THE

BEETLES OF THE HIMALAYAS

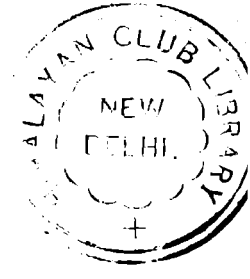
AND

HOW TO COLLECT, PRESERVE AND STUDY THEM

BY

E. A. D'ABREU

FELLOW OF THE ZOOLOGICAL SOCIETY OF LONDON; MEMBER OF THE BOMBAY NATURAL HISTORY SOCIETY; ASSISTANT CURATOR OF THE CENTRAL PROVINCES PROVINCIAL MUSEUM; SOME TIME BENGAL EDUCATIONAL DEPARTMENT



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PREFACE.

Year after year it has been my lot to see large collections of beetles made by schoolboys in the Darjeeling Himalayas at the sacrifice of both time and energy, only to be lost in the following year for want of proper care and preservation. These collections were made with no intent or purpose except that of beating a rival collector in number of specimens, or occupying leisure moments. The collectors always made attempts to find names for their specimens; but not being able to get the correct ones, usually dubbed them with inappropriate names of their own invention, *e.g.*, *Longicorn* beetles were termed stone-carriers; because when one of these insects was placed on a small stone and lifted off the ground, it carried the stone along with it. In these collections, the specimens were invariably pinned on the wrong elytron, with the wrong sort of pin and usually had pins passed longitudinally through the body for the purpose of holding the parts together but really disfiguring the mouth-parts. They were never preserved or set properly and always gave off an offensive odour.

In these pages, I have made an endeavour, to present to these young entomologists some information which may be of use to them in the pursuit of their hobby, and perhaps make it more interesting and scientific. It is also hoped that by the perusal of the same, their specimens will be better preserved so that should they eventually find their way into a museum, they may be of some use to science.

The Darjeeling Himalayas are remarkably rich in insect life in general. The beetles especially need attention and much work has yet to be done before their classification can be fully carried out.

The classification adopted in Chapter I is that of Dr. W. W. Fowler in his General Introduction of the *Coleoptera* in the Fauna of British India Series.

I must disclaim all pretensions whatsoever to being an expert entomologist, I am only interested in "bugs".

October 14*th*, 1915. E. A. D.

THE

BEETLES OF THE HIMALAYAS.

INTRODUCTORY.

Beetles (*Coleoptera*) form a very interesting Order of Insects and they can easily be distinguished from other Insects by their solidarity and by the peculiar nature of their first pair of wings called elytra. These wings are not used for flight, but merely serve to protect the hinder part of the body, and the second pair of wings which lie folded under them when not in use. Beetles are to be found almost wherever they are looked for. Some have their abode in dwellings, others inhabit fields and forests and only enter houses when attracted by lamps at night. They are very destructive to vegetation. Some are found inside tree trunks, especially in decaying trees, or boring in the bark; some defoliate trees by feeding on the leaves, others attack flowers; several species are exclusively found on the ground, many taking up their abode in refuse and decaying matter. Some of these latter serve as scavengers. Water, too, is not free from them, the Predaceous Diving Beetles and the Water Scavenger Beetles are to be found in almost every piece of water if looked for.

In Beetles the metamorphosis is complete, that is to say, the insect passes from the egg into a vermiform larva. The larvæ are generally to be found in vegetable substances of all kinds, in the earth attacking the roots of plants, or boring in

wood. Many of them are carnivorous and feed on other insects. They undergo a number of moults, and are in course of time transformed into pupæ. The pupæ are generally white in colour and are often contained in a protecting envelope known as the cocoon, these are finally, after a longer or shorter period in the pupal state, transformed into the perfect insect or imago as it is termed. Fig. 1 shows a few Coleopterous larvæ and a pupa.

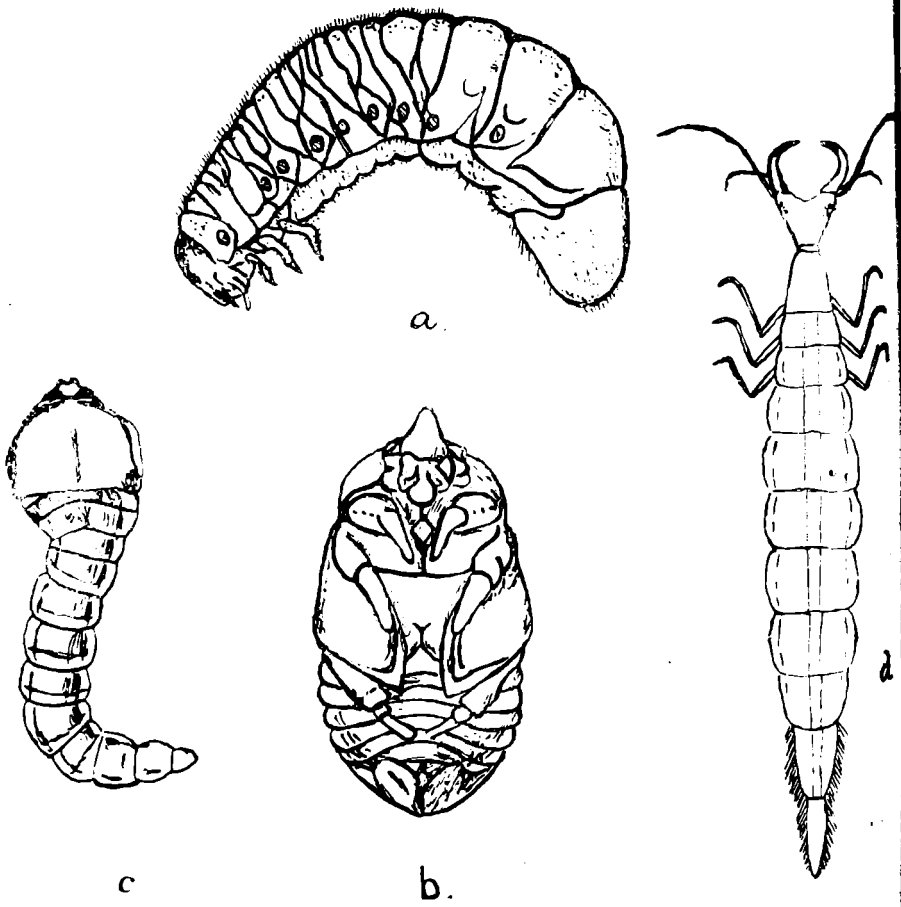


FIG. 1.—COLEOPTEROUS LARVÆ AND PUPA.
(a) Larva of Dynastid (After Lefroy).
(b) Pupa of do. (After Arrow).
(c) Larva of Buprestid.
(d) Larva of Dytiscid.

There are about 160,000 beetles known, and of Indian Forms, the life histories of only a few, comparatively speaking, have been studied. Some of these are described in Lefroy's "Indian Insect Life" and Fletcher's "South Indian Insects." Other descriptions have unfortunately to be sought in various journals which could only be consulted in scientific libraries. The collector or student of *Coleoptera* should make himself familiar with the nomenclature of the various parts of a beetle, for classification is chiefly based on the antennæ and the hard parts of the skeleton. Figs. 2 and 3 show the upper and under sides of a beetle with some of the parts named.

The head in beetles is well developed and together with the prothorax is capable of a certain amount of movement independent of the after part of the body. The head is provided with a biting mouth. The elytra almost completely cover the after part of the body, *viz.*, the meso- and metathorax and the abdominal segments. The lower wings lie folded under them. In some cases the upper part of the mesothorax, a small triangular piece called the scutellum is exposed, in others—especially the Melolonthinæ—a few of the ultimate segments of the abdomen are exposed and protrude beyond the elytra. The sexes frequently differ either in the antennæ or tarsi, and in some families the mandibles of the male are extraordinarily developed and in others the males have enormous projections and horns on their heads and prothoraces.

The antennæ in the great majority of the Coleoptera are eleven-jointed and their different forms, as well as the number of tarsal joints, have been largely used in classification, though more attention is now being paid to the venation of the wing for this purpose. For further information on these points and on *Coleoptera* in

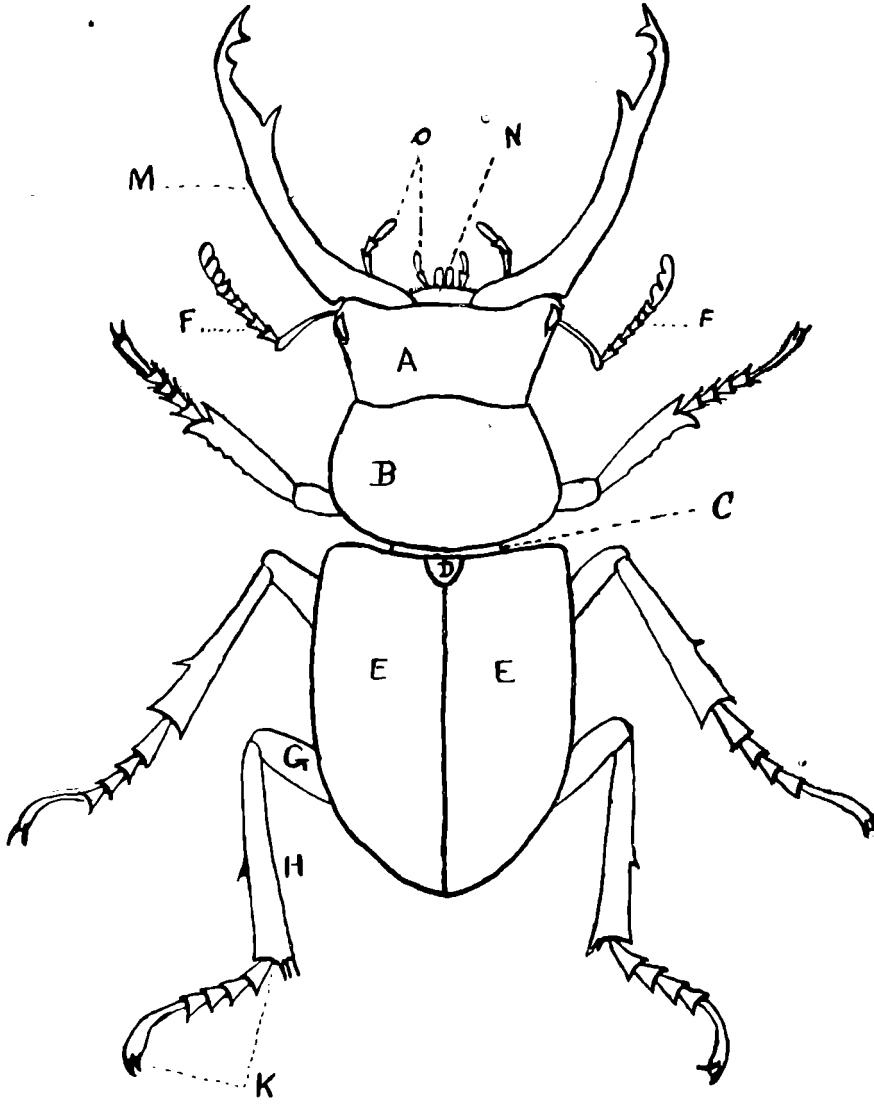


FIG. 2.—UPPER SURFACE OF LUCANID BEETLE.

A, Head; B, Prothorax*; C, Mesothorax;
D, Scutellum; EE, Elytra; FF, Antennæ;
G, Femur; H, Tibia; K, Tarsus;
M, Mandible; N, Labium; O, Labial, and Maxillary Palpi.

* The upper part of the prothorax is called the pronotum.

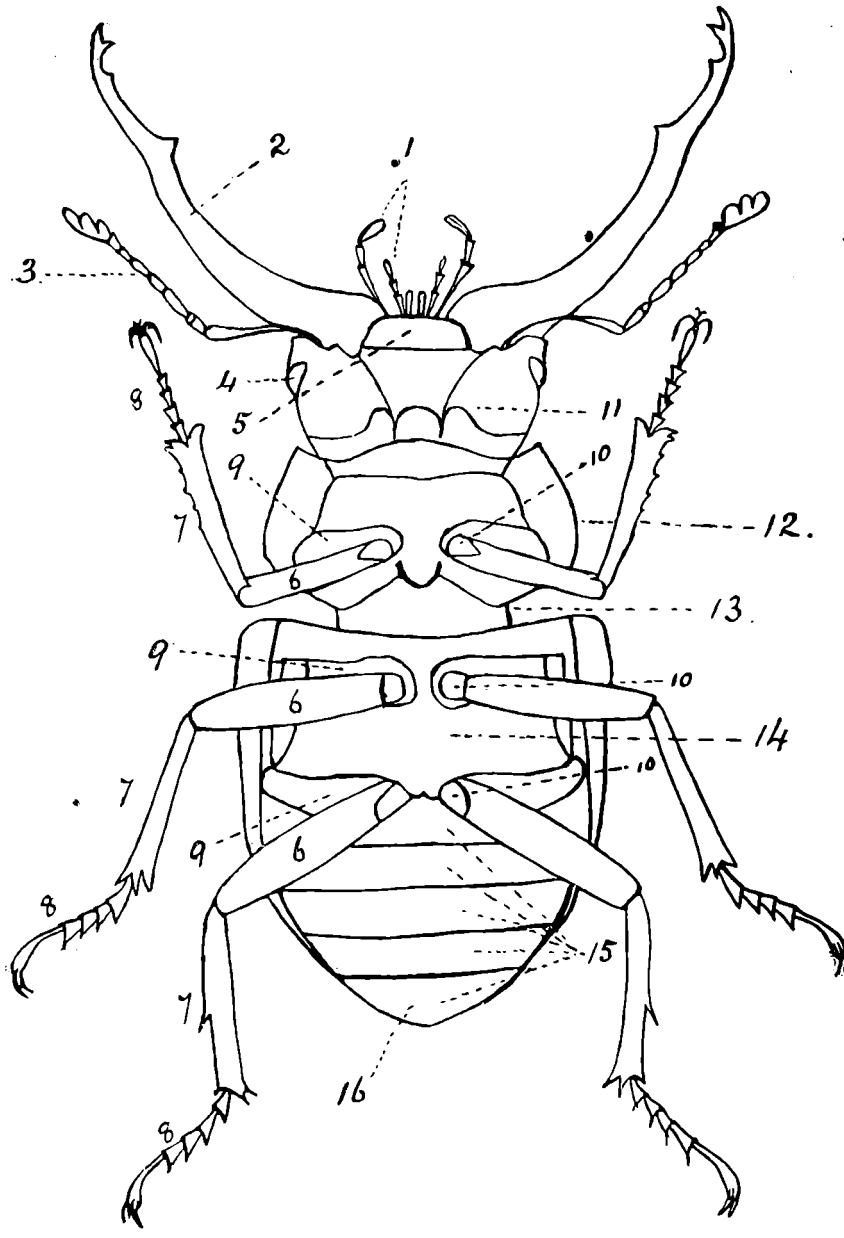


FIG. 3.—UNDERSURFACE OF LUCANID BEETLE.

1. Palpi; 2. Mandible; 3. Antenna; 4. Eye; 5. Labium; 6. Femur; 7. Tibia; 8. Tarsus; 9. Coxa of legs; 10. Trochanter; 11. Head; 12. Prothorax; 13. Mesothorax; 14. Metathorax; 15. Abdominal Segments; 16. Last abdominal segment or pygidium.

general one should consult the General Introduction to the *Coleoptera* by Dr. Fowler in the *Fauna of British India* series, which is given in his volume on the *Cicindelidæ* and *Paussidæ ;* also consult the *Cambridge Natural History*, Vol. VI (Insects, Part II), Chapter V, *Coleoptera*. Fig. 4 shows some of the various forms of antennæ found in beetles.

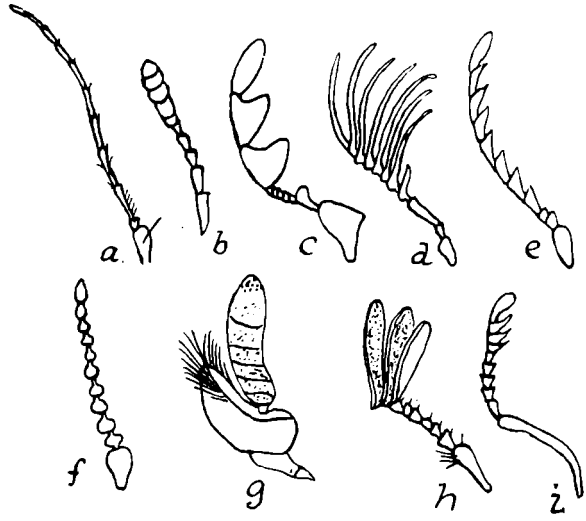


FIG. 4.—FORMS OF ANTENNÆ.

a, Filiform ; b, Clavate ; c, Irregularly serrate ; d, Flabellate ; e, Serrate ; f, Moniliform ; g, Irregular ; h and i, Lamellate. From Fowler, mostly after Leconte and Horn.)

CHAPTER I.

THE BEETLES OF THE HIMALAYAS.

Beetles (*Coleoptera*) form one of the Orders of the Class Insects (*Insecta*) and are divided into three large suborders called *Adephaga, Polycerata* and *Lamellicornia.* The *Lamellicornia* have five tarsal joints on each leg and the antennæ are lamellate, *i.e.*, the terminal three or more joints are broader on one side, so as to form a peculiar club, the leaves of which are movable and in repose have the appearance of being but one piece. Sexual dimorphism is greatly developed in this suborder. The *Adephaga*, like the *Lamellicornia*, have five tarsal joints on each leg but the antennæ are filiform or nearly so. The second suborder *Polycerata*, will present more difficulties to the beginner for it contains a large number of heterogeneous families of beetles united more for convenience than by affinity. None of the *Polycerata* have lamellate antennæ and the tarsal joints vary. All beetles with less than five tarsal joints on any leg may safely be consigned to this suborder as well as those with five tarsal joints whose antennæ are not lamellate or filiform, or if filiform are combined with a soft integument. But no hard and fast rule can yet be laid down to define this suborder. For further information the reader may consult Fowler's Introduction to the *Coleoptera* in the *Fauna of British India* series. Each of the three suborders are divided up into families and some of the families into subfamilies, but the suborder *Polycerata* is first divided into six divisions each containing a number of families.

Only the more important and familiar families and species will be dealt with in this book.

Suborder I.—ADEPHAGA OR CARABOIDEA.

All the tarsi five-jointed; antennæ filiform or nearly so; mouth parts well developed.

The beetles of this suborder are mainly carnivorous, and as a rule dark coloured; they are often slim and very active, being provided with powerful legs capable of swift movement. The more important families of this suborder are the *Cicindelidæ* or Tiger-beetles, the *Carabidæ* or Ground-beetles, the *Dytiscidæ* or Water-beetles* and the Whirligigs or *Gyrinidæ*.

The *Cicindelidæ* or Tiger-beetles are as a rule somewhat brightly coloured; green, brown or black with spots or bands of white being the most common type of colouration. These beetles are slim and very active. They fly swiftly and have long powerful legs, which are finely spined and adapted for rapid movement. They generally proceed in a serpentine manner. The eyes are large and the mandibles are set vertically and not horizontally giving the beetle a curious appearance. They are found usually in damp localities and along the banks of rivers and streams. They are all carnivorous, feeding voraciously on other insects. Cicindelid larvæ are carnivorous as well, and live in burrows sunk in the soil (subfamily *Cicindelinæ*) or in the twig of a bush (subfamily *Collyrinæ*). They block the entrance with their heads and only protrude their mandibles and in this manner wait for insects passing within their reach. *Cicindela aurulenta* and *Tricondyla macrodera* are forms common

* Not to be confused with the *Hydrophilidæ*, another large family of water-beetles. (See Fig. 9, p. 15.)

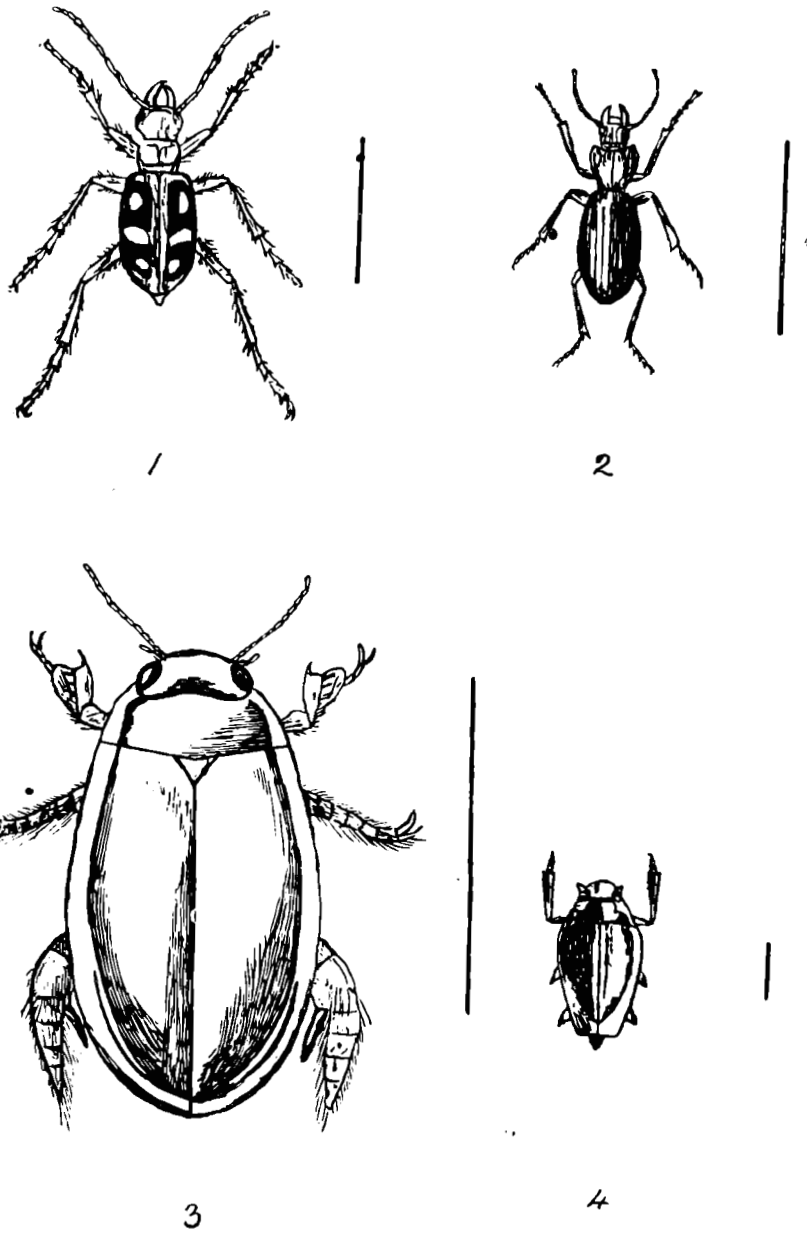


FIG. 5.—ADEPHAGA.

1. Tiger-beetle (*Cicindelidæ*).
2. Ground-beetle (*Carabidæ*).
3. Water-beetle (*Dytiscidæ*).
4. Whirligig-beetle (*Gyrinidæ*).

in the Darjeeling district, but the student should consult the volume on *Cicindelidæ* in the *Fauna of British India* series where 216 species are described from all parts of India.

The *Carabidæ* or Predaceous Ground-beetles have their mandibles set horizontally instead of vertically. They are of many different shapes. Like other beetles living on the ground, they are often dull coloured, being black, brown or blue; but sometimes the colouring is more striking, the insect being ornamented with spots or patches of white or bright yellow on a dark ground. Some forms (Bombardier beetles) have the power of emitting from glands near the anal region, an offensive volatile fluid which is discharged with a little report into the face of an approaching enemy. *Catascopus whithilli* is a common form in the Darjeeling district, but a list of Indian Carabids will be found in the *Journal of the Asiatic Society of Bengal*, Vol. LIX (1890), Supplement No. 1.

The *Dytiscidæ* or Predaceous Water-beetles are aquatic in their habits and prey upon other aquatic animals. They have been known to attack fish readily when placed along with them in an aquarium. They are oval in form and are practically *Carabids* modified for an aquatic existence. The first two pairs of legs are small, but the third or hind pair is very long and formed for swimming. The males have the three basal tarsal joints of the forelegs dilated. These beetles carry a supply of air under the elytra and periodically come to the surface with the apex of the elytra upwards to renew the supply. The largest Himalayan form is *Cybister tripunctatus*. This species grows to over an inch in length and is to be found wherever water is collected in large quantities. *Hydaticus vittatus* is another species smaller than the last, measuring only a little

over half an inch. It has a bright yellow line, bifid anteriorly, on the margins of the elytra. *Hydaticus fabricii*, another small dull coloured form, may be found in almost any pool of water if looked for.

This family has been monographed by Sharp (on Aquatic Carnivorous *Coleoptera*) and in 1899 Régimbart revised the Eastern forms (*Ann. Soc. Ent.* France, 1899, p. 186) listing 140, "Indian" species.

The *Gyrinidæ* or Whirligig beetles are small black beetles, also aquatic, generally to be seen in large numbers on the margins of fairly still water continually describing complicated figures on the surface; when disturbed they plunge under the surface carrying a bubble of air at the hind end. The posterior legs are formed into paddles, while the anterior legs are long. Régimbart has also monographed this family (*Genera Insectorum*) and enumerates 34 Indian species.

Suborder II.—POLYCERATA (POLYMORPHA OR POLYPHAGA).

Antennæ frequently clavate or serrate; but these characters, as well as the number of tarsal joints and other points, are very variable.

As mentioned before, this suborder is divided up into six large groups called Divisions. These can, to some extent, be distinguished as follows:—

A. Tarsi apparently 4-jointed.
   (*a*) Head not forming a definite prolonged beak .. *Phytophaga.* 5
   (*b*) Head more or less prolonged in front to form a snout or beak (rostrum) .. *Rhynchophora.* 6.
B. First and second pairs of legs with 5 tarsal joints, the third pair with only 4 .. .. *Heteromera.* 4

C. Tarsal joints variable 1—5.		
(*a*) Antennæ as a rule clavate (with exceptions)	*Clavicornia.*	2
(*b*) Antennæ as a rule serrate or filiform (with exceptions) ..	*Serricornia.*	3
(*c*) Antennæ variable, either simple, filiform or clavate	*Staphylinoidea.*	1

Division I.—STAPHYLINOIDEA.

The antennæ of the beetles in this Division are either simple, filiform or clavate while the number of tarsal joints is variable.

An interesting family of this Division is the *Silphidæ* which includes the burying beetles. They remove the soil below the corpses of small animals and bury them and then feed and breed in the decomposing body. Indian *Silphidæ*, however, have not yet been observed doing this. *Necrophorus nepalensis* (Fig. 6), is a Himalayan form, but one should consult the *Annales de la Société Entomologique de France*, 1904, 1905, where Portevin has described eleven new species from the collection made by Mons. Harmand at Darjeeling. With the exception of the *Silphidæ* already mentioned, and certain species of *Staphylinidæ* and *Histeridæ* the beetles included in this Division are small and obscure. The *Histeridæ* are very hard, compact, but often somewhat flattened insects found in dung and in decaying wood. The *Staphylinidæ* somewhat resemble earwigs without forceps, having very short elytra and a long

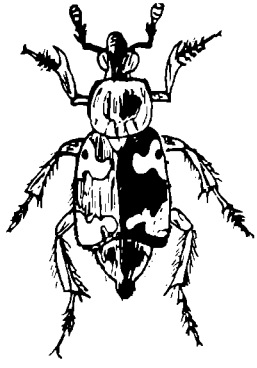


FIG. 6.—A SILPHID.

flexible abdomen which has earned the family the popular name of "cocktail beetles."

Division II.—CLAVICORNIA.

Antennæ as a rule clavate; tarsi five-jointed except in Coccinellidæ in which they are apparently three-jointed.

The antennæ of the beetles in this Division are usually thickened at the tip or knobbed; the number of tarsal joints is usually five except in the *Coccinellidæ* in which it is apparently only three-jointed. These beetles mostly are of small size and very inconspicuous, in consequence of which they are apt to be overlooked by the tyro as not worth collecting.

A conspicuous beetle in this Division, belonging to the family *Helotidæ*, is commonly called the King Beetle. It is about 19 mm. in length, with the upper portion of the body strongly pitted and ridged. Black, coppery bronze and metallic coppery pink are the prevailing tints; the head (excluding the eyes which are black) is of a brilliant metallic copper colour with a tinge of pink; the same colour prevails on the middle of the prothorax, the rest of which is black. The elytra is copper coloured with dark ridges and with four spots encircled with black. The basal tarsal joints are

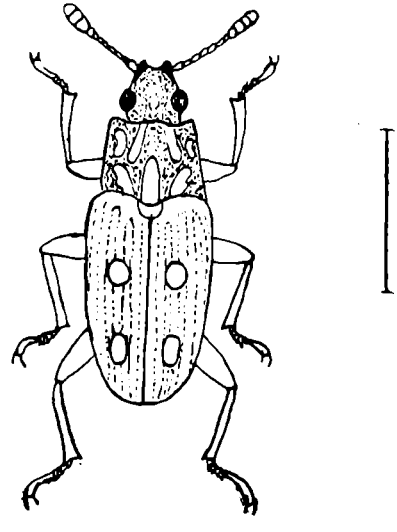


FIG. 7.—HELOTA SERVILLEI, HOPE.

reduced. It lives on the flowing sap of trees. Why it is called the King I do not know. It may be due to its colours ; but there are other Himalayan beetles far more brilliantly coloured than the King ; but these have to be content with the meagre appellation of Bow and Arrow Beetles, for the underside of these beetles is supposed to have the shape of a bow and arrow. The King Beetle, or to give him his full scientific title, *Helota servillei, Hope*, is far from common only a few fell into my hands after years of collecting.

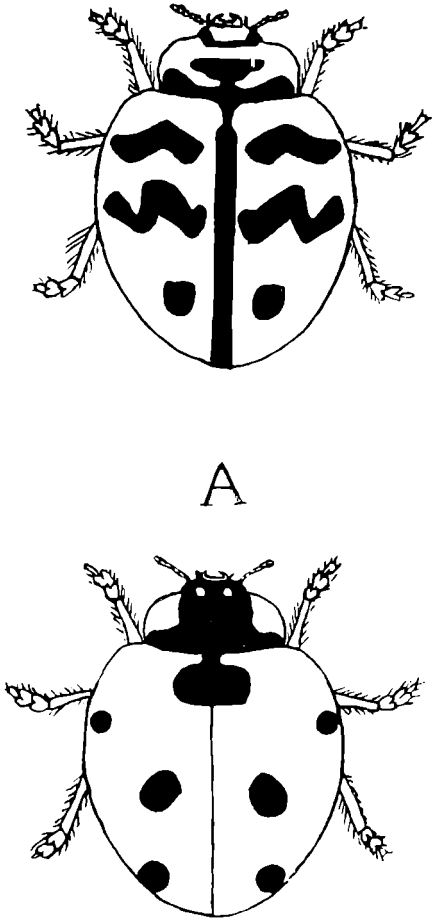


FIG. 8.

A. The Six-spotted Ladybird Beetle (*Chilomenes sexmaculata*) (After Lefroy).

B. The Seven-spotted Ladybird Beetle (*Coccinella septempunctata*).

The next family to be considered in this Division is the *Coccinellidæ* which contain the well-known Ladybird Beetles. There are apparently three tarsal joints present on all the legs and the club of the antennæ is very indistinct.

Beetles belonging to this family are small, seldom exceeding one-quarter of an inch in length. They are round or oval in shape and are predaceous upon smaller forms of insect life. The head is very small and is hidden under the prothorax which fits smoothly into the rounded elytra. The legs which are short and formed for running, are hidden under the body.

Many species are found on the hills. The Fourteen-spotted Ladybird is greyish green with seven white spots on each elytron. The Six-spotted Ladybird is yellow with six black marks on the elytra. The Seven-spotted Ladybird is a red insect with three black spots on each elytron and one on and behind the scutellum ; there is some white on its head and prothorax.

The family *Coccinellidæ* was revised by Crotch in 1874 (*A Revision of the Coleopterous Family Coccinellidæ*, published by E. W. Janson, London) and since then Gorham has described numerous species (*Ann. Soc. Ent.*, Belge, 1892, 1894, 1903) as has also Weise (*Ann. Soc. Ent.*, Belge, 1892, 1895).

The family *Dermestidæ* is also included here ; they are the beetles that attack rugs, horns and skins of animals.

The Water Scavenger Beetles (Family *Hydrophilidæ*) bear a general resemblance to the *Dytiscidæ* and many forms have similar oval bodies. They are black or dull-coloured insects with five tarsal joints but the antennæ are clubbed and not filiform as in the Predaceous Water-beetles ; moreover, the majority are vegetarians and not

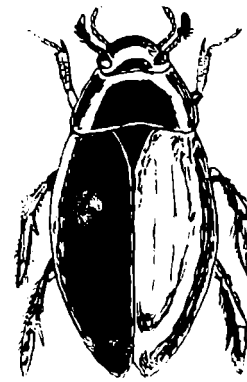


Fig. 9.

Water Scavenger Beetle (*Hydrophilidæ*). (After Lefroy).

carnivorous. Régimbart's papers (*Ann. Soc. Ent.*, France 1903, p. 52 and p. 331 also 1901, p. 188), should be consulted for this family.

For other Indian Clavicorn families one should consult *The Fauna of British India, Coleoptera*, General Introduction, page 95.

Division III.—SERRICORNIA.

Antennæ as a rule serrate, tarsi five-jointed.

The more important families in this Division are the *Cantharidæ* or *Malacodermidæ*, a sub-family of which the *Lampyrinæ*—contains the so-called Fireflies, the *Bostrychidæ* or Bark and Woodborers, the *Buprestidæ* or Bow and Arrow Beetles, and the *Elateridæ* or Click Beetles.

The *Lampyrinæ* (Fam. *Cantharidæ*) contain the so-called Fireflies or Glow-worms. Their bodies are flat and the integument is soft and without that hardness characteristic of most beetles. The luminosity displayed by these insects is under their control and no heat is produced. It is probably due to the oxidation of some fatty substance formed within the body. Some females do not attain to the winged

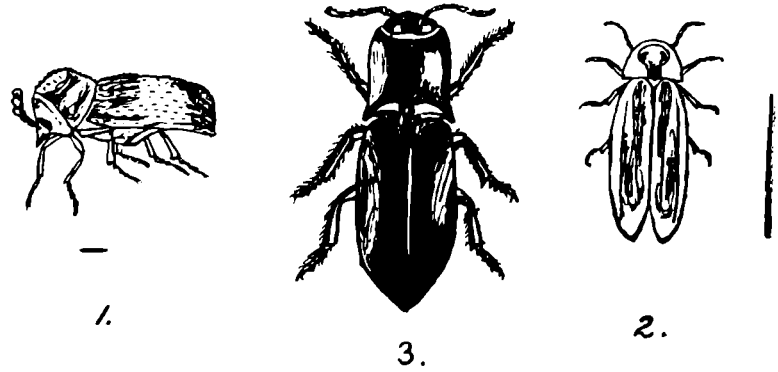


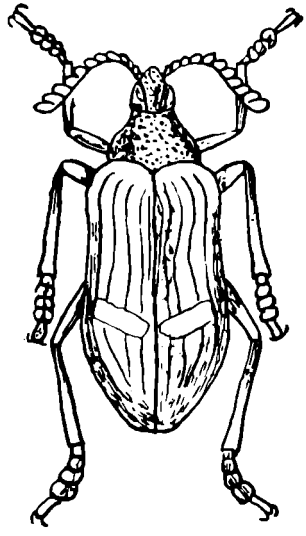
FIG. 10.—SERRICORNIA.

1. *Bostrychidæ* ... (Wood Borer).
2. *Lampyrinæ* .. (Firefly).
3. *Elateridæ* ... (Click Beetle).

form but retain a larva-like form throughout life. *Lamprophorus nepalensis* is a common form in the Darjeeling district. For further information on this group Gorham's papers on the Andrewe's collection (Ann. Soc. Ent. Belge, 1895, p. 294 ; 1903, p. 323 ; Proc. Zool. Soc., London, 1889, p. 96) and Bourgeois' papers (Ann. Soc. Ent. Belge, 1892, p. 235 ; 1907, p. 99 ; 1891, CXXXVII ; Bull. Soc. Ent. France, 1896, p. 117 ; Ann. Soc. Ent. France, 1903, p. 478) should be consulted.

The *Bostrychidæ* are small cylindrical insects under a quarter-of-an-inch in length. The antennæ have a three-jointed club, the prothorax is produced and tuberculate and overhangs the head. In some forms the hind end of the body terminates in a flat slope as if it had been cut away obliquely. Bostrychid beetles bore tunnels in wood in which they lay their eggs, and their bodies are well adapted for this purpose. In colour they are generally black or dark brown. This family has been monographed by Lesne (Ann. Soc. Ent. France, 1896, p. 95 ; 1898, p. 438 ; 1900, p. 473 ; 1906, p. 445).

The *Buprestidæ* are by far the most brilliantly coloured family of beetles. They fly actively and are diurnal. The antennæ are short and serrate, the tarsi five-jointed with the basal four joints provided with pads. The head is partly sunk into the thorax and the legs are short and fold under the body when at rest. *Catoxantha purpurea* is a common beetle of this family. It is about 48 mm. in length ; the head and thorax are copper-coloured and pitted while the elytra are dark purple and ridged, with an elongate white spot. *Chrysochoa bicolor* is a brilliant metallic greenish blue beetle about 77 mm. in length. The thorax has coppery reflexions, and there is a large yellow spot encircled with blue on each elytron.



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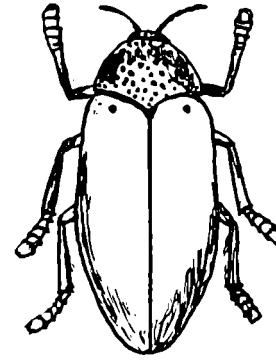

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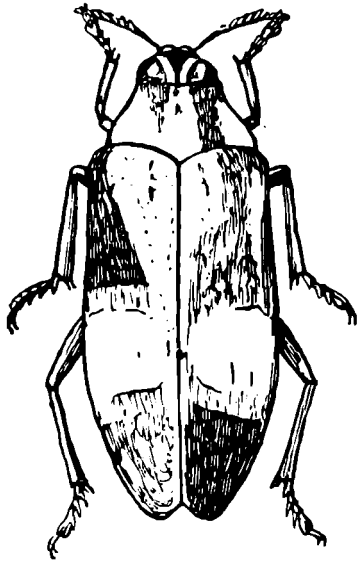

3.

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FIG. 11.

1. *Catoxantha purpurea.* (Nat. size.)
2. *Sternocera æquisignata* ,,
3. *Chrysochoa bicolor* ,,
4. *Chrysochoa chinensis* ,,

Chrysochoa chinensis is smaller measuring about 45 mm. It is of a brilliant metallic green, with copper-coloured longitudinal bands on the elytra and a little of the same colour on the thorax. The Green Plum Beetle *Sternocera æquisignata* is entirely of a brilliant dark metallic green with the head and prothorax deeply pitted.

The chief authority on the *Buprestidæ* is M. Kerremans, who divides the family into twelve sub-families (*see* "Monographie des Buprestides, Vol. I, Brussels, 1906, pp. 37, 38).

The *Elateridæ* or Click Beetles, are largely represented in the Himalayas; the smaller forms are generally dull coloured while the larger ones (half-an-inch or more in length) are sometimes more brilliant. They have the power of leaping upwards with a click when placed on a flat surface. The hind angle of the thorax is usually produced backwards in these beetles and the antennæ are often serrate or pectinate. The head is small and embedded in the prothorax.

This family is so large and complex that there is great difficulty in identifying the species. Practically all the known Indian species were described by Candeze, whose works must be consulted. Schwarz has listed the *Elateridæ*, in the *Genera Insectorum* (1906), enumerating 503 species as occurring in India and Burma alone.

Division IV. HETEROMERA.

The first and second pairs of legs have five tarsal joints, the third pair have only four.

The three most important families in this Division are the *Tenebrionidæ*, *Meloïdæ*, and the *Trictenotomidæ*. They may be distinguished from each other as follows :—

A. Mandibles ordinary, size moderate or small.

(*a*) Tarsal claws simple, body compact or slender, with close fitting elytra; no neck .. *Tenebrionidæ.*

(*b*) Tarsal claws with appendages, elytra not fitting the abdomen closely, a distinct neck .. *Meloïdæ.*

B. Mandibles long and curved, size large, antennæ long and often serrate at tip; a close resemblance to the *Cerambycidæ* .. *Trictenotomidæ.*

The student should consult the Fauna of British India (*Coleoptera*, General Introduction, p. 157) for the other eleven families of the *Heteromera*.

The *Tenebrionidæ* are usually black or sombre-coloured beetles. Many of them inhabit dry places and some may be found in houses. Others live under the bark of trees in rotten wood, under stones in damp jungles and in various other situations. The antennæ are eleven-jointed. The body is hard and is often either flattened or globular. Five abdominal segments are visible from below. The elytra fit closely and some apterous forms have them soldered together. They feed on dead vegetable matter. Fig. 12 shows a beetle of this family. For references to papers on the species of Tenebrionidæ see Junk's "Coleopterorum Catalogue," pp. 15, 22, 28 and 37, Berlin, 1910-1911.

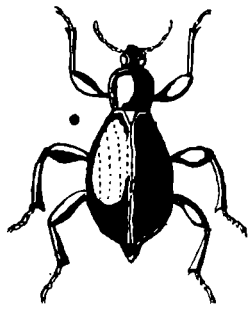


FIG. 12.
TENEBRIONID BEETLE.

The *Meloïdæ* contain the blister beetles (*Lyttinæ*) they are so called because many of them exude a fluid, having blistering properties, from the joints of the legs. In these beetles the head is joined to the prothorax by a distinct

neck. The elytra, which are weak, do not meet accurately in the median line nor do they fit tightly over the abdomen. The prothorax is narrower than the head and the claws are provided with appendages resembling double claws. These beetles are diurnal and herbivorous feeding on leaves and flowers. *Cantharis hirticornis*, the Red-headed Blister Beetle is very common on the Eastern Himalayas from July to September. It is a black beetle with a red head and is about 25 mm. in length.

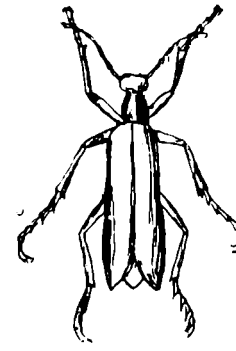


FIG. 13.
THE RED-HEADED BLISTER BEETLE.
(*C. hirticornis.*)
(NAT. SIZE.)

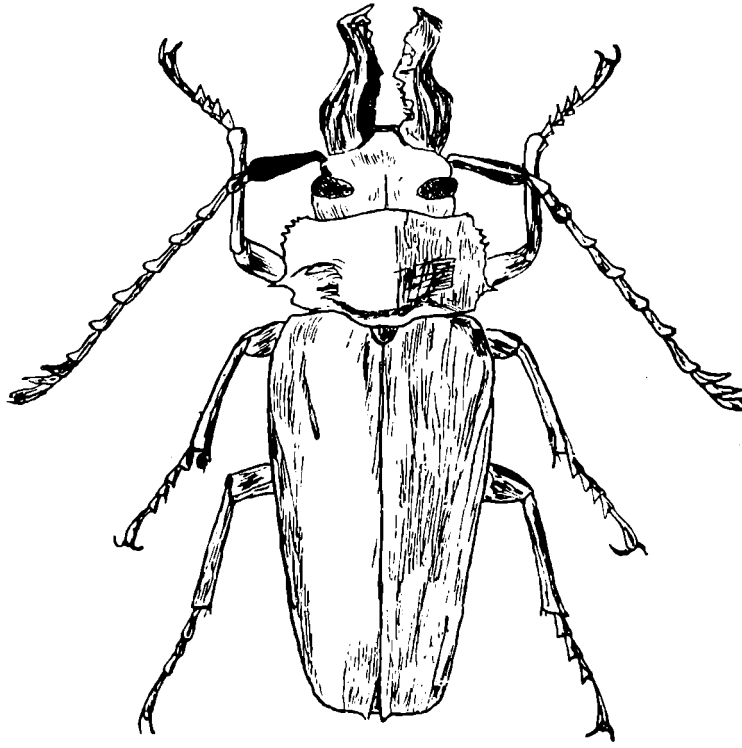


FIG. 14.—AUTOCRATES ÆNEUS. (Nat. size.)
(After Fowler.)

The family *Tricteno tomidæ* contains some very large beetles. They closely resemble Longicorn beetles and have powerful mandibles; but their antennæ though long are serrate inside at the apex. The Crock, *Autocrates æneus* is a beetle of this family found on the Eastern Himalayas. It is coloured like some of the true stag beetles (*Genus Lucanus*). The prothorax is spined and the scutellum blunt. A large specimen measures about 70 mm. For papers on these beetles see Ann. Soc. Ent., France, 1875, p. LIX; also Westwood, Cab. Or. Entom., 1848.

Division V. PHYTOPHAGA.

Tarsi apparently four-jointed; head not forming a definite prolonged beak.

The *Phytophagus* or Plant-eating Beetles fall into four large families called *Lariidæ* (*Bruchidæ*) or Pulse Beetles, *Chrysomelidæ* or Leaf-eating Beetles, *Cerambycidæ* and *Lamiidæ;* the two latter being known as Longicorn Beetles. Only the *Chrysomelidæ* and the Longicorns will be considered here. Although some of the former very closely resemble the *Cerambycidæ* the families may be distinguished as follows :—

A.	General shape variable, head prominent or inserted in the thorax as far as the eyes. Antennæ short or moderate, not tapering at apex, their insertion distinct from the eyes; upper surface bare; tibial spurs usually absent	*Chrysomelidæ.*
B.	General shape very elongate, head projecting or prominent. Antennæ long, tapering at the apex, their bases partly encircled by the eyes; upper surface often pubescent; tibial spurs distinct.	

(*a*) Head in front oblique or subvertical .. *Cerambycidæ.*

(*b*) Head in front vertical or bent inwards below the thorax .. *Lamiidæ.*

Family I.—Chrysomelidæ.

The *Chrysomelidæ* or Leaf-Beetles display a great variety of forms as will be seen from the beetles depicted in Figs. 15 and 16. The antennæ vary in position as well as in form and are usually eleven-jointed, filiform, serrate or clavate. The elytra usually cover the pygidium. The legs are variable, some forms have the hind femora considerably enlarged and often furnished with strong teeth.

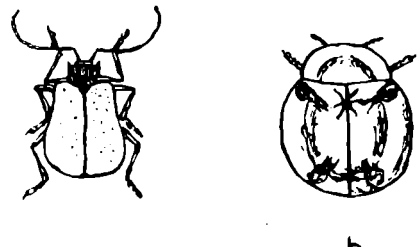


FIG. 15.
(a) *Berecyntha tibialis.*
(b) *Aspidomorpha sanctæ-crucis.*

Chrysomelid larvæ are found on or within plants and some few under water adhering to water plants. The larvæ as well as the adults vary in shape, and some forms construct cocoons. These beetles are well represented in

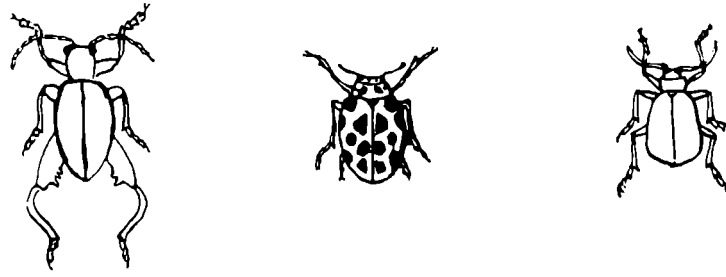


FIG. 16.
FORMS OF *Chrysomelidæ* FROM THE EASTERN HIMALAYAS.

the Eastern Himalayas ; *Berecyntha tibialis* being one of the commonest forms. It is a small beetle about 15 mm. in length ; the head, prothorax, legs, and underparts are metallic green and the elytra red. Another striking *Chrysomelid* is the Tortoise Beetle, *Aspidomorpha sanctæ-crucis*. It is a round beetle about 14 mm. in length. The head is concealed beneath an extended prothorax which is continuous with the extended elytra and this gives the insect the appearance of a tortoise ; the likeness being strengthened in the present species by four dark spots on the elytra suggesting the limbs.

The *Chrysomelidæ* are a large family containing some 20,000 known species and for the subdivisions of the family one should consult the General Introduction to *Coleoptera* in the Fauna of British India, p. 179. There is also a volume on the *Chrysomelidæ* by Mr. Jacoby in the same series in which 903 species have been dealt with.

Family II.—Cerambycidæ.

This and the next family, *Lamiidæ*, are known as Longicorn Beetles. The *Cerambycidæ* are a large family of large insects ranging from under half-an-inch to over two and a half inches. The general form is very elongate, with long antennæ ; the last joint of the palpi is not pointed at the apex and the anterior tibiæ are not grooved beneath. The head, which is well developed and prominent, is obliquely inclined in front or is subvertical and is armed with heavy biting mandibles which are very conspicuous. The eyes are oblique and partly encircle the bases of the antennæ. The antennæ are rigid and tapering at the apex. These beetles when irritated emit a squeaking sound by rubbing the posterior edge of the prothorax against a corrugated surface on the mesothorax. The life-history of all *Longi-*

corns seems to be the same. The female lays rather large eggs in cracks or fissures in the bark of trees. In some species living trees are chosen ; in others dead wood is preferred. When the larvæ hatch out they tunnel into the tree eating out large galleries. After about three years the larvæ pupate in a chamber formed by closing up the tunnel at its head and tail.

These beetles are very plentiful on the Himalayas and the following are descriptions of species often met with :—

Lophosternus indicus, Hope.—Dark brown or almost black in colour. Head coarsely punctured ; eyes rather narrow, antennæ from three-fourths to five-sixths of the length of the body. Mandibles long, curved downwards and backwards, crossing when closed. Prothorax transverse, convex above, its lateral edge oblique, denticulate in front and produced into a spine at the middle, and into another spine between the middle and front margin. Elytra more or less rugulose and punctate.

Length 25—56 mm.

Ægosoma tibiale, White.—Dark brown ; with the elytra somewhat reddish brown, naked ; impunctate and glossy. Antennæ in male longer than the body, in the female reaching to about the posterior third of the elytra. Prothorax with its lateral edge distinct from the base up to the anterior margin, furnished with a spine at the base, another just behind the middle. Elytra : each with two dorsal ridges, the inner one disappears a little beyond the middle, the outer is continued back to end a short distance before the apex.

Length 22—46 mm.

Distenia Kalidasæ, Lameere.—Head gradually narrowed behind the eyes, which are rather

large. Antennæ much longer than the body; first joint long, gradually thickened towards the apex; second very short, third to sixth or seventh subequal, the others gradually diminishing in length. Prothorax slightly constricted and transversely grooved near base and apex, acutely tuberculate at the middle of each side. Elytra elongate, gradually retracted behind. Body and legs black, the elytra dark metallic green, rather densely covered with a short greyish-tawny pubescence.

Length 23—28 mm.

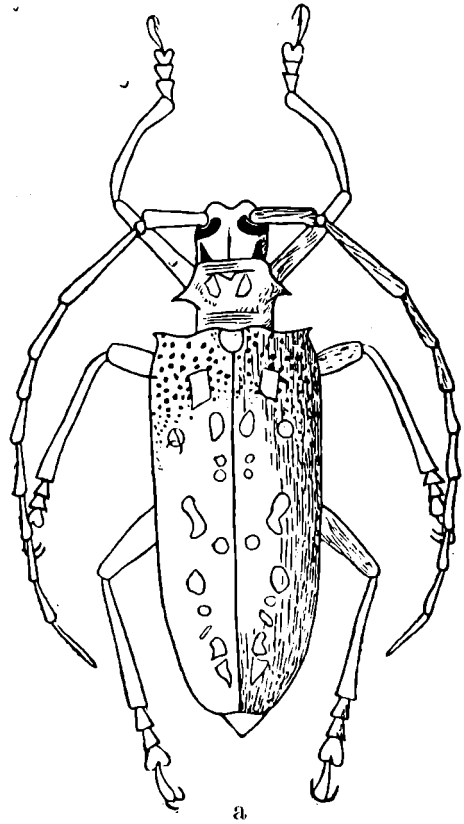
Rosalia hariola, Thoms.—Body black beneath: head black, sometimes with two red spots above: pronotum and elytra red, marked with black spots—three on the pronotum and four or five on each elytron. Antennæ of the male longer than the body; first joint rugulose; third to fifth armed with a recurved spine at the apex; antennæ of the female about as long as the body. Prothorax globose and feebly tuberculate at the sides in the male.

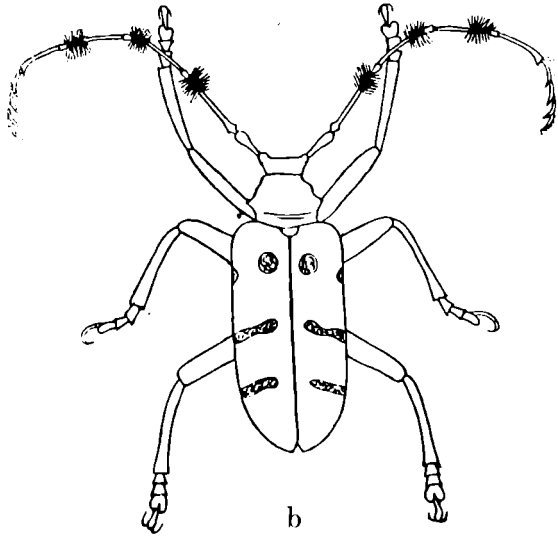
Length 24—39 mm.

Rosalia formosa, Saund.—Body beneath red, the last ventral segment black; head black, pronotum red, with three or four black spots; elytra red, with a broad black band at the base and another behind the middle, also two black spots, one dorsal and one lateral, placed obliquely on each between the bands. Third to fifth or sixth joint of the antennæ armed with a spine at the apex. Prothorax globose and, in the female, slightly tuberculate at the sides.

Length 21—40 mm.

Zonopterus flavitarsis, Hope.—Black above, with two yellow bands that cross the elytra, one about midway between the middle and the base, the other a very short distance behind the middle;





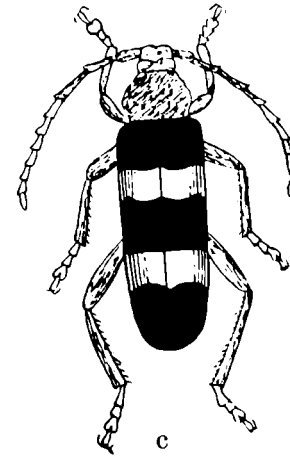


FIG. 17.—LONGICORNS.

(*a*) *Batocera rubus* Linn .. .. (*Lamiidæ*).
(*b*) *Thysia wallachii* .. ..
(*c*) *Zonopterus flavitarsis*, Hope .. (*Cerambycidæ*).

the first band somewhat narrower than the second, which is variable in width ; first four joints of the antennæ and the base of the fifth black, the rest fulvous ; legs black and glossy, with the tarsi testaceous yellow ; body beneath violaceous or steel-blue, with the abdomen of the male testaceous, that of the female blue. Antennæ stout, reaching about to the middle of the second elytral band in the female, beyond it in the male.

Length 21—35 mm.

Chloridolum nympha, White.—Metallic green, with the femora purplish red, the tibiæ steel-blue, the tarsi bluish black, the antennæ steel-blue, the breast and abdomen brassy green with a faint covering of golden-yellow pubescence. Antennæ of male twice as long as the body ; first joint strongly and rather closely punctured, marked with a groove along the front face and produced in a sharp angle or spine at the apex. Prothorax with a strong conical tubercle at the middle of each side, and a short obtuse tubercle near the front margin ; transversely and rather strongly striated and nitid all over the upperside.

Length 30—42 mm.

The Indian species belonging to this family have been fully described by Mr. C. J. Gahan (Fauna of British India, Coleoptera, Vol. I, Cerambycidæ, 1906).

Family III.—Lamiidæ.

The *Lamiidæ* are more specialised Longicorns. The head in front is vertical or bent inwards well below the thorax ; the last joint of the palpi is pointed at the end and the anterior tibiæ generally have a groove beneath. Many are protectively coloured or cryptic and others are extremely handsome. *Batocera rubus, Linn.*

is a large beetle of this family, 57 mm. in length with a lateral spine on each side of the prothorax and with the base of the elytra tuberculate. The insect is covered with a greyish pubescence and has white spots tinged with red on the elytra and prothorax. There is also a broad white lateral band from the eye to the last ventral segment. *Thysia wallachii* is a dark olive green beetle with steel-blue legs and with tufts of hair on the antennæ as well as on the back ; it is about 35 mm. in length (Fig. 17, b).

Three other small Longicorns of this family, ranging from 22 to 28 mm., which are also very common are *Epepeotes punctulatus*, West., *Agnoderus gnomoides*, Thos. and *Lamiomimus officinator*, White. The former is a black beetle with very long antennæ ; the elytra are spotted with white and there are white longitudinal lines on the head and prothorax. *Agnoderus gnomoides* is a reddish brown beetle with yellowish spots on the elytra and prothorax, the elytra are granulate and covered with raised lines. *Lamiomimus officinator* is also reddish brown in colour, with four large yellowish white spots and several other smaller ones on the elytra. There is a lateral spine on the prothorax.

A volume on this family is in preparation for the Fauna of British India Series.

Division VI. RHYNCHOPHORA.

Head more or less prolonged in front to form a snout or beak, called a rostrum. Tarsi four-jointed, the third joint usually broad.

The *Curculionidæ* or Weevils are the most important family in this division ; other families are the *Brenthidæ* and the *Scolytidæ* or Bark-borers. They may be thus distinguished.

A. Head produced into a rostrum.
   (*a*) Antennæ clubbed and elbowed .. .. *Curculionidæ.*
   (*b*) Antennæ straight, nine or eleven-jointed .. *Brenthidæ.*
B. Rostrum short or absent .. .. *Scolytidæ.*

Family—Brenthidæ.

This is a small family closely allied to the *Curculionidæ* but the body is always elongate and the antennæ are straight with nine or eleven joints. They are nine-jointed in the sub-family *Ulocerinæ* and eleven-jointed in the sub-family *Brenthinæ*. A Himalayan form frequently met with is depicted in Fig. 18.

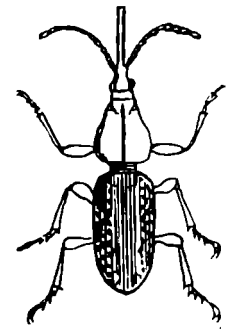


FIG. 18.—A HIMALAYAN BRENTHID.

This family is listed by Von Schonfeldt in the *Genera Insectorum* (1908), he enumerates 10 species as Indian.

Family.—Curculionidæ-Weevils.

The Weevils may easily be recognised by their rostrum and elbowed antennæ. The mouth of the insect is at the apex of the rostrum and the elytra, which completely cover the abdomen, fit the body closely. The weevils are a very large family of beetles mostly dull coloured and for the most part small in size if we except the genus *Cyrtotrachelus*. Two species of this genus, namely, *Cyrtotrachelus dux* and *C. longimanus*, are very common on the hills in the month of July. They feed on the juice of bamboo shoots

FIG. 19.—THE GIRAFFE BEETLE. (*Apoderus longiceps,*) x 2.

and are known locally as 'rangeets.' *C. dux* is the larger of the two ; good males measuring about $3\frac{1}{2}$ inches while females are smaller. The beetle is of a rich brownish yellow colour with the following dark markings—a broad band from head to

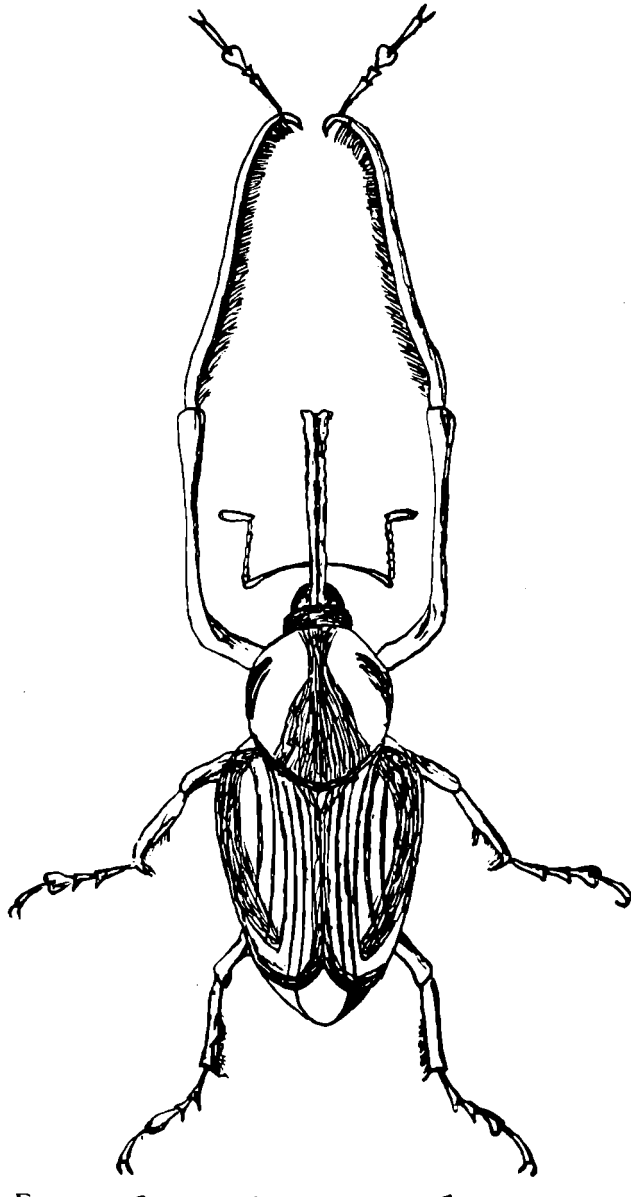


FIG. 20.—*Cyrtotrachelus dux*, Boh. ♂ (Nat. size).

scutellum passing through the middle of the prothorax and a band on either side of the same. A broad longitudinal band on the outside of each elytron and dark bands along the striations of the elytra. These colours soon fade after the beetle has been pinned and they assume a uniform dull mahogany tint. *C. longimanus* is a smaller species than *C. dux*, having the same pattern of colouration with the ground colour red instead of yellowish brown. Another curious weevil is the Giraffe Beetle, *Apoderus longiceps*, having an elongate prothorax and head (*see* Fig. 19). This family is being described in the Fauna of India by G. A. K. Marshall.

Family.—Scolytidæ.

The Bark-borers closely resemble the *Bostrychidæ* in habits and external appearance, but can easily be distinguished from them by their elbowed and more distinctly clubbed antennæ. They are closely allied to the *Curculionidæ* but differ in the almost total absence of a rostrum. An excellent account of this family will be found in Gillander's " Forest Entomology " (1908).

Suborder III.—LAMELLICORNIA.

Tarsi five-jointed ; antennæ with the terminal joints or lamellæ (usually three, sometimes more), broader than the rest, so as to form a peculiar club, the leaves of which are movable, but look like one piece as they are held close together.

Key to the Lamellicorn Families.

A. Five ventral abdominal segments visible from below ; antennæ with short lamellæ.

(*a*) Scutellum apparently absent,* antennæ not elbowed .. .. *Passalidæ.*

* The scutellum though apparently absent is really present on the isthmus between the pronotum and elytra.

(*b*) Scutellum almost always exposed between the elytra, antennæ elbowed .. .. *Lucanidæ*.

B. Six or more ventral abdominal segments visible from below, antennæ not elbowed, their lamellæ long .. *Scarabæidæ*.

Family I.—Passalidæ.

The beetles of this family, commonly called Woodies, are shining black or brown in colour with longitudinally striate elytra, they are found in decaying wood. *Macrolinus sikkimensis* (Fig. 21) is a common beetle in the Darjeeling district. Stoliczka has listed 23 Indian species in the Journal of the Asiatic Society of Bengal, XXII, page 149. More recently Gravely has published a revision of the Oriental species, recording about 30 Indian ones (Memoirs of the Indian Museum, Vol. III, 1910-1914, pp. 177-353, pl. XI—XIII). The habits of Passalid beetles are of great interest as parents do not desert their young, but live with them and are said to guard and feed them. Very little is, however, known of the habits of Indian species.

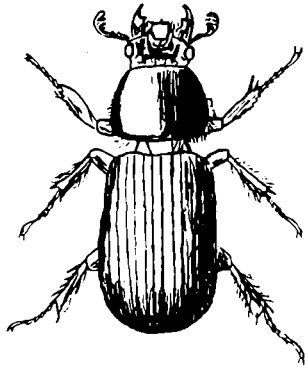


FIG. 21.—MACROLINUS SIKKIMENSIS. (Nat. size.)

Family II.—Lucanidæ. (Stag-beetles.)

The Himalayas are particularly rich in Stag-beetles which form one of the most striking features of their insect life. The mandibles in the male are often greatly developed and are usually called the horns. To what use the

insect puts these horns is still a matter of dispute. It is only in the male beetle that the mandibles are developed and sometimes they are almost as long as the rest of the body. The female beetles are generally smaller than the males and frequently quite unlike them. The elytra completely cover the upper surface of the body behind the scutellum and five abdominal segments are visible from below.

The larvæ take several years to turn into the pupal state and they, together with the adult insects, are generally to be found in decaying wood or roots. There are about 600 species of stag-beetles known, the Indo-Malayan region being very rich in them. Of the Himalayan forms the majority are shining black in colour, others are reddish-brown and some have red or orange on the elytra. The mandibles are almost always armed with teeth, but they vary even in members of the same species, the variations often being correlated with marked variation in size.

The Stag-beetles proper belong to the genus *Lucanus ;* the Common Stag-beetle of India or the King Stag-beetle (*Lucanus lunifer*) as it is sometimes called, is found throughout the Himalayas and even in the Terai. The horns of the male vary greatly and the female is quite unlike the male ; in Fig. 22 they are shown side by side. Adult beetles can be had early in June, and are to be obtained on oak and the so called 'katus' or chestnut trees (*Castanopsis hystrix*).

Another common Himalayan Stag-beetle is Cantor's Stag-beetle (*Lucanus cantoris*), it may be distinguished from both *L. lunifer* and the next species by having a row of small teeth along the basal half of the mandibles ; both the male and the female may be further distinguished by having a brown patch on the femur. They are

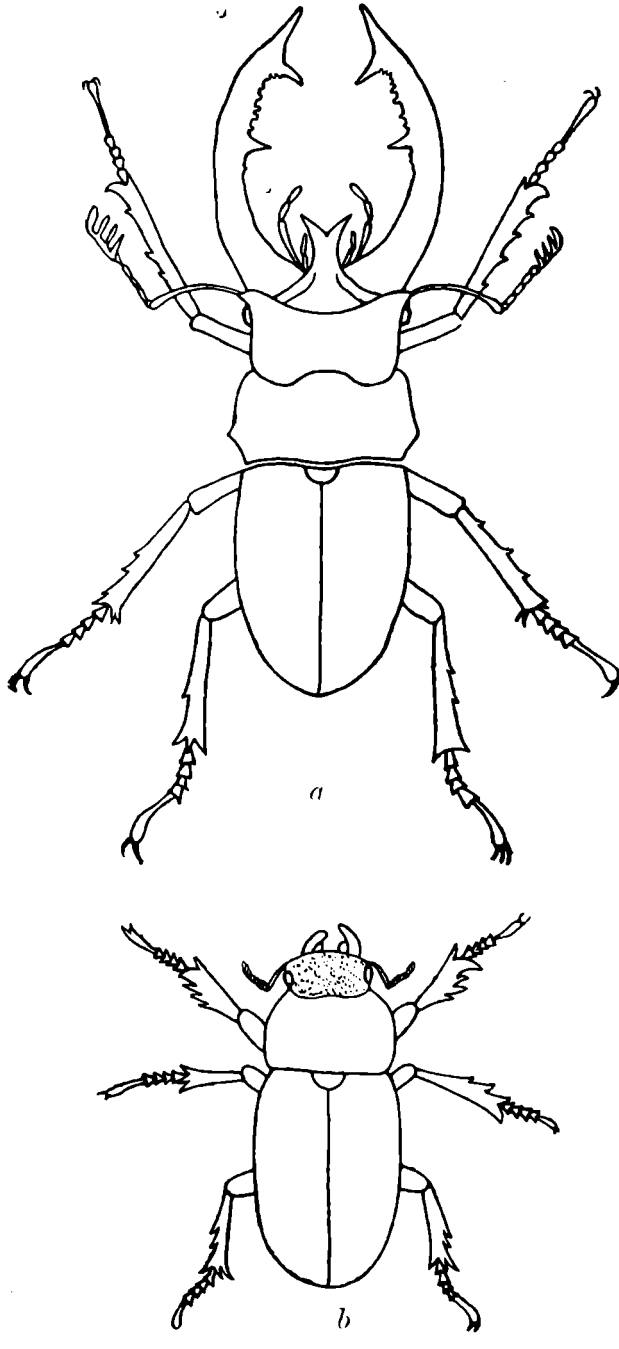


FIG. 22.—LUCANUS LUNIFER.
(*a*) Male. (*b*) Female.

to be found in decaying trees chiefly *Castanopsis tribuloides* and *Symplocos theæfolia.*

L. mearesi is another very common Lucanid found in the Eastern Himalayas; it and *L. lunifer* may be distinguished from *L. cantoris* by having

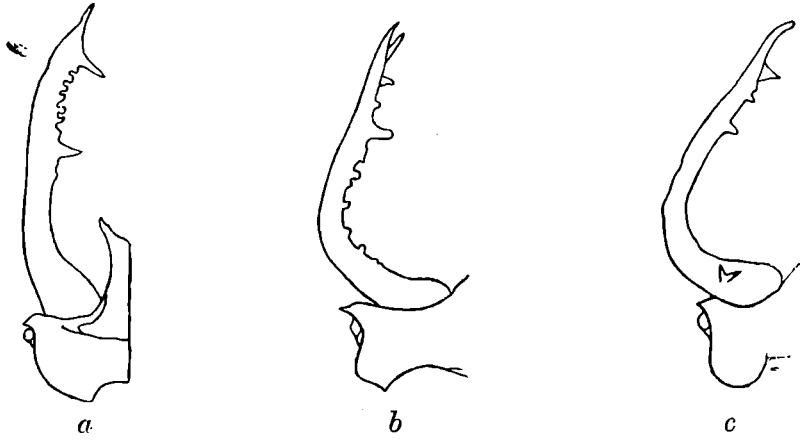


FIG. 23.—MANDIBLE OF (*a*) *Lucanus lunifer.* (*b*) *Lucanus cantoris.* (*c*) *Lucanus mearesi.*

the basal half of the mandibles devoid of teeth and more or less perfectly smooth. *L. lunifer* may have a few teeth at the anterior end of the basal half and so may small specimens of *L. mearesi,* but the greater portion of the basal half is smooth. *L. mearesi* may, however, be further distinguished from either of the two by having an isolated pair of points near the base of the mandibles. Fig. 23 shows the difference clearly between the mandibles of these three stag-beetles respectively.

A Lucanid of smaller size than the three just mentioned is Smith's Stag-beetle (*Lucanus Smithi,* Parry). It has very short mandibles and little is known about it. *Lucanus westermanni,* Hope which is also common in the

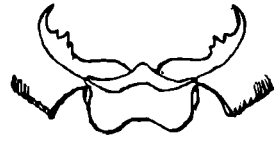


FIG. 24.—MANDIBLES OF SMITH'S STAG-BEETLE. (*L. Smithi.*)

Darjeeling district is easily confused with *L. Smithi*. It is, however, a little larger in average size and has one instead of several teeth in the middle of each mandible.

The next genus, *Odontolabis*, contains some bright coloured beetles. *Odontolabis cuvera* is about two inches long and its elytra have broad orange margins on the outer edge ; it is apparently not so common as the stag-beetles previously described. I am not aware of any suitable common names which have been applied to this beetle. Cuvera was the mythical king of riches who lived in the Himalayas and the beetle might be called the golden stag-beetle. The female closely resembles the male in coloration but is destitute of the long mandibles, her mandibles resemble rather those of the male *Neolucanus lama*. *Odontolabis siva* is somewhat larger than *cuvera*

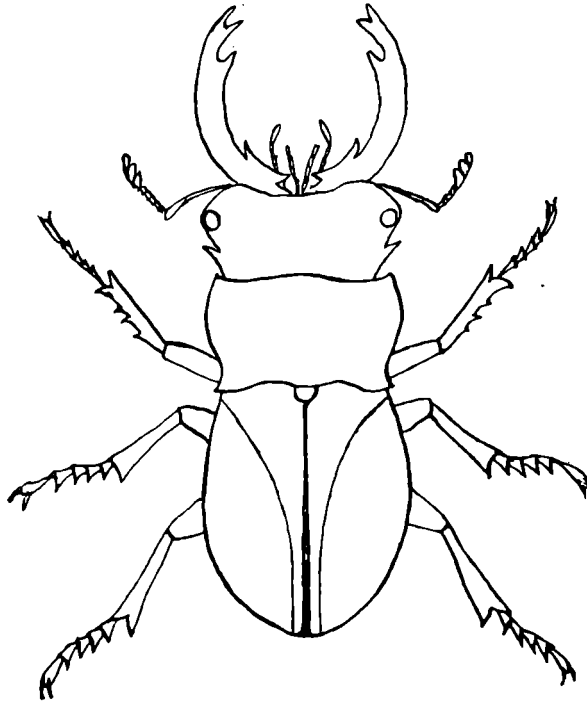


FIG. 25.—ODONTOLABIS CUVERA. Male.

and is entirely black, it is one of the common stag-beetles of the Darjeeling district.

The next group of stag-beetles are the Lama Stag-beetles. They belong to the genus *Neolucanus*. They resemble to some extent the females of the genus *Lucanus*, and even the males are destitute of long horns, and have only very short mandibles with a row of teeth on the inner edge. Fig. 26 shows one of the commonest forms *Neolucanus lama*, the Lama Stag-beetles. It is a shining black beetle very common during the months of July and August at 6,000 feet. Among juvenile collectors the male beetle is known as the Saw and the female is called the Queen Cow-beetle.

Another beetle of this genus but very much smaller than the last is *Neolucanus castanopterus*, the Chestnut-winged Lama Stag, called commonly Red-backed Saws and Red-backed Cows; the latter term being applied to the females. These beetles are identical in shape with *N. lama*, but are very much smaller, measuring only about 34 millimetres; the elytra are of a rich nut-brown colour. These insects are very plentiful late in July and in August, and are often seen walking along the ground in forests.

Two other stag-beetles found on the Himalayas are referred to the genera *Hemisodorcus* or *Macrognathus* and *Cladognathus* respectively. *Cladognathus giraffa* is a larger beetle than the *Hemisodorcus nepalensis*, with a lateral spine on each side of the prothorax. The head, mandibles and prothorax are finely punctate but the elytra are smooth. The mandibles are straight and long, being as long as the elytra and half the prothorax. In very large specimens, however, the mandibles are strongly curved outwards near the end. In the other species of the genus, which is also found in the Darjeeling district, this is not so; but in

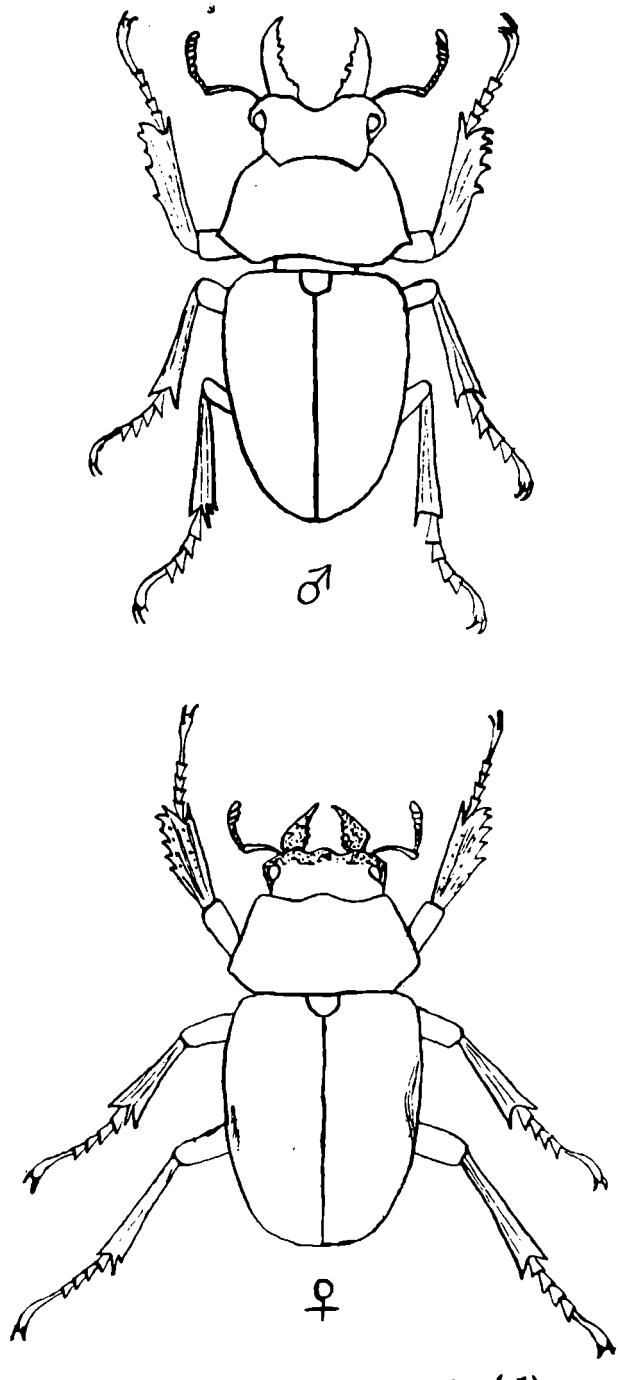


FIG. 26.—NEOLUCANUS LAMA. (Nat. size.) Male (♂) and female (♀).

this the teeth are more uniformly small. Small forms of the two species are very much alike.

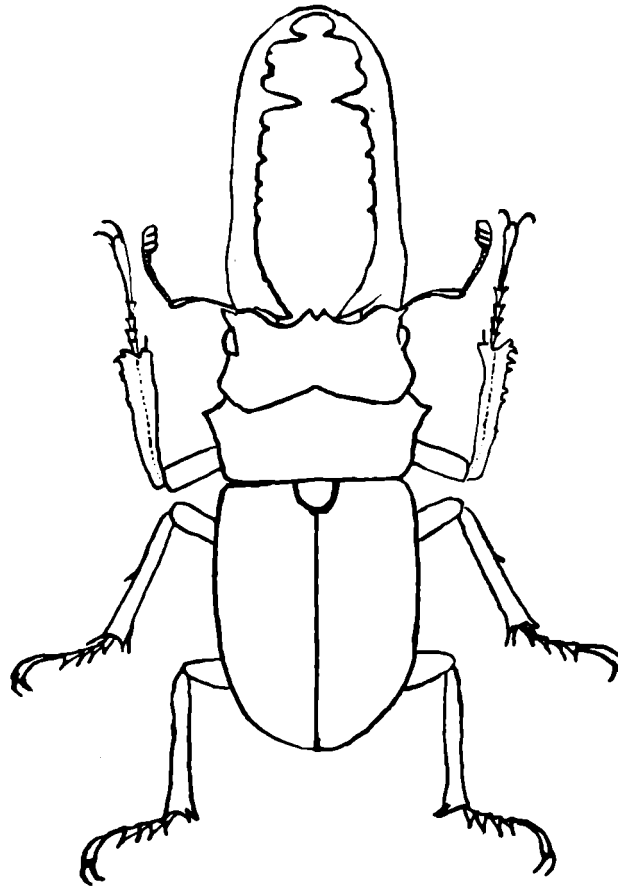


FIG. 27.—CLADOGNATHUS GIRAFFA.

The Nepal Stag-beetle (*Hemisodorcus nepalensis*) is an elegant insect with thin long mandibles armed with a few teeth at the end and one at about one-third the distance from the end. It is not a very common beetle in the Darjeeling district, where I have obtained it late in April. It is shining black in colour. The female is destitute of horns and has a resemblance to the females of *N. lama* and *L. lunifer*, but can be distinguished from the latter by its broader head

and from the former by having a rudimentary horn or spine between the eyes; its mandibles too are quite of a different nature to either of the two. Fig. 28 shows a male and female *H. nepalensis*. Adult males measure 75 mm. and females 47 mm.

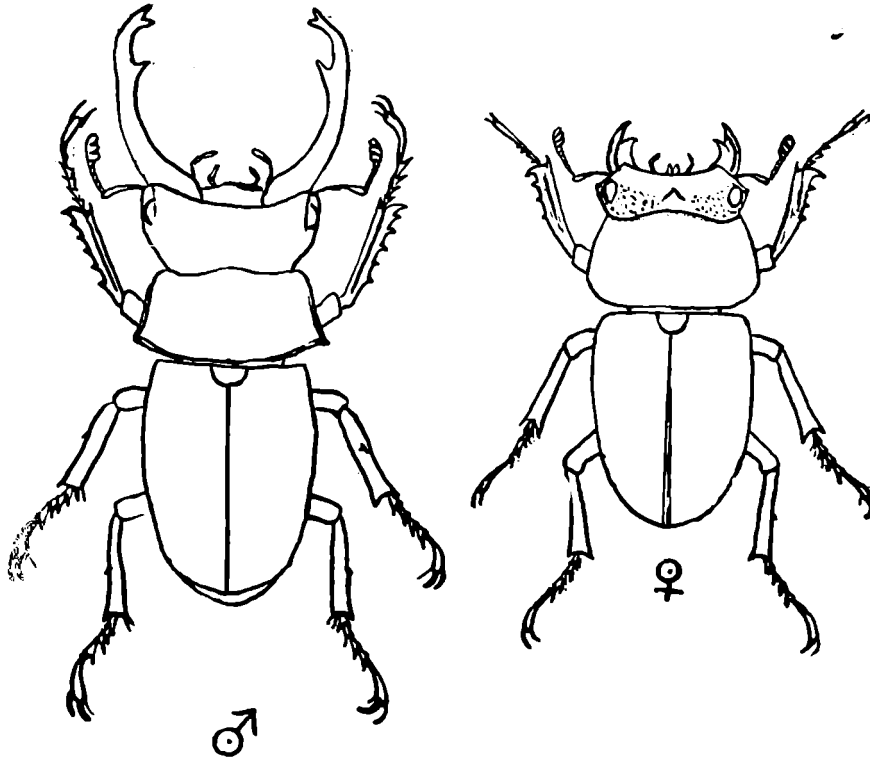


FIG. 28.—HEMISODORCUS NEPALENSIS, HOPE. (Nat. size.)

The next two genera, *Dorcus* and *Eurytrachelus*, are very much alike both in structure and habits; they are flat broad beetles with very powerful mandibles, and are to be found in large numbers in hollow and decaying trees, chiefly "sauer" (*Betula cylindrostachys*), "musre katus" (*Castanopsis tribuloides*) and "kharani" (*Symplocos theæfolia*). Of the genus *Dorcus* the largest beetle is *Dorcus antæus*, commonly called the

Dumpy Stag.* Like the other beetles of this genus it is shining black in colour, and may be extracted from hollow trees by means of a hooked rod. The male has but two points at the end of

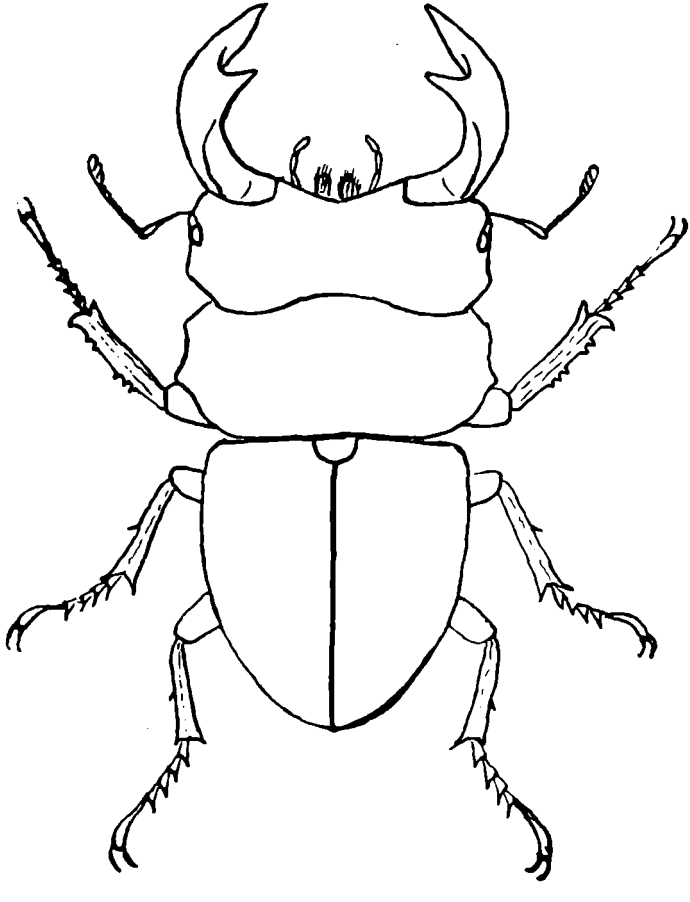


FIG. 29.—DORCUS ANTÆUS, Hope. ♂.
(Nat. size.)

its mandibles. This species is quite one of the most striking beetles in the Eastern Himalayas and good specimens measure 65 mm. from the head to the end of the elytra, excluding the mandibles, while from the tip of the mandibles to the end of the elytra it is about 86 mm.

* It might be mentioned that Anglo-Indian schoolboys in the Darjeeling-Himalayas term this species and its allies stag-beetles, while the true stag-beetles (*Lucanus*) they call deer.

Hope's Stag-beetle (*Dorcus hopei*) resembles *D. antæus* very closely and in fact are often mistaken for one and the same species. They can, however, be easily identified by the use of the following key :—

A.	A sharp projection or point springing from the head at the base of the mandible, elytra striate in the immature	*D. hopei.*
B.	No projection on the head at base of mandible, elytra smooth ..	*D. antæus.*

D. hopei is almost identical in shape to *D. antæus* but is of a lighter build and the projection on the head at the base of each mandible, if looked for, will at once disclose its identity. Its mandibles which also have two points are more slender and longer in proportion and in large specimens, a third point, pointing downwards is in evidence near the tip. Fig. 30 shows these differences clearly. Furthermore the labium in *D. antæus*, when looked at from below is densely pitted ; which is not the case in *D. hopei*. In young specimens of *D. hopei* the elytra are strongly striate.

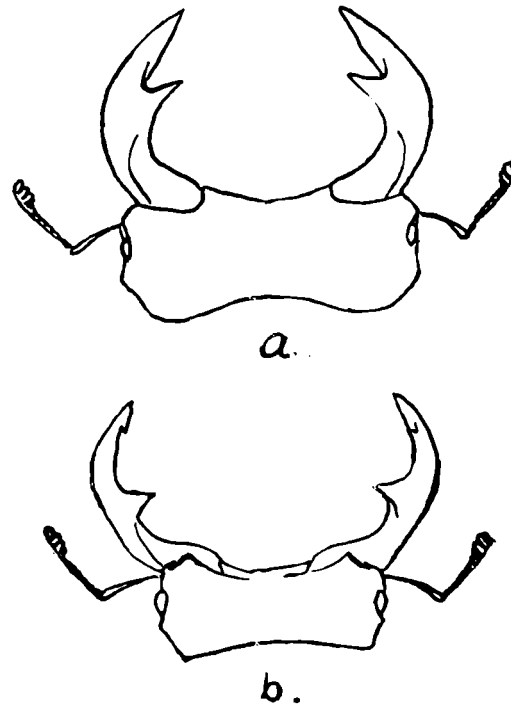


FIG. 30.—HEAD AND MANDIBLES OF
(*a*) *Dorcus antæus*, Hope.
(*b*) *Dorcus hopei*, Saund.

The above remarks apply only to the males of these species. The female of *D. antæus* is quite unlike the male and resembles a female of the genus *Lucanus*, but is flatter. It measures about 41 mm. in length; the mandibles are very short; the elytra and prothorax are smooth and the head is pitted with two points in evidence on the dorsal surface.

The female of *D. hopei* resembles the females of the next genus *Eurytrachelus*, but is larger and more rotund and has the pronotum very highly polished.

The genus *Eurytrachelus* contains two very common Stag-beetles which resemble the *Dorci* both in structure and habits; they are the Saw Stag-beetle *Eurytrachelus tityus* and the Straight-horned Stag-beetle *Eurytrachelus reichei;* neither of them are as large or as massively built as *D. antæus* and their mandibles differ. The Saw Stag has them straight and tapering with a regular row of teeth along the inner edge, giving it the appearance of a saw. Small beetles, however, have the horns curved but still they taper to a

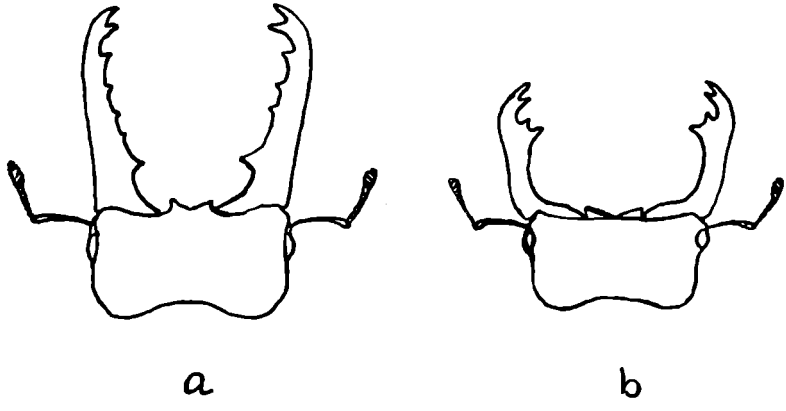


FIG. 31.—HEAD AND MANDIBLES OF
(*a*) *Eurytrachelus tityus*, Hope. ♂
(*b*) *Eurytrachelus reichei*, Hope. ♂

point. The Straight-horned Stag has the beam of his horn, so to speak, slightly curved and of about uniform thickness while they bifurcate at the end into two clusters of points. Fig. 31 shows the difference clearly. Large specimens of Saw-stags measure 73 mm. while Straight-horns range up to 60 mm. The female of *E. reichei* is an insignificant beetle quite unlike the male, with the elytra ridged longitudinally. It closely resembles the female of *D. hopei* but is smaller and the two points on the head are indistinct or wanting (see Fig. 32). The female of *E. tityus* is very similar, but the broad fourth and seventh ridges on the elytra are less inclined to unite behind.

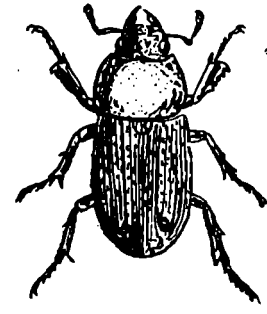


FIG. 32. EURYTRACHELUS REICHEI, HOPE.♀

A rarer beetle of this genus is *E. fulvonotatus* (The Golden-dotted Stag-beetle) ; it is a miniature *E. reichei* measuring 23 mm. if we exclude the mandibles. It may easily be recognised by the fulvous sub-marginal band on the elytra and spots of the same colour on the pronotum.

There are many species of Stag-beetles recorded, but many of these may prove to be forms of the same species. Westwood figures a number of the Indian forms (Cab. Or. Entom., 1848) ; but the student should consult Thomson's paper (Ann. Soc. Ent. France, 1862, p. 392) where 36 Indian species are listed. Leuthner published a fully illustrated monograph of the sub-family *Odontolabinæ* in 1885 (Trans. Zool. Soc., London, Vol. XI). Parry catalogued the family in the Transactions of the Entomological Society of London, 1864, pp. 1—113, listing 70 Indian species. Felsche published a later catalogue in 1898 on which

Boileau's remarks should be also seen (Ann. Soc. Ent. France, 1898, p. 401), and since then Albers listed the Kurseong species (Ann. Soc. Ent. Belgium, 1893, p. 69). Van Roon has published in Junk's "*Coleopterorum Catalogus*" a catalogue of the descriptions published up to about 1910. And Gravely is publishing in the "Records of the Indian Museum" a short account of the species in the Indian Museum Collection, special attention being paid to females.

Family III.—Scarabæidæ. The Chafers.

The Chafers may easily be distinguished from the two families which have just been described by having six or more ventral abdominal segments visible from below; moreover the elytra do not cover but leave exposed the last or the two last segments of the body, and the lamellæ of the antennæ are longer and differently constructed. They are mostly bulky beetles with the tibiæ of the forelegs flattened and spiny and well adapted for digging.

The Chafers are divided up into two large groups called *Laparosticti* and *Pleurosticti*. The group *Laparosticti* contains the Dung Beetles and is divided up into 13 sub-families 8 of which, namely, *Ochodæinæ*, *Geotrupinæ*, *Orphninæ*, *Hybosorinæ*, *Chironinæ*, *Troginæ*, *Aphodiinæ* and *Coprinæ*, are Indian. In the *Laparostict Scarabæidæ* the posterior spiracles or breathing holes are situated in the membrane between the dorsal and ventral plates of the segment, while in the latter group the posterior spiracles are situated in the dorsal part of the chitinous ventral segments. The group *Pleurosticti* contains the sub-families *Cetoniinæ* (Rose Chafers), *Dynastinæ* (Rhinoceros Beetles), *Rutelinæ* (Coloured Chafers), and *Melolonthinæ* (Cockchafers Proper).

The Coprids or Dung beetles as is well known affect the droppings of various animals and are generally seen rolling about balls of dung or breaking up and burying the same. Different species appear to affect the dung of different animals, they frequently enter houses at night and have a heavy flight; in colour they are generally black. They seem poorly represented on the Eastern Himalayas where at an attitude of 6,000 feet the largest coprid I have seen only measured 30 mm.

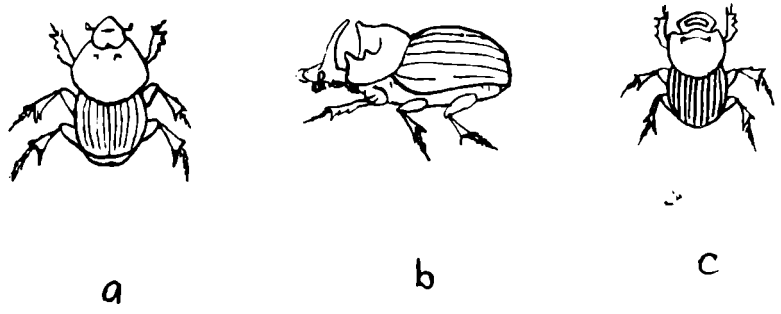


FIG. 33.
(*a*) *Onthophagus rugicollis*, Hope. (Nat. size.)
(*b*) The Rhinoceros Dung Beetle. ,,
(*c*) *Onthophagus angulatus*, Kol. ,,

The Rhinoceros Dung Beetle which is about 19 mm. in length, has a long horn on the head about 6 mm. long, while the prothorax is armed with a pair of horns at the side and two buttresses just behind the horn; the head and prothorax are smooth while the elytra are striate. Another small black coprid, 15 mm. long and affecting the dung of horses is *Onthophagus angulatus*, Kol., it has only a low ridge on the head, two rudimentary horns on the prothorax while the elytra is striate. Closely allied to the last is the Red-collared Dung Beetle (*Onthophagus rugicollis*, Hope), it has the prothorax red and is extremely common. The Crescent Dung Beetle (*Oniticellus brama*, Redt.) is another small species resembling

O. angulatus but is armed with a crescent-shaped appendage on the head. The Five-horned Dung Beetle is very much larger than either of the last three species, measuring 28 mm., the prothorax is armed with four prominent horns and a fifth much longer than the rest rises from the head.

The student should consult Indian Insect Life, p. 245 for further particulars regarding Dung Beetles.

Sub-Family.—Cetoniinæ.

The *Cetoniinæ* or Rose Chafers are the most highly coloured beetles in the family under discussion. Many of them are flat broad beetles shaped somewhat like the blade of a spade and they are not unfrequently termed Spade Beetles. They are very active in sunlight and readily take to the wing. Specimens of the same species often vary greatly in colouration, for example, individuals of one species may be coloured green, blue, black or fiery red.

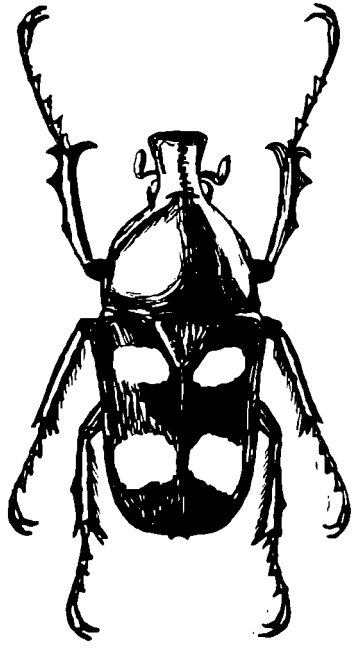


FIG. 34.—JUMNOS RUCKERI.

The commoner species are described below and common local names of such as have any, are given. There is a volume on the *Cetoniinæ* by Gilbert Arrow in the Fauna of British India Series which should be consulted.

A.—Cetonids in which the general form is rather short and broad and the prothorax subglobose. The elytra entirely cover the abdomen. The head of the male is provided with a pair of branched antlers which project forward and curve backwards at the tip.

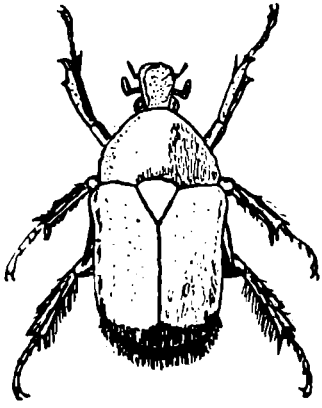


FIG. 35.
TORYNORRHINA APICALIS.

FIG. 36.
MACRONOTA PENICILLATA.

(1) *Dicranocephalus wallichi*.—The Horned Rose Chafer.

Black clothed with an ochreous velvety bloom except on the curved longitudinal lines on the prothorax and elytron.

Length 20—28 mm.

B.—Cetonids with elongate bodies and with the sides of the abdomen distinctly visible from above. The elytron is cut away behind the shoulders and tapers to the apex. The upper surface is generally covered with a fine bloom producing a velvety appearance.

(2) *Macronota penicillata*.—The Ivory Dink. (Fig. 36.)

Black with lemon yellow or white spots. The head and scutellum are yellow, the former with the frontal ridge

black. The prothorax is curiously ridged enclosing yellow patches which are strongly depressed. Each elytron is ornamented with two elongate spots adjoining the suture and two others near the outer margin with a third at the apex. There is a row of patches on each side of the abdomen and a large patch on the pygidium.

Length about 20 mm.

(3) *Macronota quadrilineata.*—The Tiger Dink.

Black with the elytra reddish and with the following yellow markings :—two longitudinal lines on the head, four on the pronotum, one on the scutellum and some spots on the elytra.

Length about 17 mm.

C.—Cetonids with elongate depressed bodies and with the base of the pronotum in a transverse line. Many bear horns or processes on the head. They are very smooth and shining and as a rule brilliantly but uniformly coloured. Bright green is the predominant shade.

(4) *Jumnos ruckeri.* (Fig. 34.)

Deep metallic green, with four large yellow spots on the elytra.

The large size of this insect will I think suffice to distinguish it from other Cetonids ; they range from 37 to 48 mm.

(5) *Torynorrhina apicalis.*—The Common Spade Beetle. (Fig. 35.)

Opalescent pink with the posterior margin of the elytra and the legs black.

Length 30—33 mm.

(6) *Torynorrhina opalina*.—The Opal Spade.

Pinkish olivaceous green with the scutellum dark-green and without a black posterior margin to the elytra. Size about the same as that of *T. apicalis*.

(7) *Rhomborrhina mellyi*.—The Apple-green Spade.

Bright apple-green, with the legs blue and the tarsi black.

Length about 35 mm.

(8) *Heterorrhina punctatissima*.—The Dark-green Spade.

Dark-green, sometimes fiery red, antennæ and tarsi black.

Length about 25 mm.

(9) *Heterorrhina nigritarsis*.—The Lesser Green Spade.

Grass green with the tarsi black. Sometimes the colour is of a golden green, red and even blue.

Length 20—23 mm.

(10) *Trigonophorus nepalensis*.—The Nepal Spade.

Deep green with the femora and tibia orange red and the tarsi black

Length about 29 mm.

(11) *Trigonophorus gracilipes*.—The Common Green Spade.

Pea-green with a slight opal tinge, some specimens are suffused with fiery red. Legs reddish brown, tarsi black.

Length 26—28 mm.

D.—Cetonids of compact build with the base of the pronotum having its sides inclined and not in a transverse line and with the part in front of the scutellum excised. The scutellum is blunt at its apex and never very acute. Most of the species have the upper parts covered with a dark bloom. These are the typical Rose Chafers.

(12) *Anthracophora dalmanni.*

Opaque black, with brick red spots on the elytra which become confluent into a large patch on the apex of the elytra.

Length about 20 mm.

(13) *Glycyphana horsfieldi.*—Horsfield's Chafer.

Opaque velvety black, pronotum encircled by a red marginal band and with an interrupted silvery or golden band across the elytra.

Length 13—14 mm.

(14) *Cetonia rutilans.*

Opaque green with six fine white transverse stripes on the elytra.

Length 19 mm.

(15) *Protætia auripes.*

Bright metallic green with the legs fiery red.

Length 24 mm.

(16) *Protætia hieroglyphica.*—The Buff Spade.

Bronzy with the upper parts covered with fine grey vermiculations.

Length 21 mm.

(17) *Protætia cariana.*

Very similar to *P. hieroglyphica* but larger and with the grey tracery very much more distinct.

(18) *Oxycetonia jucunda.*

This is a small species which varies greatly in colouration. On the Darjeeling Himalayas they are generally opaque above with a white marginal line on each side of the prothorax and with four white spots on each elytron ; two at the outer margin and two near the inner margin.

Some specimens (*var. sanguinalis*, Hope) have the elytra broadly margined with red ; others again are brown with two green spots on the pronotum and with each elytron broadly margined with green.

Length 13—17 mm., usually 14.

E.—Cetonids with the body convex above and extremely smooth and shining both above and below. Legs almost devoid of hair. Scutellum small and very acute. Elytra deeply cut away behind the shoulders. There is a raised transverse line across the elytra near the end.

(19) *Macroma xanthorrhina.*—The Black-and-tan Spade.

Head yellow with a black patch near the eye. Pronotum black with yellow lateral margins each containing a small black spot. Elytra yellow of a duskier tint margined with black and with a pale yellow patch posteriorly.

Length 23 mm.

Sub-family—Dynastinæ.

The sub-family *Dynastinæ* comprises the Rhinoceros Beetles which are the largest beetles of the family, but numerically they are few.

They are large bulky creatures and the males have enormous horns or projections on their heads and pro-thoraces, the females are destitute of these projections. These beetles are able to produce sound by rubbing the dorsal surface of the abdominal segments against the wing cases. Two of the best known examples of this sub-family to be found on the Eastern Himalayas are *Eupatorus hardwickei*, the Five-horned Rhinoceros Beetle, and the Lesser or Two-horned Rhinoceros Beetle, *Xylotrupes gideon*. Typical specimens of the former are shining black beetles with red-brown elytra, in one variety (*cantori*)

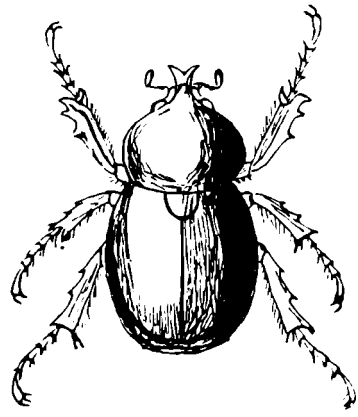


FIG. 37.
XYLOTRUPES GIDEON, Cr.

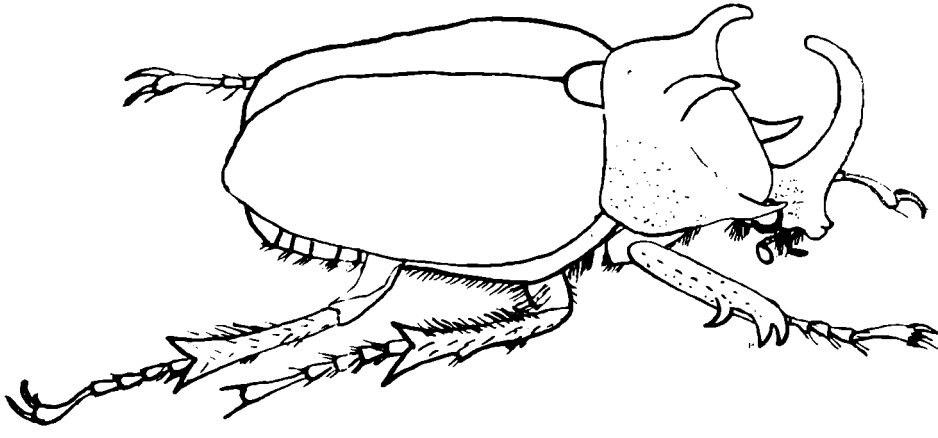


FIG. 38.—EUPATORUS HARDWICKEI.

the elytra are black broadly margined with red-brown; others again have the red-brown parts of the elytra bright reddish yellow. Four horns

pointing forward spring from the prothorax of the male and a fifth, longer than the rest, rises from the head and curves backwards. The female is destitute of horns. Large male beetles measure 70 mm. and females 63 mm. *Xylotrupes gideon* is much smaller than the last, ranging (on the Eastern Himalayas) from an inch and-a-quarter to about two inches ; and are brown or chestnut-red in colour. The use of horns to these insects is not yet known with certainty, but it is concluded that they serve as offensive and defensive structures to the males in battling for the females. Both these species, which are crepuscular and nocturnal, begin to become prevalent in the Darjeeling Himalayas during the months of August and September. Indian Dynastids have been described by Arrow in the " Fauna of British India."

Sub-family.—Rutelinæ.

This sub-family contains some brilliantly coloured pests, they are mostly beetles of moderate size usually displaying shining metallic colouration, and may be designated the Coloured Chafers. One of the larger members of this group is the Green Chafer (*Anomala viridis*) it is bright green in colour and found eating the leaves of the alder

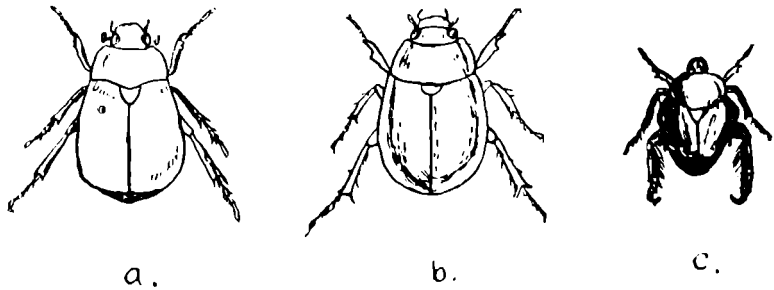


FIG. 39.—(*a*) *Anomala viridis.*
(*b*) *Anomala passerini.*
(*c*) *Popilia cyanea.*

(*Alnus nepalensis*). The Lesser Green Chafer (*Anomala passerini*) is smaller than the last, of a dull green and with a narrow whitish band encircling the body. Another Green Chafer smaller than the last is *Anomala scabra*, its upper parts are of a bright metallic green while its legs are copper-coloured. The Brilliant Green Chafer (*Anomala auroniteus*) is another small chafer about 17 mm. long, of a brilliant metallic green colour with reddish reflexions. The Rainbow Chafer (*Mimela leei*) is very common in the Darjeeling Himalayas, it is a small shining iridescent brilliant metallic green beetle with reddish or coppery stripes and reflexions. Two very small chafers measuring only 13 mm. are the Blue Chafer (*Popilia cyanea*) and the Copper-coloured Chafer (*Popilia cupricollis*) ; the first mentioned being very plentiful.

The Black Chafer (*Anomala flavopicta*) and the Buff Chafer (*Anomala anthracina*) are two species that frequently enter houses at night. They are about 15 mm. in length ; the former is a black beetle with two red spots on the pygidium and the latter is of a yellowish buff colour with the head black and with two broad black bands across the elytra and a longitudinal one on the prothorax.

Sub-family.—Melolonthinæ.

The Cockchafers comprise some of the beetles which are a source of considerable damage both in the larval and imago stages, these beetles live chiefly on flowers and leaves which they devour wholesale ; the larval stage which is of considerable length and at times lasts over a period of six years, is passed underground, the grub meanwhile attacking the roots of plants. The beetles are robust in build ; brown, black,

grey or dull green in colour, and with the elytra leaving exposed the last two segments of the body, the ultimate segment being more or less pointed.

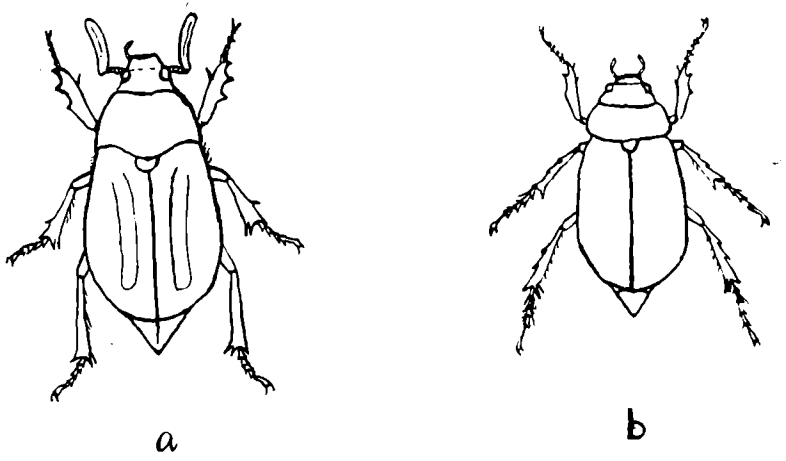


FIG. 40.—COCKCHAFERS.
(*a*) *Hoplosternus shillongensis, Brk.*
(*b*) *Lachnosterna impressa, Br.*

The Cockchafers Proper are well represented in the Eastern Himalayas ; among some of the commoner kinds may be mentioned the White Chafer (*Cyphochilus candidus*), the Brown Chafer (*Hoplosternus shillongensis*), the Yellow Chafer and the Green Chafer. The White Chafer is by far the commonest and may frequently be met with on roads and paths, it is a black beetle covered with a white scale-like substance which gives it a snow-white appearance. The Indian Chafer (*Lachnosterna impressa*) is also very common, it is a thickish brown beetle observed swarming at dusk on trees (chiefly '*kirami*') and entering houses at night.

No complete list of the Indian species exists but the specimens in the Indian Museum were listed by Barlow which should be consulted (Indian Museum Notes, IV, p. 234).

An anomalous division (*Euchirini*) of the *Melolonthinæ* contains one of the most handsome

of Himalayan insects, namely, *Euchirus macleaii* commonly called the Elephant Beetle, it may easily be recognised by its enormously prolonged anterior legs. The male beetle measures about 65 mm. and the anterior legs are about 77 mm. long. The head, prothorax and anterior legs are dark metallic green, the other pairs of legs being black, the elytra are black and covered with numerous yellow spots and the under parts are covered with yellow fur. They inhabit the North-Eastern Himalayas and adult beetles can be obtained in July and later.

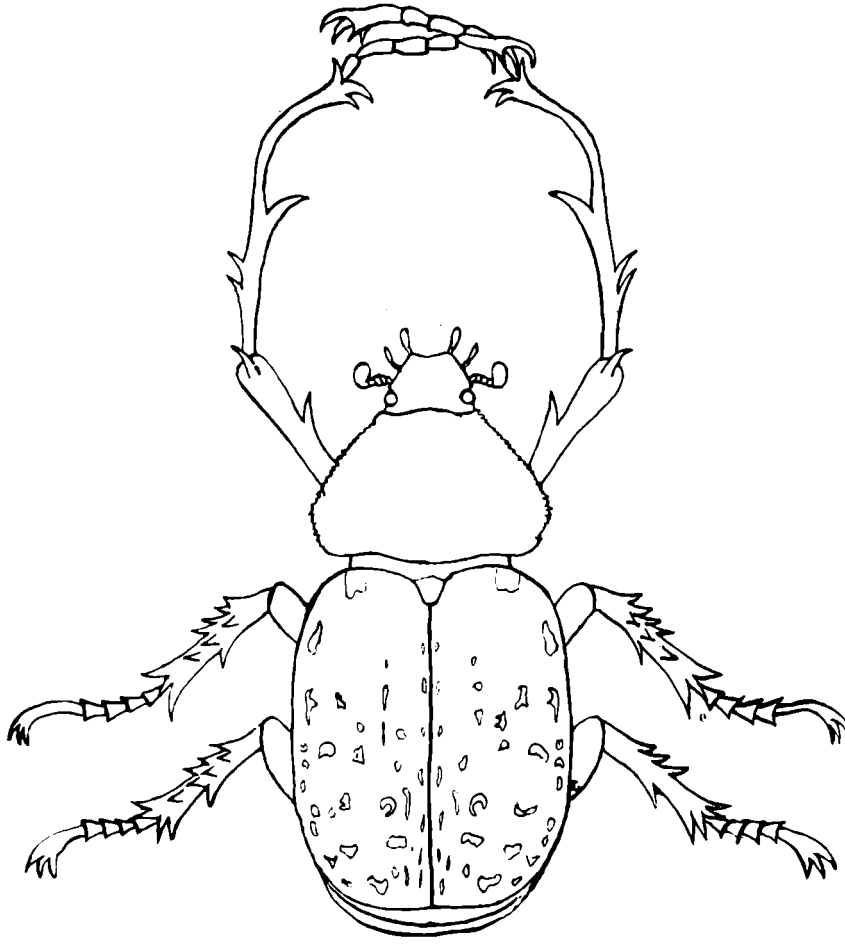


FIG. 41.—EUCHIRUS MACLEAII. Nat. size.

CHAPTER II.

Collecting, Preserving, and Setting.

Collecting.

The collector of beetles needs but few appliances, all that is necessary being a few boxes, a knife, a lens, a crook, a net, and a killing bottle. The various families will need special methods of collecting, for example the *Lucanidæ* have to be hooked out of crevices in trees with an iron crook, or cut out of the tree itself. The Coprids will have to be dug out of the earth under animal droppings or caught at night when they come to light. The Chafers sometimes swarm on large trees in the evening when a net is necessary to take them, and the need of a net will also be felt in taking *Dytiscidæ* and *Gyrinidæ* from pools of water. A good method which frequently pays is that of shaking a tree after spreading a white sheet or an inverted umbrella under it to prevent the specimens which fall off from getting lost in the undergrowth. A bright light at night will often attract many beetles, chiefly coprids, chafers, elaterids, etc. Carabids and Tiger-beetles are found on the ground; the former should also be looked for under stones, while the latter will sometimes need the use of a net.

It is well always to have with you, while out collecting, a killing bottle, a crook made out of stout wire bent at right angles at one end and a few empty boxes. As you secure your specimens drop them into the killing-jar and from time to time remove them into an empty box. Large beetles, like the *Lucanidæ*, which take a

long time to die in the killing-jar, can be brought home alive and killed afterwards. Care should be taken to confine these beetles in boxes by themselves or they are sure to damage each other with their mandibles. I prefer using tin boxes for confining beetles for they easily bite their way out from cardboard and wooden boxes.

Whenever beetle larvæ are found the pupæ and adults should be looked for and preserved with them in spirit. If the larvæ and pupæ can be killed in boiling water, which hardens them somewhat, this should be done, but they should only be left in the water for a few minutes. Beetle pupæ are sufficiently like their adults to be easily recognised when both these stages of a species are found together. Beside the pupa or newly-hatched adult is usually found the thin and fragile cast skin of the larva, with the aid of which the larva itself may be recognised. By collecting these things it is often possible to work out life-histories previously unknown, especially in the case of wood-boring beetles.

Killing Bottle.

Killing bottles $4\frac{1}{2}''$ by $2\frac{5}{8}''$ can be had from Messrs. Lawrence and Mayo for Re. 1-8, but it is easy enough to make one, all that is needed is a wide-mouthed bottle or tube with a tight-fitting cork. Cover the bottom of the bottle with dry plaster of Paris to the depth of about half-an-inch, and into this imbed crystals of cyanide of potash (one ounce or less according to the size of the bottle); over this pour some more plaster of Paris and water made into a cream. Cork up the bottle and when the plaster sets the bottle is ready for use, but a disk of blotting paper should be placed over the plaster to absorb any moisture that may appear. All insects

dropped into this bottle appear to die in a very short time, but the larger beetles may revive if taken out too soon. The bottle should always be kept corked, for the fumes given off are very poisonous. The bottle will not last for ever but after a time when it does not prove effective the cyanide will have to be renewed. Bruised peach leaves have much the same effect as potassium cyanide, but need more frequent renewal. Quite a good killing bottle may be made by crushing the leaves of the wild peach into a firm mass at the bottom of a suitable bottle, and simply covering these with blotting-paper. Beetles may also be killed by being

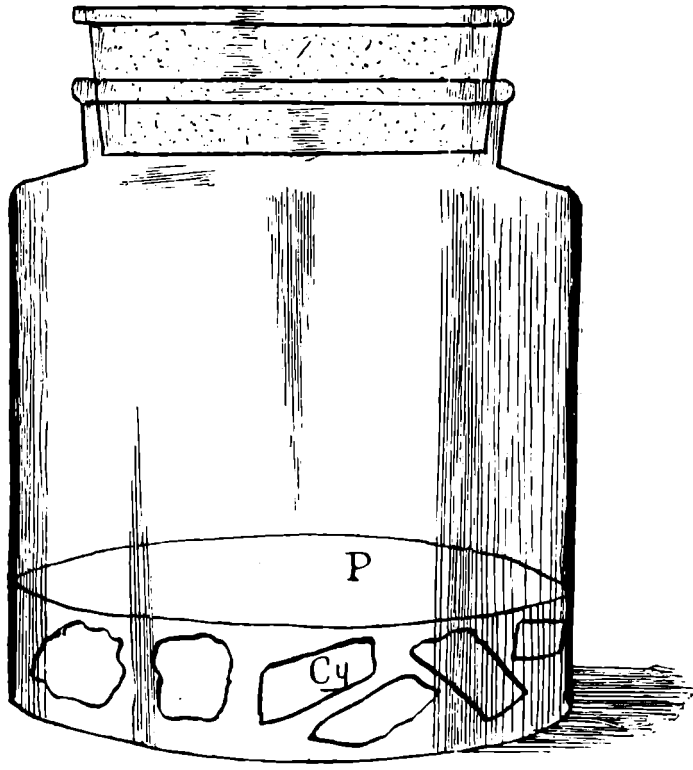


FIG. 42.—KILLING JAR.

Cy. Crystals of cyanide of potash imbedded in plaster of Paris.
P. Disk of blotting paper.

dropped into boiling water or benzene. Specimens killed in benzene and allowed to soak in it for any considerable time afterwards get nicely hardened and are less likely than others to go bad afterwards.

Pinning and Setting.

The next thing, after collecting and killing the specimens, is to pin and set them. The common toilet pins should never be used for pinning insects; these pins soon get covered with verdigris. Entomological pins, silvered or enamelled black, as manufactured by Messrs. D. F. Tayler & Co., are perhaps the most convenient, though nickel pins are really better. Nos. 2, 3, 7, 12, 16 and 20 of Tayler's pins cover practically all needs. These are priced at from As. 8 to Rs. 4 per $\frac{1}{2}$ oz. No. 20 is the smallest size and is priced at Rs. 3-8 (white) and Rs. 4 (black). These pins can be had at Messrs. Lawrence and Mayo who stock all sorts of apparatus for the use of entomologists. In these pages I intend quoting their prices only unless otherwise stated.

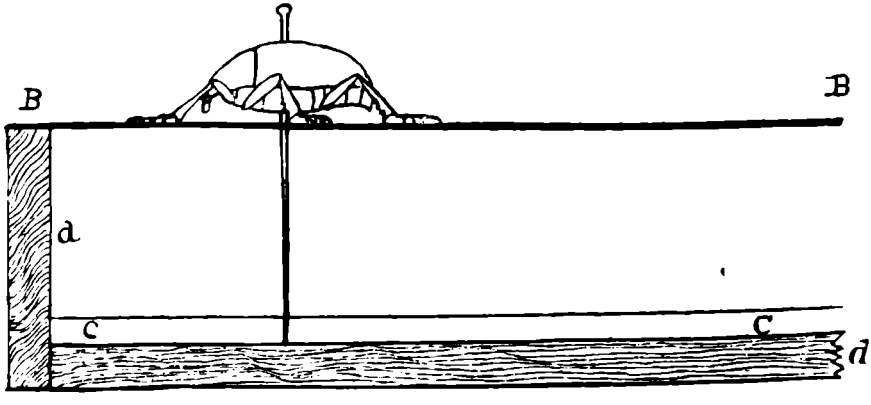


FIG. 43.—Method of mounting a beetle on a setting-frame.

(*a*) Wooden frame.
(*b*) Paper drum-head.
(*c*) Layer of cork.

Beetles should always be pinned through the right elytron or wing-case, care being exercised not to pierce the right hind leg on the lower side of the body. The pin should be at right angles to the axis of the body.

One-third of the pin should be above the insect and the rest in and below it, in fact only just enough of the pin is wanted above the insect to be grasped conveniently with the forceps. Having pinned the specimen the next step is to expand it properly. This is done by arranging the feet and antennæ in such a way that they can easily be inspected. In doing this it is well to have a frame seven-eighths of an inch deep, or thereabouts, backed by a thin piece of soft deal lined with pith or cork, and covered on top by a sheet of paper, which has been first moistened and then pasted around the edges, and which when dry expands like a drum-head (Fig. 43). Upon this a number of beetles may be pinned, their feet drawn out, and there be left to dry. If no setting-frame be available a thick pith-board or pieces of paste-board do just as well, but if the board is tough, a small hole should first be made with an ordinary pin and through it pass the entomological pin holding your specimen. The legs and antennæ can be drawn into position by means of " setting-needles " which can easily be made by inserting ordinary needles into handles, and can then be fixed in their places with ordinary toilet pins.

FIG. 44. SETTING NEEDLE.

The above applies to beetles of an appreciable size ; the smaller ones are generally *staged*, that is to say, the

insect is first pinned with a fine pin on a slip of polyporus or sola pith, and the pith is then pinned with a big pin. Any compact white pith will do though a box of strips weighing $\frac{1}{4}$oz. can be had for As. 12. Raw sola pith can usually be obtained very cheaply in the Calcutta bazaar, and can be cut up into suitable blocks as required.

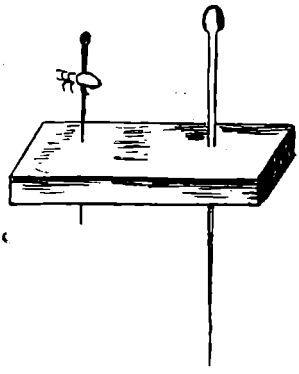


FIG. 45.—STAGED INSECT.

Smaller beetles are gummed, that is, they are fixed to a strip of card which is pinned with a big pin. Only a very small quantity of white gum or seccotine should be used for each beetle and the cards should be rectangular or triangular, but as narrow as posble. Very small beetles can be kept in small tubes, the corks of which are dipped in a solution of naphthalene, in benzene, or in carbolic acid.

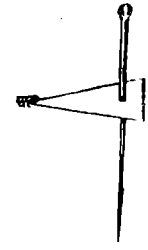


FIG. 46.
A GUMMED BEETLE.

Labelling.

All specimens should have a label, and labelling should be done at once in order to avoid mistakes. On the label is written a number, the name of the food-plant, date of capture, locality with altitude and at one side of the label the name of the collector. Labels should be written on stout white paper and should be as small as possible. When one has the name of the insect it can be written on a separate label. In fact there is no harm in having several small labels on the same pin. Regarding locality one should be precise and Himalayas (Eastern or Western)

should be added after the town or village near which a specimen was collected or if on the plains, the province and India. Labelling is done with a view to posterity for one's specimens may lie in a museum for centuries and may go to any part of the world eventually. A crow-quill pen does very well for writing labels.

Storing.

Several specimens of one species need not be pinned; after pinning a few the rest may be dried, wrapped in tissue paper with necessary labels, and packed away in a box. These may afterwards be relaxed and set if desired and in an unpinned state they are very convenient to send by post. Beetles should never be wrapped in cotton-wool for the fibres get entangled with the legs and antennæ and it becomes very difficult to remove it without breaking those members.

Coleopterous larvæ and pupæ may be preserved with their adults in rectified spirit of not less than 70 per cent. alcohol or in a solution of 4 per cent. formalin in water. As the fluid will weaken by absorbing water from the insects, it should be changed two or three times during the first day or two. The larvæ and pupæ frequently blacken when preserved. This may be avoided by placing them in boiling water for two or three minutes before putting them in spirit. It is not, however, always easy to convey such soft creatures safely home alive; and as boiling water cannot be kept constantly at hand in the jungle a mixture of 60 parts absolute alcohol, 30 parts chloroform, and 10 parts glacial acetic acid may be found useful. This mixture is really better than boiling water, but is more expensive and does not keep for very long periods after being prepared. The specimens should be left in it for an hour or more—large specimens

for at least two hours—and may then be transferred to strong spirit. They may conveniently be stored in glass tubes 3 inches long by 1 inch in diameter. These can be had for As. 12 a dozen and smaller ones at As. 8. The label should be written with a very black pencil and placed inside the tube and the number only pasted on the cork for ready reference.

Relaxing and mending.

To relax a dry specimen wrap it in tissue paper and place it between layers of cloth or blotting-paper which have been dampened in water, to which a very small quantity of carbolic acid has been added to prevent mould. Another method is to lay the specimen at the bottom of a jar, half-filled with sand, which has been moistened and well carbolized. The jar should be tightly closed so as to retain the moisture. After exposure to the moist atmosphere of the jar for a period varying from a few hours to a day, the specimens will be sufficiently relaxed to permit of their being treated as if they had been freshly taken.

Sometimes a specimen may have broken, *i.e.*, the head and prothorax or the legs may have come away, such a specimen can easily be mended by pasting together the broken parts with a cement made as follows :—

Take equal parts of white gum arabic and white gum tragacanth, powder and mix together and then make a paste with enough water and a few drops of carbolic acid. A solution of shellac in spirit may be used as an alternative.

CHAPTER III.

CARE AND DISPLAY OF BEETLES, METHODS OF WORK, ETC.

After pinning and drying your specimens they should be kept in air-tight boxes lined with sheets of cork $\frac{3}{8}$ of an inch thick. A useful size is $17\frac{1}{2}'' \times 12'' \times 3\frac{1}{2}''$ lined with cork top and bottom, these can be had ready made for Rs. 4-8. There are two things to guard against now, mould and mites. If no disinfectant be put inside the boxes, sooner or later the specimens will be attacked by minute insects and it will not be long before they crumble away. A good disinfectant is what is known as the 'naphthalene-paraffin mixture' and it is applied inside the box as follows—Take $\frac{3}{4}$ lbs. of hard paraffin wax, place it in a saucepan and heat it over a fire till it melts and then add to it $\frac{1}{4}$ lb. of powdered naphthalene. Place the box on a level table and pour the mixture inside it and allow it to cool and harden, when it will have the appearance of white marble. Naphthalene and paraffin wax can be had at Messrs. D. Waldie and Co., Chemical Works, Konnagar, near Calcutta.

Naphthalene crystals kept inside the box or turpentine, creosote or carbolic applied to the inside with a brush will keep off mites for a time but their effects wear off more quickly than do those of naphthalene. They are, however, more effective while they last, and a ball of cotton-wool on the top of a pin should be soaked in creosote or carbolic and placed in one corner of each box in addition to naphthalene, the disinfectant being renewed periodically.

To prevent mould one should be careful to dry one's specimens properly before placing them in the store box. In India this is the greatest difficulty one has to encounter. When a specimen has been attacked by mould, the mould may be largely removed by thorough drying in a cool oven and then dusting off the specimen with a soft camel's hair pencil that has been rubbed in carbolic acid and dried. If a collection gets attacked by mould or mites a little benzene should be poured into the box which should then be closed for a few days. Benzene vapour kills everything; but benzene evaporates too quickly to be used as a permanent disinfectant.

Specimens sometimes become greasy, and it is then desirable, if possible, to remove the grease with which their bodies are saturated. The only method which can be employed advantageously is that of washing out the grease by means of benzoline or some of the allied volatile mineral oils.

A collection is best kept in boxes, and as it expands the various families can be removed into boxes by themselves. These boxes should not be laid one upon the other, as this causes the specimens pinned upon the upper side to get detached through the jarring and thus cause breakages among the specimens. They are best placed on their ends upon shelves. The name (if known) of a specimen should be written on a slip and pinned below the insect, but a slip bearing the same name should also be on the pin or species may sometimes get mixed. A good method is to work by numbers, keeping all specimens which you take for one species under one number. A note-book should also be kept and against the number of a species all notes made should be entered.

A great many instruments of different sorts will suggest themselves to the collector in the

process of his labours, the most necessary instrument being the forceps. Two pairs of these should always be kept, one with fine points to be used for pinning and setting and one with thick curved points for handling pinned insects. These can be had from Re. 1 to Re. 1-8. A good lens is also essential, and these can be had for various prices ranging from Rs. 5 to Rs. 10 or more according to the quality.

Field notes are of great importance. For instance, one should try to find out and record why an insect is in a particular spot, what it is doing there and what its life history is. No chance of rearing from the grub should be lost. The difficulties of rearing coleopterous larvæ are so great that a reared beetle may be looked upon as an achievement.

Should you have occasion to send your beetles from one place to another, you must be careful how you pack them. All large specimens

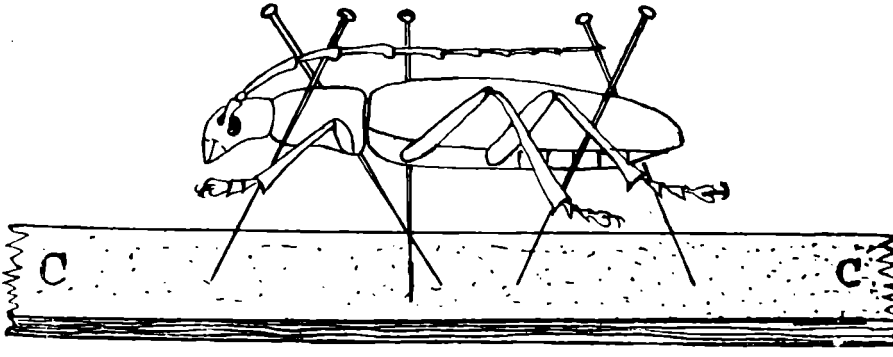


FIG. 47.—Method of cross pinning a large beetle.
C.C. Cork layer at bottom of cabinet.

should be cross-pinned to prevent them rolling about should they shake loose during transit, and your box of specimens should be placed inside a larger box and the intervening space on all sides should be filled with wood shavings. This prevents jarring and the specimens do not break.

GLOSSARY OF TECHNICAL TERMS.

Names of parts of the body explained in the diagrams are not included here.

♂ indicates the male ; ♀ the female.

APEX,—the distal or outer extremity of a part.

DORSAL,—belonging to the upper side.

DENTICULATE,—provide with small teeth-like projections.

FRONTAL,—belonging to the forehead or face.

GLOBOSE,—globular.

GRANULATE,—bearing fine closely-set elevations.

IMAGO,—the final or mature stage of an insect.

LARVA,—the primary active stage of an insect.

mm,—millimetre.

NITID,—lustrous.

OPAQUE,—dull, not reflecting light.

PUBESCENCE,—a clothing of soft hairs.

PUNCTATE,—bearing pits or punctures.

PUNCTULATE,—bearing very minute pits.

PUPA,—the penultimate stage of an insect.

RUGOSE,—having an irregularly wrinkled surface.

RUGULOSE,—having a more finely wrinkled surface.

STRIATE,—bearing parallel scratches or grooves.

SUTURE,—the meeting line of two adjacent edges.

TESTACEOUS,—having the colour of tortoise shell.

TUBERCLE,—a small sharp elevation.

TUBERCULATE,—covered with small sharp elevations.

VENTRAL,—belonging to the lower surface.

VERMICULATE,—covered with marks resembling the tracks of worms.