RAJPUTANA: Aboo, *King*! *Stocks*! C. INDIA: Gwalior, *Maries* 22! Khandwa District, *Duthie* 8211! WESTERN INDIA;

Bas-sein, *Burkill* 15787! Concan, *Stocks*! near Malcolmpett, *Campbell*! Deccan; near Poona, *Woodrow*! *Cooke*! S. INDIA: Nilgiris, *Schmid*! *Clarke* 11282! *Gamble* 11646! Shevaroi Hills, *Perrottet* 33! 456! 467! localities doubtful, *Wight* 462 (K.D.)! 463 (K.D.)! and in Wall. Cat. 4301 F! *Heyne* in Wall. Cat. 4301 B! CEYLON: localities doubtful, *J. Watson*! *Thwaites* C. P. 1232! BENGAL: village jungles in Central Bengal *Kurz*! W. Bengal, on Pachete, *Kurz*! Manbhum *Campbell*! BEHAR: Rajmahal Hills near Sahebganj, *Kurz*! Low hills near Topechana at 2,000 ft., *Kurz*! CHOTA NAGPUR: Palamow, in Kumandi reserve, *Gamble* 8780! Hazaribagh, Golah, *Prain*! Parasnath, 2,000 ft, *Kurz*! and 2,500! *Clarke* 24,857! BURMA: Karenee, *Kurz* 1926! Pegu Yomah, *Kurz*! Ava; *Wallich* 4301 K! Yeu, *Cole*! Shwebo, *Abdul Huq*! Shan Hills; at Keloh, *Collett*! Pwehla, *Collett*! Fort Stedman, Lwekaw and Taunggyi, *King's collectors*!

A very distinct form of this plant, distinguished mainly by its leaves being pubescent beneath, is confined to Burma. It may be known as:—

C. PANICULATA var. PUBESCENS Kurz (= *C. pubescens* Wall. Cat. 4303).

BURMA: Pegu, *Eyre*! Prome Hills, *Wallich* 4303! Pegu Yomah, *Kurz*! Maymyo, *King's collector* 11! 36! 259! Shan Hills; Taunggyi, *King's collector*!

Another but less distinct form with unusually large and rather firmer leaves occurs in the Andamans. This may be termed *C. paniculata* var. *andamanica*. It is not uncommon in the vicinity of Port Blair.

CELASTRUS MULTIFLORUS Roxb.

NEPAL: *Hamilton*, *Wallich* 4302 (*C. dependens* Wall. Mss.)! SIKKIM: Rungit 700 ft., *Clarke* 26 339! 2,000 ft., *Hooker*! Ryang 800 ft., *Osmaston*! Gurubathen, 1,500 ft., *Prain's Collector*! DAPHLA HILLS: Radhu pokri, *Lister*! ASSAM: Valley of Brahmaputra; Dibroo Mukh, *Masters*! localities uncertain, *Griffith*! *Wallich, Griffith and M'Clelland*! Gauhati, *Simons*! Khasia Hills, *Simons*! *Hooker and Thomson*! BURMA: Chindwin, near Tummoo, *Prazer* 167! Kendat, *Prazer*! Chin Hills, *Prazer* 236! Kalay Hills *Prazer*! Kachin Hills; near Sadon, *Shaikh Muqim*! Koni, *Prazer*! Pinmona, *Abdul Huq*! Shan Hills; Taunggyi, *King's Collector*! TENASSERIM: Tavoy, Oomaigoi, *Shaikh Muqim*!

CELASTRUS NUTANS Roxb.

S. INDIA: Kurg (Collector unknown)! Travancore; Peermed, 3,000 ft., *Bourdillon*!

2. CELASTRUS STYLOSA Wall.

Lawson has under this name confused two very distinct species, *viz.*, *C. stylosa* Wall., which he describes a second time as *Gymnosporia* *neglecta* and *Celastrus* sp. n. 3 Hook. f. in Herb. Ind. Or. which is a very distinct plant, quite different from *C. stylosa.* The two can be at once distinguished by the stamens which have hirsute filaments in *C. stylosa*, but glabrous ones in Hooker's species, which is defined below. *C. stylosa* is abundant in Nepal, Sikkim and Khasia, but has not been met with in Burma.

2*b*. CELASTRUS HOOKERI *Prain*; calyx segments oblong obtuse! petals ¼ in. oblong with faintly toothed margins towards the apex, entire below; stamens glabrous; style faintly 3-lobed; fruit brown, 3-celled, 6-seeded.

SIKKIM: Lachen Valley, 8-10,000 ft., *Hooker*! *King's Collector*; Darjeeling and neighbourhood, 6,000-9,000 ft., *King*! *Kurz*! *Clarke* 27040! 35758! *Gamble* 682! 1926! DAPHLA HILLS: *Lister*! KHASIA: Nurtiang, *Hooker and Thomson*! BURMA: Chindwin, *Prazer*!

A shrub; usually climbing. *Leaves* 4 in. long, 2–2·5 in. wide, elliptic or ovate-oblong, acute or acuminate, serrate or subentire, turning brown (when dry). *Flowers* in axillary or terminal racemose cymes, sometimes up to 3 in. long. *Fruit* brown, tipped by the persistent style.

C. Hookeri, as the definition shows, is very nearly related to *C. stylosa*, but it is easily distinguished by the thinner leaves which become reddish-brown when dry, those of *C. stylosa* remaining green; by the capsules with thinner valves which are brown instead of yellow; by the filaments which are glabrous instead of pubescent; and by the petals which are only faintly toothed not deeply undulate.

2*c*. CELASTRUS MEMBRANIFOLIA *Prain*; calyx segments shortly ovate subacute; style slender entire, fruit 3-celled, about 6-seeded, seeds black.

KHASIA HILLS: *G. Mann*!

A shrub, with terete branches. *Leaves* ovate-lanceolate, tapering from the middle to the acuminate apex and the cuneate base; 4·5 in. long, 2 in. wide, membranous, pale-green, glabrous, margins serrate; petiole slender ·4 in. long. *Flowers* in short axillary or terminal racemose cymes. *Fruit* green, valves 3, very thin, style persistent, slender.

3. CELASTRUS VENULOSA *Wall.* Fruit 3-celled.

Add to localities of F.B.I.:—

SIKKIM: outer hills, above 2,000 ft., *Dungboo*! DAPHLA HILLS: Harmati, and elsewhere in the outer hills, *Lister*!

This species has, as its nearest ally, one from the Malay Archipelago, *C. racemulosa* Hassk. The two are related to each other much as the forms united under *C. paniculata* are.

3*b*. CELASTRUS LISTERI *Prain*; calyx segments half orbicular; style short; fruit 3-celled, 3-seeded.

DAPHLA HILLS: Tenir Lampa, 3,000 ft., *Lister*!

A small tree, with smooth dark-brown round branches. *Leaves* large, ovate or obovate, dark-brown when dry, glabrous, apex rounded with an abrupt acumen, base wide-cuneate, margin entire; 8 in. long, 3·5 in. across, subcoriaceous. *Flowers* in short axillary or terminal cymes. *Fruit* large ·5 in. across, 3-celled, 3-seeded; *Seeds* brown, ·3 in. long, somewhat curved.

Nearly related to *O. monosperma*, but with larger leaves, a different habit and a 3-celled, 3-seeded fruit.

8. GYMNOSPORIA W. & A.

2. Gymnosporia neglecta *Wall.*

This species should be deleted. It is based originally on *Celastrus neglectus* Wall. Cat. 4341, which is *Celastrus stylosa.*

Lawson in the *Flora of British India* has associated *Celastrus? attenuata* Wall. Cat. 4319 with the preceding number. The material at Calcutta is not very good, but so far as it goes, it does not admit of this number being distinguished from *Celastrus oxyphylla* Wall. Cat. 4312 which is treated by Lawson as the basis of *Gymnosporia acuminata* Hook f. Moreover Lawson brings under *G. neglecta* the plant issued by Wallich as ?*Baebotrys acuminata* Wall. Cat. 2321. This last, which appears to be the true basis of *G. acuminata* Hook. f., is certainly identical with Wall. Cat. 4312.

7*b*. Gymnosporia sikkimensis *Prain;* leaves 5·7 in. by 2·25–3 in., ovate obtuse, very obscurely serrate, thinly coriaceous, glabrous.

Sikkim: Tista Valley, *Gamble* 1748! Ambiokh, *Prain's Collector*!

A small tree; branches unarmed, stoutish, dark, glabrous. *Flowers* small, in numerous clustered cymes from old leaf-scars; peduncles, 1·75 in. long, cymes 2 in. across. *Sepals* 5, short, obtuse, concave, puberulous, externally corrugate. *Petals* 5, wide-oblong, obtuse, thrice as long as sepals. *Stamens* 5, filaments slender incurved, attached outside disk anthers short, broad, 2-celled. *Disk* thick fleshy, corrugated. *Styles* short, coherent with vertical grooves; stigmas slightly recurved. *Fruit* turbinate, 3-celled, ·5 in. long, ·3 in. across.

7*c*. Gymnosporia Curtisii *King in Journ. As. Soc. Beng.*, lxv., 2. 353; leaves 4–6 in. by 2·25–3 in. ovate-elliptic subacute, distantly shallowly crenate, coriaceous, glabrous.

Kedah: *Curtis*!

A scandent shrub; young branches stoutish, grey, glabrous. *Flowers* small, in clustered cymes from old leaf-scars; peduncles ·5–·7 in. long. *Sepals* 5, semiorbicular, the edges with a few short thick cilia. *Petals* 5, oblong, obtuse, much longer than sepals. *Stamens* 5, filaments slender, incurved, attached outside disk; anthers small, suborbicular. *Disk* thick, fleshy, entire. *Style* short clavate. *Fruit* widely ovoid, almost globular, 3-angled, 3-valved. *Seeds* 1, or often 2 in each cell.

13. SIPHONODON Griff.

1. Siphonodon celastrineus *Griff.*

Add to localities of F. B. I.:—

ANDAMANS: Coco group, *Prain!* EASTERN HIMALAYA: Sikkim; Tista Valley, *Prain!*

L. LEGUMINOSÆ.

108. CRUDIA SCHREB.

CRUDIA MANSONI *Prain;* leaflets thinly coriaceous, glabrous, ovate-oblong or oblong, shortly acuminate, rachis slightly prolonged beyond the terminal leaflet. *Touchiroa Mansoni* Prain Mss.

BURMA: Tenasserim; Tavoy, *Manson's Collector* 172! 3061!

A tree with glabrous branchlets. *Leaves* odd-pinnate, rachis 4-5 in. long, petiole articulate, the interpetiolar stipules united at the base; leaflets 5, petiolules ·25 in. long, glabrous as is the rachis which is prolonged as an acumen beyond the last leaflet; alternate, ovate-oblong or oblong, base cuneate rarely rounded, apex rounded, with an abrupt sharp tip ·25 in. long, 6–8 in. long, 2·25–2·5 in. wide, dark-green above, paler beneath, quite glabrous on both surfaces, lateral nerves about 10 pairs, spreading, and looping within the margin, not very prominent but distinctly visible as is the secondary venation on both surfaces. *Flowers* in long narrow racemes from old leaf-axils, beset at the base with ovate-lanceolate coriaceous bud-scales, rachis 8–12 in. long (including flowerless peduncle 2 in. long) finely puberulous throughout; pedicels close-set, slender, puberulous, ·25 in. long. *Calyx*-tube short, lobes 4 oblong imbricate reflexed in flower, sparingly puberulous externally glabrous within. *Petals* 0. *Stamens* not seen. *Ovary* shortly stipitate, densely tawny-velvety, 3–4-ovuled, stipe glabrous below, pubescent above, as long as calyx-tube; style slender glabrous except at base. *Pod* oblong, obliquely rounded at both ends, finely rusty-velvety, 2·5 in. long, 1·5 in. wide.

A very distinct species with leaflets and long racemes of close-set flowers not unlike those of *Crudia bantamensis* Hassk., and quite unlike those of any other hitherto described species from South Eastern Asia. The present species, however, differs markedly from *C. bantamensis* in the more numerous leaflets and the longer pedicels.

Mr. Manson's collectors have associated with this tree two Burmese names, viz., *Tsintonui* and *Thit kouk wüt.*

The present opportunity is taken of providing a description for hitherto uncharacterised Bornean species.

CRUDIA HAVILANDI *Prain*; leaflets thinly coriaceous, almost glabrous, very long caudate-acuminate, rachis slightly prolonged beyond the terminal leaflet. *Touchiroa Havilandi* Prain MSS.

BORNEO: Sarawak, near Kuching, *Haviland* 3070! 3703!

A shrub with slender quite glabrous branchlets. *Leaves* odd-pinnate, rachis 1·5–2·5 in. long, petiole articulate, the interpetiolar stipules united at the base by their inner margins, thereafter free, lanceolate, sparsely puberulous on their petiolar aspect; leaflets 4–6, very rarely 3, petiolules ·15 in. long, glabrous as is the rachis, which is prolonged beyond the last leaflet as a short blunt process; alternate, narrowly ovate or obovate-oblong, base rounded, apex prolonged into a ·75 in. long narrow-caudate tip, 2–4 in. long, ·75–1·6 in. wide, dark-green, glabrous dull above, glaucescent and very finely and minutely puberulous beneath, lateral nerves 7–8 pairs slightly ascending, looped ·25 in. within the margin, rather prominent as is the secondary venation beneath, obscure above. *Flowers* in narrow racemes at bases of new leafy shoots, with finely puberulous rachis 2–3 in. long; pedicels slender, under ·25 in. long, finely puberulous with 1 or 2 minute puberulous bracteoles, one-third below calyx; buds oblong, ·2 in. long. *Calyx*-tube short, lobes 4, ovate, imbricate, reflexed in flower, finely puberulous externally, glabrous within. *Petals* 0. *Stamens* 10, filaments glabrous, free, slender, as long as style; anthers oblong, versatile. *Ovary* shortly stipitate, densely rusty-velvety, 2-ovuled, stipe glabrous, as long as calyx-tube; style long, slender, glabrous, ·25 in. long, rather longer than ovary and stipe. *Fruit* not seen.

A species very closely related to *Crudia caudata* Prain, (*Journ. As. Soc. Beng.*, lxvi. 2. 220) but easily distinguished by the absence of the rusty pubescence characteristic of that plant, and by the broader leaflets.

112. HUMBOLDTIA Vahl.

Humboldtia Bourdilloni *Prain;* branches solid, nodes not constricted, leaves distinctly petioled, rachis winged, leaflets normally 6, but lowest pair may be absent though the joint in the main rachis corresponding to their position is present, petiolules 0; petals 5.

Travancore: Peermerd Ghât, 3,000 ft., and Peermerd Road, 2,800 ft., *Bourdillon* 906! 1080!

A handsome tree, 50 feet high. *Stipules* not seen. *Leaf-rachis* 2·5–3 in. long, leaflets ovate-lanceolate or lanceolate, thinly coriaceous, 2–4 in. long, ·6–1·5 in. wide, base unequal, rounded below, cuneate anteriorly, apex gradually tapering from near the middle, tip rounded or acute. *Corymbs* from tubercles on the stem, clustered; 2 in. across; 1·75 in. long; lower pedicels slender, their peduncles 1–2 in. long, puberulous; bracteoles and sepals finely closely grey-silky, bracteoles ·2 in. sepals ·45 in. long. *Petals* ovate, obtuse, rather longer and wider than the sepals. *Pod* bright crimson, finely silky, 4 in. long, 1 in. wide.

This very fine species is quite unlike any other *Humboldtia* except *H. decurrens* Bedd., by reason of its winged petiole and rachis. It differs from *H. decurrens* by its much smaller leaves with fewer leaflets; its smaller flowers with bracteoles less than half the size, and its much longer, slender pedicels.

II. Rosaceæ.

9. GEUM Linn.

3. Geum (Sieversia) sikkimense *Prain;* hirsute, leaves lyrate, pinnatisect with a large orbicular or reniform terminal lobe and numerous small terminate lateral lobes, irregularly crenate serrate; flowers erect, achenes hirsute. (Plate 7).

Eastern Himalaya: Sikkim; Jongri, Onglathang and Huhalanghi, *King's Collector*! *Prain's Collector*!

Rootstock stout. *Leaves* 3–5 in. long., terminal lobe 1·75–3 in. wide, lateral, lobes 6–12-jugate, close-set or distant ·15–·25 in. long. *Flowering* stems with 2–3, rarely 4 leaves, reduced to the terminal lobe or with only 1–2 pairs of lateral lobes and solitary, rarely 2, flowers. *Flowers* ·75 in. across. *Calyx*-lobes triangular or ovate-acute, enlarging in fruit, finely pubescent and at the same time rather sparingly hispid, not spreading. *Petals* rounded with cuneate base, yellow, distinctly veined, hirsute at least at the base within, sometimes sparsely pubescent on both surfaces; not much exceeding the calyx-lobes in flowers, marcescent but shorter than the calyx-lobes in fruit. *Stamens* 40–50, filaments hirsute. *Carpels* hispidly hairy, sessile at the base of the calyx, style glabrous or finely pubescent. *Achenes* acute at both ends, hispidly hairy.

Very different from the common Himalayan *Sieversia* (*Geum elatum* Wall.) and more resembling the Northern Asiatic *Geum* (Sieversia) *rotundifolium* Langsdorff, but with more numerous lateral lobes to the leaves and very different achenes. The species appears to be both local and rare. It has been collected on three occasions but always in Western Sikkim not far from the Nepalese border.

11. POTENTILLA LINN.

6. POTENTILLA PURPUREA *Royle.*

Add to localities of F. B. I.:—

SIKKIM: Thangu *Hooker*! *Younghusband*! CHUMBI: Syampoo, *King's Collector*! DISTRIB. Kiala, *Soulie.*

66. POTENTILLA SIKKIMENSES *Prain;* leaflets 3, obovate, cuneate, truncate, 3–5-lobed, flowers in small cymes dark-red, 5-merous, achenes with a few hispid hairs, style short, ventral.

EASTERN HIMALAYA: Sikkim; Gnatong, *Dungboo*! Lyang, Gabur on Kinchinjanga, 15,000 ft., *King's Collector*! Jongri, *King's Collector*!

Rootstock woody, depressed branched. *Leaves* mostly radical with a few scattered cauline, clothed with soft silky hairs; petiole up to 2·5 in. long, slender; leaflets ·25–·75 in. long, cuneate at the base, lobes short, ovate, subacute. nerves obscure; stipules large, membranous. *Flowering stems* ·5–5 in. long; cymes leafy and silky. *Flowers* pedicelled. *Calyx* ·2 in. long, lobes ovate-lanceolate, acute; bracteoles lanceolate. *Petals* suborbicular, not exceeding calyx. *Stamens* 5. *Carpels* 30. *Achenes* ovoid, obtuse, with a few hispid hairs at apex and round the base, receptacle flat.

Nearest to and much resembling *P. Sibbaldi*, but differing markedly in the dark-red petals and the hispid achenes.

16. ROSA LINN.

1. ROSA INVOLUCRATA *Roxb.*

Delete from Synonyms of F.B.I.:—Rosa Lyellii *Lindl.* The Rose known as *Rosa Lyellii* and excellently characterised by Lindley seems quite a distinct species from *R. involucrata.* Its resuscitation calls for some amendment in the distribution of *R. involucrata* which, as testified by specimens in the Calcutta Herbarium, is as follows:—

Typica; leaves pubescent beneath.

UPPER GANGETIC PLAIN: Moradabad, *Holled*! N. BEHAR: *Kurz*! *Clarke*! *Anderson*! N. BENGAL: Naogaon, *Prain*! Rangpur, *Watt*! ASSAM: Nowgong, *Simons*! BURMA: Minbu Dist., at Sinbok, *Gage*! Kyoukmyoung, *King's Collector*!

VAR. *glabra;* leaves glabrous or very slightly pubescent beneath. *R. bracteata* Roxb. Ic. Ined.

UPPER GANGETIC PLAIN: Gorakhpur, *Duthie's Collector*! CHOTA NAGPUR; Udaipur Tributary State, *Prain's Collector*! VIZAGAPATAM: Jaipur State, *V. Ball*! EAST BENGAL: Pabna, *Clarke*! Jatrapur, *Watt*! ASSAM: Sylhet, Jhils, *Hooker & Thomson*! *Mann*! *Robertson*! BRAHMAPUTRA VALLEY: Gauhati, *Jenkins*! *Mann*! *King's Collector*! Golaghat, *Masters*! Sibsagar, *Masters*! MANIPUR: Imphal, *Watt*! BURMA: Myitkyina, *Pottinger*!

To this variety also belongs Wall. Cat. 696 "E montibus Pundooa Sylhet confinibus" which, as Hooker says, is most probably also from Sylhet.

VAR. *parvifolia;* leaflets as in VAR. *glabra*, but less than half the size, (not exceeding ·5 in. in length). *R. palustris* Ham. MSS.

N. W. HIMALAYA: Kamaon, *Blinkworth*! Nepal, *Wallich*! BEHAR: Nakeswar, *Buchanan*! CHOTA NAGPUR: *Gamble*! *J. J. Wood*!

The diagnosis between *R. involucrata* and *R. Lyellii* is very simple, and may be given as follows:—

Rambling shrubs, never climbing on banks of slow running rivers below high-water mark or in the beds of jheels and backwaters; bracts pectinate; flowers sessile ... ... *involucrata.*
Climbing over trees on dry ridges; bracts entire; flowers long-peduncled ... ... *Lyellii*

In other respects the two roses, as Sir Joseph Hooker truly says, are exceedingly closely allied. Crepin hazards the suggestion that *R. Lyellii* is a natural hybrid between *R. involucrata* and *R. moschata*, a suggestion rather difficult to admit even if *R. Lyellii* had been, as was long supposed to be the case, confined to Nepal. The distribution of *R. Lyellii*, which is given below shows, however, in the writer's opinion, that Crepin's hypothesis is untenable.

ROSA LYELLII *Lindl. Monogr. Ros.* p. 12, tab. 1 (1820). *R. pubescens* Roxb. Fl. Ind. i. 514.

SIWALIKS: "native of the mountains north of Rohilkand" *Roxburgh* (*Ic.*)! *Royle*! NEPAL: in woods, climbing on trees, *Wallich*! SIKKIM: *Kurz*! CENTRAL INDIA: Sagor, *Vicary*! S. INDIA: Nilgiris, *Schmidt*!

Monro's Mysore plant referred to *R. involucrata* is possibly *R. Lyellii.* It is very unlikely to be Roxburgh's plant.

10. ROSA GIGANTEA *Collett* ex *Crepin Comptes-Rendus Soc. Roy. Bot. Belg.* xxvii. 152; climbing, evergreen, glabrous, subcoriaceous stipules very narrow, adnate for ·75–1 in. with lanceolate free points ·2–·25 in. long; flowers very large, on short peduncles always solitary; sepals reflexed; fruit large, globose. *Coll. & Hemsl., Journ. Linn. Soc.* xxvii. 55.

MANIPUR: Sirohifurar, 5–6,000 ft., *Watt*! BURMA: Shan Hills; *Collett*! *Candler*! *Prazer*!

Climbing over rocks and lofty trees. *Leaves* 2-jugate, rarely 3-jugate, the uppermost only 3-foliolate, 3–7 in. long, leaflets large 1·25–3·25 in. long, ·75–1·75 in. wide, ovate or elliptic, base rounded, apex acute or mucronate, marginal teeth rather small, petiolulate; petiole glabrous minutely glandular above, margin of stipules minutely glandular. *Flowers* solitary, peduncles ·5–·75 in long. *Calyx*-tube ovoid as long as the peduncle; calyx-lobes 1·5 in. long, margins entire, lanceolate, minutely spathulate at the tips, glabrous externally, finely pubescent within. *Corolla* 4–5 in. across; petals large yellowish-white wide-obovate with a median triangular mucro, very thick. *Styles* hirsute throughout or glabrous at the tips. *Fruit* large, globose, yellow, fleshy, with a few large achenes.

A magnificent species, very like an extremely luxuriant form of *R. indica* Auct., but the writer believes quite distinct.

11. ROSA COLLETTII *Crepin Comptes Rendus Soc. Roy. Bot. Belg.* xxviii. 2. 49; climbing, stipules free or nearly so, deciduous, setaceous, pubescent; prickles few, short, slightly recurved; leaflets mostly 3-jugate, ovate-elliptic, rounded or somewhat cuneate at the base, narrowed to an acute or sub-obtuse tip, margin finely serrate, glabrous above, pubescent beneath; petioles and inflorescence softly tomentose; flowers corymbose; ripe fruit globose. *Coll. & Hemsl. Journ. Linn. Soc.* xxviii. 56.

BURMA: Shan Hills; Koni, 4,000 ft., *Collett*! Tamakan and Noungtaya, 3,000 ft., *Collett*!

A considerable climber. *Leaves* 2–3 in.; leaflets, terminal 1–1·5 in. long, ·45·7 in. wide, proximal ·5–·75 in. long, shortly petiolulate, finely papery. *Corymbs* short, 1·5 in. long, by 1·5 in. wide; bracts small, setaceous, deciduous, pubescent. *Calyx*-tube obovoid, pubescent, lobes ovate-lanceolate ·25 in. long. *Corolla* small, ·75 in. across, petals ovate faintly retuse. *Fruit* pisiform, ·25–·3 in. in diam., calyx-lobes deciduous. *Styles* connate, short.

Nearest *R. microcarpa* Lindl., from China.

20. PYRUS LINN.

11*b*. PYRUS (*Sorbus*) KURZII *Watt MSS. in Herb. Calcutta;* leaflets 4–5 pairs small, oblong, acute, sharply serrate especially at the apex, very sparingly grey-puberulous; corymbs long-peduncled, lax-flowered, petals small orbicular.

SIKKIM: Phalut, 11,000 ft., *T. Thomson*! *Kurz*! *Prain's Collector*! Sandakphu, 12,000 ft., *Gamble*!

A small tree; young parts perfectly glabrous. *Leaves* 3–4 in. long; leaflets coriaceous, sparingly grey-puberulous above, glabrous beneath, base unequal, rounded, entire, sides entire below, sharply serrate above as is the apex, which ends in an acute or mucronate tip; ·75 in. long, ·35–·45, in. wide, venation not visible above, of a fine close-meshed subequal reticulation. *Corymbs* 1·25 in. wide, their peduncles glabrous, 1·5 in. long; pedicels slender. *Flowers* ·25 in. across. *Styles* 5, glabrous. *Fruit* ·25 in diam.

A species no doubt near *P. foliolosa* but abundantly distinct. It has been collected on five separate occasions, in 1857, 1868, 1880 and 1903, always on the same ridge—that along the Nepalese Frontier of Sikkim. Considering how very frequently this ridge has been explored by botanical collectors we must conclude that the tree in Sikkim is not only local but rare.

15. PYRUS GRIFFITHII *Dcne.*

Add to localities of F.B.I.:—

ASSAM: Naga Hills; Pulinabadza, *Watt*!

16. PYRUS KHASIANA *Dcne.*

Add to localities of F.B.I.:—

ASSAM: Naga Hills; Kohima, *Conry*! Konoma, *Prain's Collectors*! BURMA: Kachin Hills; *Prain's Collectors*!

17. PYRUS GRANULOSA *Bertol.*

Add to localties of F.B.I.:—

MALAYA: Perak, *Scortechini*! *Kunstler*!

DISTRIB. Sumatra; *Forbes*!

LVIII. COMBRETACEÆ.

1. TERMINALIA LINN.

16. TERMINALIA BURMANICA *King MSS. in Herb. Calcutta*; leaves clustered towards ends of branches, base cuneate, petiole eglandular; fruit shortly beaked, flattened so as to show two ridges.

BURMA: Sagain, *Calcutta Garden Collectors*!

A tree: young branches stout, densely rusty-tomentose. *Leaves* crowded near the apices of the branches, alternate, obovate, the apex very broad, sometimes obscurely and minutely cuspidate, tapering from about the middle to the short eglandular petiole; upper surface shining and glabrous everywhere except at the rusty-tomentose base of the midrib, lower surface everywhere covered with short rusty-tomentum; length 4 or 5 in., breadth 2·5 to 3 in., petiole ·3 to ·4 in., stout, densely rusty-tomentose. *Spikes* axillary, alternate, shorter than the leaves, almost glabrous, solitary. *Flowers* rather less than ·15 in. in diam., those in the upper part of the spike male, those in the lower part hermaphrodite. *Calyx* very sparsely pubescent outside, pubescent inside, the tube narrow, the mouth companulate and with ovate acute teeth. *Fruit* ellipsoid, much compressed, vertically grooved, the apex flattened and shortly beaked, the base narrowed, the edges keeled, quite glabrous, 1·25 in. long and 1 in. broad, the pericarp crustaceous, very thick.

Of this only two specimens have as yet been collected. In the shape both of its leaves and of its fruit it approaches *T. Catappa* L., from which, however, it is well distinct. The measurements of fruit above given are of unripe specimens.

LXXXIII. MONOTROPEÆ.

3. CHEILOTHECA HOOK. F.

Anthers long, like linear lips on each side of the connective ... ... 1. *C. khasiana.*
Anthers short, hippocrepiform ... ... 2. *C. malayana.*

1. CHEILOTHECA KHASIANA *Hook. f. Flor. Brit. Ind.* iii., 477.
KHASIA MTS.; *Hooker & Thomson; Clarke.*

2. CHEILOTHECA MALAYANA *Scort. in Hook. f. Icon. Plant.* xvi. t. 1564; stems erect, simple or 2—3-forked; stamens puberulous, alternately somewhat shorter and longer, anthers short, hippocrepiform; stigma obscurely lobed.

MALAY PENINSULA: Perak, in heavy jungle about 3,500 feet elev., *Scortechini, Kunstler* 2715!

Stem 6-9 in. high, stoutish; *scales* ·25-·75 in. long, imbricate, ovate-oblong, obtuse, gradually increasing upwards, lurid purple (*Scortechini*) or waxy white (*Kunstler*). *Flowers* terminal 1 in. long, solitary, "hidden inside the leaves at top, bright-yellow" (*Kunstler*) or with the tips of the petals exserted, white (*Scortechini*). *Sepals* 5, resembling the uppermost scales, linear-oblong, obtuse or sub-acute, glabrous. *Petals* 8, larger than the sepals, rounded cucullate at apex, glabrous externally, internally more or less pilose. *Stamens* 6, filaments pilose; anthers short, innate, cells confluent at apex, dehiscing by marginal pores. *Ovary* narrowly fusiform, stigma obscurely 4-lobed, placentas 6 parietal. *Fruit* a white fleshy berry, ·75 in. across, tipped by the persistent remains of the style.

The specimens collected by Kunstler differ from those obtained by Scortechini, according to the notes of these two collectors, in having white instead of purple scales and yellow instead of white flowers. The petals of Kunstler's plant are very sparingly hirsute within, and the anthers are about twice as long as the figure in the *Icones*, t. 1564, shews. In other respects, however, the two are identical, and the doubt is not so much that Scortechini's and Kunstler's specimens represent the same species, as whether the Malayan *Cheilotheca* really differs specifically from the Khasia one.

CIV. OROBANCHACEÆ.

2. CHRISTISONIA GARDN.

3*b*. CHRISTISONIA SCORTECHINII *Prain;* stem short, glabrous, scales linear, pedicels short or 0, calyx oblong, lobes acute; upper anthers

1-celled simple, lower thickened, connective produced behind into an oblong appendage with an acute tip.

MALAYAN PENINSULA: Perak, *Scortechini* 2121 !

Whole plant 1·5—3 in. high. Stems very stout, covered with linear scales. *Flowers* sessile or shortly peduncled, each with an oblong cucullate basal bract ·75 in. long, all parts loaded with sticky mucilage. *Calyx* spathaceous rupturing into usually 2, occasionally 3-4 lobes in the fully opened flower, the tube 1 in., the lobes ·25 in long. *Corolla*-tube white, with a yellow line inside in front, 2 in. long, infundibuliform and curved above, the lower part narrowly cylindric 1 in. long; limb 2-lipped; upper lip outermost in bud, erect, 2-lobed, lower lip 3-lobed, spreading. *Stamens* didynamous, anthers all conniving; filaments glabrous, inserted below middle of corolla-tube, 1-celled, adnate to the enlarged filament, lower pair with a projecting acute posterior process. *Ovary* 1-celled, placentas 2, 2-fid, uniformly covered with ovules; style glabrous downwards; stigma peltate, flat, ·2 in. in diameter.

A species that most nearly approaches *C. Hookeri* from the Khasia Hills, but by coloration and other characters is evidently abundantly distinct. Scortechini's specimens are not good but are fortunately supplemented by a manuscript description written in the field. Scortechini takes the processes on the lower anther-cells to be empty cells, but they appear to the writer to be due to the production beyond the anther of the thickened connective.

CXII. LABIATÆ.

15. ELSHOLTZIA WILLD.

13. ELSHOLTZIA (Euelsholtzia) KACHINENSIS *Prain;* pubescent, leaves short petioled, ovate acute, crenate, spikes broad, pubescent, fruiting calyx ·2 in. long, campanulate, glabrous.

UPPER BURMA: Kachin Hills, Nakharan Road, near water, *Shaik Muqim* ! Sima, 6,500 ft. elev.—*Shaik Muqim* !

A prostrate herb, stems pubescent 6-14 in. long, rooting below. *Leaves* ·6-·7 in. long, ·35-·4 in. wide, base cuneate, entire, margin elsewhere crenate, glabrous except the faintly puberulous midrib above, quite glabrous and paler beneath, nerves oblique, about 5 pairs, rather prominent beneath; petiole ·15 in. long, glabrous. *Spikes* ·5-·75 in. long, ·4 in. wide, rather pubescent, bracts subsecund, ovate to orbicular, cuspidate, imbricate, membranous, ·25 in. across; cusps subulate. *Calyx* in flower minute, in fruit slightly vesicular, teeth 5, short, triangular, with 5 nerves running up to the teeth and as many to the sinuses, the latter being close fine reticulations rather than nerves each with on the outside a corresponding raised spongy ridge. *Corolla* pinkish-purple, tube exserted curved, margins of lobes of upper lip ciliate, elsewhere glabrous. *Disk* with a large clavate gland much exceeding the ovary and as long as the ripe fruit. *Fruit* of a solitary nutlet with three abortive nutlets, the developed nutlet almost filling the slightly inflated fruiting calyx.

A very distinct species.

EXPLANATION OF THE PLATES.

Plate 7.

Geum (Sieversia) sikkimense *Prain.*

1, A plant × ½; 2 and 3, radical leaves, *nat. size*; 4, flower, dissected, *nat. size*; 5, fruiting head, *nat. size*; 6, stamens × 4; 7 carpel × 4; 8 and 9, ovules × 4; 10, ripe achene × 4; 11 and 12, seeds × 4.

Plate 8.

Potentilla sikkimensis *Prain.*

1, A plant, *nat. size*; 2, flower × 8; 3, flower, dissected × 8; 4, stamens × 8; 5, fruiting head, *nat. size*; 6, carpels, *much enlarged*; 7, ripe achene × 4; 8, the same, laid open × 4; 9, seed × 4.

Additions to the Collection of Oriental Snakes in the Indian Museum. —*By* Nelson Annandale, B.A., *Deputy Superintendent of the Indian Museum.* (With Plate IX)

In 1891 my predecessor Mr. W. L. Sclater published his *List of the Snakes in the Indian Museum.* Since that date a large number of specimens have accumulated, the more important coming from the North-West Frontier, Assam, Siam and Java. Among them are examples of species of intrinsic or geographical interest or new to our collection. I propose to offer to the Society a series of short papers on these specimens. For the sake of convenience, and in order not to interrupt other work in progress, I will deal with the accumulation in sections of moderate bulk. This will make it possible to put on record new specimens as they reach the Museum, and will enable such records to be published within a reasonable time. The names of species new to the collection since 1890 are distinguished by an asterisk. The identifications, except as regards the Afghan-Baluch species, are chiefly my own, and I have made a careful re-examination of such specimens as other officials of the Museum had determined.

Part I.

TYPHLOPIDÆ.

1. Typhlops diardii Schleg.

One specimen, presented by H. W. Biggie, Esq., from Pitsanuloke, N. Siam.

This species, known from Burma, Assam and Cochin China, does not appear to have been recorded from Siam.

2. Typhlops acutus (D. & B.)

T. acutus, *W. L. Sclater, J.A.S.B.* LX, p. 232; and *List Snakes*, p. 3.

One of the Museum attendants lately brought to the Superintendent a living specimen of this species from Calcutta. It was formerly regarded as quite a typical S. Indian form. Possibly the specimen may have been introduced into Calcutta with the earth round the roots of plants; but this does not seem probable. Sclater records the species from other parts of Bengal as well as Calcutta.

UROPELTIDÆ.

(3) *Silybura myhendræ* Bedd.* (4). *S. madurensis** Bedd, and (5) *Melanophidium punctatum** Bedd., all from S. India, have been added to the collection.

COLUBRIDÆ.

6. Xylophis stenorhynchus* (Gthr.)

7. Trachischium fuscum (Blyth)

Several specimens have been found in a large collection of Assamese snakes sent by the Government of Assam to the Museum in 1891.

8. Lycodon striatus (Shaw)

One specimen, obtained by Col. McMahon on the Perso-Baluch frontier.

9. Contia angusticeps.* Blgr. (Plate IX, fig. 1.)

Five specimens from Malakand, from Col. McMahon.

This species was described by Boulenger (*Cat. Snakes* ii, p. 262) after the publication of his volume in the "Fauna of India" series. The type, which was from Baluchistan, appears to have been lost. I think that the author of the species has examined at any rate some of the specimens collected in Malakand.

10. Lytorhynchus ridgewayi* Blgr.

L. ridgewayi, *Alc. and Finn, J.A.S.B.* LXV (2). 1896, p. 562.

11. Lytorhynchus maynardi* Alc. and Finn.

L. maynardi, *Alc and Finn, loc. cit.*

12. Zamenis diadema (Schleg.)

Two specimens, sent by Col. McMahon from the Perso-Baluch frontier. The larger is light in colour, with few markings; the smaller is well-marked. Neither belongs to the form *atriceps*.

13. Zamenis rhodorachis* Jan

Z. rhodorachis, *Alc. and Finn*, *op. cit.* p. 563.

In addition the specimens mentioned by these authors the Museum has lately received from Col. McMahon two specimens from the Perso-Baluch frontier.

14. Zamenis karelinii (Brandt)

Z. karelinii, *Alc. and Finn*, *loc. cit.*

Six specimens from Col. McMahon, from the same district as the last.

15. Stoliczkaia khasiensis* Jerd. (Plate IX, fig. 2.

S. khasiensis, *Blgr. Faun. Ind. Rept.*, p. 354, fig. 103; *Cat. Snakes*, i. p. 75.

In the collection of Assamese snakes to which reference has been made, I have been so fortunate as to find an example of this extremely rare species. It appears to be the second specimen known. The type, from the Khasi Hills, is in the British Museum. In the Indian Museum specimen the frontal shield is completely divided by a longitudinal suture. There are four small chin shields on each side, each in contact with the opposite shield mesially, the hindermost pair in contact with the first ventral behind. Ventrals—210: sub-caudals—116: anal entire: 28 rows body scales, the three lowest on each side pale with dark bases. Total length—809 mm: length of tail—235 mm.

The only other known species of this genus occurs in Borneo[1].—

16. Dipsadomorphus trigonatus (Schneid.) (Plate IX, figs., 3, 4.)

Dipsas trigonata, *Blgr. Faun. Ind. Rept.*, p. 358. *W. L. Sclater*, *List*, *Snakes*, p. 45. Dipsadomorphus trigonatus, *Blgr. Cat. Snakes*, iii, p. 63.

Three specimens sent by Col. McMahon from the Perso-Baluch frontier.

They agree in having the dorsal surface of head of an almost uniform sooty-black, which is most intense in the youngest specimen. The markings on the back also appear to be brighter than those of most examples from Peninsular India. A specimen from Assam agrees with them in this respect, but differs in having the head marked in the typical manner.

Should it be considered right to give the black-headed form a name, it may be known as var. *melanocephalus*.

The Perso-Baluch specimens exhibit—apart from their black heads—the close superficial resemblance to *Echis carinatus* noted by Boulenger

[1] *Stoliczkaia borneensis*, Blgr. *Ann. Mag. N. H.* (7) iv, 1899, p. 452.

and others. Of this venomous species no less than 15 specimens occur in Col. McMahon's small collection from the Perso-Baluch frontier.

17. DIPSADOMORPHUS MULTIMACULATUS (Boie)

Dipsas multimaculata, *Blgr. Faun. Ind. Rept.* p. 360. *W. L. Sclater, List Snakes*, p. 46. Dipsadomorphus multimaculatus, *Blgr. Cat. Snakes*, iii, pp. 63, 64.

A specimen from Pitsanuloke, N. Siam, has been presented by H. W. Biggie, Esq.

18. DIPSADOMORPHUS DIGHTONII* (Blgr.)

Dipsas dightoni, *Blgr. J. Bomb. N. H. Soc.* viii, 1894, p. 528, pl. Dipsadomorphus dightonii, *id.*, *Cat. Snakes* iii, p. 69.

A specimen from Peermerd, Travancore, has been obtained by exchange with the Trevandrum Museum.

19. DIPSADOMORPHUS DENDROPHILUS* (Boie)

D. dendrophilus, *Blgr. Cat. Snakes* iii, pp. 70, 71.

Several specimens from the Royal Natural History Society of Batavia.

The majority of the specimens belong to var. E. of Boulenger's *Catalogue;* the remainder to var. B. All are probably from the Malay Archipelago, but no exact locality can be assigned them.

20. TAPHROMETOPUM LINEOLATUM (Brandt)

T. lineolatum, *Alc. and Finn.*, *op. cit.* p. 563.

In addition to the specimens recorded by these authors, Col. McMahon has recently sent down seven from the Perso-Baluch frontier.

21. DRYOPHIS XANTHOZONA* Boie.

A specimen from the Royal Natural History Society of Batavia. Not an Indian species.

22. CHRYSOPELEA ORNATA (Shaw)

C. ornata, *S. Flower*, *P.Z.S.* 1899, p. 682.

A specimen of Boulenger's var. D from Pitsanuloke, N. Siam; presented by H. W. Biggie, Esq. This is the common variety in Assam, Burma, the Siamese Malay States and Siam proper.

23. BUNGARUS BUNGAROIDES (Cant.)

Two young specimens, measuring from 310–340 mm., from N. Cachar.

Coloration.—Dorsal surface intense black: ventral surface dark-grey with a pearly lustre. Chin and throat yellow: a yellow bar across the top of the head slightly behind the nostrils: head-shields sparingly dashed with yellow: an incomplete yellow collar on the nape. On the tail and body about sixty yellow rings, narrow and more or less V-shaped above, expanding below, sometimes joined together longitudinally by irregular blotches of the same colour on the belly.

VIPERIDÆ.

24. Eristocophis macmahonii* Alc. and Finn

E. Macmahonii, *Alc. and Finn, op. cit.* p. 564.

25. Pseudocerastes persicus* (Pall. ?)

P. persicus, *Blgr. Cat. Snakes* iii, p. 501.

A specimen, collected and presented by Lieut. F. C. Webb-Ware, from Koh Malik, Sujah, Baluchistan. I am not aware that this snake has hitherto been recorded from British India. Boulenger gives the distribution as Persia.

26. Ancistrodon rhodostoma* (Boie)

A. rhodostoma, *Blgr. Cat. Snakes* iii, p. 527; *Fascic. Malay. Zool.* i, pp. 170, 171, 176.

Several specimens from the Royal Natural History Society of Batavia.

This snake has recently been recorded by Boulenger from the Siamese Malay States and from the island of Salangka, Salang or Junk Ceylon. Probably it will be reported from Tenasserim also, as it is said to occur in Siam. The Malays of Patani, where Mr. H. C. Robinson and I have collected it, deny that its bite is deadly. A servant of mine was bitten in the foot by a snake which he stated to belong to this species near the Siamese border in Upper Perak. The effect was very little more serious than that of a hornet's sting. Boulenger, however, talks of "this large and deadly Crotaline snake," and probably the venom is more powerful in specimens from Java, where the snake would appear to be far more common than it is in most parts of the Malay Peninsula. All poisonous snakes except the Hydrophinæ are, however, scarce in both the Federated and the Siamese Malay States. In the latter, where I have spent, in the aggregate, more than a year collecting reptiles and other animals, I have only twice come across a cobra.

INDEX SLIPS.

BOTANY.

PRAIN, D. and BURKILL, I. H.—*On Dioscorea deltoidea*, Wall., *Dioscorea quinqueloba*, Thunb., *and their allies.* Journ. As. Soc. Bengal, LXXIII, pt. ii, 1904. Supplement, 1904.

DIOSCOREACEÆ.

Characters (p. 1.) division into groups (p. 2.) and key to eleven species of Dioscorea (p. 2).

Descriptions of the following new species:—

Dioscorea prazeri, from Burma (p. 2).
" *sikkimensis*, from Sikkim (p. 3).
" *panthaica*, from S. W. China (p. 6).
" *yokusai*, from Japan (p. 10).
" *enneanura*, from Central China (p. 11).

ZOOLOGY.

ANNANDALE, NELSON.—Contribution to Oriental Herpetology I. The Lizards of the Andamans, with the description of a new Gecko and a note on the Reproduced Tail in Ptychozoon homalocephalum. Journ. As. Soc. Bengal, LXXIII pt. ii, 1904. Supplement, pp. 12-22.

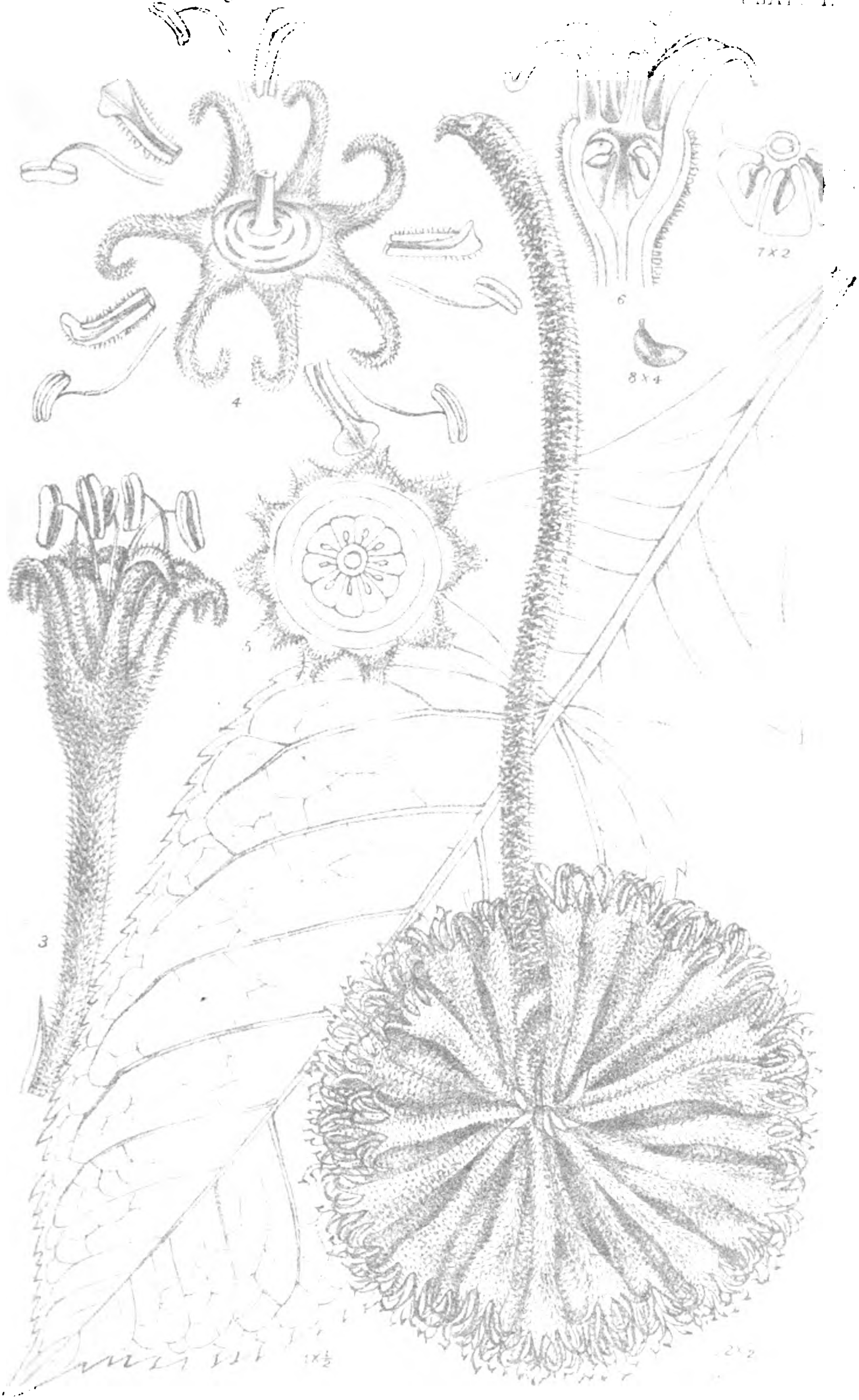
Burma, list of Geckos of, p. 15.
Sumatra, list of Geckos of, p. 15.
Ptychozoon homalocephalum, eggs of, p. 16; tail of, p. 22.
Gonatodes andersonii, sp. n., position of, p. 16; description of, p. 21.
Calotes versicolor, distribution and habits of, p. 18.
Gonyocephalus humei = *G. subscristatus* (aged individuals), p. 19.
Varanus salvator, habits of, p. 19.
Skinks of the Andamans, pp. 13, 19.
Geckos of the Andamans, pp. 12, 13, 14.
Draco, absence of from the Andamans, p. 20.
Calotes mystaceus, recorded from the Andamans, p. 18.
Gonatodes wicksii = *G. kandianus*, p. 21 (Stoliczka's specimens examined.)

PHYSIOLOGY.

INDEX.

Names of New Genera and Species have an asterisk (*) prefixed.

SUPPLEMENT.



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WOODBURNIA PENDULIFLORA Prain.

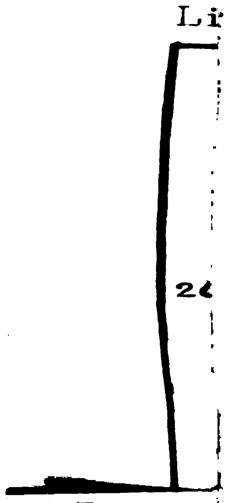
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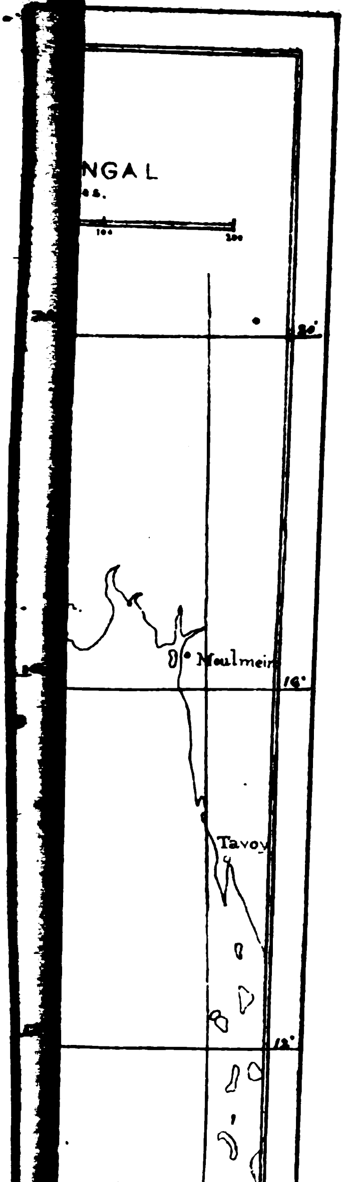
Plate III.



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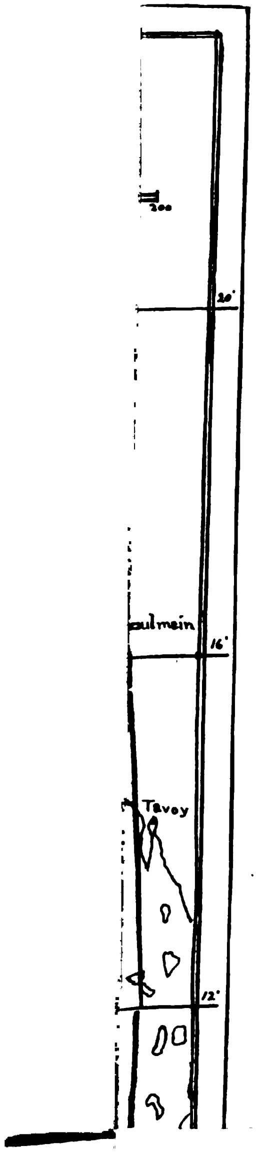
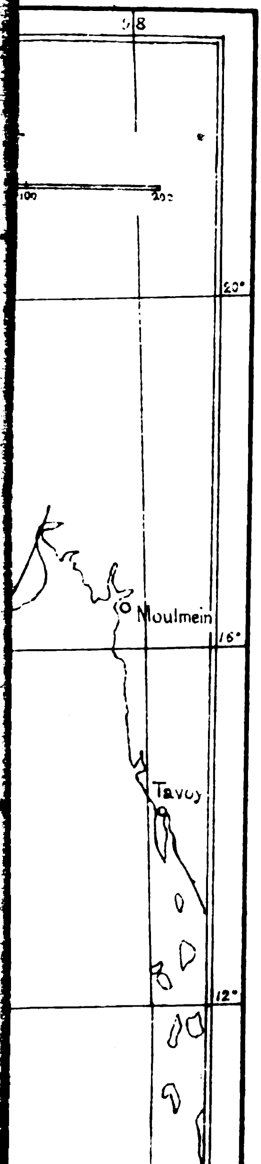
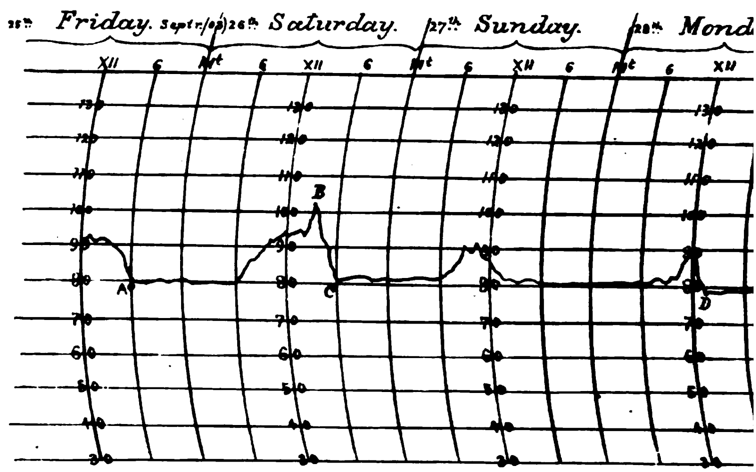


Plate V.





A marks the fall of temperature with the thunderstorm betw

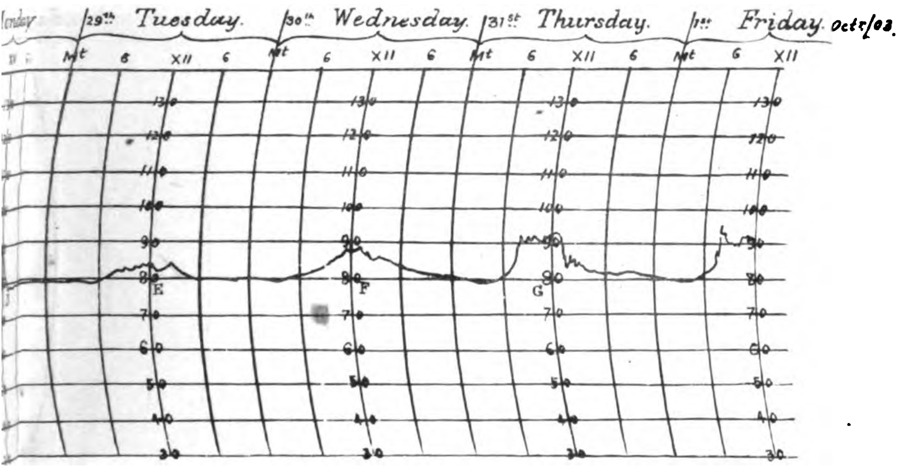
B. ,, the high temperature due to direct sunshine.

C ,, the fall of temperature with the thunderstorm between

D ,, the fall of temperature about noon of the 28th.

E ,, the small range of temperature during the cloudy

F. & G. ,, the steady recovery of temperature after the depr



...en 5 & 6 P.M. on the 25th.

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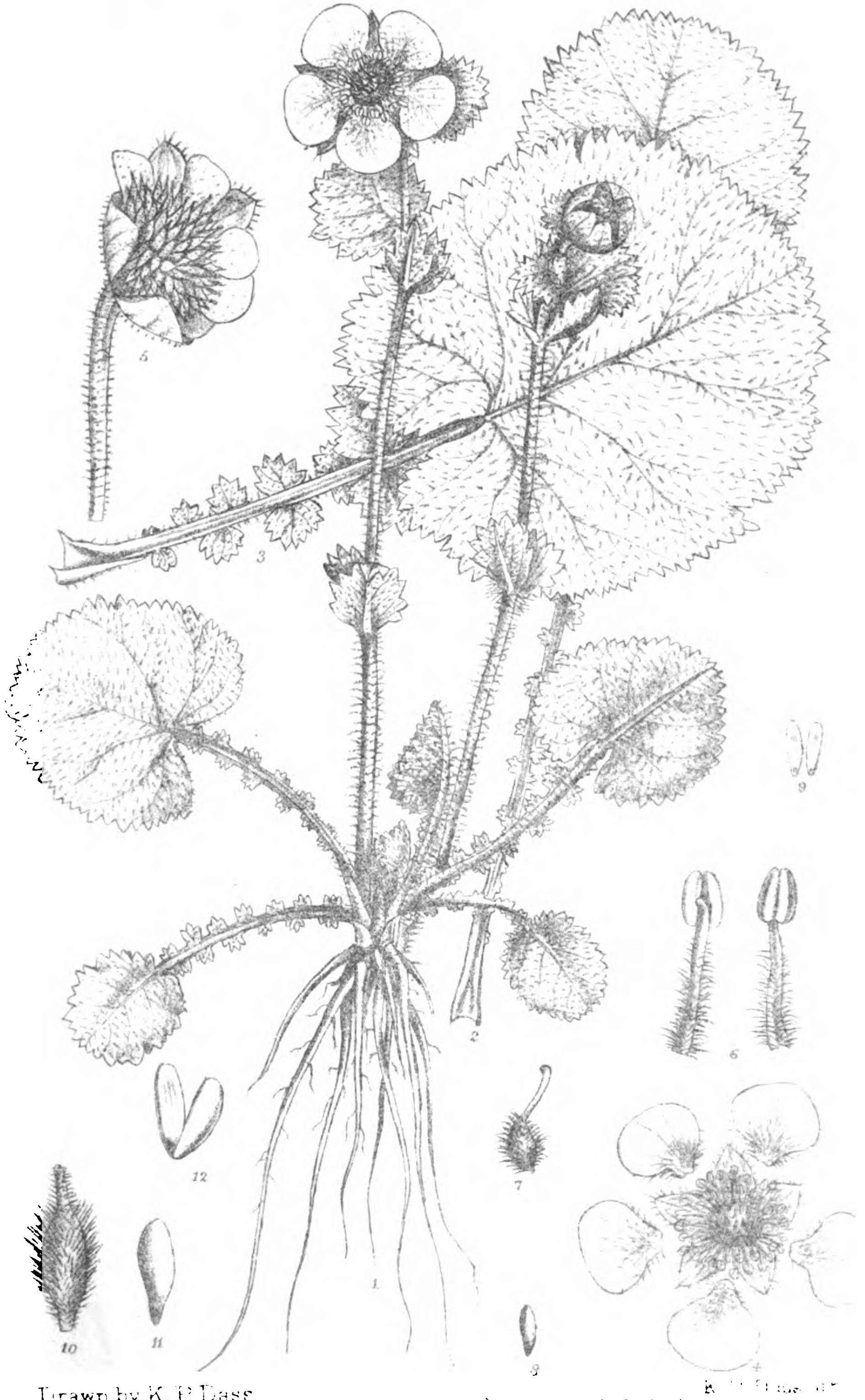
...ainy weather while the depression was over lower Bengal.

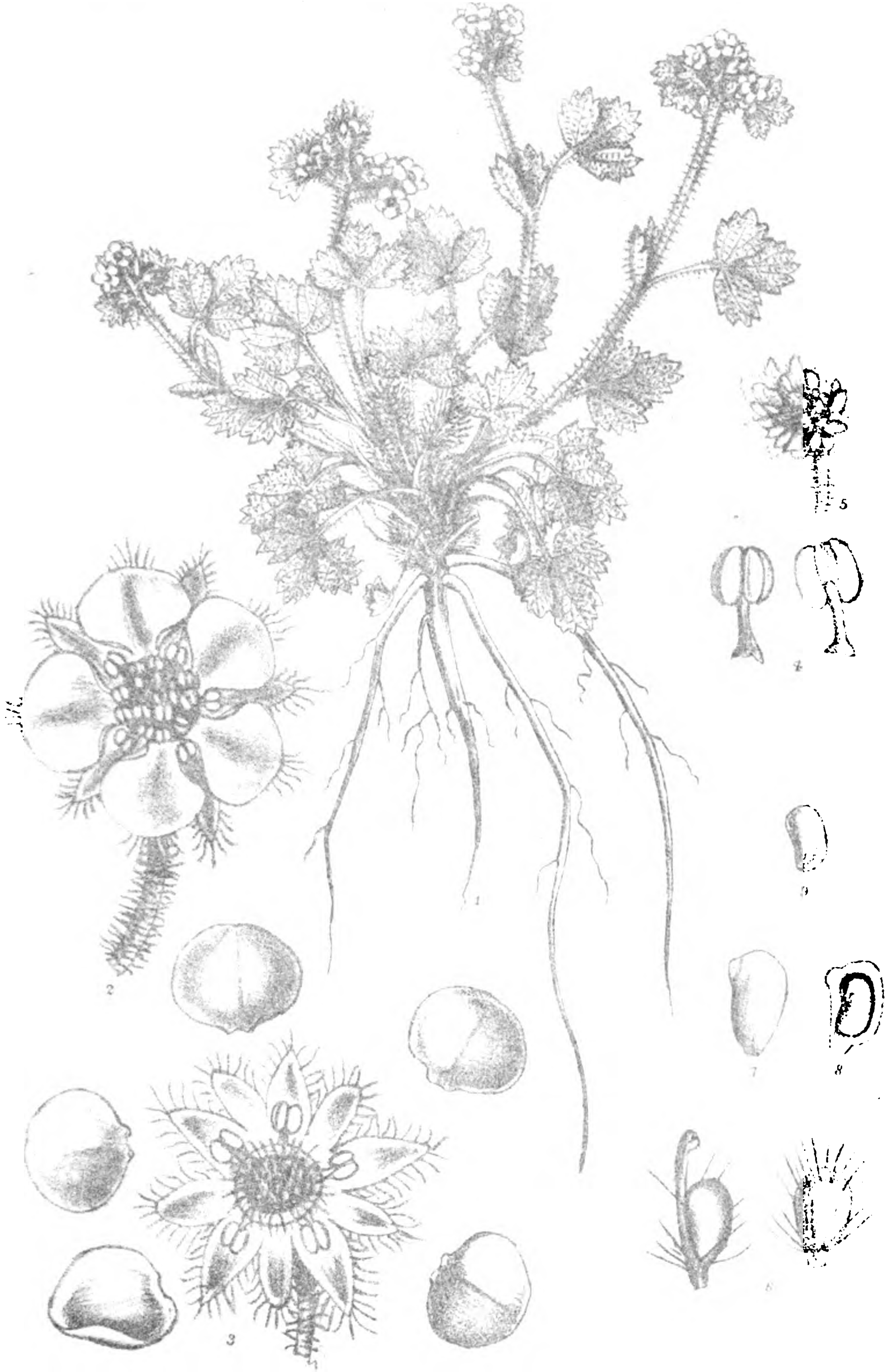
...ssion moved westward



Drawn by K. P. Dass

GEUM (SIEVERSIA) SIKKIMENSE Prain.

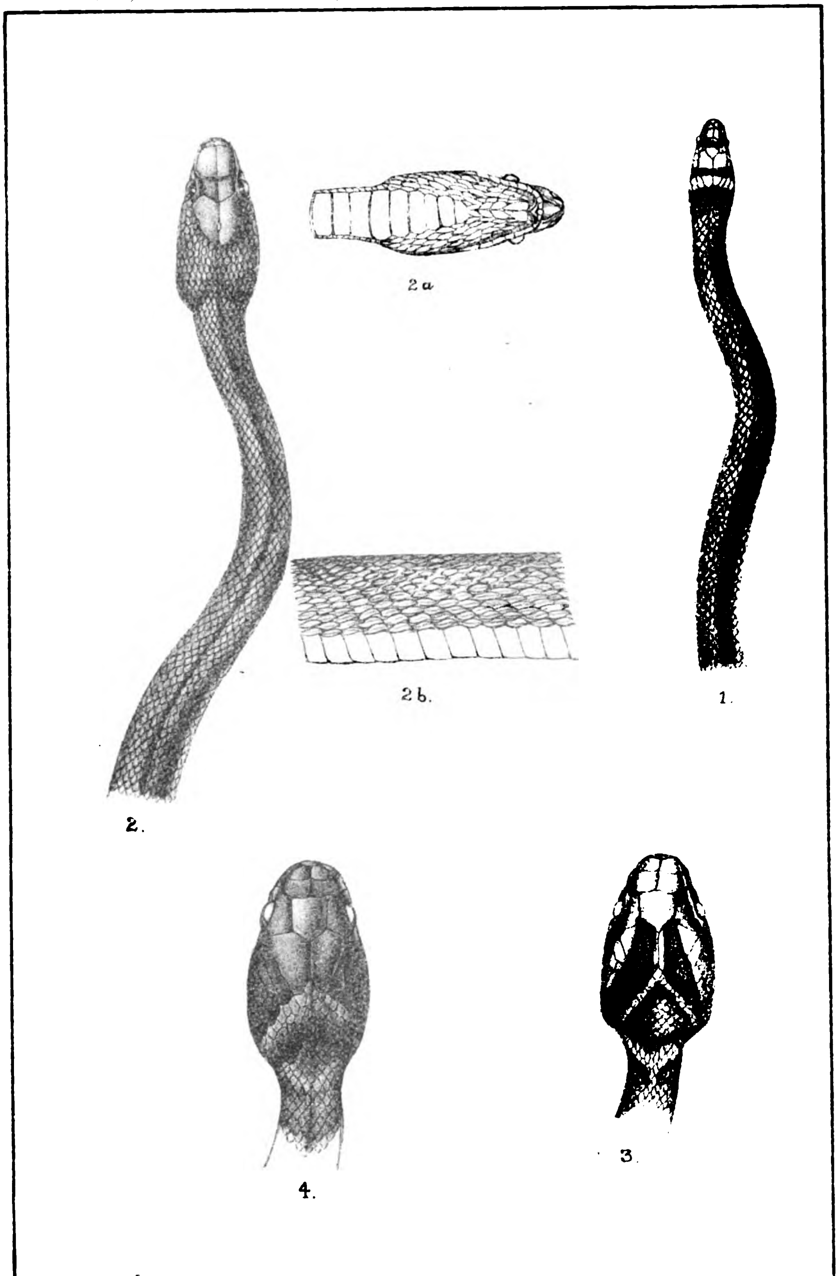
PLATE 8



Drawn by K. P. Dass.

POTENTILLA SIKKIMENSIS Prain.

K. P. Dass, lith.



G.C Chuckerburtty. del. Lith by A.C.Chowdhary.

1. CONTIA ANGUSTICEPS.
2. STOLIZKAIA KHASIENSIS.
3. DIPSADOMORPHUS TRIGONATUS
4. " " ver melanocephalus

JOURNAL

OF THE

ASIATIC SOCIETY OF BENGAL.

Vol. LXXIII. Part II.—NATURAL SCIENCE.

Supplement—1904.

On Dioscorea deltoidea, Wall., *Dioscorea quinqueloba,* Thunb., *and their allies.—By* D. Prain and I. H. Burkill.

In the following paper we describe eleven species of Dioscorea—three Indian, three Chinese, and five Japanese. They are all allied plants, with many characters in common: and as it may perhaps conduce to clearness we give the common characters as a preliminary.

Characters which these Yams have in common.

I. Tubers as far as known inedible, not lying deep in the soil, at times growing like rhizomes parallel with the surface.
II. Stems always twining to the left.
III. Leaves cordate (or truncate below), constricted more or less towards the middle, or else lobed, with 5–9 palmately arranged nerves.
IV. Male flowers generally two or more together.
V. Female spikes pendulous, with recurved fruit.
VI. Wings of capsules with a tendency to be quadrate.
VII. Seeds winged all round but irregularly so, apparently distributed as from swinging censers by the movement of the flexuous slender spikes in the wind.

The species group themselves naturally in a way that more or less accords with their distribution. The first little group contains four,—

Dioscorea deltoidea, D. sikkimensis, D. Prazeri, and *D. panthaica* which are found in the lower Himalaya and mountains east of it: they are all closely allied. Next stands rather alone *D. acerifolia* from Central China. Thirdly come the three closely allied Japanese species *D. septemloba, D. nipponica* and *D. quinqueloba.* Lastly stand two species from Japan, *D. tenuipes* and *D. Yokusai*, associated with *D. enneaneura* from Central China. Uline, who has recently done valuable work upon the genus Dioscorea, refers some of the species to a section which he names *Stenophora;* but it is not clear to us if he would so refer all. We therefore leave undiscussed for the present the question of sections.

Dioscorea birmanica, which we described in a recent paper, is allied to the yams under discussion; but, with the horizontal inedible rhizome and dependent female inflorescences and the censer mechanism for seed distribution, it combines leaves not constricted or lobed, as well as a robustness which is foreign to all except, it may be, *D. acerifolia;* moreover none are thorny to the degree that it is, and none have precisely similar cymules of male flowers.

The following is a key to the species which we shall forthwith describe:—

Anthers not didymous:—
  Leaves quite smooth beneath:—
    Male flowers not pedicelled ... ... *Prazeri.*
    Male flowers pedicelled ... ... *sikkimensis.*
  Leaves with hairs or papillæ beneath:—
    Male flowers sessile:—
      Male inflorescence slender, little branched ... ... *deltoidea.*
      Male inflorescence much branched, subthyrsoid ... ... *panthaica.*
    Male flowers stalked:—
      Male inflorescence long and rigid ... ... *acerifolia.*
      Male inflorescence slender:—
        Leaves 7-lobed, lobes acute ... ... *septemloba.*
        Leaves 3-5-lobed, lobes obtuse:—
          Capsule longer than wide ... ... *nipponica.*
          Capsule as wide as long ... ... *quinqueloba.*
Anthers didymous:—
  Perianth segments equal ... ... *tenuipes.*
  Perianth segments unequal:—
    Male flowers in cymules, larger ... ... *Yokusai.*
    Male flowers solitary or in pairs, smaller ... ... *enneaneura.*

DIOSCOREA PRAZERI. *Rhizoma* crassum, aliquanto informe, parum hypogæum, venenosum, carne albo. *Caulis* e radice singulus, glaber, sinistrorsum volubilis, teretiusculus, inermis, viridis, bulbifer. *Folia* alterna, chartacea, utrinque glaberrima, subtus glauca, pellucide punctata, late cordata vel sursum ovato-cordata, acuminata, apice minutissime mucronulata, basis sinu lato vel latissimo, margine nonnunquam plus minusve undulata, 7- vel 9-nervia, nervis extimis profunde bifidis, nervulis secondariis reticulatis utrinque distinctis, plurima 8–12 cm. longa 10–16 cm. lata, nonnunquam tamen ad 20 cm. longa lataque: petiolus glaber, sulcatus, 4–7 cm. longus. *Spicæ masculæ* simplices (rarius singulæ sæpius 2–6-næ) vel paniculatæ, axillares; flores glomerati, 2–3-ni, sessiles in rhachi trigona sparsim sed fere prorsus dispositi: pedunculus glaber: bracteæ sub ramulis panicularum lanceolatæ 3mm. longæ, sub glomerulis florum ovato-lanceolatæ: bracteolæ ovato-acuminatæ, naviculari-concavæ. *Perianthii masculi* laciniæ ovatæ, obtusæ, subæquales et subsimiles, patentes. *Stamina* 6, æqualia, filamentis æquilonga: antheræ filamentis multo breviores. *Spicæ femineæ* axillares, solitariæ, simplices, ad 12 cm. longæ, dependentes; flores ad 10–12, sessiles, deorsum spectantes, circiter 1 cm. remoti: bracteæ et bracteolæ adsunt. *Capsulæ* sessiles, assurgentes: alæ maturæ pergamentaceæ, irregulariter subquadrato-semicirculares, 2·5 cm. longæ, 1·5 cm. latæ, stramineo-corneæ, glaucescentes. *Semina* in loculo quoque gemina, ovato-oblonga, ·85 cm. lata, 1·25 cm. longa circumcirca alata, rufo-brunnea.

Northern Burma. Upper Chindwin District: Sittaung, *Prazer.* Bhamo District: Bhamo, *Burkill* in herb. R.E.P. 21537; Momouk, east of Bhamo, *Burkill* in herb. R.E.P. 21507, 21509, 21514. Katha District: Katha, in forests on black soil, *Burkill* in herb. R.E.P. 21557, 22493, 22494, 22495, 22496, 22652, 22658, 22664, 22665.

In the districts of Bhamo and Katha this Dioscorea occurs in the forests of Dipterocarps.

Dioscorea sikkimensis. *Rhizoma* crassum, aliquanto informe, parum hypogæum, venenosum, carne luteo-albo. *Caulis* e radice singulus, glaber, sinistrorsum volubilis, teretiusculus, inermis, purpureo suffusus, bulbifer (an semper?). *Folia* alterna, chartacea, utrinque glaberrima, subtus læte viridia, pellucide punctata, subdeltoideo-ovato-cordata vel late cordata, acuminata, apice minutissime mucronulata, basis sinu lato vel latissimo, margine nonnunquam plus minusve undulata, 7- vel 9-nervia, nervis extimis profunde bifidis, nervulis secondariis reticulatis utrinque distinctis, plurima 9–16 cm. longa, 7–9 cm. lata nonnunquam tamen usque ad 20 cm. longa lataque: petiolus glaber, sulcatus, 4–7 cm. longus. *Spicæ masculæ* simplices vel rarius paniculatæ, singulæ vel binæ vel ternæ, axillares: flores glomerati, 2–3-ni, breviter pedicellati, glomerulis in rhachi trigona 2–4 mm. distantibus:

pedunculus glaber: bracteæ sub ramulis panicularum lanceolatæ, 3 mm. longæ, sub glomerulis ovato-lanceolatæ pedicellos subæquantes: bracteolæ ovato-acuminatæ, naviculari-concavæ, pedicellis dimidio breviores. *Perianthii masculi* laciniæ ovatæ, subacutæ, subæquales et subsimiles, patentes. *Stamina* 6, æqualia, filamentis æquilonga: antheræ filamentis breviores. *Spicæ femineæ* axillares, solitariæ, simplices, ad 12 cm. longæ, dependentes; flores ad 10–12, sessiles, deorsum spectantes, circiter 1 cm. remoti: bracteæ et bracteolæ adsunt. *Capsulæ* sessiles, assurgentes: alæ maturæ pergamentaceæ, irregulariter subquadratæ, 2 cm. longæ, 1 cm. latæ, stramineo-corneæ, livido suffusae, glaucescentes, majores ad 2·75 cm. longæ, ad 1·6 cm. latæ. *Semina* in loculo quoque gemina, complanata, subquadrata, ·85 cm. diam., ala membranacea alba inæqualiter circumcincta.—Dioscorea deltoidea, Hook. f., Fl. Brit. Ind. VI., (1892), 291, partim.

EASTERN HIMALAYA. Sikkim: without precise locality, 1000–5000, feet, *J. D. Hooker*, No. 7, Herb. Ind. Or.; Herb. *Griffith*, 5555; Great Rungeet, 1800–2500 feet, *T. Anderson*; Rungeet Valley, *Kurz*; Rungeet, *C. B. Clarke*, 8936; Rungneet Valley, 4000 feet, *Gamble*, 9764; Dikiling, 2000 feet, *C. B. Clarke*, 9682; Naksabari, *Gamble*, 322 D; Tukwar, 3000 feet, *Gamble*, 9799; Pashok, 7000 feet, *Lister*; Mungpoo, *Hartless*, *Gammie*, *Dungboo*, 2000 feet and 3500 feet, *King*; also 600–3000 feet, *King*; Restrop, *Prain's Collector*; Silake, *Prain*; Nagree, 3000 feet, *T. Anderson*; between Richi and Rinchingpong, 2000–2500 feet, *T. Anderson*. Western Duars: *Haines*, 4187. Nepal: *Scully*, 34.

Dioscorea sikkimensis is the Kencheong or Kúkur Turul of Sikkim. It was included in *D. deltoidea* in the Flora of British India by Sir Joseph Hooker. It is indeed closely allied to that species: but it differs markedly in the absence of the short crisp simple hairs that are so abundant on the veins and nerves of the under surface of the leaf of *D. deltoidea*. There are besides other differences: the rhachis of the inflorescence in both sexes of *D. sikkimensis* is distinctly angled, while that of *D. deltoidea* in the male is terete and in the female only slightly angled: the fruit is also slightly different in shape; it is sessile and destitute of purple lines or dots in *D. sikkimensis*, while that of *D. deltoidea* is distinctly pedicelled. It is to be noted that both *D. deltoidea* and *D. sikkimensis* occur in Central Nepal, which is the eastern limit of the one and the western limit of the other.

More closely allied to *D. sikkimensis* than *D. deltoidea*, is *D. Prazeri*. The chief differences between the two are (i) in the male flowers, which in *D. Prazeri* are sessile and in *D. sikkimensis* are distinctly pedicelled, (ii) in the seeds, which are of a different colour and shape, and (iii) in the foliage which is chiefly composed of wide cordate leaves in the Burmese plant, though there are leaves on the ultimate branches which are longer than broad as is the usual condition in the Sikkim plant. In *D. sikkimensis* such leaves as there may be, which are as long as they are broad, are confined to the lower part of the main stem. The male plant of *D. Prazeri* is often bulbilliferous: this is a rare condition in *D. sikkimensis*. The bulbils of both when present are smooth with a silvery skin: the specimen of *D. Prazeri* collected by one of us at Momouk, east of Bhamo, close to the Chinese frontier, had such silvery bulbils, slightly verrucose, and Haines notes on the ticket of his Duars specimen that it bore bulbils with a silvery smooth skin.

We have had the two species in cultivation, side by side, at the Royal Botanic Gardens, Sibpur, where they flowered simultaneously, but at the end of September the leaves of *D. Prazeri* were in full defoliation, while *D. sikkimensis* as still in vigorous growth.

DIOSCOREA DELTOIDEA, Wall. *Rhizoma* crassum, aliquanto informe, parum hypogæum, venenosum, carne albido. *Caulis* glaber, sinistrorsum volubilis, teretiusculus, inermis, viridis. *Folia* alterna, chartacea, supra glaberrima, subtus ad nervos et nervulos pilis minutis simplicibus hirtella, pellucide lineolata, basis sinu lato vel latissimo, subdeltoideo-cordato-ovata, acuminata, apice minutissime mucronulata, margine sæpissime plus minus undulata necnon aliquomodo ad medium constricta, 7-nervia, nervis extimis profunde bifidis, vel 9-nervia, nervulis secondariis reticulatis utrinque distinctis, ad 12 cm. longa, ad 10 cm. lata: petiolus glaber, sulcatus, tenuis, 4–12 cm. longus. *Spicæ masculæ* simplices vel (inferiores) compositæ, axillares; flores glomerati, 2–3-ni, sessiles, in rhachi angulata glomerulis ·5–1 cm. distantibus sparsim dispositi: pedunculus glaber, simplex ad 15 cm. longus vel maximus ad 30 cm.: bracteæ lanceolatæ, ad 2 mm. longæ: bracteolæ ovato-acuminatæ, naviculari-concavæ, glabræ, floribus dimidio breviores. *Perianthii masculi* laciniæ ovatæ, obtusæ, subæquales, patentes. *Stamina* 6, æqualia, filamentis æquilonga; antheræ filamentis multo breviores. *Spicæ femineæ* axillares, solitariæ, simplices, 8–15 cm. vel rarissime ad 25 cm. usque longæ, dependentes: flores 4–12, breviter pedicellati, deorsum spectantes, circiter 1 cm. remoti: bracteæ et bracteolæ adsunt. *Capsulæ* breviter pedicellatæ, assurgentes: alæ maturæ pergamentaceæ, vertice versus subquadratæ, basin versus rotundatæ, stramineo-corneæ, punctulis lineolisque purpureis horizontaliter notatæ, ad 3 cm. longæ, 1.6 cm. latæ. *Semina* in quoque loculo gemina, latissima, complanata, 11 mm. longa, 15–18 mm. lata, ala membranacea loculam fere implente inæqualiter circumcincta,—*Dioscorea deltoidea*, Wall. Cat. (1832), 5100; Stewart in Journ. Agric. and Hortic. Soc. Ind. XIV., (1867), p. 37; Kunth, Enum. V., (1850), 340; Hook. f., Flor. Brit. Ind. VI., (1892). 291 pro parte; Duthie in Records Bot. Survey Ind. I., (1898), 173, Lawrence, Valley of Kashmir, (1895), p. 75; Griseb. in Mart., Flor; Brasil., III., (1842), i. 43, quoad Wall. Cat., 5100, sed ref. ad Rumph. Hort. Amb., V., t. 180 exclus.

NORTH-WEST HIMALAYA. Without locality, *Stoliczka:* Herb. *Falconer*, 1116. Chitral: Ziarat, 7200 feet, *Harriss*, 16683, 16684. Dir:

Mirga, 7200 feet, *Gatacre*, 17567, 17568. Hazara district: without precise locality, but abundant in many places, 3000–6000 feet, *Stewart;* hill between Mahowa and Bojdarrah, *Stewart* in litt., l. c.; Khagan, Valley, 4800 feet, *Inayat*, 20205, 20205a, *Stewart*, 603½. Kashmir: near Muliyal, *Winterbottom*, 336; Baramula, *Winterbottom*, 335; above Shapiyon, 7000 feet, *C. B. Clarke*, 28566. Chamba: between Tisa Nala and Bara, 6000 feet, *Lace*, 1381; Pangi, on the Chenab, *Brandis*, 3362; Kulal Forest in Pangi, 8000 feet, *Lace*, 1669. Kulu: Phulga, *Watt*, 13473. Simla: Gowai, 6000 feet, *Gamble*, 5140; Narkanda *Brandis*; Chur, 8000 feet, *J. R. Drummond:* Jubal, 5000–7000 feet, *Edgeworth*. Bhaji Forest, *Kalka Pershad* in herb. R. E. P. 19065. Bashahr: Dippi, 7000 feet, *Brandis*, 3361. Jaunsar: Konam, 7000 feet, *Webb*, 153. Dehra Dhun: Mussoori, *Brandis*, 1477, *King;* Mussoori Range, *King*. Tehri-Garhwal: Ganges valley near Jhala, 8000–9000 feet, *Duthie*. British Garhwal: *King*. Kumaon: Kuntagong, 5000–8000 feet, *T. Thomson;* near Kathe, 7500 feet, and Valley of Sarju at 3500 feet, *Strachey and Winterbottom*, 1; Sujahce Devee, Puinath Village, Barchoola Ridge, *Strachey and Winterbottom* 68; near Kupkot, 3500 feet, *Strachey and Winterbottom*, 570. Nepal: Sankas, *Wallich*, 5110.

Dioscorea deltoidea may flower very much earlier than its allies; it was collected in young fruit in the Bhaji Forests in the end of May.

Although in no places eaten as food, it is not without its uses. Sir George Watt notes on the ticket of his specimen "Roots used for washing clothes, especially wool; vern. name "Shingli": and Sir Walter Lawrence in his Valley of Kashmir, p. 75, calls it Krits, and says that the root is used as a diuretic in doses of 1 dram, and that in large doses it is a poison. E. T. Atkinson in the Gazetteer of the North-Western Provinces, X., (1882), p. 703, names a plant as *D. deltoides*, and calls it "Gun" in the vernacular: doubtless he means *D. deltoidea*. Stewart in his Panjab Plants, (1869), p. 128, under *D. deltoidea*, gives a number of vernacular names many of which seem to belong to another widely distinct species of Dioscorea.

DIOSCOREA PANTHAICA. *Radix* ignota. *Caules* glabri, sinistrorsum volubiles, teretiusculi, ad basin petioli spinis flaccidis stipulinis obsiti, purpurei. *Folia* alterna, chartacea, supra glaberrima, subtus ad nervos et nervulos papillis minutissimis simplicibus densius hirtella, pellucide punctata, subdeltoideo-ovato-cordata, acuminata, apice minutissime mucronulata, basis sinu latissimo, margine plus minus undulata, 7-nervia, nervis extimis profunde bifidis, vel 9-nervia, nervulis secondariis reticulatis parum distinctis, 8·5 cm. longa, 6 cm. lata: petiolus glaber, sulcatus, tenuis, 5 cm. longus. *Spicæ masculæ* simplices, in paniculas axillares dispositæ,; flores 2-ni in glomerulis sessilibus 4–6 mm. remotis in rhachi nonnunquam minopere angulata ad angulas nonnunquam papilloso-lineolata dispositi: panicula 12 cm. longa: spicarum rhachides 4·5 cm. longæ: pedunculus paniculæ 3 cm. longus: bracteæ lanceolatæ, ad 1·5 mm. longæ: bracteolæ ovato-acuminatæ, naviculari-concavæ, glabræ, floribus breviores. *Perianthii masculi* laciniæ ovato-oblongæ, obtusæ, subæquales et subsimiles patentes. *Stamina* 6, æqualia, antheræ filamentis multo breviores. *Planta feminea* ignota.

South-West China. Yunnan: Mengtse, northern mountains, at 7000 feet, *A. Henry*, 11065.

This species seems to be most nearly allied to *D. deltoidea.*

Dioscorea acerifolia, Uline ex Diels. *Radix* ignota. *Caules* glabri, sinistrorsum volubiles, teretes, inermes, nigro-purpurei. *Folia* alterna chartacea, supra glaberrima, subtus ad nervos et nervulos pilis minutis nunc sparsim nunc densius hirtella, pellucide lineolata, cordato-acuminata, apice minutissime mucronulata, basis sinu latissimo, margine undulata vel sæpius palmatim sinuata vel lobata, lobis obtusis vel nonnunquam acutis, 9- vel 11-nervia, nervis extimis profunde bifidis vel trifidis, nervulis secondariis reticulatis subtus distinctis, 10–18 cm. longa, 10–12 cm. lata: petiolus apicem versus hirtellus, cæterum glaber, crassior, supra canaliculatus, 10–12 cm. longus. *Spicæ masculæ* simplices vel parum ramosæ, sæpius solitariæ, nonnunquam binæ, axillares, 20–25 cm. longæ: flores in cymulas in rhachi puberula 5–7 mm. remotas dispositi: pedunculus puberulus, 4·5–5 cm. longus: bracteæ lanceolatæ, ad 2 mm. longæ: bracteolæ ovatæ, acuminatæ, glabræ, floribus breviores. *Perianthii masculi* laciniæ ovato-oblongæ, obtusæ, subæquales, patentes. *Stamina* 6, æqualia; antheræ filamentis paullo breviores. *Spicæ femineæ* axillares, solitariæ, simplices, 16–20 cm. longæ, dependentes; flores 30–40, sessiles, deorsum spectantes, circa ·75 cm. remoti: bracteæ et bracteolæ adsunt. *Capsulæ* sessiles, assurgentes: alæ maturæ pergamentaceæ, basin versus rotundatæ, apice parum retusæ, stramineæ, purpureo notatæ, 2 cm. longæ, 8 cm. latæ. *Semina* in loculo quoque gemina, obovata, complanata, ala membranacea alba irregulariter circumcincta. *Dioscorea acerifolia*, Uline ex Diels in Engl. Bot. Jahrb. XXIX., (1900), 261. D. quinqueloba, C. H. Wright, in Journ. Linn. Soc. Bot. XXXI, (1903), 92 (syn. excl.).

Central China. Hupeh: without precise locality, *A. Henry*, 150. Chienshih, *A. Henry*, 5870; Patung, *A. Henry*, 7358.

Wright, uniting *D. acerifolia* and *D. quinqueloba*, adds to the above localities some in northern China: we are unable to state to which of the two species these northern specimens belong. Diels adds to Dr. Henry's localities in Central China

"Nanshan, *Rosthorn*, 2128": and he further describes a variety, naming it var. *Rosthornii*, also from Nanshan, in the following words:—"foliis amplis acutissime acuminatis subtus ad nervos albo-setulosis ideoque cinerascentibus."

DIOSCOREA SEPTEMLOBA, Thunb. *Radix* ignota. *Caules* glabri, sinistrorsum volubiles, teretes, inermes, virides. *Folia* alterna, tenuiter chartacea, supra glaberrima, subtus ad nervulos minute papillosa, opaca nec pellucide lineolata, ex siccitate brunnea, cordata, acuminata, apice minutissime mucronulata, basis sinu lato, margine septemloba lobis basalibus obtusis sed cæteris subacutis vel acutis, 7-nervia, nervis extimis profunde bifidis, nervulis secondariis reticulatis subtus distinctis sursum obscuris, 10 cm. longa, 12 cm. lata. *Spicæ masculæ* ignotæ. *Spicæ femineæ* axillares, solitariæ, simplices, 8–10 cm. longæ, dependentes; flores 10–12, sessiles, circiter 1 cm. remoti: bracteæ fructu maturo late ovatæ: bracteolæ ovatæ, acuminatæ. *Capsulæ* sessiles, assurgentes, colore cupreæ: alæ maturæ pergamentaceæ, basin versus attenuatæ, apice rotundato-truncatæ, 2 cm. longæ, 1·2 cm. latæ, castaneæ. *Semina* in quoque loculo gemina, obovata, complanata, ala membranacea alba inæqualiter circumcincta. *Dioscorea septemloba*, Thunb., Fl. Jap., (1784), 149. D. quinqueloba, Franchet et Savatier, Enumr. Flor. Jap., II., (1879), 46.

CENTRAL JAPAN. Island of Nippon: Joshu (Hitachi); Yubiso, *Makino.*

Makino gives the Japanese name as Momiji-dokoro on the label of a herbarium specimen kindly sent to us from the Hongkong Herbarium by Mr. S. T. Dunn.

DIOSCOREA NIPPONICA, Makino. *Radix* ignota. *Caules* glabri, sinistrorsum volubiles, teretes, inermes, virides. *Folia* alterna, chartacea, supra glaberrima, subtus ad nervos et nervulos pilis albis simplicibus hirtella, opaca nec pellucide lineolata, subdeltoideo-cordato-ovata, acuminata, apice minutissime mucronulata, basis sinu lato, margine undulata vel parum 5–7-lobata, lobis rarissime subacutis, 7–9-nervia, nervis extimis bifidis, nervulis secondariis supra obscuris subtus subdistinctis, 7–10 cm. longa, 5–10 cm. lata: petiolus apicem versus hirtellus, cæterum glaber, gracilis, supra canaliculatus, 4–8 cm. longus. *Spicæ masculæ* ignotæ. *Spicæ femineæ* axillares, simplices, singulæ, 15–25 cm. longæ, dependentes: flores 25–30, sessiles, deorsum spectantes, 5–8 mm. remoti: bracteæ lineari-lanceolatæ, acutissimæ: bracteolæ similes, minores. *Capsulæ* sessiles, assurgentes, stramineæ, purpureo-punctatæ: alæ maturæ semiovatæ, apice retusæ, basin versus attenuatæ vel rotundatæ, stramineæ, 2 cm. longæ, ·6–·7 cm. latæ. *Semina* in quoque loculo gemina. ovata, complanata, ala membranacea alba inæqualiter circumcincta.

Dioscorea nipponica Makino, Illustr. Flor. Jap., I., (? 1891) No. 1 (not seen).

CENTRAL JAPAN. Island of Nippon: Joshu (Hitachi); Schimizu-toge, *Makino.*

Makino gives the Japanese name as Uchiwa dokoro on the label of a herbarium specimen kindly sent to us by Mr. S. T. Dunn from the Hongkong Herbarium. Besides this specimen we have seen a coloured drawing of the fruit made by Mr. Makino.

DIOSCOREA QUINQUELOBA, Thunb. *Radix* ignota. *Caules* glabri, sinis; trorsum volubiles, teretes, inermes, virides. *Folia* alterna, tenuiter chartacea, supra glaberrima, subtus nonnunquam ad nervos et nervulos pilis minutis simplicibus hirtella, pellucido lineolata, cordata, acuminata, apice minutissime mucronulata, basis sinu lato, infima septem—, rare novem—, loba, media quinqueloba, superiora triloba vel sinuata, 7-nervia, nervis extimis profunde bifidis, nervulis secondariis reticulatis utrinque distinctis, 6–8 cm. longa, 5–10 cm. lata: petiolus glaber, canaliculatus, 3–7 cm. longus. *Spicæ masculæ* simplices vel ramosæ, solitariæ vel binæ, axillares, 4–6 cm. longæ pedunculo ·5–1·0 cm. longo incluso: flores pedicellati, in cymulis ·3–·4 cm. remotis dispositi: rhachis pedunculusque glabri: bracteæ lanceolatæ, 1·5 mm. longæ: bracteolæ ovatæ, acutæ, glabræ, floribus breviores. *Perianthii masculi* laciniæ ovatæ, obtusæ, subæquales, patentes. *Stamina* 6, æqualia: antheræ filamentis multo longiores. *Spicæ femineæ* axillares, solitariæ vel geminæ, simplices, 10–12 cm. longæ, dependentes; flores 10–12, breviter pedicellati, deorsum spectantes, circa ·75 cm. remoti: bracteæ et bracteolæ adsunt. *Capsulæ* assurgentes: alæ maturæ pergamentaceæ, basin versus rotundatæ, apice truncatæ, 1·75 cm. longæ, ·7 cm. latæ, stramineæ. *Semina* in quoque loculo gemina, latissima, complanata, ala membranacea alba inæqualiter circumcincta.—*Dioscorea quinqueloba*, Thunb. Flor. Jap., (1784), 150; Kæmpfer, Ic. Sel., (1791), t. 15 (a satisfactory picture) Somoku Dusets, 2nd. ed., XX., t. 54.

SOUTHERN JAPAN. Island of Kiusiu, Nagasaki, *Buerger*, *Oldham* 890, *Maximowicz.*

The Japanese name as given in the Somoku Dusets is Kikuba Dokoro.

DIOSCOREA TENUIPES, Franchet et Savatier. *Radix* nobis ignota, teste Franchetio Savatieroque tuberosa et depresso-globosa. *Caules* glabri, sinistrorsum volubiles, teretiusculi, juniores minopere angulati, inermes, virides. *Folia* alterna, membranacea, glaberrima, nitentia, margine interdum undulationibus minutis notata, cordato-ovato-acuminata vel subdeltoideo-cordata-ovato-acuminato, apice mucronulata, basis sinu lato, aliquomodo ad medium constricta, 7–9-nervia, nervis extimis profunde bifidis, nervulis secondariis reticulatis utrinque distinctis, ad 9–10 cm. longa, 6–10 cm. lata: petiolus glaber, supra parum canaliculatus, 6 cm. longus. *Racemi masculi* simplices, solitarii vel 2–4-ni, 10 cm. longi; flores longius pedicellati, glomerati, 2–5-ni (glomerulis ·75 cm. remotis) sparsim dispositi: pedicelli 3–5 mm. longi (teste Franchetio Savatieroque 5–8 mm. longi). Pedunculus glaber, ad 3 cm. longus; bracteæ ovato-lanceolatæ, ad 2 mm. longæ; bracteolæ suborbiculatæ, glabræ, pedicellis multo breviores. *Perianthii masculi* laciniæ lanceolatæ, obtusiusculæ, refractæ, subæquales. *Stamina* 6, æqualia, perianthio distincte breviora: antheræ didymæ. *Spicæ femineæ* axillares, simplices, solitariæ, usque ad 12–15 cm. longæ, dependentes; flores ad 25, solitarii vel cymulosim bini (alter major alter minor) in ramulis perbrevibus 5–7 mm. distantibus dispositi, deorsum spectantes: rhachis distincte trigona, aliquomodo zigzag. *Perianthii masculi* laciniæ iis floris masculi similes: bracteæ et bracteolæ adsunt. *Capsulæ* assurgentes, latiores quam longæ, basi et apice emarginatæ (teste Franchetio Savatieroque). *Semina* (teste Maximowicz) circumcirca alata.—*Dioscorea tenuipes*, Franchet et Savatier, Enum. Flor. Jap., II., 525. Dioscorea sativa, Miq., Prolusio Flor. Jap., (1867), 323, quoad plantam masculam.

SOUTHERN JAPAN. Island of Kiusiu: Nagasaki, *Maximowicz*. Island of Shikoku: Tosa; Nanokawa, *Makino*.

DIOSCOREA YOKUSAI. *Radix* ignota. *Caules* glabri, sinistrorsum volubiles, minopere angulati, inermes, virides. *Folia* alterna, membranacea, glaberrima, nitentia, cordato-acuta vel breviter acuminata, apice mucronulata, sinu basis latissimo, margine integra vel plus minus undulata, nonnunquam ad medium constricta, 7-nervia, nervis extimis profunde bifidis, nervulis secondariis reticulatis subtus distinctis, 5 cm. longa, 5 cm. lata: petiolus glaber, gracilis, supra profunde canaliculatus, 3·5 cm. longus. *Inflorescentia mascula* per rhachin angulatam ad 7 cm. longam cymulas 3–5-floras 5–10 mm. remotas gerens: flores distincte pedicellati, pedicellis 2–3 mm. longis: pedunculus glaber, angulatus, 2–3 cm. longus: bracteæ ovato-lanceolatæ, acutæ vel acuminatae, ad 2 mm. longæ: bracteolæ ovatæ, acutæ, pedicellis multo breviores. *Perianthii masculi* laciniæ biseriatæ, exteriores ovato-lanceolatæ subacutæ, interiores obovatæ obtusæ vel truncatæ, patentes. *Stamina* 6, æqualia, perianthio distincte breviora: antheræ didymæ. *Spicæ femineæ* axillares, simplices, solitariæ, usque ad 8 cm. longæ, dependentes; flores solitarii sessiles, 5–7 mm. distantes, deorsum spectantes: rhachis distincte trigona, aliquomodo zigzag: bracteæ et bracteolæ adsunt. *Perianthii feminei* laciniæ lanceolatæ, subacutæ, subæquales. *Capsulæ* assurgentes, æquilongæ et latæ, maturæ non visæ.

JAPAN. Without precise locality, *Buerger* (mixed with *Dioscorea Batatas* and issued by Miquel as *D. japonica*).

This species is most nearly allied to *D. tenuipes* with which it agrees in the didymous stamens and in the distinctly pedicelled male flowers: but from which it differs markedly in the biseriate perianth, the lobes of which are not refracted, in the rather shorter and stouter pedicels, the thicker and larger perianth-lobes and in the distinctly cymulose (not glomerate) clusters of flowers. The fruits, which we have not seen ripe, when young closely resemble those of *D. tenuipes*. We suspect that this may prove to be the plant for which Uline has proposed the name *D. Buergeri* (teste Diels in Engl. Bot. Jahrb, XXIX., 260), but we have not seen specimens which could corroborate the idea. We have therefore been compelled to find a new name for it, and have thought well to connect thename of the author of the *Somoku Dusets* with it.

DIOSCOREA ENNEANEURA. *Radix* ignota. *Caules* glabri, sinistrorsum volubiles, minopere angulati, inermes, virides. *Folia* alterna, membranacea, supra glaberrima subnitentia, subtus nervis et præcipue nervulis secondariis minute rugoso-cristatis, cordata, breviter acuminata, apice mucronulata, basis sinu obtuso, margine integra, 9-nervia, nervis extimis profunde bifidis, nervulis secondariis distinctis subtus prominulis, 6 cm. longa, 5 cm. dimidio lata: petiolus glaber, gracilis supra canaliculatus, 3·5 cm. longus. *Racemi masculi* simplices, axillares, solitarii; flores solitarii vel bini, distincte pedicellati, sparsim 3–4 mm. remoti, pedicellis 2 mm. longis: pedunculus glaber, 5 mm. longus: rhachis ad 4 vel 5 cm. longus: bracteæ ovato-lanceolatæ, ad 2 mm. longæ: bracteolæ subsimiles, pedicellis dimidio breviores. *Perianthii masculi* laciniæ ovato-lanceolatæ, biseriatæ, exteriores acutæ ad medium incrassatæ, interiores obtusæ vel truncatæ fere ad apicem incrassatæ, patentes. *Stamina* 6, æqualia, perianthio distincte breviora: antheræ didymæ. *Planta feminea* ignota.—Dioscorea Buergeri, var., enneaneura, Uline ex Diels in Engl. Bot. Jahrb., XXIX., (1900), 260, nomen tantum.

CENTRAL CHINA.—Hupeh. *A. Henry*, 3641 A.

This species is most nearly related to the plant here described as *D. Yokusai* It differs very markedly in the much smaller flowers which are solitary or geminate and not cymulose on the rhachis.

Contributions to Oriental Herpetology I.—The Lizards of the Andamans, with the Description of a new Gecko and a note on the Reproduced Tail in Ptychozoon homalocephalum.—By NELSON ANNANDALE, B.A., *Deputy Superintendent of the Indian Museum.*

In a recent paper on the distribution of the Indian vertebrates Blanford (1) says regarding the Andamans and Nicobars, "These islands are included because they are under the Government of British India, but they are of small importance zoologically." A collection of lizards from Narcondam, lately presented to the Indian Museum by Major A. R. Anderson, I.M.S., has led me to doubt whether this summary dismissal by so catholic and liberal an authority does not perhaps unduly minimize the zoological importance of the Andamans, however true it may be of the Nicobars, the faunistic separation of which from the neighbouring archipelago he fully recognizes. The Indian Museum is rich in material for a study of the Andaman fauna, and it has seemed worth while to undertake an analysis of this one sub-order, even though I have few facts that are absolutely new to put on record and only one new form to describe.

The following list, probably still far from complete, embodies what I have been able to discover as to the species of lizards known from the Andamans or represented in our collection. I understand that Major Anderson is about to publish an account of the fauna of these islands and am much indebted to his generosity in permitting me to make use not only of his collection but also of his observations on the distribution of *Calotes versicolor* in the archipelago. Those species in the list which are also known from the Nicobars have their names distinguished by a star.

LIZARDS KNOWN FROM THE ANDAMANS.

GECKONIDÆ.

Gymnodactylus rubidus (Blyth); *Gonatodes andersonii* nov.; *Hemidactylus frenatus** (Schleg.); *Gehyra mutilata** (Wiegm.); *Lepidodactylus lugubris* (D. & B.); *Gecko verticillatus* Laur.; *Gecko stentor** (Cant.); *Ptychozoon homalocephalum*[1] * (Crev.) ?; *Phelsuma andamanense*, Blyth.

[1] I am not altogether satisfied with the evidence on which this species is included. A specimen which I thought to be from the Andamans (*Ann. Mag. N. H.* (vii) xv, 1905, p. 31) appears to have been labelled wrongly. (But see Theobld, *Cat. Rept. Brit. Ind.*, p. 73.)

AGAMIDÆ.

*Gonyocephalus subcristatus** (Blyth); *Calotes versicolor* (Daud.); *C. andamanensis*, Blgr.[1]; *C. mystaceus*,* D. & B.

VARANIDÆ.

*Varanus salvator** (Luar.)

SCINCIDÆ.

*Mabuia multifasciata** (Kuhl); *M. tytleri*, Blgr.; *Lygosoma maculatum* (Blyth); *L. olivaceum** (Gray); *L. macrotympanum* (Stol.).

The Museum possesses a number of specimens of a Skink the exact position of which I am not yet prepared to state. They are closely allied to, if not identical with, *L. maculatum* (Blyth), but differ from the descriptions of this species in proportions. Possibly they may be new; but as I have not yet worked through the Skinks in the Museum collection, I prefer not to express an opinion at present. The specimens were collected by Major Anderson on Narcondam.

ANALYSIS OF THE LACERTILIAN FAUNA OF THE ANDAMANS.

Gymnodactylus rubidus is a form peculiar to the Andamans. It has close allies in *G. marmoratus* of the Malay Peninsula and Sumatra (possibly occurring also in Tenasserim) and *G. khasiensis* of Assam. *Gonatodes andersonii* is closely related to *G. kandianus* of Ceylon, South India, Preparis Island (which lies between the Andamans and the coast of Burma to the north) and Engano,* an island off south-west Sumatra. Its exact relationship to this form is discussed below. Although it is difficult to split up the genus *Gonatodes* into definite sections, *G. kandianus* and *G. andersonii* may be said to belong to its Malabar, as distinct from its Malayan, division. In South India and Ceylon there are a number of species which have their headquarters within the Malabar Province of recent zoologists (chiefly on the hills of the east coast on the mainland) but extend into places not included therein. In the Malay Peninsula two species, *G. affinis* and *G. kendallii*, occur, the former of which possibly extends northwards into Tenasserim. On the whole they are distinguished from the Malabar species by their larger size, more brilliant coloration (in some cases), the greater degree of specialisation of their dorsal scales (in some cases), and above all by the absence of femoral or præanal pores in the male. The genus extends eastwards into the Malay Archipelago, is represented by a number of species in Tropical America, and by at least one in East Africa.[2]

[1] *Ann. Mag. N. H.* (vi.) viii., 1891, pp. 288, 289.

[2] Boulenger, *Ann. Mag. N. H.* (6) xvi., 1895, p. 173; and Tornier, *Zool. Jahrb. Syst.* xiii., 1900, p. 584.

Gehyra mutilata, *Hemidactylus frenatus* and *Gecko verticillatus* are house-lizards and have a wide adventitious range on coasts and islands, being easily carried with merchandize or personal baggage. On the mainland of Asia their range extends northwards and westwards from the Malay Archipelago, through Malaya and Burma, to the north-eastern districts of India proper. This range they share with many other animals. Of the three, *G. verticillatus* (which is only a house-lizard in some districts) is most restricted. Probably it does not occur in the southern part of the Malay Peninsula, though abundant (not as a house-lizard) in the northern, and the few specimens taken in Singapore would seem to have been introduced from Bangkok (where it occurs in almost every inhabited building) or Java. *Gecko stentor*, on the other hand, is usually a jungle species; in the dense woods of northern Malaya its peculiar cry is heard perpetually, though the lizard is seen but seldom. In Selangor and elsewhere, however, it has been known to take up its abode in houses. Its retiring habits render it somewhat rare in collections, and it is not known to occur west of Chittagong. *Lepidodactylus lugubris*, regarding the habits of which little or nothing is known[1], has a very wide insular distribution in the Indian and Pacific Oceans and occurs sparingly in Malaya and Burma.

Phelsuma andamanense is probably the most interesting of the Andaman lizards. Its allies are found not in the Malayan islands or on the mainland of Asia, nor even on the mainland of Africa, but in Mauritius, the Seychelles, Réunion and Madagascar. The number of cases in which the names of authors of species are enclosed in brackets in the tables which accompany this paper shows how little reliance can often be placed on the generic distinctions of herpetologists; but *Phelsuma* would appear to be a natural genus, in which the species are closely related. It would not be difficult to confuse an example of the Andaman species in which the colours had faded with one of *P. cepedianum* from Mauritius, though the specific differences are much greater than those between *Gymnodactylus rubidus*[2] and *G. marmoratus*.[2]

Both *P. andamanense* and *G. rubidus* (also *G. marmoratus*) are arboreal. Probably they never enter houses.

In considering the fauna of any tropical district the Geckos have a peculiar interest. Their structure (especially that of the vertebral column, on which great stress must be laid) proves them extremely ancient, and their genera (except in a few cases, such as the *marmoratus* section of *Gymnodactylus* and the Malabar division of *Gonatodes*) lack the plasticity of some families. I have compiled lists

[1] That is in Asia. Schnee has a note on its habits in the Pacific (*Z. Natur.* Stuttgart, 1901) which I have not seen.

[2] These two forms were once placed in separate genera.

of the Geckos of Burma and Sumatra for comparison with that of the Andaman representatives of the family. Boulenger (3), as recently as last year, has published a list of the reptiles of the Malay Peninsula, and I need only say here that the Geckos, with a few exceptions, are the same as those of Burma. For information regarding the Sumatran species I am indebted chiefly to Werner's (5) recent memoir, and regarding the Burmese to Boulenger's volume (2) in the "Fauna of India" series and the same author's account (4) of Fea's collection, now in the Genoa Museum. Two species included have been described by myself (6) quite recently.

GECKOS OF BURMA AND SUMATRA.

Name of Species.	Burma.	Sumatra.
1 *Gymnodactylus pulchellus*[1] (Gray) §	× (Lower Burma)	—
2 „ *variegatus* (Blyth)	× (Lower Burma)	—
3 „ *peguensis*, Blgr. §	× (Lower Burma)	—
4 „ *feæ*, Blgr.	× (Lower Burma)	? (Sinkip Island)
5 „ *lateralis*, Wern.	—	×
6 „ *marmoratus* (Kuhl) §	—	×
7 *Gonatodes kandianus*, (Kelaart.)	? (Preparis)	? (Engano)
8 *Phyllodactylus burmanicus*, Annand.	× (Lower Burma)	—
9 *Hemidactylus frenatus* * (Schleg) §	×	×
10 „ *brookii*, Gray §	×	—
11 „ *subtriedroides*, Annand.	× (Upper Burma)	—
12 „ *leschenaultii*, D. & B §	?	—
13 „ *flaviviridis*, Rupp. §	×	—
14 „ *bowringii* (Gray)	×	—
15 „ *garnotii*, D. & B. §	×	×
16 „ *platyurus* (Schneid.) §	×	—
17 *Gehyra mutilata* * (Wiegm.) §	×	—
18 *Spathoscalabotes mutilatus*, D. & B.	—	×
19 *Lepidodactylus lugubris* * (D. & B.) §	×	—
20 „ *ceylonensis*, Blgr. §	×	? (Engano)
21 *Gecko verticillatus* Laur. * §	×	×
22 „ *stentor* (Cant.) * §	×	×
23 „ *monarchus*, Schleg. §	—	×
24 *Ptychozoon homalocephalum* * (Crev.) §	× (Lower Burma)	×

In the above list a × denotes the occurrence of a species, a — that it has not been recorded. The names of those species known from the Andamans are distinguished by a *, of those known from the Malay Peninsula by a §. The Geckos of Sumatra are still very imperfectly known, while the discovery of fresh species both in Upper and Lower Burma is probable.

Of the Geckos common to the Andamans and Burma or Sumatra all but *Ptychozoon homalocephalum*, *Gecko stentor* (which is sometimes found in houses) and *Lepidodactylus lugubris* (whose insular distribution

[1] We have in the Museum specimen from Lower Burma of an allied species not yet described.

would suggest that it too may be carried from island to island) are house-lizards, and as such of no importance in considering questions of geographical distribution. They may very well have been introduced in the nineteenth century. As regards *P. homalocephalum*, a curious fact in its life history may have had an influence on its dispersal; I mean the long period spent in the egg. An observation by F. H. Bauer (quoted by Gadow in *Amphibia and Reptiles*, p. 512) shows that this period may last for five *months*, and from eggs which I have examined in the Malay Peninsula I am prepared to conclude that this case was normal. It is obvious that an egg with a hard shell, to some extent impermeable to liquids, can endure conditions which would be fatal to a delicate young lizard. Boats have been carried out from the coast of Malaya to the Andamans in very much less than five *weeks*, and logs of wood must frequently come by the same route. *P. homalocephalum* lays but two eggs at a time; they adhere to leaves and tree-trunks. It is essentially a jungle species, but Flower has taken a specimen of the closely allied *P. horsfieldii* on a wooden post in the Botanical Gardens at Penang (*P. Z. S.* 1896, p. 868), showing that it may desert the jungle occasionally for human erections in the immediate neighbourhood.

Thus, of the nine Geckos recorded from the Andamans, the presence of five, possibly six, can be accounted for without assuming that they have been in the islands for any long period. The remining three are peculiar to the archipelago (including Narcondam). None of these have been recorded from the Nicobars; but one is closely related to forms on the nearest mainland, a second has Malabar affinities, while the third exhibits a Madagascan facies.

As regards *Gonatodes andersonii*, any argument derived from its relationship to *G. kandianus* has its weak point; for *G. kandianus* is, at any rate in some places, a house-lizard[1], and though it probably originated in the mountains of Ceylon or S. India, it occurs also in the plains; it may therefore, have been introduced by man into the Andamans. In any case it must be regarded as the ancestor of *G. andersonii*, which is merely an offshoot from it: whether we look upon the two forms as specifically distinct depends entirely on the answer we are prepared to give to the question, "What is a species?" I have given the Andaman form a name because it is convenient that things should have names, and because the lizard can be distinguished by characters which appear to be constant; but I should doubt whether it is a "physiological" species. Poulton (7) in one of the latest general contributions to the subject of specific characters, regards it as impossible, from a scientific

[1] It is worthy of note that the distribution of this species is much wider than that of its allies.

standpoint, to determine a species from a mere examination of specimens. Undoubtedly he is right. Without a study of bionomics it would be impossible to group together the seasonal forms of certain butterflies he instances, or to draw the line between closely related local races of many animals. But in a museum—and too often the naturalist exists for the museum, not the museum for the naturalist—any system of arrangement is impossible, unless names are given to specimens. Anyone who would have the courage, the skill, and the patience (and would live long enough), to classify the whole animal kingdom according to some system of numbers and letters, which could be recorded as in a library catalogue, would confer an enormous boon on scientific zoology. The tendency at present among systematists is to search for differences rather than relationships, and very little is being done in tropical countries to find out what these differences mean. No investigations are being made, so far as I know, to discover whether the members of the fauna of any given island or group of islands of limited extent are undergoing modification in any one direction. That this is probably the case even in Northern Europe is shown in a recent paper by Eagle Clarke (8), who points out that in the Farœs animals as distinct from one another as the wren, the starling and the house mouse (*Mus. musculus*) have all developed in the direction of increase of bulk and coarseness of the feet. The work of Darwin and of Wallace on island life is of course classical, and as such liable to be ignored. When they wrote and laboured on the subject the extraordinary elaboration of modern zoology had scarcely begun, and it was less easy to lose sight of philosophical principles. We now know a considerable part of what is to be known about the "species" of the larger Indian vertebrates, using the term "species" in the loose way to which the museum zoologist is condemned; we do not know, even in a few cases, why one animal survives[1] under any given change of environment while another, apparently just as fitted for survival and quite as variable perishes. It is not likely that we shall soon gain any such knowledge, at any rate in the tropics; for such problems can only be studied in the field. Collectors have rarely time to observe, and all that can be done in a Museum is to classify and anatomize dead and imperfectly preserved material.

The object of this digression from the subject strictly in hand has been to illustrate the position of the Andaman *Gonatodes* as a distinct form, and at the same time to point out that even where a fauna has

[1] For example, why is it that certain species of the Indian tank molluscs succumb almost at once if kept in an aquarium without ventilation, while others from the same tank live for a considerable period under such conditions?

been completely "worked out," the greater and the more important part of its zoology has still to be investigated.

To return to the Andaman lizards. Of the Agamids, one, *Calotes andamanensis*[1], is known from a single specimen in the Copenhagen Museum; it is allied to *C. liolepis* of Ceylon. Another is *C. mystaceus*,[2] which has a somewhat restricted range on the mainland of S.E. Asia and is common about Mandalay.[3] Major Anderson tells me that, in the Andamans, *C. versicolor* is found only in the Cocos group, not south of Table Island. It is essentially a mainland form and does not, as a general rule, penetrate into primæval jungle. In the Siamese Malay States it is only to be met with in cultvated land or secondary jungle and I believe that this is also true of India. It generally lays its eggs at the base of bushes in hedges or plantations. According to Prain (11), there are several cultivated plants which have run wild in the Cocos, and if these were brought from the mainland or elsewhere as plants, it is quite possible that the eggs of this lizard may have been brought with them. Although it has been recorded from the southern districts of the Malay Peninsula, *C. versicolor* is rare south of the Perak and Kelantan Rivers, its place being taken by *C. cristatellus*, which is closely allied to *C. jubatus* of the Nicobars and Malayan Islands. The southward range of *C. versicolor* as a common member of the local fauna is greater on the eastern than on the western side of the mountains which form the backbone of Malaya,[4] as is also the case with of a number of other animals.

Gonyocephalus subcristatus, on the other hand, is peculiar to the Andamans and the Nicobars. *G. humei* (Stol.) also occurs in the latter islands, but I do not think that this species can be maintained. We have in the Museum two males from Tillinchong identified as *Tiaris humei* by Stoliczka and possibly the types of the species. From the same island we have a normal specimen of *G. subcristatus*, also named by Stoliczka; but in a series from Kondal (an island in the other division of the Nicobar group), identified by the same authority as belonging to the latter species, I find a female which must be associated with the two males from Tillinchong. These three specimens are distinguished from the whole of a

[1] Boulenger, *Ann. Mag. N. H.* (vi) VIII, 1891, pp. 288, 289.

[2] I have found a well-authenticated specimen of this species from the Andamans in the Museum collection, which also contains several of *C. versicolor* from the Cocos.

[3] J. Anderson, *Res. Yunnan Ex.*, p. 806.

[4] It is convenient to confine this term to the Malay Peninsula, using "Malaysia" for the Malay Archipelago.

large collection (over one hundred specimens), made by different collectors in different islands of the Andamans and Nicobars, only by their greater size and more pronounced crest, which is interrupted in a very distinct manner just behind the neck and raised on a fleshy, laterally compressed hump in front of this point. On the whole, I am inclined to regard them not as representing a local race or even an incipient species, but as aged individuals of the common form. Against this view must be placed their rarity—and Major Anderson tells me that he has examined very large numbers of specimens without finding any like them. However, the adults of some Agamids (*e.g.*, *G. borneensis* and *Aphaniotis fusca* in the Malay Peninsula, *fide* Laidlaw (9)) are seldom taken as compared with the young, while in some cases (*e.g.*, that of *Calotes cristatellus* in Lower Siam) the largest individuals are only seen in very deep jungle, where of course there is less chance of their capture.

Of *Varanus salvator*, one of the bulkiest of lizards, I need say very little. It has practically the same range in Asia as *Gehyra mutilata* (except that it is found nearer the heart of India) and extends eastwards to Australia. Although it cannot be carried accidentally on ships, it is extremely tenacious of life and has frequently been observed swimming in salt water, though never far from shore. Probably it might survive in the sea for a considerable period clinging to a floating log, for it can go without food for weeks, if not months, without apparent inconvenience.

The Skinks, judging from the enormous number of closely allied species in the family, are among the most plastic of lizards; yet some of them have an extensive distribution. Of the Andaman forms, *Mabuia multifasciata* is the common Skink of the Malay Peninsula and extends northwards into Burma, possibly into Sikhim, southwards and eastwards into the Malay Archipelago. Specimens from the Andamans, of which I have seen a considerable number, may differ to a slight extent, on the average but not individually, from those taken on the mainland; for the proportion with quinquecarinate dorsal scales is probably greater than that given by Flower (10), who examined a large series in Malaya. *M. tytleri* and *L. macrotympanum* are only known from the Andamans. *L. maculatum* has a range similar (as far as the mainland of Asia is concerned) to that of *V. salvator*; *L. olivaceum* does not extend so far to the north, but is characteristically Indo-Malayan.

In comparing the Agamidæ and Scincidæ of the Andamans with those of the Nicobars, we find that several forms occur in the later group which are absent from the Andamans but have Malayan or Malabar affinities. *Calotes jubatus*, apparently common in the Nicobars, occurs in the Malay Archipelago, but has not been recorded from the Peninsula; *C. ophiomachus* is only known from Ceylon and S. India. Several Skinks probably occur in the Nicobars which are absent from the Andamans, and the same may be true of *Dibamus novæ-guineæ*—the sole representative of a family closely allied to the Skinks and once regarded as peculiar to the Nicobars and Papuasia, but now known to exist both in the Malay Peninsula and in several of the islands of the Malay Archipelago.

What is perhaps a true relationship between the Andamans and Ceylon consists in the absence from both of the genus *Draco*, which occurs within the Malabar province in S. India (also in Malaya, Burma and Assam) and consists of forms too striking to escape notice readily.

Prain (12, 13) has shown that the flora of the Cocos group and that of Narcondam differ considerably from that of the southern Andamans. The geological separation between the different islands, and especially between Narcondam and the rest of the archipelago, is well illustrated by the marine depths marked on the maps recently published by Alcock (13) and Kloss (14). Narcondam is distinguished zoologically by the possession of an isolated Hornbill (*Rhytidoceros narcondami*). I have very little information about the lizards of the Cocos, except that *Calotes versicolor* and *Gonyocephalus subcristatus* occur; on Narcondam Major Anderson has taken *Gymnodactylus rubidus*, *Gonatodes andersonii* and *Phelsuma andamanense*, as well as *Mabuia multifasciata* and another Skink. The three Geckos characteristic of the Andamans therefore occur on this island. Of three specimens of *G. rubidus* from Narcondam in the Museum, two are considerably larger than any in a large series from other parts of the Andaman archipelago; otherwise no difference can be detected. The only adult specimen of *G. andersonii*,[1] is from Narcondam, but, except in point of size, it agrees with two young individuals collected by Wood-Mason somewhere in the Andamans (exact locality not specified) and confused by him with the young of *G. rubidus*, to which they bear a close superficial resemblance. Specimens of *P. andamanense* agree in every respect with those from the other islands.

I do not propose to generalize as to geography on the basis of the lizards. The study of a single sub-order somewhat poorly represented (or perhaps rather imperfectly known) does not permit wide generalizations as to the whole fauna, much less the geology and geography, even of a small group of islands. It has been my object to show, in the first place, that the vertebrates of the Andamans are not devoid

[1] Since this was written two more have been received from Narcondam, collected and presented by Mr. C. G. Rogers.

of zoological interest, in the second that the study of the geographical distribution of animals must be preceded by a study of their bionomics.

Description of *Gonatodes andersonii*, nov.

Measurements.

Total length	...	...	...	73 mm.
Body	...	...	...	23 „
Tail	...	...	...	40 „
Head	...	...	...	10 „
Fore-limb	...	...	...	11 „
Hind-limb	...	...	...	16 „
Breadth of head		...	...	5 „

Closely allied to *G. kandianus* (Kelaart) from which it differs only in the following points :—(1) The habit is more slender, the limbs slightly, the tail considerably, longer ; (2) the scales on the back and sides are more nearly homogeneous, none of the former having a definite keel; (3) the spine-like tubercles on the flanks are much reduced, but not altogether absent ; (4) there are only five or six labials on each jaw. The scales on the belly are smooth, as in the typical form of *G. kandianus*, or feebly keeled. *G. andersonii* differs from *G. gracilis* (another very close ally of *G. kandianus*) chiefly in respect of its proportions, but also in its scaling. The specimens have been compared with examples of *G. gracilis* named by Boulenger and of *G. kandianus* from the Sarasins' collection.

I have also examined specimens of *G. wicksii* (Stol.) from Preparis which have been identified by the author of the species and may be his types. They agree exactly with Boulenger's description of *G. kandianus* and also with specimens of this species from Ceylon regarded by Theobald as typical of *G. humei*. There can be no doubt, therefore, that Boulenger was right in considering both these names to be synonyms of *G. kandianus*, as he does (but with a query) in the "Fauna of India" and his *Catalogue of Lizards*.

In a recent paper (6) I identified, with some doubt, the immature specimens of *G. andersonii* in the Museum with Beddome's *G. marmoratus* from S. India. The examination of an older specimen in better preservation shows that I was wrong.

LITERATURE.

1. Blanford ... "On the Distribution of Vertebrate animals in India, Ceylon, and Burma."—*Phil. Trans. Roy. Soc.* B. CXCIV, 1901.

2. Boulenger ... *Fauna of British India, Reptiles and Batrachians.* 1890.

3. Boulenger ... "Report on the Reptiles and Amphibia."—*Fascic. Malay. Zool.* 1. 1903.

4. Boulenger ... "Concluding Report," etc.—*Ann. Mus. Genova* 1893.

5. Werner ... "Reptilien und Batrachien aus Sumatra."—*Zool. Jahrb.*, 1900.

6. Annandale ... "Observations on some Oriental Geckos," etc.—*Ann. Mag.* N. H. 1905.

7. Poulton ... "What is a species? Presidential address read before the Entomological Society of London," 1904.

8. Clarke ... "Some Forms of *Mus musculus*," *etc.*—*Proc. Roy. Phys. Soc., Edinburgh*, XV. (2), 1902-1904.

9. Laidlaw ... "The Lizards of the 'Skeat' Expedition."—*P.Z.S.*, 1901 (i).

10. Flower ... "The Reptiles of the Malay Peninsula and Siam."—*P.Z.S.*, 1899.

11. Prain ... "The Vegetation of the Cocos Group."—*J.A.S.B.*, 1892.

12. Prain ... "The Flora of Narcondam and Barren Island,"—*J.A.S.B.*, 1893.

13. Alcock ... *A Naturalist in Indian Seas.* 1902.

14. Kloss ... *In the Andamans and Nicobars.* 1903.

Note on the Reproduced Tail in Ptychozoon homalocephalum.

I am not aware that the appearance of the tail after it has been lost and reproduced has been described in this species. It has a certain interest, because Müller[1] regards the character of the lobes of the tail as being of some importance as a specific distinction in the genus. In a specimen from the Nicobars, lately presented by Major Anderson to the Indian Museum, the distal part of the tail is reproduced. The scales upon it are slightly smaller than those upon the uninjured portion, and the dorsal tubercles are completely absent. The loose membrane surrounding it is only about half as wide as is normal, asymmetrical, not divided into lobes or expanded at the tip of the tail. Thus the condition differs considerably from that apparently normal in *P. horsfieldii*, Gray, but rather less so than from that of the uninjured tail of *P. homalocephalum*.

[1] *Festschr. Nat. Ges. Basel*, 1892, p. 209.

Special Report on the prevalence of Fevers in the Dinajpur District—By LEONARD ROGERS, M.D., M.R.C.P., F.R.C.S., B.S., I.M.S.

The present enquiry was ordered by the Government of Bengal to be carried out on account of the death-rate from "fevers" having risen to over 40 per thousand, a previously unknown maximum, the plan of work being drawn up by the Sanitary Commissioner. The lines of investigation suggested by this officer w ere the following:—Firstly, lists of those who had died during the previous year in certain areas or villages were to be obtained from the thana books, and then the villages were to be visited, the relatives of the deceased sought out, and enquiries made from them as to the duration and symptoms of the fatal illness, and a diagnosis to be thus arrived at whenever possible. Secondly, any fever cases met with were to be examined in order to ascertain their exact nature. Owing to the investigation having to be carried out during the latter half of the cold weather and early part of the hot season, which is just the season of minimal prevalence of fever, opportunities of using the latter and more accurate method of enquiry were unfortunately very scanty, but on the other hand the time was most favourable for the village enquiry, which has occupied the greater portion of my time, and, in spite of the necessarily imperfect character of the data obtainable, a good deal of valuable information has been collected, which will at least enable a more accurate estimate to be made of the relative frequency of the principal causes of death generally returned by the village chaukidars under the very elastic heading "fever" than has hitherto been possible. This portion of the enquiry will, therefore, first be dealt with.

PART I.— THE VILLAGE ENQUIRY.

In accordance with the orders of the Sanitary Commissioner certain villages or groups of villages had to be selected for the enquiry. Unfortunately the only records obtainable of the death-rates of different areas related to whole thanas, and no separate figures were avilable of those of different circles, much less of the separate villages. The thana death-rates were, therefore, first examined, and it was noted that the areas which returned the highest "fever" death-rates were the three northern thanas, while the two in the southern extreme of the district had much the lowest death-rates. The intermediate ones all had a fairly uniform and interemediate rate. It was therefore arranged to examine circles in each of the three northern very unhealthy areas, in the two southern comparatively healthy ones, and in two intermediate ones, one to the east of Dinajpur and one to the west (see map). The headquarters of the thanas were first visited and enquiries made as to any specially unhealthy parts made, which, however, seldom resulted in any definite information on that point being gained owing to the absence of mortality figures for small areas. The circles were, therefore, chosen to illustrate as far as possible different conditions. Thus to the east of the town of Dinajpur a circle was selected which was bounded on both sides and to the south by streams, one of which was of a specially stagnant and swampy nature. At Birganj to the north-west of the district one group of villages on a main stream to the north-east of the thana was chosen, and another well away from the river in a drier area to the north-west. In the extreme south a business, as opposed to an agricultural class of people were selected at Nitpur, as well as a village population on either side of it, but unfortunately the population of the town proved to be so "floating" a one that no relative of many of the deceased could be found to give any information as to their illnesses. Circles containing three to four thousand inhabitants were taken, and a list of the deaths in each village returned as "fever" was obtained from the thana, together with the name of their nearest relatives, who were then collected in the villages and questioned. The notes of each case were taken down in shorthand, a regular series of questions being put designed to cover the principal symptoms of the diseases which most commonly produce fever, supplementary ones being asked whenever necessary. As a rule the answers received were surprisingly clear, and in the great majority of the cases a very fair history was obtained. In one or two villages only was a tendency noticed to systematically answer every question in the negative without a moment's consideration, and these cases had to be omitted from the tables. An idea of the nature of the information obtained can best be conveyed by recording the notes of a few consecutive cases such as the following group:—

Thana, Thakagaon, village, Salanda.

No. 1. Female; aged 57; died 11th February, 1903. Informant her son. Had suffered from several attacks of intermittent fever during the last two months accompanied with shivering fits The last fatal attack of fever was of a continued type and lasted about twelve days.

There was pain in the left side of the chest, cough and mucous expectoration. The spleen was not noticed to be enlarged. There was no swelling of the feet, and neither pain nor swelling in the joints. During the last three days the bowels were loose, about three motions a day being passed. Diagnosis: pneumonia: following chronic malarial fever.

No. 2. Male; aged 18; died on 3rd March, 1903. Informant his brother. He had suffered from repeated attacks of fever for about one year. The last attack was of a continued type of six days' duration. He suffered from much cough, with muco-purulent expectoration throughout the whole course of his illness, and had pain in the right side towards the end. The spleen was not noticed to be enlarged, and there was no swelling of the feet or joints and no diarrhœa, but he was much wasted. Diagnosis: phthisis.

No. 3. Male; aged 34; died 13th March, 1903. Informant his brother. Suffered from fever of eight days' duration, of continued type, accompanied by pain on both sides of the chest, much cough and much muco-purulent expectoration. There was no enlargement of the spleen, diarrhœa or swelling of the feet of joints. Diagnosis: broncho-pneumonia.

No. 4. Female; aged 80; died 16th March, 1903. Informant her son (aged 50). She is said to have had intermittent fever for fifteen days, some pain in the right side, but no cough or expectoration, and no splenic enlargement. There was no swelling of the feet or joints, but she suffered from diarrhœa several times a day during the last two days of her life, and had been in a feeble condition of health for some time previously. Diagnosis: diarrhœa.

No. 5. Male; aged 80 years; died 21st March, 1903. Informant his nephew. He had suffered from fever on and off for the last six months, the final attack lasting fifteen days. He had no pain on the chest and no enlargement of the spleen, but suffered much from cough all through his illness accompanied by mucous expectoration, but no blood. He had no diarrhœa or swelling of the feet or joints. He was not wasted, but his chest was large and barrel-shaped. Diagnosis: chronic bronchitis.

No. 6. Male; aged 49; died 22nd March, 1903. Informant his uncle. He had suffered from fever for one-and-a-half years of an intermittent character, the last attack lasting one month. He had pain on the right side, and throughout his whole illness he had a cough, accompanied by mucous expectoration; but no blood. His spleen was not enlarged, and he had no swelling of the feet or joints. At the end he had diarrhœa for the last five days. Diagnosis: phthisis.

No. 7. Male; aged 60; died 6th April, 1903. Informant his son. His last illness lasted fifteen days, during which he suffered from continued fever. He had no pain, cough, enlargement of the spleen, swelling of the feet or joints, but suffered during the whole time from looseness of the bowels which were moved about eight times a day for fifteen days, the motions being accompanied by the passage of blood and mucous. Diagnosis: dysentery.

The above will serve to give some idea of the kind of histories obtained. Over one thousand cases in all were enquired into, and similar tabulated shorthand notes taken down on the spot in pencil, and as a rule on the same evening they were inked in and an analysis made. The principal difficulty occurred in deciding under what heading to place complicated cases, such as a chronic malarial fever with terminal dysentery or pneumonia. When the final illness and death was clearly due to the complication after an interval of freedom from fever, it was placed under the heading of the disease which actually produced death, but the malarial complication predisposing was also noted. In all a diagnosis was come to in just 1,000 cases, a number which could not have been noted with in anything like as full a manner as was done within a reasonable time without the use of shorthand. Before making up the tables every case was gone over again after the whole of the notes had been taken, and great care taken that the same system of diagnosis and classification was carried through the whole series, the advantages of the lengthy experience gained being brought to bear on the whole number. It will be most convenient to first deal with the percentages of deaths due to the principal diseases as derived from an analysis of the whole number, so as to gain an idea of the main causes of the mortality of the district and their relative frequency; and then the variations in their frequency in different circles in the district will be pointed out. Next the rates per thousand of population in each area of the main diseases will be given and the deductions to be drawn from them indicated. Lastly, any variation in different village groups in each circle which appear to throw any light on the subject will be discussed. In this way we shall work backwards from the more accurate data based on the largest figures to the less certain ones supported by smaller series of cases, the former giving a standard of comparison for the latter.

Analysis of 1,000 Deaths returned as "Fever" in the Dinajpur District.

Before going on to the various tables in which I have analysed the data collected, the whole of the cases must first be summarised in the following form which the Sanitary Commissioner has asked for :—

TABLE I.

Total number of deaths from "fever"	1,104
Number of deaths from malarial fevers*	318
Number of deaths from non-malarial fevers	368
Number of deaths wrongly reported under "fever" ...	314
Doubtful or unascertained	104

It appears from this table that nearly one-third of the cases returned under the head of "Fever," which includes 90 per cent. of all deaths in the Dinajpur District, are incorrectly classed as such, while of the two-thirds correctly returned less than half are due to malarial fevers, including chronic fevers, some of which are probably due to unclassified fevers while a few others may be cases of various chronic diseases, the histories of which were not sufficient to enable them to be accurately diagnosed.

In the following table the 1,000 cases which were diagnosed are classified according to the most frequent causes of death, the percentages from each cause for the different circles examined being shown, while in the last column the percentages of the total number of deaths from each cause is entered :—

TABLE II.

	Dinajpur.	Balurghat.	Porsa.	Churaman.	Birganj.	Ranisankail.	Thakurgaon.	Percentage of total cases diagnosed.
Thana fever rate per thousand	44·06	29·99	29·05	38·93	43·43	47·21	41·67	...
Malarial, acute	17·5	14·7	16·25	11·3	14·58	5·3	12·0	13·3
Ditto chronic	24·0	16·0	18·75	18·6	16·7	17·3	15·5	18·5
Pneumonia ...	18·6	21·3	11·25	11·3	27·7	22·0	28·0	21·7
Phthisis ...	5·5	6·7	10·0	8·0	8·3	13·3	10·0	9·0
Bronchitis ...	3·8	2·0	1·25	1·6	1·4	1·3	3·0	2·3
Diarrhœa ...	4·4	10·0	11·25	12·1	10·4	13·3	9·0	10·2
Dysentry ...	3·8	7·3	3·75	11·3	5·5	7·3	3·5	6·1
Enteric ...	...	2·0	3·75	1·6	1·4	0·8	3·5	1·8
Born feeble ...	15·8	10·7	10·9	10·5	3·5	11·3	8·0	10·4
Other causes ...	6·6	8·7	5·0	8·8	7·6	4·8	5·0	6·7
Not diagnosed ...	...	0·6	8·75	4·8	3·9	3·3	2·5	...
Total cases ...	183	150	80	124	144	150	200	100·0

* Chronic cases many of which were doubtless due to the parasite recently described by Majors Leishman and Donovan are included under this heading.

This table presents several points of interest. In the first place it brings out the fact that all varieties of diseases are returned by the village chaukidar as "fever," a point which will be further illustrated when I come to discuss the cases classed above under "Other causes." The most striking evidence in this connection is the fact that although in the figures for the Dinajpur district for 1902 only 0·07 per thousand deaths were recorded under the head of "Dysentery and Diarrhœa," yet we find that among the cases returned as "fever" in the circles investigated no less than 16·3 per cent. belonged to this class, while in many other cases diarrhœa and dysentery were present as complications of malaria, phthisis and other diseases. The total death-rate of the district from fevers having been 37 per thousand, it is evident that the death-rate under dysentery and diarrhœa should have been about 4·5 per thousand, instead of 0·07, or in other words, only one case out of 63 dying of these bowel-complaints were correctly returned. Of course both dysentery and diarrhœa are often accompanied by fever, which the village chaukidar may well consider to be the primary cause of death, but the fact remains that the figures yearly published in the voluminous tables of the Sanitary Commissioner's annual report, the yearly variations of which have to be carefully explained, are, to say the least of it, grotesquely inaccurate and necessarily so under the present conditions of reporting. These cases of bowel-complaints, together with the deaths classed as "born feeble" (a term which will be explained presently) and many of those under "Other causes," together make up almost one-third of the total, all of which have been incorrectly returned under the head of "fever."

Secondly, the proportions of the different diseases correctly reported under the head of "fever" are most instructive. Thus we find pneumonia accounted for the largest proportion of deaths, namely 21·7 per cent., then came "Chronic malaria" 18·5 per cent., thirdly Acute malaria 13·3 per cent., and not far behind Phthisis no less than 9 per cent., while Bronchitis and Enteric accounted for the greater part of the remaining cases. It will be instructive to compare these figures with those I obtained for another purpose some time ago by analysing 950 consecutive *post-mortems* on cases from the medical wards of the Medical College Hospital, in order to ascertain the most frequent causes of death likely to be returned under "fever." At the same time the diagnosis made in fatal cases occurring in the Dinajpur hospital during the last two years may be given. These figures are shown in table III, but in comparing them with the results of the Dinajpur village enquiry certain points must be carefully borne in mind. The most important of these is the question of the ages of the patients in the different series, for in the village death-rates all children are included, while at the Medical College Hospital but few children are admitted, while *post-mortems* are, practically speaking, never obtained on any who may die in the hospital. Similarly children are very rarely admitted to the Dinajpur hospital and infants never. This fact accounts for the comparatively small number of cases of acute malaria, diarrhœa, and to a less extent of pneumonia in the hospital figures. Due allowance being made for these differences, the figures are not without instruction :—

TABLE III.

	Deaths in the Dinajpur Hospital. Per. cent.	Calcutta Medical College *post-mortem.* Per cent.
Malaria, acute, and remittents ...	26·4	3·2
Ditto chronic	13·6	5·6
Pneumonia	10·0	11·0
Phthisis	5·0	16·9
Serous inflammations	6·9	...
Enteric	0·7	0·4
Other fevers	2·9	8·6
Diarrhœa	5·0	...
Dysentery	19·3	...
Other causes	10·2	54·3*

In the Dinajpur hospital many of the cases returned as remittents occurred in the cold weather months, and were no doubt due to pneumonia, but still, allowing for this, acute malarial fevers were certainly much more common than in Calcutta, as might have been expected. Some of these cases were probably of a chronic type, making the figure under that head lower than it should be. Pneumonia was equally prevalent in both hospitals although this figure for Dinajpur under Dinajpur under-estimates the real number, for during the time I was in the district this disease was the most frequent cause of admission and death from continued or remittent fever.

Phthisis is of great importance, as in the Calcutta hospital it is by far the most frequent cause of death accompanied by marked fever during the illness, having constituted almost one-third of such cases. The high figure of 9 per cent. obtained in the village enquiry probably under-estimates rather than exaggerates the death-rate from this cause, while the 5 per cent. of cases dying in the Dinajpur hospital is probably too low, owing to some cases being overlooked by the Hospital Assistant.

* Includes diarrhœa and dysentery cases.

We have, then, clear evidence that phthisis plays a very important part in the death-rate of Bengal villages as well as of the towns, and the disease was especially prevalent in the larger villages with more numerous substantial houses with impermeable walls, in which the people delight to shut themselves up in at night as closely as possible in the cold weather months. Several well-marked cases of the disease were seen in the villages, while it will be seen from tables II and VI that the disease was most prevalent in the northern and coldest thanas. It must, however, be remembered that malarial fever plays a most important predisposing part in the production of pulmonary tuberculosis, so that the high rate in the northern parts of the district may be partly due to their malarious character. This predisposition is well seen in two different class of cases,—firstly, in the case of adolescents, in which phthisis frequently makes its first appearance as a sequel to chronic malarial fever, and, secondly, in middle-aged people in whom old and latent tubercle of the lungs becomes fatally active as a result of the resisting powers being broken down by malarious attacks, as I have often seen in the Medical College *post-mortem* room.

The only other form of fever which requires comment here is probably enteric. The correctness of the diagnosis of these cases from the history of the illnesses obtained is open to greater question than in most of the other forms of fever deal with, and in no case was a clear history of hæmorrhage from the bowel obtained. Cases were, however, met with in every circle visited of two to four weeks' continued fever without signs of pneumonia or other cause, some of which I feel sure were enteric cases. The figures must only be taken as indicating that the disease does occur in the villages in small numbers, while this is supported by the fact that one case was seen in the jail recently, and the diagnosis confirmed *post-mortem*, and another case was diagnosed in the hospital at Dinajpur about a year ago. That the disease is common enough in Calcutta among natives I demonstrated[1] some three years ago, while I have since that time seen cases in Chota Nagpur, and obtained positive serum reactions for typhoid in the blood of several cases sent from that part of Bengal, and have no doubt it occurs not very rarely in the province. I have not, however, obtained any evidence during this enquiry of its being at all a common cause of death in the Dinajpur district, so am inclined to think that the figure of 1·8 per cent. of fever deaths shown in table II is approximately correct, although probably somewhat under the mark. It was not found to be especially prevalent among children.

[1] Typhoid as a common continued fever of natives.—*Indian Medical Gazette*, January 1902.

Lastly, the term "born feeble" has been used to denote a very common class in which infants die during the first few days of life, being invariably returned under the head of "fever" by the bewildered chaukidars. These cases form no less than 10 per cent. of the total mortality thus returned, and account for a great part of the very high infant mortality. In only a small proportion of these could a history of premature birth be obtained, but as the informants were nearly invariably men this proportion was probably too low. In a larger number it was found on enquiry that the infant was small and thin at birth, although syphilis does not appear to be nearly as common in the villages as in the town. An attempt was made to ascertain if this mortality was due to immaturity of the mothers or over-frequent child-bearing, but the husbands nearly always professed complete ignorance of their wives' ages, or stated that it was from twenty to thirty even when they had but one child. One important fact was, however, ascertained, namely, that in a large proportion of the cases the mothers had suffered from malarial fevers for some time in the last month or so before delivery, while it will be seen from table IV that the majority of these feeble infants were born during the height of the malarial fever season from August to December. These facts point to the high infant mortality being largely due to repeated malaria during pregnancy causing the birth of many very feeble infants, which succumb in a few days after their entrance into conditions which they are unfitted to withstand. The other chief cause of the high infant mortality is diarrhœa, which is most prevalent during the hot weather months. In several of these cases the mother had died either during delivery or from puerperal septicæmia, the infant being fed on cow's milk. As may easily be imagined its chance of survival in a native village under such conditions is small. Several of the early infant deaths occurred in the case of twins, while males died as often as females.

"Other causes" include two classes of cases, diseases rightly returned under fever and those of which fever is not an essential symptom. Among the former are puerperal fever 10 cases, or 1 per cent. of fever deaths; peritonitis 5; meningitis 3; rheumatic fever (?) 1; and lymphangitis 1, making a total of 20, or 2 per cent. The second class include dropsy 19 cases; child-birth 5, or 0·5 per cent.; tetanus neonitorum 5; old age 5; malignant tumours 3; small-pox 1, cholera 3; and one each of epilepsy, measles, liver abscess, asthma, bad feeding in an infant, snake-bite, syphilis, epistaxis hæmatemisis and drowning, all of which had been returned under the head of "fever." Many of these mistakes show obvious carelessness on the part of the chaukidars, but many of the more common errors would appear to be due to want of some small degree of instruction and control. Thus some thanas show no cases at all returned under the head of diarrhœa and dysentery, while only 70 deaths were returned under this head in the whole district in 1903. The numbers under "Other diseases" are always very much below the mark, only 295 cases having been shown in 1903. Whether the slight improvement which might be expected to result in from some elementary instructions being issued to the chaukidars is worth the trouble of undertaking must be left to the Sanitary Commissioner to decide, for in no case can anything approaching a reasonable degree of accuracy be expected from the present agency, while it is not easy to see how any other agency could be employed except at a prohibitive cost. The question whether many deaths escape registration my enquiry was not best fitted to ascertain, but on several occasions after going through the list of deaths returned I enquired for other deaths, but, as a rule, those which were mentioned by the villagers belonged to other years, and I came across very few deaths which had not been reported. The introduction of the duffadari system several years ago appears to have produced a considerable improvement in this respect, and as far as I can make out the total death-rates are now fairly accurate, although possibly somewhat below the mark in the southernmost thanas.

Monthly Distribution and Age Incidence of the Principal Diseases.

The age and date of death of each case was noted, and the analysis of these data has presented some points of interest and importance, which can best be shown in tables illustrating these data in regard to the chief causes of deaths returned as "fever."

TABLE IV.—MONTHLY INCIDENCE OF DISEASES.

	Malaria, acute.	Malaria, chronic.	Pneumonia.	Phthisis.	Bronchitis.	Diarrhœa.	Dysentery.	Enteric.	Born feeble.
January ...	...	16	27	8	4	10	2	...	5
February ...	...	11	27	6	...	8	4	1	10
March ...	...	20	8	10	4	9	4	6	8
April ...	7	17	19	5	2	12	11	2	11
May ...	2	11	17	8	2	10	1	2	2
June ...	9	13	16	7	1	6	5	1	3
July ...	17	14	10	3	1	6	2	1	2
August ...	17	13	8	2	2	5	8	...	7
September ...	19	11	6	6	...	5	2	...	9
October ...	22	15	20	4	2	5	4	...	13
November ...	24	20	28	14	2	17	3	2	16
December ...	16	24	31	17	3	9	15	3	18
Total ...	133	185	217	90	23	102	61	18	104

The seasonal distribution of the different diseases shown in this table are just what might have been expected, and thus indirectly confirm the general accuracy of the diagnosis arrived at. The most striking figures are those classed as acute malaria, the diagnosis of which was largely a matter of exclusion of other likely kinds of fever, and the fact that the very great majority of the cases occur in the height of the malarial season strongly supports the substantial accuracy of the data obtained, and also show that the time of the enquiries was the minimum malaria fever season, a fact which is in agreement with the returns of cases treated at the dispensaries of the district. Again, in the case of pneumonia the majority of the cases occur in the cold weather months, when the temperature falls to 30°F., the early mornings being both cold and misty. The cases classed as chronic malaria are more uniformly distributed, yet the largest numbers occur in the latter part of the malarial season, while an examination of the duration of these cases shows that the great majority of deaths from chronic fevers of from one to three months' duration occurred during the late autumn and early cold weather months, being thus doubtless mostly of malarial origin; while on the other hand most of the cases of very long duration, namely, six months or a year and more, died during the months of from March to July and most frequently in the hot weather season. Most of these latter were probably cases of the cachexial type of fever in which Leishman-Donovans bodies are found.

The prevalence of the cases classed as enteric in the dry months in the greatest numbers, and the nearly complete absence of them in the wet malarial season is also in accordance with the distribution of enteric fever in Calcutta, as I have shown in a previous paper.[1]

The great frequency of deaths in infants of a few days old during the malarial autumnal months has already been pointed out and discussed. Diarrhœa cases were most frequent in the hot season among children of under one year.

In the table on the next page, again the most striking and important figures relate to acute malaria, for it appears that three-quarters of the fatal cases under this heading occurred in children under ten years of age; and as it is now known that the infection of malaria is also spread mainly through children, it is clear that any measure which will appreciably lower the amount of malaria in children will have a most marked effect in reducing the death-rate from this disease. In the case of chronic malaria, too, a large proportion of the shorter and most definitely malarial cases also occurred among the children, while the majority of cases

[1] The differentiation of the continued and remittent fevers of the tropics by the blood changes. Trans. of the *Medical Chir. Soc.*, 1903 and *Lancet*, Volume 1, 1903.

TABLE V.—AGE INCIDENCE OF THE PRINCIPAL DISEASES.

Year.	Under 1.	1—5.	5—10.	10—15.	15—20.	20—30.	30—40.	40—50.	50—60.	Over 60.	TOTAL.
Acute malaria ...	21	59	21	7	7	5	3	6	3	1	133
Chronic malaria ...	2	30	20	12	11	28	23	20	11	28	185
Pneumonia ...	16	34	23	19	21	21	20	19	11	33	217
Phthisis ...	...	...	...	4	6	21	22	20	9	8	90
Bronchitis ...	...	...	...	...	...	...	1	...	2	20	23
Diarrhœa ...	41	23	4	3	2	5	6	3	2	13	102
Dysentery ...	8	9	5	3	2	8	10	4	6	6	61
Enteric ...	...	1	...	4	1	5	6	...	1	...	18

among adults were of a chronic nature, that is of a month or more in duration.

In the case of pneumonia it appears that nearly one-half of the cases occurred in children under 15 years old, who are scarcely ever admitted to hospitals, while the next most common age is over 60, generally in the form of broncho-pneumonia. Phthisis, on the other hand, is met with chiefly in young and middle-aged adults and bronchitis in old people.

Diarrhœa was by far the most common in infants under one year of age, more especially in the hot weather months, and next in children between one and five years of age, and in very old people, between 60 and 90 years. Dysentery was more evenly distributed, children and middle-aged adults chiefly suffering. Enteric was most prevalent between the ages of 10 and 40, and was not frequently met with in young children.

The figures given in table II, showing the relative proportion of deaths from different diseases in each circle, show a considerable degree of uniformity, but the exact percentage of different diseases in any one class will necessarily be dependent on those in the others. For example, in the case of the Thakurgaon district in the extreme north pneumonia is particularly prevalent, leaving a smaller number of cases to be distributed among the other causes of death. For this reason only general deductions can be drawn from these figures such as the larger proportion of cases of pneumonia and phthisis in the northern colder circles, as already pointed out. For the comparison of the degree of healthiness of the different parts of the district the death-rates per thousand of population must be examined.

DEATH-RATES PER THOUSAND IN EACH CIRCLE FROM THE PRINCIPAL DISEASES.

The distribution in the district of the different groups of villages in which the enquiries were made has already been briefly indicated, but some further remarks on the topographical conditions of these areas must be made. At this the driest time of the year it is very difficult to find any definite differences in the general surroundings of the villages in different circles, all resembling each other exceedingly closely. The whole district is one huge collection of rice-fields together with areas where jute is grown, and here and there patches of jungle, especially in the northern portion of the district. Numerous shallow half-dried up streams traverse the district from north to south, mostly in wide sandy beds, while among the rice-fields here and there small swamps of shallow weed-grown water still remain in the cold season. Tanks are fairly numerous and, in many places, are situated at a distance of several hundred yards from the villages, so that, their banks not being the nearest and most convenient latrine, the water of many of them appears to be good. There are also numerous wells in all parts of the district except the south, where the water-level is much lower than elsewhere, and wells therefore much more difficult to construct. In fact, the higher the ground water-level the greater the number of village wells. The water-supply, however, of neighbouring villages, whose general surroundings were similar, differed so little that no definite instances of variations in the death-rates, which could be attributed with any reason to their water-supply, were met with. In a previous enquiry,[1] which I carried out in the Bogra district, I found a very definite relationship between the lowness of the ground water-level in the dry season and the lowness of the spleen-rate, while the Malaria Commission have recently shown that there is a definite relationship between the spleen-rate and the proportion of children infected by the malarial parasites, or as, they call it, the "endemic index." This is a most important fact, as in a single-handed enquiry of the comprehensive nature required in the present instance it was impossible to attempt to work out the "endemic index" in all the areas visited, while an attempt to do so on a limited scale in the Bogra enquiry showed that in the minimal fever season of the late cold weather it does not give results proportional to the labour involved in carrying it out. In the present instance, therefore, I examined as many children between the ages of 2 and 10 as I could in each circle, and also carefully took measurements of the ground

[1] Report on the effect of the silting up of the Karatoya river on health of the Bogra district, 1901.

water-level in the wells. These figures are embodied in the following table of the death-rates per thousand in each circle from the main diseases :—

TABLE VI.

	1 Dinajpur.	2 Balughat.	3 Parsa.	4 Churaman.	5 Birganj.	6 Ranisankail.	7 Thakurgaon.
1. Position in district	C.	S.-E	S.-W.	W.	N.-E.	N.-W.	N.
2. Ground water-level in feet	8-10	16-20	33	15	9-17	5-12	12
3. Spleen-rate per cent.	54·3	56·7	28·3	29·3	72·8	83·2	95·0
4. Thana birth-rate	42·5	38·87	37 62	45·38	40·44	39·96	37·75
5. " total death-rate	49·28	34·78	31·33	41·60	44·93	48·52	43·56
6. " fever death-rate	44·06	20·99	29 05	38·93	43·43	47·21	41·67
7. Population of circle	3,886	4,253	3,848	3,307	3,[illegible]55	3,400	4,459
8. Fever death of circle	187	164	109	132	15[illegible]	157	205
9. Ratio per 1,000	48·06	3[illegible]33	28·62	39 88	44·70	46·20	45·96
10. " " " of acute malaria	8·19	5 2	3·41	4·23	6·26	2·35	5·38
11. " " " of chronic malaria	11·31	5 4	3 94	6·95	7·15	7·35	6 94
12. " " " of pneumonia	8·70	7·52	2·36	4 23	11 02	9·69	12·55
13. " " " of phthisis	2·57	2·35	2·10	8 02	3·57	5·88	4·48
14. " " " of bronchitis	2·05	0·7	0·26	0·6	0 59	0·59	1·34
15. " " " of diarrhœa	2·05	3 5	2·36	4·53	4·47	5·88	4·03
16. " " " of dysentery	1·80	2 6	0·79	4·23	2 38	3·23	1·57
17. " " " of enteric	...	0·7	0·79	0 6	0·59	0·59	1·57
18. " " " of "born feeble"	7·45	3·7	2·10	3·93	1·49	4 96	3·59
19. " " " of other causes	2·05	3·4	1·05	3·33	3·28	2·35	2·24
20. " " " of not diagnosed	1 03	3 5	9·46	4·23	3·87	3·53	2·24
21. Total malar a including complicated cases ...	21 55	11·3	8·40	12·38	15 51	16·10	16·83

A comparison of the second, third and the sixth lines of the table shows a remarkable relationship between a high ground water-level and high spleen-rates and fever mortality of the thanas and *vice versâ.* Thus at Porsa the ground water-level was 33 feet down, and the spleen-rate was only 28·3, the lowest met with, while the fever death-rate of 29·05 per thousand was also the lowest of all the thanas. Exactly the reverse holds good of the Ranisankil circle, in which the highest ground water-level coincides with the highest spleen and fever-rates. Similarly, Dinajpur, Birganj, and Thakurgaon thanas show high ground water-levels and spleen and fever rates, while those of Balughat and Churaman have lower rates approaching those of Parsa. The Dinajpur spleen-rate was not as high as might have been expected, but the number of children examined in that circle was small. Turning next to line 9, which shows the fever death-rate per thousand in the circles examined, we find a remarkably close relationship between the death-rates of these small circles and those of the thanas in which they are situated (line 6), clearly showing that the number of deaths enquired into in each circle were sufficient for the purpose of getting fairly accurate figures. An examination of the death-rates per thousand from the principal diseases reveals the fact that in the unhealthy thanas (1, 5, 6, and 7) the cases returned under acute and chronic fever and under pneumonia are especially high as compared with the less unhealthy areas (2, 3, and 4): further the highest rate for children dying within a few days of birth are also found in thanas (1 and 6), that is just the two which have the highest fever death-rates. The highest rates for phthisis are also met with in the unhealthy northern thanas 6 and 7. The rates for bowel-complaints are irregularly distributed in this respect. In line 21 the figures of the total death-rate from cases classed as malarial fever, including those dying of complications, such as pneumonia, dysentery and diarrhœa, are given, and they bring out clearly the fact that the principal cause of the differences in the death-rates of the unhealthy and less unhealthy circles is mainly due to the greater mortality from malarious diseases in the former class—a point of the utmost practical importance, as it is among these cases that there is the best chance of lowering the mortality and saving lives by proper sanitary and prophylactic measures. This is in fact one of the most important conclusions to be derived from the analysis of the tables, based on figures which have been collected with great care and trouble, and which are at least very much more accurate than the ordinary statistical data available.

The relationship to the ground water-levels of the health of the different areas shows that these local variations are dependent on the physical characters of the country, which cannot be altered save by the slow operations of nature in raising a deltaic tract or by the more rapid action of severe earthquakes, such as that of 1897, which is said to have improved the health of the Rangpur district, probably by slightly raising the level of the country and thus allowing of better surface drainage and more rapid drying up of the soil at the end of the rainy season.

The Seasonal Influence of Variation in the Rainfall.

In this connection it will be convenient to refer to the seasonal conditions which influence the mortality from fevers in different years. It is unnecessary to go into detail on this point, as the results of a close study of the monthly rainfall of different parts of the district and the fever death-rates for the last ten years have only confirmed the very close relationship between a marked deficiency of the rainfall and a high death-rate from fevers, which I pointed out in 1897 in my report on Kala-azar[1] to have been characteristic of the Rangpur and Dinajpur

[1] Report on Kala-azar, 1893.

districts, for the last thirty years, and which I showed in my report on the health of the neighbouring Bogra district[1] also holds true of that area. In Dinajpur there was one marked exception to this rule for the rainfall was heavy in 1902, and the fever death-rate also high, but on examining the monthly figures it appeared that, although the total fall was high, the rains stopped earlier than usual, the amount in the latter part of the rainy season being deficient. The explanation of the relationship is simple enough, as when the rains are deficient and especially when they are so in the latter part of the season, then the time during which the country is drying up, and innumerable pools suitable for the breeding of mosquitoes are present, is prolonged, and the fever season, which is autumnal in these parts, begins early, and also as a rule continues late, the total death-rate being considerably enhanced. On the other hand, when the rains are steady and prolonged, these low-lying parts are mostly flooded and the mosquito larvæ are carried away. In support of this supposition I may cite the case of the floods in Calcutta in 1900, during which year I was making regular observations on the breeding places of anopheles in a suburb of Calcutta,[2] and the only time I failed to find any was soon after the floods. On the other hand, in high ground, such as Chota Nagpur, the fever season is at the height of the rains and follows the rise and fall of the ground water-level, malarial cases rapidly decreasing at the end of the rains owing to the quick subsidence of the ground water-level, as I showed in the case of Ranchi in 1896.[3] These seasonal variations are also beyond control, but a knowledge of them will not only allow the variations in the incidence of malaria to be easily understood in different districts, but the increases of the fever-rate may be confidently predicted as soon as the character of the monsoon has fully declared itself and measures taken by the medical authorities to meet the coming rise, while a decrease may also be forseen on the onset of a favourable season, and needless alarm of a recurrence of the high fever-rate may be allayed.

BIRTH RATES.

The Sanitary Commissioner has also asked for information on the relationship of the birth and death-rates. In 1902 the high death-rate was accompanied by a high birth-rate, that of the Dinajpur district

[1] Report on the effect of the silting up of the Karatoya river on the health of the Bogra district, 1901.

[2] The seasonal prevalence of anopheles and malarial fever in Lower Bengal and the practical application of the mosquito theory. *Journal of Hygiene*, October 1901.

[3] *Indian Medical Gazette*, February 1896.

having been 49 per thousand, and it has been pointed out that this is an unusual state of affairs. In line 4 of table VI are shown the birth-rates of the thanas in which I worked, and it will be seen that they are very much lower than those of the previous year. The explanation seems to be simply that as the highest death-rate due to fevers take place in the autumn, its effect in reducing the birth-rate will not be evident until the figures of the succeeding year are available, so that the lower birth-rate of 1903, corresponds with the high death-rate of 1902, as might have been expected. The large number of infants which die within a few days of death in the malarial season, their mothers having suffered from malaria before delivery, which has been already pointed out, also go to swell both the birth and death-rates of the Dinajpur district and partially account for the relatively high birth-rate. No definite relationship between the birth and death-rates of the different thanas can be made out from the figures given in table II, the birth-rates not having varied greatly in different parts of the district. The fact that both the birth and the death-rates are lowest in the two southern thanas may possibly be due to less efficient registration in that part of the district. The rates for all the villages visited have also been obtained for me by the District Superintendent of Police, Mr. F. L. Peters (to whom I am greatly indebted for all the trouble he has taken over my enquiry), but the figures show such extreme variations that it is clear that the populations of individual villages are too small for such a study to be of any value. Taking several villages together I find that the birth-rates were unusually low in most of the villages of the very unhealthy Ranisankail circle, where they averaged only about 30 per thousand, but more than that cannot be said.

Variations in the Mortality from Fevers in Individual Villages.

Next we have to consider the variations in the surroundings of different villages in relationship to the fever mortalities in them. Here we have to be specially cautious in drawing conclusions for several reasons. In the first place the villages are mostly very small, containing two or three hundred inhabitants only, so that small and possibly accidental variations in the number of deaths in a single year will make great differences in the rate per thousand of population. In the second place the subdivision of a circle into different villages for the purposes of mortality returns in this part of Bengal is a very artifical one, for villages in the sense of a collection of considerable number of houses close together are rarely met with, each so-called village really consisting of a number of scattered homesteads dotted at irregular intervals over a considerable area, which may amount to one or more square miles, so that the relationship of different parts of a village to such a source of mosquitos as a small stream may differ widely. Further, as already pointed out, the conditions in the cold dry weather give but a faint and totally inadequate idea of the surroundings in the rainy fever season, as will be further illustrated in the section on mosquitos. Nevertheless in a few instances there seemed to be a definite relationship between certain conditions and the fever death-rate which are worth mentioning. Thus the Dinajpur circle comprised an area between two streams, one of which was a clean sandy river bed with a good flow, while the other was a stagnant weed covered and very sluggish one. Two villages on the banks of the latter had a fever death-rate of 81·8 per thousand, the highest rate met with during the whole enquiry. The other villages did not show such marked variations, but the death-rate of the whole area was very high, as was the water-level and the malarial rate. In short, it was a typical example of a waterlogged area in a "dying river" district.

Next we may take the Birganj circle, which furnished an instructive example. As already mentioned, the villages in this circle were chosen partly on a good river and partly several miles from it in an area quite dried up at the time of my visit. Nevertheless, the latter dry area showed a death-rate of 54·3 per thousand against one of 41·1 in a group of villages near the river and of 34·7 in a large village close to the river, but on higher ground with a water-level 17 feet down. The explanation of this difference was revealed when it was found that the dry area had the high ground water-level of 9 feet. It was therefore less well drained than the higher areas near the stream, and the floods of the rainy season would be longer in subsiding at the end of the year, and would thus form favourable mosquito-breeding grounds for a longer time. In the Thakurgaon circle there were four large villages of scattered hamlets all under very similar conditions and with about the same ground water-level (12 feet), and here the death-rates varied very little, all being between 40 and 50 per thousand. In Ranisankail itself the ground water was 12½ feet down and the spleen-rate was 62·7 per cent., while the fever death-rate was 45·5 per thousand. In the villages to the north and south the spleen-rate was 98 per cent. and the ground water-level only from 5 to 11 feet down, while the fever death-rate was 74·3 per thousand, a very high figure. Here once more we find a relationship between a high ground water-level and a high spleen and fever rate. It was here that numerous cases of chronic fever with very large spleens were met with, the nature of which will be discussed in the second part of this report. They are precisely those cases which have always been known as "Malarial Cachexia" and which are responsible for much of the death-rate returned as chronic fevers in my tables, although some of them fall under the head of pneumonia and dysentery, as these diseases often attack people debilitated by prolonged fever and prove the actual cause of their deaths.

The above four circles are those with the highest fever death-rates and the uniformity with which they show a marked relationship between a high ground water-level and high spleen and fever death-rates, a relationship which I have repeatedly pointed out in previous reports and papers,[1] is the most striking and important point brought out by this part of the inquiry.

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PART II.—THE NATURE AND ETIOLOGY AND PROPHYLAXIS OF THE FEVERS IN DINAJPUR.

The Varieties of Fever met with.

It has already been mentioned in the first part of this report that the enquiry was carried out in the minimal fever season, and that the village enquiry occupied the major part of my time. Nevertheless, a few cases of fever were met with attending the Dinajpur dispensary, the blood of which was examined for malarial parasites, while on two occasions a number of chronic fevers in the most feverish part of the district were examined by means of spleen puncture for the recently described parasite-like bodies found last year in chronic fevers by Leishman and Donovan, and more recently in a case from Sylhet by Manson and Low.

Firstly, with regard to the kinds of malaria met with, the commonest variety was the malignant tertian form just as it is in Calcutta and most parts of India. One case of benign tertian was also found in Dinajpur. During the village enquiry a history of quartan fever was obtained in a number of cases in the circle a few miles to the east of the town, and these cases were usually of a chronic nature, terminating fatally after several months of fever. During my last visit to Ranisankail a patient came to the hospital with a history of fever of the quartan type, and having suffered from an attack two days before. An examination of his blood showed typical quartan parasites, some just beginning to sporulate, which would correspond with his statement. These cases are probably much more common in the rainy season, and are of interest in connection with the finding of A. Listoni in the district to be mentioned presently, for in the Duars the Malarial Commisson found quartan fever to be the commonest type and to be also associated with the same species of anopheles. All three varieties of malaria were thus met with

[1] The relationship of the level of the ground water-level to the incidence and seasonal distribution of malarial fevers in India. *Lancet*, March 12th, 1898.

in the district even in the dry season, but it is not possible to deduce accurately the relative prevalence of each from the few cases found at this time of the year.

A more important question to solve was whether the Leishman-Donovan bodies could be found in chronic fevers in this district, and, if so, the frequency of their prevalence and how to differentiate from ordinary chronic malaria. Dinajpur was an especially interesting place in which to examine this question, for, as I showed in my report on Kala-azar, that epidemic took its origin in a very severe outbreak of fever in the Dinajpur and Rangpur districts in the early seventies owing to a succession of very unhealthy years on account of deficient rainfall. The brief description as yet published by Donovan[1] pointed to a close resemblance between his cases and Kala-azar, and he has recently suggested that they may be the same disease. For purposes of searching for this new parasite it is necessary to do a spleen puncture, as they have not yet been found in the peripheral circulation. This little operation is without danger if properly done, but it necessitates being able to examine the cases in a hospital and careful antiseptic precautions. For over a month a careful watch was kept for suitable cases in the Dinajpur in-door dispensary, but no such case presented itself. On discussing the question with Captain Megaw (to whom I am very greatly indebted for much help throughout my investigation both in getting me cases and in helping in the microscopical examination of some of the slides) he informed me that he had seen a number of such cases at one place only, and that was Ranisankail in the north-west part of the district. When at this place on the village enquiry a number of such cases were met with in the villages around, and they came to the dispensary, which was the most popular one in the district, and by means of anæthetising the surface of the skin with an ethyl chloride spray, spleen puncture was readily performed, even in children, in a painless manner and without the slightest difficulty, on the part of the patients, except in so far that some without fever were disappointed at not being submitted to the new treatment. On a subsequent occasion a second series were done at the same dispensary, every case with any considerable enlargement of the spleen and recent fever being taken without any selection, the histories of the cases being also carefully recorded. These cases taken as a whole were exactly those which have always been considered to be "Malarial Cachexia," some of them presenting as great enlargement of the spleen and liver, accompanied by general wasting and darkening of the skin, as seen in typical cases of Kala-azar

[1] Donovan, *Indian Medical Gazette*, December 1903.

or Kala-dukh when they were considered individually. Others of the cases only presented comparatively slight enlargement of the spleen such as invariably results from repeated attacks of malarial fever. Including one case examined later in the Dinajpur hospital, 30 in all were submitted to spleen puncture, and in most of them a slide was also made from the peripheral blood, and examined for malarial parasites, and a differential leucocyte[1] count made. In this way it was expected that it would be possible to get some clear ideas as to the differentiation of the class of cases in which the new parasites were found from the malarial cases. The results obtained can best be shown by tabulating them in groups.

TABLE VII.—CHRONIC MALARIAL FEVERS.

No.	Sex.	Age.	Duration of fever.	Recent fever.	Anæmia.	Darkening of the skin.	Enlargement of the spleen.	Liver edge below ribs.	Wasting.	Malarial parasite.
1	M.	7	3 years...	Slight ...	Slight ...	Very dark	Beyond navel.	Nil	Thin	Mal tert.
2	„	7	2 „ ...	Frequently	Do. ...	Extremely dark	A. S. S.	1″	Do.	Ditto.
3	„	12	2½ „ ...	Every day	Marked ...	Dark ...	To navel	...	Do.	Ditto.
4	„	14	2 „ ...	Ditto ...	Do. ...	Nil ...	Beyond navel.	Nil	Nil	Ditto.
5	„	8	3½ „ ...	Frequently	Very marked	Dark ...	A. S. S.	1″	Thin	Cresents.

A. S. S. equals down to the anterior superior spine of the ilium.

It will be seen that these cases were of a very chronic type of fever, and all showed the malignant tertian variety of malarial parasite and marked splenic enlargement. Nos. 2 and 4 also showed marked increase of the large mononeuclear white corpuscles, namely 14 and 17 per cent., respectively. No. 3 showed 9 per cent. and No. 5 only 6 per cent.

TABLE VIII.—CHRONIC FEVERS SHOWING LOSHMAN-DONOVAN BODIES.

No.	Sex.	Age.	Duration of fever.	Present fever.	Anæmia.	Darkening of the skin.	Enlargement of the spleen.	Liver below ribs.	Wasting.	Leishman-Donovan •bodies.
1	F.	4	15 months	Daily ...	Very marked	Dark ...	A. S. S.	1″ ...	Extreme	Numerous.
2	M.	15	1 year	Do. ...	Marked ...	Very dark	Beyond navel.	1″ ...	Ditto..	Scanty.
3	„	25	2 years	Slight ...	Slight ...	Dark ...	4″ ...	Nil...	Slight ...	Numerous
4	„	15	7 months	Daily ...	Do. ...	Do. ...	Beyond navel.	Do.	Extreme	Scanty.
5	„	40	2 years	Do. ...	Do. ...	Nil ...	4″ ...	Do.	Thin ...	Numerous.
6	„	14	1 month	Do. ...	Do. ...	Do. ...	To navel	1″ ...	Nil ...	Scanty.
7	„	8	1 year	Do. ...	Very marked	Do ...	Ditto ...	Nil	Extreme	Do.
8	F.	7	1 month	Do. ...	Marked ...	Dark ...	Beyond navel	¼″ ...	Thin ...	Numerous.
9	„	6	1 year	Do. ...	Slight ...	Nil ...	A. S. S.	4″ ...	Extreme	Scanty.
10	M.	8	1 „	Nil ...	Marked ...	Dark ...	Ditto ...	1″ ...	Ditto...	Do.

• Died of pneumonia. Bodies found in spleen, liver and bone marrow *post-mortem*.

[1] Since my return to Calcutta I have been able to find these parasites in still

The table on the previous page shows a very similar class of cases to those in that of the malarial series, and also a very great variation in the duration of the disease. Thus in cases 6 and 8 the fever had only lasted one month and no marked cachexia was present, although the spleen in both cases was very large for such a duration of fever, being down to the navel. In No. 8 the temperature was 100·2 at the time the spleen puncture was performed, and the slides contained the largest number of bodies met with in any case in the Dinajpur district. In both series of cases darkening of the skin was a marked feature of the majority, and in some instances the patients or their relatives volunteered the statement that the skin had become darker recently. In nearly all of both series there was distinct and often extreme wasting, the face and limbs being very thin, and contrasting with the large abdomens, presented the typical picture of the condition always known as "Malarial Cachexia," but this remark is equally applicable to those which showed only malarial parasites as to those which presented the new bodies recently described. In short, these examinations throw no light on the very difficult question of the differentiation of the malarial cases from those which are presumably due to the new bodies, admitting for the present that they are parasites, as they appear to be. It is of course possible that all these chronic cases may be due to the new bodies, and the presence of malarial parasites in some of them was an accidental complication. It appears to be more likely, however, that the new bodies are a form of protozoa very closely allied to the malarial parasites, and producing a very similar train of symptoms, but with a greater tendency to produce rapid cachexial state, and with a greater resistance to the action of quinine in ordinary doses. In view of the above results it is clear that the differentiation of the two forms by purely clinical means apart from spleen puncture will be a matter of extreme difficulty and will require a study of a much larger series of cases than the present one. The fact that one-third of these cases showed the new parasite is sufficient to prove that it is present in a large proportion of these chronic fevers. On the other hand, in no less than half the cases neither malarial parasites nor the new bodies could be found even by spleen puncture, although all but two of the patients gave a history of fever continuing for a long time up to the date of examination, and chiefly occurring at night or in the evening. It is clear, then, that no more can be said than that the new parasite-like bodies can be found by spleen puncture in a number of chronic fever cases with large spleen

larger proportion of this class of cases, nearly every case of so-called "Malarial Cachexia" having shown the new parasites in the spleen, while they could not be found after deaths from other diseases.

in the Dinajpur district, and that no distinction can at present be made out between the symptoms seen in these cases and in those due to repeated attacks of malaria in which malignant tertian parasites were found.[1]

With regard to the nature of the bodies found in the former cases there is little to be said; for in view of the fact that such authorities as Laveran, Ross and Manson are at complete variance as to the classification of them, it is useless to add one more to the opinions already expressed with regard to their nature. I will only say that nothing like a trypanosome was ever seen in any of the cases, either in the peripheral blood or in that drawn direct from the spleen during life. I hope to be able to submit coloured drawings and specimens to high English authorities on protozoa very shortly in the hope that they will be able to throw some light on the question, but in all probability some of the stages of the parasite have still to be discovered. The form most frequently seen is a small oval body slightly longer than it is broad, measuring about one-third the diameter of a red blood corpuscle in its longest axis. It has two nuclei, one of which is small and often rod-shaped and stains deeply, while the other is rounded, considerably larger, but more feebly stained. They are free in the blood from the spleen and in most of the cases are scantily met with, but in exceptional instances, and usually in cases which showed an actual fever at the time the blood was taken, they may be very numerous, a number of them being seen in some fields. In addition to this common form small groups of similar bodies are met with clumped together so as to very closely resemble a quartan sporulating body, some of them being in the act of breaking up. A still earlier stage is sometimes seen in which pairs of unequal sized neuclei are grouped within a single cell, but no separation into the small bodies is yet to be distinguished. These last bodies are somewhat larger than the largest of the simple forms, and appear to be formed by a subdivision of the nuclei of the largest full-grown small forms. I have not been able to detect these bodies in the peripheral circulation by examinations of ordinary blood films, but this would not exclude the possibility of their being present in small numbers there. They may be found within the polynuclear white corpuscles, and be thus undergoing degeneration, which is of interest in connection with the very great reduction of the total leucocytes, and especially of the polynuclears in these chronic fevers which I have previously pointed out.

KALA-DUKH AND KALA-AZAR.

In accordance with my instructions to visit the Kala-dukh area of

[1] The differentiation of the continued and remittent fevers of the tropics by the blood changes. Trans. of the *Medical Chir. Soc.*, 1903, and *Lancet*, Volume I, 1903.

Purnea district, I made enquiries from the district authorities as to the parts at present affected by the disease, and was informed by the Civil Surgeon, Captain Hayward, I.M.S., that it was to be found in the north of the Kissenganj subdivision. I wrote to the Subdivisional Officer for information some three weeks before I intended to start for the Purnea district, but did not receive any reply until after my return from a fruitless search for the disease, and then was informed that it had died out of the district. During my visit to the area under the kind guidance of Captain Hayward evidence was obtained of the spread of the disease in a northerly direction, for at Aloobaree it had been present eight years ago, while eight miles further north at Chapra it has disappeared only three years ago. On reaching Thaurganj, 16 miles north-west of the first-named place, search was made for cases in the neighbouring villages which were badly affected by the disease at the time of the enquiry made by Major Harold Brown[1] in 1898, but here we were informed that it had disappeared a year ago, and two persons who had suffered from the disease were shown me, one of which had been free from fever for a year and appeared to be nearly completely recovered from its effects, while the other had had no fever for six months, and but was still thin and his spleen reached nearly to the navel. No cases still suffering from fever could be found, so no spleen punctures could be performed with any hope of finding the new parasite-like bodies.

On the other hand, thanks to the kindness of Dr. Dodds Price of the Nowgong district of Assam (who helped me so materially in my enquiry into the nature of Kala-azar in 1896-97) in very kindly sending me slides made from blood obtained by spleen puncture in seven cases of Kala-azar, I was able to search for the new parasites in these cases. The results are shown in the following table: one slide was spoilt in trying a new fixing agent:—

TABLE IX.—KALA-AZAR CASES.

No.	Duration of disease.			Parasites.
1.	7 months	...	...	Numerous.
2.	3 years	...	...	Ditto.
3.	2 ,, improving	...	...	Nil.
4.	5 months	...	...	Numerous.
5.	8 months	...	...	Scanty.
6.	$2\frac{1}{2}$ years	...	...	Ditto.

NOTE.—This observation has since been confirmed in two further series of slides from Kala-azar cases.

[1] Report on Kala-dukh by Major Harold Brown, I.M.S., 1898, and in *Indian Medical Gazette* of 1898.

It will be seen from this table that the new bodies were found in every case except one, which was improving and in which recovery was expected to take place. They were more frequently present in large numbers in this series than in the Dinajpur cases, but no differences in the appearances they presented could be made out in the two series. Since these observations were made a paper by Dr. Bentley, of Assam, has appeared announcing that he has also independently found the Leishman-Donovan bodies in Kala-azar cases, and abandoning the theory he advanced so warmly a little over a year ago that Kala-azar was a severe form of Malta fever.[1]

The importance of these observations lies in the fact which I pointed out several years ago[2] that single cases of the Assam epidemic disease were indistinguishable from cases of ordinary "Malarial Cachexia," so that the discovery that a protozoal parasite (differing from that of malaria and producing the same condition as repeated attacks of malaria causes) is to be found in many cases of "Malarial Cachexia" and in the communicable form of the disease in Assam will fit in with the known facts. So far the new form of parasite has not been found to contain pigment, so that if this is confirmed, then it will be certain that in both the endemic and the epidemic form of the new fever, malaria must be a nearly universal complication, for I showed both in Assam in the case of Kala-azar, and in Calcutta in the case of "Malarial Cachexia,"[3] that melanotic pigment characteristic of malaria is, in my experience, always to be found in the organs *post-mortem* in both series or cases. Possibly it may prove that the new parasites are a secondary infection in patients already infected with malaria, which is so well nigh universal in both Eastern Bengal and Assam, but such points can only be cleared up by further investigations. From the practical point of view the most important inference lies in remembering that quinine in large doses is the only drug which will cure these chronic fevers, although it undoubtedly not infrequently fails in neglected cases. Further, as demonstrated by Dr. Dodds Price, of Nowgong,[4] the drug is undoubtedly an efficient prophylactic against the disease; for while carrying out the segregation measures I

[1] Bentley on Epidemic Malta fever in Assam, *Indian Medical Gazette*, September 1902.

[2] Report on Kala-azar, 1893.

[3] Is malarial cachexia purely malarial? *Indian Medical Gazette*, October 1902.

[4] Note on Kala-azar by Dr. J. Dodds Price. *Indian Medical Gazette*, October 1902.

recommended (which proved eminently successful[1] in getting rid of the infection of coolie lines), he found that his hospital assistants and menials in the Kala-azar camp one after the other contracted and died of the disease. He then took to dosing them regularly with quinine, after which, in the course of several years, he only lost one man, who had become infected before the quinine administration. If it is such a powerful prophylactic it can hardly fail to have curative effects in big doses in early cases of the disease, so that the measures which will be of value in preventing this class of fevers will be the wide distribution of quinine as in malarial fevers.

Varieties and Distribution of Anopheles.

The facts collected bearing on the presence of malarial-bearing mosquitoes in different parts of the district may next be dealt with. A careful study of this part of the question was first made in Dinajpur town, and subsequently the varieties found in different circles in the district were worked out. As Stephens, Christophers and James have shown that the varieties of anopheles present in any district play a very important part in the etiology of malaria, it is necessary to ascertain the proportion of the different kinds as well as the total number of the anopheles present. Thanks to the recently-published book of the two first-named authors, this is not such a difficult task as it was a short time back. In searching for anopheles it is necessary to ascertain both their breeding places and also the numbers actually met with in the houses of the people. The latter was done with the aid of the Municipal Overseer, who rendered great assistance in the matter. In the month of January, when this survey was carried out, the breeding places were limited to the rivers which run past and through the town, and the tanks within it, which are not very many in number. The former include a very sluggish weed-overgrown stream and a canal of a similar nature, which run through the eastern part of the municipal area, while it is bounded on the west side by the river. There are several good brick-lined drains in the town, but most of the roads still have only earth surface ones, which always retain water and form the most important breeding-ground for anopheles in the rainy season, so that the distribution of the different varieties will be very much more widespread at that time than they were at the time of my inquiry.

In all no less than five varieties of anopheles mosquitoes were

[1] Kala-azar successfully eradicated from tea gardens by segregation measures. *British Medical Journal*, September, 1898, and Trans. *Medical Chir. Soc.*, 1899.

actually caught in the houses. That which was by far the most commonly met was A. Fuliginosus, as will be seen from the table below. Next came A. Rossii, although this variety was only present in large numbers in the houses near the tanks in the centre of the town. The next most frequently met with was A. Listoni, and this is probably the most important of all, for the Malaria Commission[1] found it to be associated with a very high prevalence of malaria in the Duars, where it was the most common anopheles met with and the only one which they found to be naturally infected. It has not hitherto been found south of the Jalpaiguri district as far as I know, so its presence throughout all the most malarious parts of Dinajpur is noteworthy, for although only found in small numbers during my visit from January to March, yet there are good reasons for believing that it may be present in much larger numbers in the rainy fever season. In the first place this variety breeds exclusively in running water, so that its breeding-places in the cold dry season are limited to the streams on either side of the town. In the rainy season, however, there will be numerous flowing streams and earth-lined drains which will afford it adequate breeding-grounds throughout the town. Once more in the Punjab Major Adie[2] has shown that although in the dry season A. Fuliginosus is the common anopholes met with, yet in the rainy fever season it is nearly entirely replaced by the A. Culicifacies, which belongs to the same group of small dark malaria carrying mosquitoes as does the A. Listoni met with in Dinajpur. It is probable, then, that this dangerous variety is much more common in the fever than it is in the dry season. The other two varieties met with in the houses are of much less importance, for they belong to the wild group, which breed in swampy places and rarely enter inhabited houses, while they have never yet been found to be carrying malaria under natural conditions. These are the A. Barbirostris and A. Sinensis, the latter having only once been found in the houses, although their larvæ were met with not very rarely in weed-grown streams and canals, especially to the east of Dinajpur.

With regard to the breeding-places of these varieties, it may be said that A. Fuliginosus was met with in both the streams and also in weed-grown tanks. A. Rossii in the tanks most commonly, A. Listoni chiefly in the sandy river to the west of the town, especially close to the grassy banks, but they must also have been breeding in the more sluggish stream to the east, as they were caught in the houses of that part of the town. The other two were found in the weedy streams as

1 Reports of the Malaria Commission of the Royal Society.

2 Adie, *Indian Medical Gazette*, 1903.

already mentioned. While making collections in the houses in different parts of the town striking differences in the local distribution were met with. Thus, while A. Rossii abounded in the central tank strewn portion, and A. Fuliginosus and A. Listoni near the streams on either side of the town, there was a dry zone between the central and the western portions in which a very careful search failed to reveal a single anophele. Moreover, the more intelligent inhabitants of the riverine portion where most A. Listoni were found were convinced that this was the most malarious portion of the town in the rainy season, although this was not evident at the time of my visit in the dry healthy season.

Turning next to the distribution of the anopheles in the district circles, which is illustrated in table X, we find the A. Fuliginosus to have been the common variety in all parts of the district in the cold season. A. Rossii and A. Sinensis were seldom found except in the town of Dinajpur, and A. Barbirostris was only occasionally met with. With regard to the malarial carrying A. Listoni it is worthy of note that it was not met with in Porsa at the extreme south of the district, this being also the least feverish part, nor could its larvæ be found in the river, which appeared to present favourable conditions for its presence. In Churaman also, which is also comparatively little feverish, I failed to find this variety. It would not be wise to lay too much stress on this point as the distribution of this mosquito might be much more extensive in the malarial season.

TABLE X.—VARIETIES FOUND IN THE HOUSES.

	Dinajpur.	Balughat.	Porsa.	Churaman.	Ranisan-kail.	Total.
A. Fuliginosus ...	178	51	103	106	108	546
A. Rossii	39	5	...	...	...	44
A. Litsoni... ...	6	4	...	...	6	16
A. Barbirostris ...	3	1	...	1	3	8
A. Sinensis ...	2	...	...	...	...	2
Total ...	228	61	103	107	117	616

Dissection of Anopheles.—In addition to ascertaining the varieties of anopheles present in the houses it is also necessary to find out by means of dissections and microscopical examinations of the salivary glands for sporozoits which varieties are actually carrying infection. For this purpose 138 anopheles caught in the houses in Dinajpur were examined for sporozoits, but none were found. Nearly all of them were A. Fuliginosus, which was never found to be naturally infected by the

Malarial Commission, although they showed that it can be artificially infected. More recently Major Adie[1] in the Punjab found one of these anopheles to contain sporozoits resembling those of human malaria, but it is clear that it is not a common carrier of the disease. Unfortunately very few A. Listoni could be obtained for dissection, and no sporozoits were found in them. This is not surprising, for these dissections were carried out in the cold month of January, and it is well known that a certain temperature is necessary to allow of the development of the malarial parasite in mosquitoes. In a previous paper I showed[2] that the number of cases of malarial fever fell off very rapidly in a suburb of Calcutta as soon as the minimum temperature fell to 60F., doubtless for the reason just mentioned, and as the minimum temperature in Dinajpur in January was much below that point it is not surprising that no sporozoits could be found. I had hoped to be able to ascertain if the A. Listoni was infected when the weather had become warmer again, and just before leaving Dinajpur in the middle of March, I tried to collect the necessary mosquitoes, but they were still as scanty as earlier in the year, so I was not able to obtain them in sufficient numbers for dissection. This point can only be settled in the rainy season, but as Dinajpur is close to Jalpaiguri, where the Malaria Commission found the A. Listoni to be infected later in the year than the time of my inquiry, there can be little doubt that this is the variety which is mainly responsible for the prevalence of malaria in Dinajpur and the neighbouring districts, for I also found this species in small numbers in the northwest corner of the Purnea district.

The Possibility of Destroying Anopheles in Lower Bengal.

It will be convenient in this place to discuss the practicability of attempting in Lower Bengal to destroy those anopheles which carry the infection of malária as a method of malarial prophylaxis. It will be clear from what has been written above that it would be an utter waste of money and labour to attempt to destroy all the different kinds of anopheles, when only one, or possibly two, of them, have been found to carry the disease in nature. Thus, it is now generally admitted from dissections of many hundred A. Rossii that these are never found to be naturally infected, although they can be infected by artificial means, and are thus theoretically capable of conveying the disease. For the same reason, we may exclude from our consideration the swamp species

[1] Adie, *Indian Medical Gazette*, 1903.

[2] The seasonal prevalence of anopheles and malarial fever in Lower Bengal and the practical application of the mosquito theory. *Journal of Hygiene*, October 1901.

which very rarely enter houses, and have also not been yet found to be naturally infected. This leaves us with only the A. Fuliginosus and A. Listoni, the former of which has only once been found naturally infected in the Punjab, while there it almost disappears before the fever season begins. If it proves to have a similar seasonal distribution in Bengal it may also be excluded from consideration as not being of any material importance in the etiology of malaria. Some three years ago a plan for destroying anopheles mosquitoes in Calcutta was initiated under the idea that they only bred in small pools which could be easily dealt with, as suggested by Major Ross. At that time I made a careful search for the breeding-places of anopheles month by month for more than a year in a selected area in a suburb of Calcutta, with the result that I found them[2] to be breeding in enormous numbers in nearly all the tanks during the hot-weather months, that is, at the time of the minimal malarial season. On the other hand, they were much fewer in number during the rainy malarious time, but their distribution was then different, the tanks being free from them, while the chief breeding-places were small pools and more especially the shallow uneven earth drains on each side of every road. Moreover, in these roadside drains varieties of anopheles which can carry malaria were found, whereas those which had swarmed in the tanks at an earlier period were all A. Rossii, which we now know [1] are harmless as far as the spreading of malaria is concerned. The measures which were being taken for destroying the A. Rossii in the small pools and tanks, then, were only money thrown away as far as malarial prophylaxis was concerned. This example is mentioned to show that great circumspection is required in recommending measures for destroying anopheles in Lower Bengal.

A still more instructive example is that of the measures which have been carried out under the directions of members of the Malaria Commission during the last two years at great expense to test the practicability of destroying anopheles in a portion of the very malarious cantonment of Mian Mir,[2] the results of which have recently appeared. In this place the chief breeding-ground of the malaria-bearing variety was the irrigation canals which traverse the cantonment. The results of these operations will be familiar to the Sanitary authorities, but briefly it may be said that the elaborate measures carried out persistently for two years resulted in only a slight diminution of the number of anopheles in the houses of the treated area. On the other hand, much good was obtained by prophylactic issue of quinine, and still more

[1] Reports of the Malaria Commission of the Royal Society.

[2] Report on anti-malarial measures at Mian Mir. Scientific Memoirs, New Series, No. 6, by S. P. James.

marked effects were got by treating all the children in a syce line in this way, malaria being nearly absent from both the children and the adults. Further, the moving of some syces from their old lines near the canals to one-half a mile or more from them resulted in an entire absence of both the anopheles and of malaria fever among them. That the total destruction of the malaria-bearing mosquitoes will prevent the fever is certain, but experience in India has proved that it is only very exceptionally favourable conditions that this measure is practical, while it must be continued indefinitely. Such conditions were met with at Ismalia, where rain falls on but very few days of the year, and certain swamps and pools were easily permanently filled up. Here the resulting reduction of malaria has been most marked, but to attempt to apply this method to the totally different conditions of Lower Bengal and to expect similar results would be utter folly.

In view of the above facts, let us return to the conditions met with at Dinajpur. Here we have the malaria-bearing A. Listoni breeding throughout the course of two streams one on either side of the town, and probably also in the rainy season in the numerous subsidiary streams which flow into the main one during that time. To attempt to destroy the larvæ in these rivers throughout the rainy season is obviously utterly impracticable. Something may be done by steadily extending year by year the brick-lined drains through the main streets, so as to do away with the stagnant earth-lined drains, the bottoms of which it is almost impossible to keep sufficiently level to prevent water standing in them. Further within the municipal limits the formation of borrel pits during road-making by the Public Works Department should not be allowed, as at present, for they form excellent breeding grounds in the rainy season. These measures are only applicable to the town itself, and do not touch even the smallest proportion of the total population of the district among whom it is quite clear, then, that some other measure than mosquito destruction must be relied on.

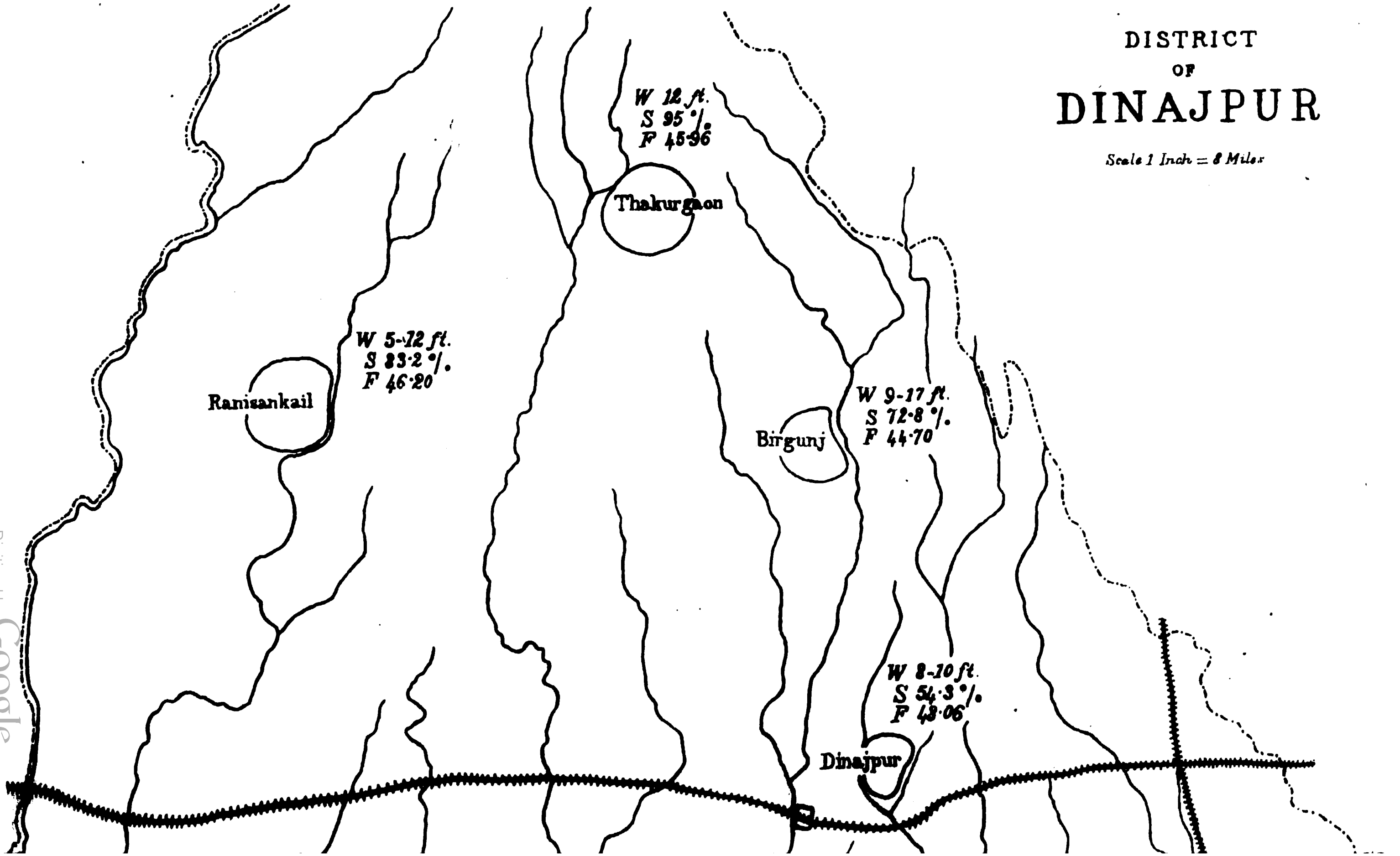
The Village Distribution of Quinine.

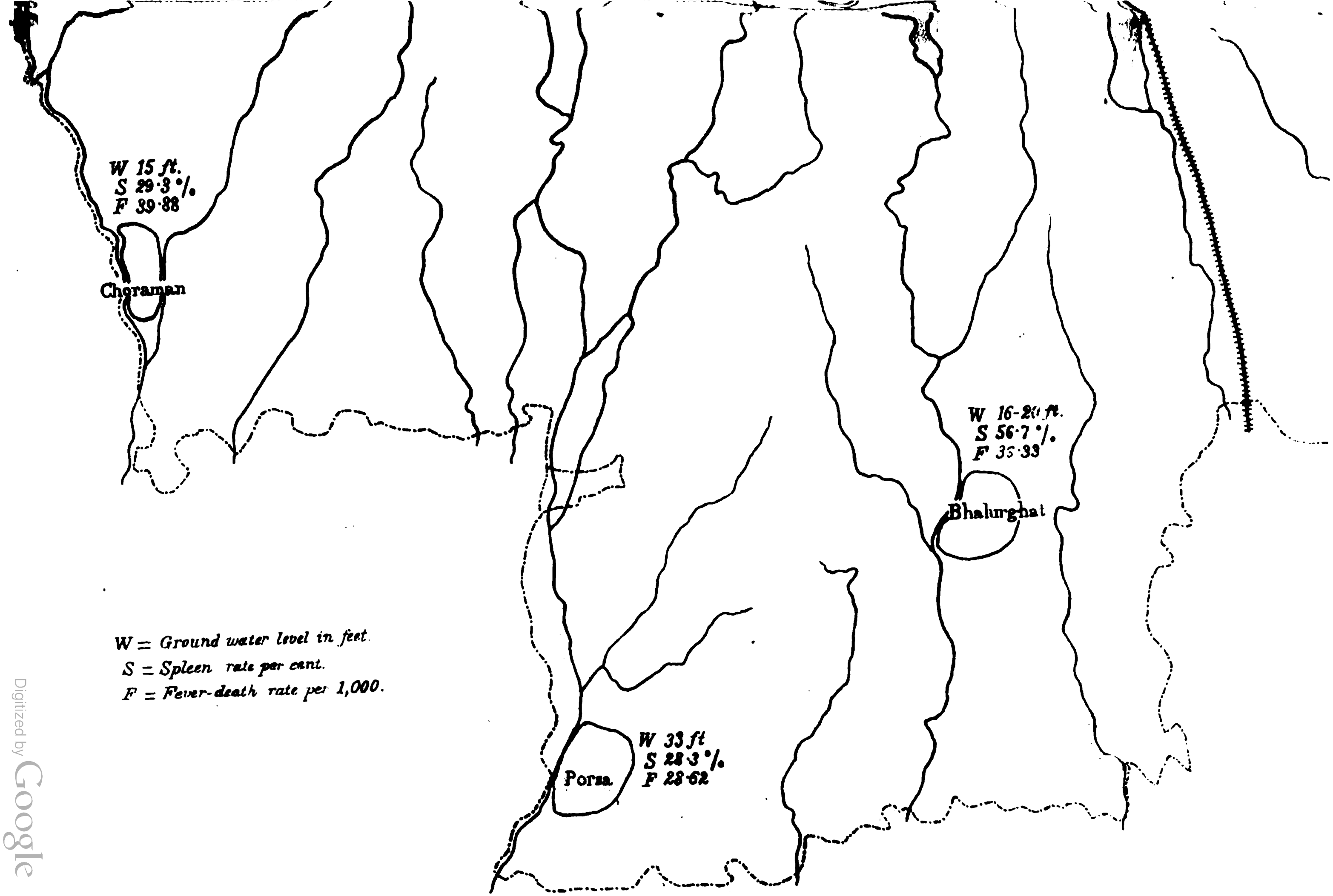
Where it is found impossible to destroy the intermediate host of the malarial parasite, namely, the malaria-carrying varieties of anopheles, the only other practical method of malaria prophylaxis is the destruction of the parasites during their cycle in the human subject. This can only be done by efficient doses of quinine, so that the problem resolved itself into one of devising a practical scheme of village distribution of quinine. It has already been mentioned that the administration of quinine regularly as a prophylactic to the children of a syce line in Mian Mir not only saved nearly the whole of them from malaria, but was also effective in preventing the infection of any of the adults in the same lines, although these latter took no quinine whatever, because adults are infected by mosquitoes which have first derived the infection from children as a rule. I have also shown in an earlier part of this report that the main death-rate from acute malaria is among children during the few months of the rainy season and immediately afterwards. If these could be adequately treated with quinine as soon as they developed fever (for its prophylactic distribution to children in villages is as yet beyond the region of practical policy), not only would the main source of death-rate from malaria be stopped, but at the same time there would be much less infection among adults, and fever deaths from chronic malaria and from other diseases such as pneumonia, dysentery and phthisis, which so often attack those debilitated by previous malaria.

In discussing this important question we must first consider how far the present agencies for the distribution of quinine meet the necessities of the case. They are the dispensaries, private practitioners and the post-offices. That the dispensaries effect great good by the treatment of fevers with quinine was abundantly evident throughout my inquiry, for in every place where there was a flourishing dispensary the spleen-rate was considerably lower than it was in the neighbouring villages, the differences being much greater than could be accounted for by the position of the dispensary village on a slightly higher and more healthy site in some instances. The difference was most marked among the children of the more intelligent classes, for it was particularly marked among the children attending the larger schools. The most striking example met with was that of a school at Churaman which stood next to the dispensary, for among 31 children only two had any enlargement of the organ, or 6 per cent., by far the lowest rate met with in the district. In this instance I ascertained from both the School Master and the Hospital Assistant that the boys were regularly sent to the dispensary from the school when they were found to be getting fever. In Balughat a very similar state of affairs was found. As it was not uncommon for about one-third of the children attending the school to be down with fever at one time in the rainy season, it is clear that they must, most of them, have been treated during the year. The Civil Surgeon, Captain Megaw, I.M.S., had been struck by this fact before my arrival in the district, and my own experience amply confirms his. The range of such a dispensary unfortunately is seldom more than two or three miles, or five at the outside, so that the quinine distribution of seven dispensaries among the one-and-a-half million persons in the district of Dinajpur is scarcely more than a grain in an extensive sandy desert, and any practical increase can only be a matter of very slow growth. Private practitioners abound in Dinajpur itself, and although a large proportion of them profess homœopathy, yet they doubtless do some good in the treatment of fevers. In the district itself, however, they are almost a negligible quantity.

Turning next to the post-office distribution I found that there are but 40 post-offices to very nearly 4,000 square miles, or one to every 100 square miles. Further, seven of these are in the same places as a dispensary is situated. During 1903 throughout the whole district only 8,064 packets of the drug were sold among 1,500,000 people, although my enquiries showed that the great majority of the population suffer from fever repeatedly in each year. These figures will suffice to bring home the fact that the infinite majority of the population of Dinajpur, and doubtless of all other malarious districts of Bengal, are beyond the reach of the one drug which will save their lives when attacked by malaria, to say nothing of an infinite amount of suffering and loss, while thousands of children die yearly, whose lives could be saved with absolute certainty if quinine were readily available for their treatment.

My object in laying stress on this fact, which is only too well known, is because my enquiries have led me to believe that something can and ought to be done to remedy this cruel loss of life from malaria, specially among children. Some of the dispensaries do not do all they might, the stock of quinine supplied being often utterly inadequate, while it is occasionlly allowed to run perilously low, with the result that it is not dispensed when it should be, as in one case only six drachms were in hand at the time of my visit, but this is a matter for administrative care. Perhaps more quinine would be used if the good an outdoor dispensary does was measured by the amount of quinine dispensed rather than by the number of petty operations performed, but still any improvement thus effected would only touch the fringe of the question. What is really wanted is some system of distribution of the drug in every village. I have discussed with the district postal authorities the possibility of a more extended distribution of the drug through the postal peons on their visits to the villages, and I am of the opinion that something might be done in this direction by giving a small commission to those agents in order to stimulate the sale of the pice packets. Still it appears that many small villages and hamlets may not be visited for weeks at a time by the postman, especially during the rainy fever season when communication is at its worst, and some new agency actually residing in the villages themselves is necessary if any real success is to be obtained. Such an agent should be somewhat more intelligent than the village chaukidar, whose burden is already quite as much as he can bear, and should also, if possible, be in close touch with the children, whom it is particually desired to reach. Such a man is the village schoolmaster, for a primary school is now to be found in nearly every village, or group of villages, and it would be to the advantage of the master to get his pupils to take quinine whenever they get fever, for he is interested in keeping up the figures of his attendance-roll, which is greatly affected by absence on account of malarial fever in the rains. I am informed that the masters of the primary schools get only about Rs. 10 a month, so they would not be above accepting a small commission on their sales, which would encourage them to do their best in the matter. The headman of the village might in some cases also be enlisted among the dispensers of quinine. I have spoken to many intelligent natives, both official and unofficial, about this plan, and they have all approved of its being given a trial. Whether it would be advisable to supply packets free to the schools or to sell them below cost-price at first in the most malarious tracts is rather difficult to decide, as it might lead to purchase for the sake of selling again at a higher price, while difficulties might arise when the drug had become sufficiently popularised to make it advisable to raise the price to its cost-point. I think, however, some packets might be supplied free to the schools. This is a matter for the sanitary and administrative authorities to settle, but that some system of village distribution of quinine, among the children more especially, is an urgent necessity if the heavy death-rate from malarial and chronic cachexial fevers is to be lessened, is quite certain, for it is the only practical method of prophylaxis in the swampy mosquito-swarming tracts of Lower Bengal.


DISTRICT
OF
DINAJPUR
Scale 1 Inch = 8 Miles
W 12 ft.
S 95 %.
F 45·96
Thakurgaon
W 5-12 ft.
S 83·2 %.
F 46·20
Ranisankail
W 9-17 ft.
S 72·8 %.
F 44·70
Birgunj
W 8-10 ft.
S 54·3 %.
F 43·06
Dinajpur


W 15 ft.
S 29·3 %.
F 39·88
Choraman
W 16-20 ft.
S 56·7 %.
F 35·33
Bhalurghat
W 33 ft
S 28·3 %.
F 28·62
Porsa
W = Ground water level in feet.
S = Spleen rate per cent.
F = Fever-death rate per 1,000.