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MISCELLANEA (pp. 201—215).

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XIII A NEW GENUS OF PSYCHODID DIPTERA FROM THE HIMALAYAS AND TRAVANCORE.

By N. ANNANDALE, D.Sc., F.A.S.B., Superintendent, Indian Museum.

The genus described below is represented in the collection of the Indian Museum by specimens of two species. One of these species I attributed in a former paper to the fossil genus *Diplonema*, which it resembles as regards the structure of the antennæ and the male genitalia. The venation of the wings is, however, so distinct that it seems necessary to recognize it as representing a new genus, which I have named *Brunettia* in honour of Mr. E. Brunetti, who has done so much to increase our knowledge of the Indian Diptera.

BRUNETTIA, gen. nov.

Diplonema, Annandale (nec Loew), *Rec. Ind. Mus.*, vol. iv, p. 39 (1910).

Heavy moth-like Psychodidæ with broad, thickly-scaled wings, which are held in a horizontal position during repose; second longitudinal vein with three branches, which originate close together near the base of the wing; fourth longitudinal vein with two forks. Mouth parts not forming a proboscis; palpi long, with 4 joints. Antennæ with 15 joints, of which two form the scape; each of the first 12 joints of the flagellum bearing a couple of stout S-shaped chætæ as well as fine hairs. Eyes strongly emarginate. Male genitalia of complicated structure; the inferior appendages bearing numerous racket-shaped spinules; a chitinous intromittent organ present.

Habitat. Darjiling district (E. Himalayas) and Travancore (S. India).

Brunettia differs from *Diplonema*, Loew,¹ not only in its much broader and heavier wings but also in having three branches instead of two to the second longitudinal vein. The palpi also appear to be longer. In respect to venation the wing is to some extent intermediate between that of the Phlebotominæ and that of the Psychodinæ. The lowest branch of the second longitudinal vein is, however, less distinct from the other two than is the case in the genera of the latter family. The male genitalia, moreover,

¹ "Zu der öffentlichen Prüfung der Schüler des Königlichen Friedrich-Wilhelms-Gymnasium zu Posen," *Dipt. Beitr.*, i, 7 (1845).

agree in their complexity with those of the Phlebotominæ, and the female genitalia in the absence of the horny ovipositor. *Brunettia* may therefore be placed provisionally in the Phlebotominæ.

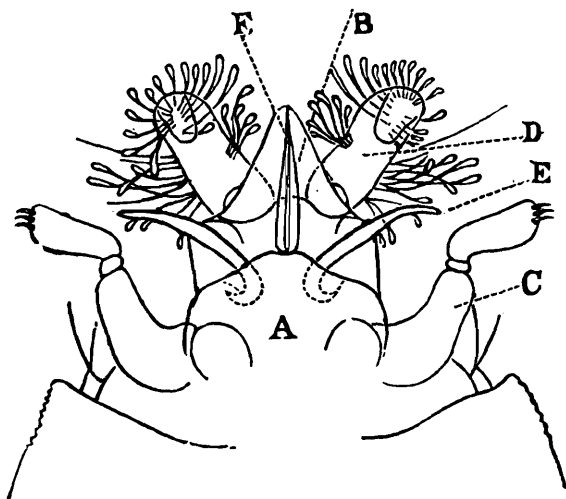
Brunettia superstes (Annandale).

Diplonema superstes, Annandale, *Journ. Asiat. Soc. Bengal*, vol. iv, p. 353 (1908).

♂, ♀ Total length 3 mm.; expanse of wings 8 mm.

Colour sooty black with a strong white refulgence; the first joint of each tarsus partly white, the extent of the white portion varying with the incidence of light.

Antenna with 15 joints; the basal joint cylindrical, the second almost discoidal, these two (the scape) covered with scales; each joint of the flagellum except the last bearing, in addition to a broad basal band of hairs, a long, stout S-shaped chæta on



Male genitalia of *Brunettia superstes*, from above.

either side; joints of the flagellum spindle-shaped, the distal end of each smooth, devoid of hairs; the last joint bearing hairs only, produced at the tip into a minute, cylindrical, blunt process covered with exceedingly fine pubescence. Palpi 4-jointed; the first joint short, the others longer, subequal; the whole organ covered with flattened hairs, which gradually take the form of scales towards the base of the second joint.

Wings broadly heart-shaped; the convexity of the anterior margin pronounced and irregular; the length to the greatest breadth as 4 to 3; the alula large, elongate, bearing a dense tuft of long hair; the disk covered with overlapping, spatulate scales, which are narrower near the margins than at the centre and base; the veins clothed with a double row of hairs; the marginal fringes long on both margins, a tuft of very long hairs at the posterior basal angle. Subcostal vein practically obsolescent; base of first

longitudinal vein approximating to the stem of the second, the two branches of which arise close together, the second fork being practically opposite the anterior fork of the fourth longitudinal vein; the bases of the second and third and of the fifth and sixth longitudinal veins united; the third vein reaching the margin at a point posterior to the tip of the wing; the fourth nearly straight; the sixth almost as long as the fifth.

Abdomen covered with bristling hairs; thorax covered with similar hairs mixed with scales; front bearing a dense tuft of semi-erect scales.

The male genitalia can now be described in detail, for it has been possible to examine specimens preserved in spirit: to give a satisfactory account of their structure from dried specimens is very difficult. The arrangement of the appendages, etc., is clearly shown in the text figure, which is drawn from a specimen mounted in canada balsam. A represents the supergenital plate (last abdominal tergite), which is thin and membranous, transverse, subtriangular, with the apex slightly emarginate. At either side it becomes chitinized and bending downwards and inwards gives rise to a very stout chæta (E), which bends outwards and slightly downwards. This structure does not appear to be homologous with any in the genitalia of *Phlebotomus*, *Psychoda* or *Pericoma*. On either side, at a lower level, however, there is an appendage (C) evidently homologous with the superior appendage of these genera. It consists of two joints the proximal of which is stout in form and somewhat conical, while the distal joint is flattened and membranous, its sides being sinuous and its tip truncate or very broadly rounded. There are three or four short sensory hairs at the tip, but otherwise the appendage is naked; its integument is thin. The subgenital plate (B) projects as a narrow triangle; its integument is rather thick and bears a minute pubescence. The inferior appendages (D) are borne at the base of the subgenital plate. In the dried specimen they appear to be short and rounded, but they are actually elongate and pointed, with the tips curved upwards and forwards. They bear numerous long hairs and spatulate spinules, each of which (fig. 11, pl. xii) has a fringe of minute spines round its flattened extremity. These spines are all turned inwards towards one surface of the spinule. The intromittent organ (F) consists, as in *Phlebotomus*, of a pair of narrow flattened chitinous valves closely pressed together, the fissure between them being vertical, with a pair of delicate chitinous filaments that can be thrust out between them. The form of the organ in this species is narrowly conical.

The original specimens were taken at an altitude of about 5,000 feet at Kurseong during the "rains" (July) on a window-pane and on the upper surface of a fern-frond. They rested with the wings spread out quite flat. I have recently (June, 1910) taken other specimens at the same place. They were running erratically on the leaves of *Caladium* in dense jungle at dusk.

Brunettia travancorica, sp. nov.

♀ Total length 1.5 mm.; expanse of wings 4 mm.

Colour jet-black with a slight metallic sheen, which is most conspicuous on the lower surface of the wings; nine small white spots at the edge of the wings, each consisting of a tuft of white hair-like scales and situated at the tip of a vein; first tarsal joints white; a tuft of long white hairs on each side of the mesonotum just in front of the wings; some of the hairs on the abdomen grey or white in a reflected light.

The verticels of hairs surrounding the antennæ rather less compact than in *B. superstes* and the S-shaped chætæ more slender.

Wings heart-shaped, the maximum breadth being rather more than $\frac{5}{8}$ of the length; the convexity of the anterior margin much less pronounced and more regular than in *B. superstes*; scales little different from those of the wing of *B. superstes*; a very long marginal fringe on the posterior border only; anterior fork of second longitudinal vein distinctly nearer the base of the wing than that of the fourth longitudinal vein; third longitudinal vein reaching the tip of the wing.

Habitat. Base of Western Ghats, Travancore, S. India: a single female taken by myself in November, 1908.

Lack of material makes it impossible to give a fuller description of *B. travancorica*, which may be distinguished from *B. superstes* at a glance by its smaller size and by the white spots on its wing. It will be noted that the two species differ from one another in the character that distinguishes *Psychoda* from *Pericoma*, namely, the position of the apex of the third longitudinal vein. I think, however, that they must be regarded as congeneric.

ADDENDUM—

A third species of *Brunettia* has recently been taken by Mr. E. E. Green and Mr. F. H. Gravely at Peradeniya in Ceylon. *Psychoda atrisquamis*, Brunetti, from Calcutta also belongs to this genus.—N. A., 24-viii-10.

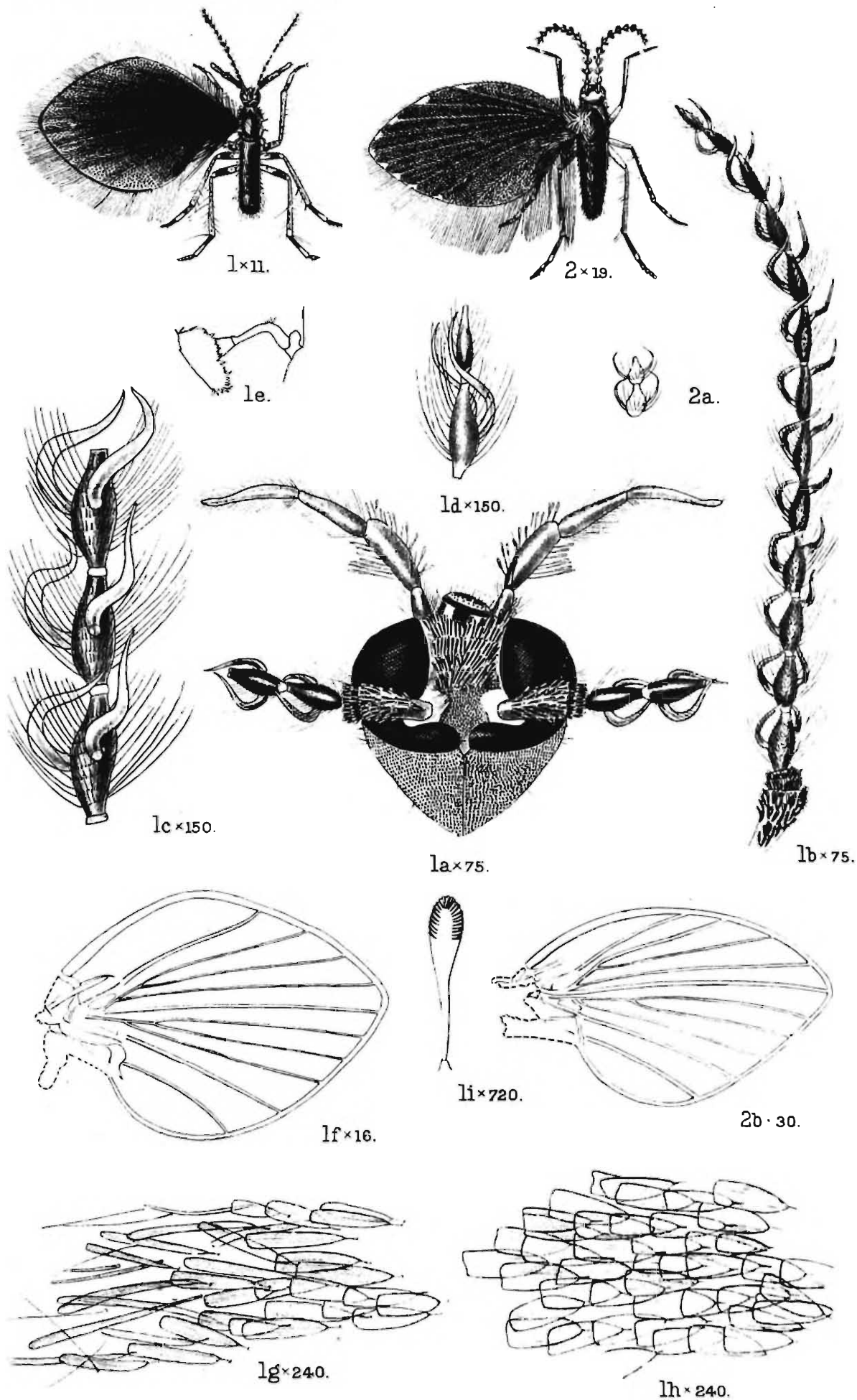
EXPLANATION OF PLATE XII.

Brunettia superstes and *B. travancorica*.

FIG. 1.—*Brunettia superstes* (♀ type), × 11.

- „ 1a.—Head of *B. superstes* as seen from above, × 75. The posterior part of the head has been denuded of scales but the pits from which they arise are shown. Only the first four joints of the antennæ are represented.
- „ 1b, 1c, 1d.—Antenna of *B. superstes* (♂): 1b = whole antenna, × 75; 1c = first three joints of the flagellum, × 150; 1d = two distal joints, × 150.
- „ 1e.—Halter of *B. superstes* (magnified).
- „ 1f.—Venation of *B. superstes*, × 16.
- „ 1g, 1h.—Scales on wing of *B. superstes*, × 240: fig. 1h represents scales from the centre of the wing; fig. 1g scales from near the margin, illustrating the transition between hairs and scales.
- „ 1i.—Spinule from inferior appendage of male genitalia of *B. superstes*, × 720.
- „ 2.—*Brunettia travancorica* (♀ type), × 19. (The palpi of the specimen are concealed.)
- „ 2a.—First two joints of flagellum of antenna of *B. travancorica* (♀) (enlarged).
- „ 2b.—Venation of *B. travancorica*, × 30.

With the exception of figs. 1, 1e, 2 and 2a, all the figures are drawn from preparations mounted in canada balsam.



XIV. THE INDIAN BARNACLES OF THE SUBGENUS *SMILIUM*, WITH REMARKS ON THE CLASSIFICATION OF THE GENUS *SCALPELLUM*.

By N. ANNANDALE, D.Sc., F.A.S.B., *Superintendent, Indian
Museum.*

A full account of the Indian representatives of the family Pollicipedidæ must be deferred until opportunities of investigating the littoral fauna of the coasts of India have occurred, for at present our knowledge of this fauna is meagre as compared with that of the fauna of the deeper parts of the Bay of Bengal and the Arabian Sea. In the meanwhile the species of the genus *Scalpellum* may be discussed with some degree of confidence, because, with one exception, they are only found, in Indian seas, at depths greater than 100 fathoms, and because it is now some years since any species not previously represented in the collection of the Indian Museum was obtained by the "Investigator." The present paper, so far as individual species are concerned, deals only with the forms that in my opinion should be placed in the subgenus *Smilium*, but the facts that must be taken into consideration in discussing the subdivision of the genus as a whole are treated in some detail.

DWARF MALES IN *SCALPELLUM*.

Perhaps the most remarkable fact about the genus *Scalpellum* is that its species possess dwarfed and otherwise degenerate males, which live as parasites or rather semi-parasites on the capitulum of the much larger female or hermaphrodite. Probably these males occur in the case of all species of the genus, but they are not always to be found and may, perhaps, only be produced at certain seasons or in certain generations. It is curious that they are invariably absent in the closely allied genus, *Pollicipes*. I do not propose to deal with the minute structure of the dwarf males in either of the genera (*Scalpellum* and *Ibla*) in which they occur, for my friend Captain F. H. Stewart is doing so in the case of several species in a much more detailed manner than I could have hoped to do; but I may point out certain characters in the males that are of systematic importance.

As will be seen (p. 150), two subgenera of *Scalpellum* are recognized in this paper, their recognition depending to a considerable extent on the structure of the male. In the more primitive subgenus (*Smilium*) the larger individuals appear to be invariably

hermaphrodite, that is to say to have the organs of both sexes well developed and functional. The males attached to them resemble young hermaphrodites, so far as external appearance goes, in a more or less accurate manner. As a rule they have the capitulum and the peduncle distinctly separated, and bear calcified valves on the former, the peduncle being devoid of calcareous plates. The capitulum, however, never bears more than six valves (*viz.*, a pair of terga, a pair of scuta, a carina and a rostrum), and even these may be occasionally absent. The external anatomy

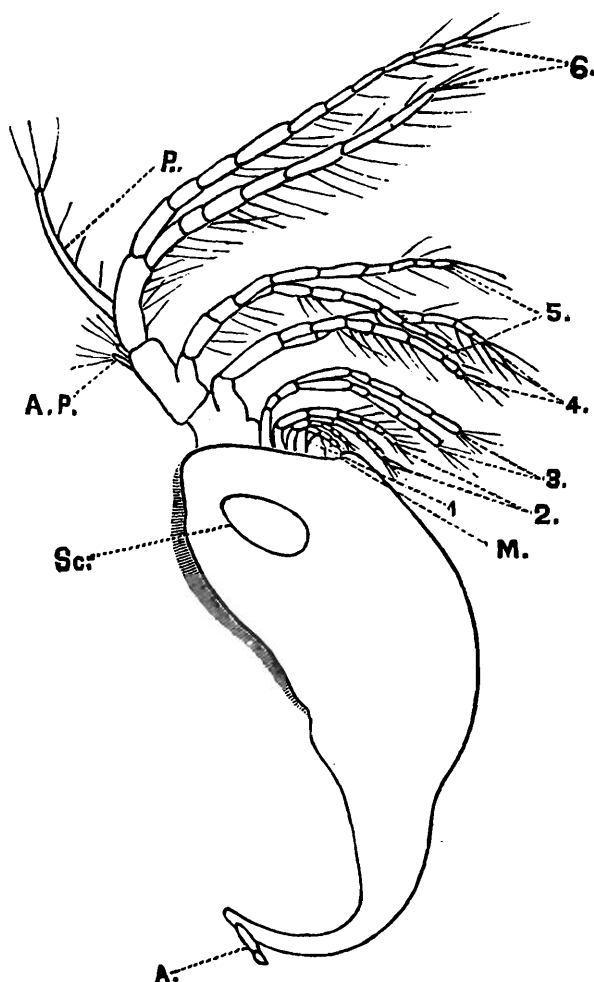


FIG. 1.—*S. bengalense*, male, $\times$ ca. 52: A. = antennæ; A.P. = anal appendages; M. = mouth parts; P. = penis; Sc. = scutum; 1–6 = cirri.

of the body of the male closely resembles that of the young hermaphrodite, differing from that of the adult mainly in the following characters:—(1) the cirri are shorter and less distinctly curved, with the bristles and hairs fewer and exhibiting less differentiation; (2) the mouth parts are more primitive, the labrum being relatively smaller, the teeth of mandible less distinctly separated and often fewer, the bristles on the maxillæ more alike. If the maxilla is notched, this character is less evident in the male than in the hermaphrodite. The male has a well-developed penis,

which often, if not always, differs in shape from that of the hermaphrodite. The alimentary canal is furnished with both a mouth and an anus, and is certainly functional. These characters are better seen in the male of *S. bengalense* than in that of any other species with which I am acquainted, because the body of the male of this species, owing to the peculiar shape of the capitulum, can apparently be thrust out of the capitulum further than is usually the case without interfering with the relations of the different parts. An outline drawing of this form is therefore reproduced in text fig. 1.

In one respect, however, the male of *S. bengalense* differs considerably from that of allied forms, namely, in the degeneracy or absence of the capitular valves, never more than four of which (two terga and two scuta) are present. In more typical species, such as *S. squamuliferum*, the shape and relative positions of the

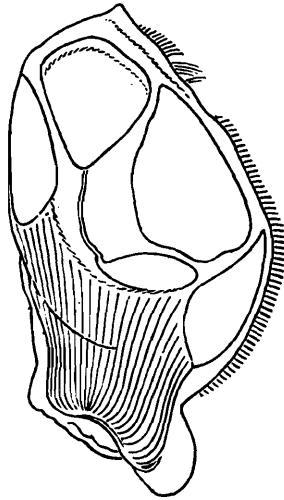


FIG. 2.—*S. squamuliferum*, male, $\times 52$.

valves appear to be very constant and to afford sound diagnostic characters. The external shape of the capitulum and peduncle is also characteristic.

In the less primitive species of the genus comprised in the subgenus *Scalpellum*, the male is far more degenerate. In external shape it is usually ovoid, with no trace of a peduncle. There is rarely any trace of valves, but the whole surface is covered with minute hairs or spines as in the males of *Smilium*. At or near the end opposite to that by which the animal is attached to the capitulum of the female or the hermaphrodite—for in this subgenus the larger individuals appear to be in the case of some species exclusively female—there is an aperture, which is usually circular in outline. From this aperture the generative products are given out and, at any rate in some cases, the tips of the cirri can be protruded. The cirri, however, are much more degenerate

than is the case in the more primitive species. The mouth parts and anal appendages have completely disappeared and even the penis is absent; the alimentary canal is a mere rudiment, without mouth or anus.

Such males are of course incapable of feeding, whereas those of *Smilium* apparently nourish themselves in the manner characteristic of the Cirripedia, that is to say by wafting minute living organisms to their mouth by means of the cirri and then either masticating them or swallowing them whole.

Specific characters are less strongly marked in the case of the more degenerate males than they are in that of the males of *Smilium*, but the nature of the armature is often characteristic, and certain species (e.g., *S. velutinum*) could almost be distinguished by an examination of their males alone, on account of peculiarities in the spines with which the males are invested.

The exact shape of the more degenerate males is, however, a dangerous character on which to lay great stress in classification or specific diagnosis, for it is very liable to be distorted by pressure or by the methods of preservation commonly adopted.

INDIVIDUAL VARIATION IN *SCALPELLUM* AS REGARDS THE DEVELOPMENT OF VALVES.

A fact that has caused some confusion as regards the taxonomy of *Scalpellum* has recently been brought to light by the researches of Hoek and Pilsbry; I mean the fact that in certain species certain hermaphrodites and females have the capitular valves incompletely developed, so that the valves appear as mere skeletons. Such individuals may conveniently be called "incomplete," while more normal individuals may be called "complete." Incompleteness of the valves is usually accompanied by a thickening of the membrane in which they are embedded and consists mainly in an excavation of one or more margins of the larger paired valves and of a reduction in the size of the latera and carina.

Just as in *Dichelaspis* it is often possible to trace the outlines of the fine primitive valves of the Lepadidæ on the membrane of the capitulum even in species in which the valves themselves have almost disappeared as calcified plates, so in incomplete forms of *Scalpellum* the outlines of twelve or more large valves can be seen, with the calcified plates occupying only part of their area. The nature of the reduction, however, resembles that seen in *Conchoderma* rather than that found in *Dichelaspis*. It is perhaps noteworthy that the reduction of the valves in the dwarf males of *Scalpellum* is again of a different nature, an actual reduction in number taking place, and that the valves in these degenerate individuals differ from those found in typical Lepadidæ in including a rostrum, a valve that is never found in that family. The six valves of the dwarf males of *Smilium* apparently represent the six essential valves of the genus *Scalpellum*, for there is a stage

in the development of the females or hermaphrodites of many species in which these six valves are at any rate very much more conspicuous than any others, if they are not actually the only valves represented. Incompleteness, however, is much more common in the subgenus *Scalpellum*, if it is not actually confined to that subgenus, for species like *Scalpellum* (*Smilium*) *scorpio*, in which the valves are embedded in very thick membrane, do not exhibit incompleteness in the sense in which I have defined the term.

In the young hermaphrodites or females of those species of *Scalpellum* in which incompleteness occurs, at the stage at which all the valves have already made their appearance, the valves are practically normal, and it is only as maturity approaches that their margins become strongly excavated.

As regards variation in the development of the valves one other point may be noted, *viz.*, the rudimentary character of the subcarina and the rostrum in some otherwise normal individuals of species in which they are habitually present. These two valves are rightly considered to be of great importance in the taxonomy of the genus, but it must be noted that even in some species of *Smilium* (e.g., *S. squamuliferum*, otherwise a very constant species) the subcarina is often very minute and still more often completely concealed beneath the membrane. In some species of the subgenus *Scalpellum*, on the other hand, the rostrum, which is always small, may be present or absent, and even the subcarina, which is normally absent in this subgenus, occurs as a minute rudiment in some individuals of *S. laccadivicum*, of which my *S. subflavum* is evidently no more than a "complete" variety.

SUBDIVISION OF THE GENUS *SCALPELLUM*.

Considerable difference of opinion has been held at different times, and, indeed, is still held, by different authorities as regards the subdivision of the genus *Scalpellum* (*sensu Darwinio*). Darwin's great work must be taken as the foundation of all scientific study of the Cirripedia, but it must be remembered that he was only acquainted with a very small proportion of the species of *Scalpellum* now known, and that even as regards the few species he had examined he did not express a dogmatic opinion. Before he wrote his Monograph (1851) Gray and other authors had already described several genera wholly or in part synonymous with the forms he called *Scalpellum*. Pilsbry¹ has recently (1908) revived two of these genera, namely, *Calantica* and *Smilium*, and has also raised several other groups in the genus to generic or subgeneric rank, basing his conclusions partly on the external form of the dwarf male and partly on the position or presence of certain valves in the female or hermaphrodite. Hoek and Gruvel, on the other hand,

¹ "On the classification of Scalpelliform Barnacles," *Proc. Acad. Nat. Sci. Philadelphia*, 1908, p. 104.

while differing as regards details of classification, agree in recognizing only the genus *Scalpellum*, which they subdivide in different ways. Gruvel's classification (1905) was, indeed, based on that set forth by Hoek in the "Challenger" Reports (1883); but the latter author has recently published a new one in his account of the Cirripedia of the "Siboga" (1907).

Taking into consideration the great difference in external form between the males of such closely allied forms as *Scalpellum squamuliferum* and *S. bengalense*, and the variation displayed by the valves in certain species, notably *S. squamuliferum* and *S. laccadivicum*, I find it possible to recognize only two groups of species that can be called subgenera. It is impossible to regard them as distinct genera, because no one character of importance can be stated to be constant in either of them, although the sum of the characters of each differs from that of the characters of the other. These two groups may be called *Smilium* and *Scalpellum*. The former is undoubtedly the more primitive and includes several species that come very close to *Pollicipes*, while the latter consists of forms that have undergone a considerably greater amount of specialization. The two subgenera may be defined as follows:—

SMILIUM, Gray.

Rostrum and subcarina as a rule well developed in the hermaphrodite, but the subcarina sometimes absent; anal appendages usually with one joint, sometimes absent. Dwarf males with well-developed capitulum, cirri, mouth parts and alimentary canal.

TYPE *Smilium peronii*, Gray.

SCALPELLUM, Leach.

Subcarina absent or represented by a mere rudiment; rostrum often absent, never large or prominent; anal appendages as a rule with several or many joints. Dwarf males with the appendages and alimentary canal degenerate and the capitulum not distinct from the peduncle.

TYPE *Scalpellum vulgare*, Leach (= *Lepas scalpellum*, Linné).

Both these subgenera are represented in Indian seas, *Smilium* by three species and *Scalpellum* by at least twelve.

Subgenus SMILIUM.

Key to the Indian species of the subgenus.

- I. Capitulum of hermaphrodite about half as broad as long.
 - A. Peduncular plates in the form of rods set obliquely in the membrane and forming complete circles round the peduncle . . . *S. squamuliferum*.

B. Peduncular plates in the form of flat, transversely oval discs on the surface of the membrane, never completely surrounding the peduncle *S. bengalense*.

II. Length of capitulum of hermaphrodite much more than twice the breadth. Peduncular plates in the form of imbricating, upwardly directed scales *S. acutum*.

Scalpellum (Smilium) squamuliferum. Weltner.

S. squamuliferum, Weltner, *Sitz.-Ber. naturf. Freunde*, 1894, p. 80, figs.; Annandale, *Illustr. Zool. "Investigator,"* Crust. (Entom.), pl. ii, fig. 4 (1907), and pl. iii, figs. 4—6 (1908).

CAPITULUM compressed, irregularly ovoid, the carinal margin being more strongly arched than the occludent, which, except for the projecting rostrum, is nearly straight and slopes outwards from above. *Valves* 15, moderately stout, white, imbricate, feebly striated vertically, with the lines of growth well marked, covered by a thin but opaque brownish, minutely hairy membrane, the tips projecting upwards. *Carina* simply and not very strongly arched; its dorsum convex; its sides concave (especially above); with strong outer and inner ridges; the umbo apical, situated well above the centre of the terga. *Subcarina* triangular, not very prominent, variable in size, often small and as a rule entirely concealed beneath the membrane. *Rostrum* large, narrowly triangular, curved and prominent, strongly ridged in front. *Terga* narrowly rhomboidal, pointed above, with the main axis slanting outwards from the carina; the sides forming the upper angle straight, shorter than those forming the lower angle, which are arched. *Scuta* subequal to the terga, which they resemble in shape; their main axis vertical; the upper part of each valve slightly retroverted; the occludent margin longer than any of the other sides. *Upper latera* resembling the scuta but of as a rule about half the size, variable, however, in this respect. *Inframedian, carinal* and *scutal latera* triangular, more or less completely concealed beneath the membrane; the inframedian latera much larger than the others.

PEDUNCLE variable in length, covered with complete undulating rings of calcareous plates embedded in thick membrane. These plates take, individually, the form of minute rods embedded more or less obliquely in the membrane; the outer extremity is slightly inflated and bears a small pit. Sometimes they are almost completely concealed in the membrane and the rings they form appear to consist merely of raised ridges on the surface of the peduncle.

CIRRI, etc. *Cirri* delicate, not very long or strongly curved, densely fringed on the anterior margin but with the posterior

bunches of hairs feebly developed, especially on the 4th, 5th and 6th cirri. First cirrus long, slender, tapering, with the two rami nearly equal; both margins densely fringed. *Anal appendages* barely reaching the junction of the rami of the 6th cirrus, with one joint, compressed, bluntly pointed at the tip, which bears an irregular tuft of long slender hairs; the whole surface minutely pilose. *Penis* long, slender, contorted. A pair of delicate *ovigerous lamellæ* depending from the dorsal surface of the abdomen.

MOUTH PARTS. *Labrum* produced and pointed. *Mandible* with 5 teeth; the 1st longer but no broader than the 2nd, the outer margin of which is somewhat irregular at the base; the 4th and 5th close together, forming the inner angle; the 5th notched at the base both externally and internally; the whole structure covered with minute hairs. *Maxilla* with a very broad but shallow excavation, which occupies the greater part of its free margin; none of the bristles very stout or long; the exact outline variable.

<i>Length of capitulum</i>	26 mm.
<i>Breadth of capitulum</i>	13 „
<i>Length of peduncle</i>	26—44 „

MALE with the peduncle very short and stout, distinctly separated from the capitulum, which bears six calcified valves. The capitulum pointed above, broad in comparison with its length, minutely hairy. *Tergum* broadly triangular, with the base of the triangle rounded and the apex pointing directly downwards. *Scutum* much larger than the tergum and more narrowly triangular; the apex pointing upwards; the outlines somewhat sinuous. *Carina* triangular, with rounded base, not quite so broad (viewed from behind) as the tergum and only a little longer, not reaching upwards as high as the upper margin of this plate; the base slightly lower than that of the scutum and above the apex of the rostrum. *Rostrum* of about the same length as the tergum, rather broader than the carina and with the base produced to a point. *Cirri* and *penis* well developed; *anal appendages* present; *mouth parts* resembling those of the hermaphrodite in miniature except that the labrum is not produced and the inner teeth of the mandibles are not so distinctly separated.

SYSTEMATIC REMARKS. This species is remarkable on account of the possession by the hermaphrodite of ovigerous appendages, which depend from the dorsal surface of the abdomen in the form of a pair of delicate filaments placed one behind the other (*Illustr. Zool. "Investigator,"* Crust. (Entom.), pl. ii, fig. 4). The male belongs to the type most commonly found in the subgenus.

DISTRIBUTION, etc. *S. squamuliferum* has been taken by the "Investigator" at many stations in the Andaman Sea and off the south of India, while the British Museum possesses a specimen from Singapore. Gruvel's statement that the species occurs in Japan is apparently due to a miscalculation of latitude and longitude (*Mon. Cirrh.*, p. 56).

The bathymetrical distribution is a wide one, ranging from a little over 100 fathoms to nearly 1,900 fathoms.

Specimens are most abundant on the glassy filamentous spicules by means of which sponges of the genus *Hyalonema* are anchored in the mud. They also occur, however, on the stems of Antipatharians and even on shells of living molluscs, e.g., on that of *Xenophora pallida*. The species is markedly gregarious, a fact that may be due to the larvæ undergoing a considerable part of their metamorphosis in the egg.

S. squamuliferum is by far the commonest species of Pedunculate in the deeper parts of the Bay of Bengal, and the specimens in the Indian Museum considerably outnumber those of all the other Indian Pollicipedidæ put together. In fact, the species is one of the few (so far as this family is concerned) of which it is possible to say that a satisfactory series exists in any museum. It is therefore unfortunate that it is one which does not, except in two particulars, exhibit any very marked tendency to variation and is apparently of limited geographical distribution. Two features in which its characters are the least constant are the length of the peduncle and the size of the subcarina. Compared with such species as *S. laccadivicum*, it may be described as a constant species. In the neighbourhood of Singapore and in the Gulf of Siam it is replaced by *S. kampeni*, which, however, is a much less constant species and inhabits comparatively shallow water (30—50 fathoms). But *S. rostratum*, also a form that has not been found at great depths, replaces *S. kampeni* in the eastern parts of the Malay Archipelago; it appears to be a fairly constant species.

Scalpellum (Smilium) bengalense, Annandale.

Scalpellum bengalense, Annandale, *Ann. Mag. Nat. Hist.* (7), vol. xvii, p. 395 (1906), and *Illustr. Zool. "Investigator,"* Crust. (Entom.), pl. i, fig. 5 (1907) (young form).

Subsequent additions to the collection prove the type specimens of this species to have been immature. The adult hermaphrodite resembles *S. squamuliferum* very closely both as regards external structure and as regards anatomy, but may be recognized by the following characters:—

- (1) The membrane covering the valves of the capitulum is transparent and of a yellowish colour.
- (2) The peduncular plates take the form, viewed from without, of small, transversely oval, flat bodies, and never surround the peduncle in complete rings or form ridges on its surface.
- (3) There are no ovigerous lamellæ.
- (4) The peduncle is never much longer than the capitulum.

The MALE, however, is completely different in external form and may be described as follows:—

Peduncle long and slender, merging gradually into the capitulum in such a way that the whole body has a vase-like shape.

Capitulum entirely without calcified valves, or with a pair of amorphous scuta, or occasionally with minute terga in addition to such scuta. *Cirri* and *anal appendages* well developed, resembling those of the male of *S. squamuliferum*. *Penis* bluntly rounded at the tip, which is armed with several stout hairs.

SYSTEMATIC REMARKS. The great external difference between the males of *S. squamuliferum* and *S. bengalense*—species so closely allied that the hermaphrodites alone might almost have been considered specifically identical—is a remarkable phenomenon and renders it impossible to regard the external form of the male or the structure of its capitular valves a matter of much systematic importance. The absence of ovigerous lamellæ in the hermaphrodite of the one species and their presence in the other is also a noteworthy feature. The structure of the appendages, etc., of the males of the two species, however, as distinct from the external form, is not dissimilar, and the presence of ovigerous lamellæ is a rare character in the genus. The male is variable not only as regards the armature of its capitulum, but also as regards size and the length of the cirri.

DISTRIBUTION, etc. This species has been taken both in the Bay of Bengal and in the Arabian Sea at depths varying from about 70 to over 500 fathoms. On one occasion it was found in considerable numbers on the carapace of crabs (*Encephaloides armstrongi*), while a few individuals have been taken at greater depths attached to the stems of horny corals.

Scalpellum (Smilium) acutum, Hoek.

Scalpellum (Smilium) acutum, Hoek, *Siboga-Exped.*, “*Cirripedia Pedunculata*,” Monogr. xxxia, p. 64, pl. vii, fig. 1 (1907).

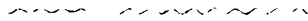
Scalpellum longirostrum, Gruvel, *Cirrh. du “Travailleur” et du “Talisman,”* 1902, p. 70.

There is a single small specimen of this species in the collection of the “*Investigator*,” taken at a depth of 490 fathoms off the Andamans. It is attached to the anchor-filaments of a sponge of the genus *Hyalonema* and is probably immature. The species has been so clearly defined and portrayed by Hoek that no further description is needed. I may say, however, that the Indian specimen is almost exactly intermediate between the form originally described by Hoek in the “*Challenger*” Reports and that subsequently called *Scalpellum longirostrum* by Gruvel, and I have no doubt that the two forms are specifically identical.

S. acutum has a very wide range in the deeper parts of the Indian, Atlantic and Pacific Oceans.

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XV ON A SUB-SPECIES OF *SCUTIGERELLA*
UNGUICULATA, HANSEN, FOUND
IN CALCUTTA.

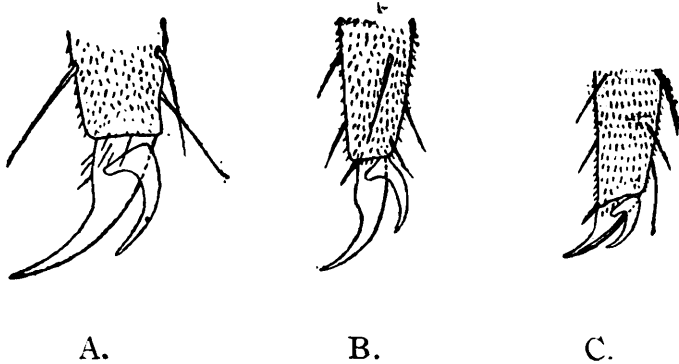
By F. H. GRAVELY, *M.Sc.*, Assistant Superintendent, Indian
Museum.

When hunting for insects under pieces of brick round the Museum tank between March 10 and March 19 of this year (1910), I was fortunate enough to find, close to the water's edge, six specimens of a little white centipede which proved to belong to the interesting genus *ScutigereUa*, and to Hansen's Venezuela species *unguiculata* (Hansen, 1904, pp. 34—36, pl. ii, figs. 2a—2k).

The only previous record of any specimen of Symphyla from the Museum compound—or indeed from Bengal—was made by Wood-Mason (1876, p. 175), who “ exhibited specimens of a species of *Iapyx* which he had recently found amongst the decaying leaves and fungi at the foot of a bamboo-clump in his own garden at Calcutta,” and mentions as one of the creatures found in association with it “ a species of the very remarkable genus *Scolopendrella*.” This record appears to have been made in the month of August when the ground would be much wetter than in March, and as the few remaining bamboo-clumps in the garden are at present much too dry to harbour Symphyla at their base, it seems reasonable to suppose that this so-called “ *Scolopendrella* ” was in reality the species of *ScutigereUa*—this genus was not yet established when Wood-Mason wrote—which now occurs beside the tank. Its present distribution round the tank appears to be extremely limited, however, for it has only been found near the north-east corner, although I have carefully searched for it along all four banks. Since writing the above I have also found a few specimens in the drier neighbourhood of the rubbish-heap near the north-east corner of the tank.

The only named species of Symphyla previously known from India is *ScutigereUa subunguiculata*, Imms, which was found at a height of about 9,000 feet up in the Himalayas in the native state of Tehri Garhwal (Imms, 1908). This species, as its name suggests, is very closely allied to *S. unguiculata*, and it is curious to find that the Calcutta specimens depart from the typical form of the latter in the direction of this Himalayan species. Thus, though the two species may be most easily distinguished from each other by the form of the claws of the twelfth foot, in the Calcutta

specimens this foot bears a distinct front seta¹ (see text-figure); the size of the Calcutta specimens (up to 4 mm.) is rather greater than that of any of Hansen's numerous specimens; and the sinus on the posterior margin of the penultimate segment is perhaps hardly as great as in the type. On account of these differences between the Calcutta specimens and the type the former may be regarded as belonging to a local race for which I propose the subspecific name *indica*.



A. Claws of twelfth foot of *S. unguiculata*, Hansen (after Hansen).

B. Claws of twelfth foot of *S. unguiculata (indica)*.

C. Claws of twelfth foot of *S. subunguiculata*, Imms (after Imms).

All drawn to one scale (diam. $\times 330$ about).

The shape of the claw of *S. unguiculata (indica)* may be almost identical with that of *S. unguiculata (s. str.)*; but the distinct front seta is always present.

The known geographical distribution of the two Indian species is—

Scutigereilla unguiculata.

Venezuela: La Moka (type; Hansen, 1904).

India: Calcutta (sub-species *indica*; new record).²

Scutigereilla subunguiculata.

India: near Dhanaulti in Tehri Garhwal (Imms, 1908).

LIST OF PAPERS REFERRED TO.

1876. Wood-Mason, J. "Exhibition of forms of Arthropoda new to India," *Proc. Asiat. Soc. Bengal*, 1876, pp. 174-5.

¹ Hansen says of these claws in *S. unguiculata* (*loc. cit.*, p. 35), "the front seta is rather weak," and in his figure no seta can be clearly distinguished by its size as the front seta. In the Calcutta specimens this seta is quite as distinct as in Imms's figure of the same claws in *S. subunguiculata*.

² This Indian sub-species of *Scutigereilla unguiculata* I have recently found in abundance in Ceylon, both in the Kandy district (1,500 ft. and upwards) and at Pattipola (6,000 ft.). Probably it is widely distributed throughout the island and Mr. Green tells me that he has seen a similar looking little centipede at Pundaloya (4,000—5,000 ft.) and on the top of Namunakuli Hill (6,600 ft.).

1904. Hansen, H. J. "The genera and species of Symphyla,"
Q. J. M. S. (N.S.), xlvii, 1904, pp. 1—101, pl. i—vii.
1908. Imms, A. D. "On a new species of Symphyla from the
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252—255, pl. xxxi.



XVI. THE DISTRIBUTION OF THE ORIENTAL SCOLOPENDRIDÆ

By F. H. GRAVELY, *M.Sc.*, Assistant Superintendent,
Indian Museum.

WITH A LIST OF THE SPECIMENS IN THE COLLEC-
TION OF THE INDIAN MUSEUM, COMPILED
FROM DATA SUPPLIED BY DR. KARL
KRAEPELIN.

The Scolopendridæ in the Indian Museum have recently been identified by Dr. K. Kraepelin who, however, published no report upon them as they all belonged to well-known species. At the suggestion of Dr. Annandale, therefore, I have prepared a list, drawn up in the order adopted by Dr. Kraepelin in his "Revision der Scolopendriden" (*Mitt. Naturhist. Mus. Hamburg*, xx, 1902, pp. 1—276), with the object of recording their distribution. The page-number given after each genus and species is a reference to the place of its description in this "Revision." The number given in brackets after each locality refers to the number of specimens in the collection. The names of localities enclosed in square brackets are those of places not in the Oriental Region. When that of a *genus* or *species* is similarly enclosed no specimen of it is recorded in Dr. Kraepelin's "Revision" from this Region.

List of the Scolopendridæ in the Collection of the Indian Museum.

Genus CRYPTOPS, Leach ; p. 32.

1. *C. sp.* (doubtful).

W. Himalayas : Bhim Tal, 4,500 ft., Kumaon (1).

Genus OTOSTIGMUS, Fbr. ; p. 97.

2. *O. politus*, Karsch ; p. 109.

W. Himalayas¹ : Matiana, c. 8,000 ft., Simla hills (1).

E. Himalayas¹ : Sureil, 5,000 ft., Darjiling district (1).

Assam : Dikrang valley.

¹ The western frontier of Nepal has been taken as the division between E. and W. Himalayas. All records from Nepal, Naini Tal, Almora, etc., have been regarded as Himalayan unless definitely known to belong to the Terai.

3. *O. insularis*, Haase ; p. 112.
E. Himalayas : Ghumti, 1,800 ft., Darjiling district (1).
[Found since the collection was returned by Dr. Kraepelin.
I am responsible for this identification.]
4. *O. rugulosus*, Por. ; p. 115.
Little Andaman (9).
Lower Burma : Tavoy (5) ; Mergui Archipelago (3).
[By an oversight the Mergui specimens were not sent to Dr. Kraepelin. They were originally described by Mr. Pocock in the "Mergui Expedition Results," vol. i, pt. 1, 1889 (reprinted from *Journ. Linn. Soc., Zool.*, xxi), as *O. carinatus* var. *insulare*, Haase. Kraepelin raises this variety to specific rank : and he also gives as one of the synonyms of *O. rugulosus*, Por., the *O. carinatus* of Pocock's "Myriopoda of Burma" (*Ann. Mus. Civ. Genova*, xxx, p. 112). A comparison of the Mergui specimens with the *O. rugulosus* identified for us by Dr. Kraepelin reveals no specific difference between the two, whereas the finely grooved polished terga of all these specimens are in striking contrast to the strongly ridged granular terga of our specimen of *O. insularis*. The confusion appears to have arisen from the difficulty, often experienced in examining centipedes, of distinguishing fine grooves on the terga from ridges.]
5. *O. spp.* (doubtful).
W Himalayas : Murree, Punjab ; Theog, Simla hills.
Bombay Presidency : W. Ghats.
Assam : Dikrang valley.
Burma : Upper—Kakhyen hills ; Irrawady, 2nd defile.
Lower—Pegu ; Tavoy ; Upper Tenasserim.
Malay Peninsula : Penang.

Genus RHYSIDA, Wood ; p. 139.

6. *R. immarginata* (Por.) ; p. 143.
W Himalayas : Naini Tal (1).
E. Himalayas : Nepal—Chitlong, Little Nepal Valley (23) ;
Pharping (1) ; Gowchar (1).
Darjiling district—Darjiling (3) ; Sureil, 5,000 ft. (1) ; Punkabari (1).
Central Provinces : Nowgong (2).
Bengal : Calcutta (3) ; Narail, Jessore (2) ; Ranigunge (5) ;
Tinpahar (3) ; Sahibgunge (12).
Assam : Samagooting (12) ; Dilkoosh, Cachar (1).
Burma : Lower—Rangoon (1) ; Moulmein (2).
Upper—Pudupyu (3).
Malay Peninsula : Penang (3).
Andamans : Port Blair (1) ; "Andamans" (6).

7. *R. nuda* (Newp.); p. 144.
Lower Burma : Pegu (2).
 8. *R. longipes* (Newp.); p. 148.
United Provinces : Lucknow (2); Chandan-Chowki (1).
Nepal Terai : Dekkat-Bhuli (2).
Bengal : Calcutta (4 + a number of young); Ranigunge (2).
Ceylon : Paradise (1).¹
Lower Burma : Moulmein (3).
Malay Peninsula : Penang (1); Johore (1).
Andamans (3).
[Mauritius (2).]
 9. *R. spp.* (doubtful).
E. Himalayas : Kurseong, 5,000 ft., Darjiling district.
[Found since the collection was returned by Dr. Kraepelin.
I am responsible for this identification.]
United Provinces : Bijnor; Kichha
Bombay Presidency : Poona.
Travancore : Maddathorai, at the western base of the W
Ghats.
Andamans.
- Genus *ETHMOSTIGMUS*, Poc.; p. 155.
10. *E. pygomegas* (Kohlr.); p. 158.
E. Himalayas : Darjiling district—Darjiling (3).
Dafla Hills—Harmutti (4); "Daflas" (3);
Burroi, at base of hills (2).
Assam : Garo hills (1); Dikrang valley (7); Silcuri, Cachar
(2); "Cachar" (3); Sibsagar (3).
Burma : Lower—Pegu (1); Pagae, Tavoy (1).
Upper—Nampong, Kakhyen hills (2).
Narcondam Island (1).
Nicobars (1).
 11. *E. rubripes* (Brdt.); p. 161.
[Torres Straits : Murray Island (1); N. S. Wales (2).]
 12. *E. platycephalus* (Newp.); p. 162.
Lower Burma : Upper Tenasserim (1); hills dividing Burma
and Siam (1).
 13. *E. spinosus* (Newp.); p. 163.
Madras Presidency : South Arcot (4).
 14. *E. spp.* (doubtful).
Madras Presidency : Chevroy hills.
[Galilee : Mt. Tabor.]

¹ There is a Paradise estate in the Kurunegala district of the N. E. Province; but it is conceivable that the label is an incorrect copy of some contraction of Peradeniya, where the specimen may have been collected by someone working at the laboratories of the Royal Botanic Gardens.

Genus CORMOCEPHALUS, Newp.; p. 184.

15. *C. dentipes*, Poc.; p. 191.
Bengal: Calcutta (1); Paresnath, 4,000—4,500 ft., Chota Nagpur (1).
16. *C. pygmæus*, Poc.; p. 192.
E. Himalayas: Punkabari, Darjiling district (1).
Bengal: Calcutta (2); Chakardharpur, Chota Nagpur (3).
Assam: Silcuri, Cachar (1).
Lower Burma: Tavoy (1).
- [17. *C. rubriceps* (Newp.); p. 198.
New Zealand (1).]
- [18. *C. westwoodi*, Newp.; p. 200.
N. S. Wales (1).]

[Genus TRACHYCORMOCEPHALUS, Kraepelin; p. 218.

19. *T. mirabilis*, Poc.; p. 219.
E. Arabia (1).]

Genus SCOLOPENDRA (L.), Newp.; p. 223.

20. *S. valida*, Luc.; p. 234.
Punjab: Rawal Pindi (1).
Sind: Karachi (2).
Rajputana: Ajmere (2).
Malay Peninsula: Johore (4).
[Persia: Bushire (1).]
- [21. *S. canidens*, Newp.; p. 248.
Galilee: Mt. Tabor (6).]
22. *S. morsitans*, L.; p. 250.
W. Kashmir: Chitral (4); Malakand (1).
W. Terai: Naini Tal district—Joulasal (1); Rausali (1); Bhura (1).
Almora district—Dugari (3); Melaghat (3).
E. Himalayas: Punkabari (5).
Sind: Cutch (30).
Punjab: Delhi (68); Dera-Ghazi-Khan (3).
Rajputana: Ajmere (3); Jeypore (1).
United Provinces: Hurdwar (48); Bhanwar (1); Buzru-Kurme, Basti district (1); Allahabad (2; recently received; my identification).
Bombay Presidency: Poona (2); Mahableshtar (2).
Central Provinces: Chanda (1); Sambalpur (2); Nowgong (1).
Bengal: Calcutta (9); Ranigunge (8); Tinpahar (1); Singbhum (1); Gmatia, Birbhum (1); Rajshahi (1); Berhampore (4); Bettiah, Champaran (1); Chakardharpur, Chota Nagpur (2).
E. Bengal and Assam: Rajshahi (1); Samagooting (2); Dilkoosh, N. E. Cachar (8); Sibsagar (1).

- Madras Presidency: Anantigiri, Vizagapatam (7); Waltair (6); Ganjam (2); Ramnad (4); Coimbatore (1); Gopkuda Island, Chilka Lake (1).
 Burma: Lower—Rangoon (1); Moulmein (3); Pegu (2); Tavoy (1); Upper Tenasserim (2).
 Upper—Mandalay (2); Pudupyu (1).
 Malay Peninsula: Johore (2); Penang (7); Perak (2).
 Andamans: Port Blair (1); "Andamans" (4).
 [Baluchistan: "N. Baluchistan" (10).
 Afghanistan (4).
 Persia: Bushire (1).
 Mauritius (1).]
23. *S. cingulata*, Latr.; p. 254.
 Malay Peninsula: Johore (1).
 Andamans (1).
 [Galilee: Mt. Tabor (2).]
24. *S. subspiniipes*, Leach; p. 256.
 Madras Presidency: Cochin (1).
 Ceylon: "Paradise"¹ (1).
 Lower Burma: Rangoon (1).
 Malay Peninsula: Johore (2).
 Singapore (1).
 Sumatra: Sinkip Island (1).
 Java (1).
 Hongkong (1): with right anal leg as in var. *dehaani*.
25. *S. subspiniipes* var. *dehaani*, Brdt.; p. 260.
 W. Himalayas: Naini Tal (1).
 E. Himalayas: Punkabari, Darjiling district (3).
 Madras Presidency: Ootacamund, Nilgiris (3); Upper Godavery (1).
 Bengal: Calcutta (11); Chinsura (1); Barrackpore (2); Serampore (1); Barrakur (2); "Bengal" (2).
 E. Bengal and Assam: Dacca (1); Silcuri, Cachar (2); Dilkoosh, Cachar (3); Jettinga River, N. Cachar hills (5); "Cachar" (1).
 Burma: Lower—Moulmein (1); Prome (1); Amherst (3); Upper Tenasserim (12); Ye-bu, Tenasserim (1); Dawna hills (1); Hills dividing Burma and Siam (2); Pegu (3); Kyuk Phyu (1); "Tavoy" (12); Samuading, Tavoy (1); Egaya, Tavoy (1); Mintao, Tavoy (1); Pagae, Tavoy (3); Cheduba Island (3); Mergui Archipelago (8).
 Upper—Tsagain (1).
 Malay Peninsula: Penang (9); Johore (9).
 Sumatra: Deli (1).
 Java (1).

¹ See footnote, p. 163.

Andamans: Port Blair (20); "Andamans" (38); Little Andaman (4).

Nicobars (20).

26. *S. subspinipes* var. *hardwickei*, Newp.; p. 262.

Madras Presidency: S. Arcot (1).

Distribution of Oriental Scolopendridæ.

Selecting the records from the Oriental region notified by Dr. Kraepelin in his "Revision" and incorporating with these those of the above list and in a few other papers referred to separately, we have the following distribution recorded for Oriental species:—

Genus CRYPTOPS, Leach.

C. jeæ, Poc.—Burma (Palon).

C. modigliani, Silo—Sumatra.

C. inermipes, Poc.—Christmas Island; ? Burma.

C. doriæ, Poc. (= *C. loriæ*, Silv.¹)—Burma (Palon, Shwegoo, Carin Berge, etc.); Sumatra?; Java; New Guinea.

C. spp. (doubtful)—India (W Himalayas, Madras Presidency 6,000 ft. alt.²).

Genus PARACRYPTOPS, Poc.

P. weberi, Poc.—Flores; Java.

Genus MIMOPS, Kraep.

M. orientalis, Kraep.—China (Prov. Schensi).

Genus OTOCRYPTOPS, Haase.

O. rubiginosus (L. Koch)—China; Japan; N. America (Minnesota, Indiana).

O. melanostomus (Newp.)—From the Philippines over Java, Celebes, Halmaheira, etc., to New Guinea; from Central America (Porto Rico, St. Vincent in the W Indies) through Venezuela and Brazil to Argentina (Rosario).

var. *celebensis*, Haase—Celebes.

Genus SCOLOCRYPTOPS, Newp.

S. broelemanni, Kraep.—China (Chou-San).

¹ See C. Attems, "Javanische Myriopoden," *Mitt. Naturhist. Mus. Hamb.*, xxiv, 1906 (1907).

² See Kraepelin, *Bull. Mus. Hist. Nat. Paris*, x, 1904, p. 244.

Genus OTOSTIGMUS, Por.

- O. aculeatus*, Haase—Java ; Tonkin.
O. nudus, Poc.—India (Madras Presidency).
O. politus, Karsch—India (W. Himalayas, E. Himalayas, Assam); Burma; Sumatra; China (Tientsin, Tsingtau, Peking); New Guinea; Australia.¹
O. geophilinus, Haase—Java; Timor.
O. ceylonicus, Haase—Ceylon; Burma.
O. scaber, Por.—Burma¹; Malay Peninsula²; Siam; Nicobars; Cochin China¹; China.
O. insularis, Haase—India (E. Himalayas—Bhutan¹ and Darjiling district); Ceylon; Philippines; Seychelles.
O. longicornis (Töm.)—Borneo.
O. asper, Haase—Philippines; Marianne Islands.¹
O. sumatranus, Haase—Sumatra.
O. punctiventer (Töm.)—Sumatra¹; Borneo; Philippines.¹
O. astenus (Kohlr.)—Philippines; Marianne Isles; Caroline Isles; Samoa; Solomon Isles; New Caledonia¹; New Guinea; Australia; Seychelles.
O. rugulosus, Por.—Burma (Tavoy); Siam; Andamans; Seychelles¹; Mauritius.
O. oweni, Poc.—Burma (Mergui Archipelago).
O. spinosus, Por.—Burma (Tenasserim); Java; Borneo; Algeria.
O. feæ, Poc.—Burma.
O. splendens, Poc.—India (Madras Presidency).
O. sucki, Kraep.—Borneo.
O. niasensis, Silv.—Sumatra (Nias Island).
O. morsitans, Poc.—India; Burma; Ceylon.
O. rufriceps, Poc.—India (Madras Presidency).
O. nemorensis, Silv.—Sumatra; Java.
O. orientalis, Por.—India (Bombay Presidency, Madras Presidency 6,000 ft. alt.¹); Seychelles.
O. metallicus, Haase—Ceylon; Sumatra¹; Sangir Island.
O. multident, Haase—Sumatra; Java; Borneo¹; Celebes; Mentaway Island.

Genus RHYSIDA, Wood.

- R. immarginata* (Por.)—India (W. and E. Himalayas, Central Provinces, Bengal, Assam, Madras Presidency 6,000 ft. alt.¹); Ceylon²; Burma; Malay Peninsula; Sumatra⁴; Borneo⁴; Andamans; Philippines.
R. nuda (Newp.)—Ceylon; Burma; Siam⁴; Banda; Australia; Paraguay.¹

¹ See Kraepelin, *Bull. Mus. Hist. Nat. Paris*, x, 1904.

² See Flower, *Journ. Straits Asiatic Soc.*, No. 36, July, 1901.

³ See Pocock, *Journ. Bomb. Nat. Hist. Soc.*, vii, 1892-93, p. 139.

⁴ See C. Attems, "Javanische Myriopoden," *Monatsh. Naturhist. Mus. Hamb.*, xxiv, 1906 (1907).

- R. carinulata*, Haase—Malay Peninsula¹; Sumatra; Celebes; New Guinea; Thursday Island; Australia.
R. calcarata, Poc.—Siam²; Cambodia.
R. monticola, Poc.—Borneo.
R. longipes (Newp.)—Entire tropical zone of Australia, through Malaysia, Burma, India (United Provinces, Nepal Terai, Bengal) and Ceylon to E. and W. Africa (also Madagascar and Mauritius); Mexico; Central and South America.
R. paucidens, Poc.—India (Madras Presidency); Somaliland.
R. lithoboides (Newp.)—India (Madras Presidency²); China.
R. crassispina, Kraep.—India (Bombay Presidency, Madras Presidency²).
R. petersi (Por.)—India (Bhutan²); Cape Colony.
R. cuprea, Kraep.—India (Bhutan).

Genus ETHMOSTIGMUS, Poc.

- E. pygomegas* (Kohlr.)—N. India (throughout E. Himalayas and Assam); Burma; Narcondam Island; Nicobars.
E. albidus (Töm.)—Singapore.
E. bisulcatus (Töm.)—Siam; Java; Borneo.
E. rubripes (Brdt.)—China; Java; New Guinea; Solomon Isles²; Thursday Island; Australia (Queensland, Sidney, etc.); Tasmania.²
E. platycephalus (Newp.)—India (Madras Presidency); Burma; Java; Molucca; New Guinea; New Britain.
E. spinosus (Newp.)—India (Madras Presidency); Ceylon; Burma (Thagata, Carin Berge).

Genus ANODONTOSTOMA, Töm.

- A. octosulcatus*, Töm.—S. E. Borneo (Matang, Bendjermasin).

Genus ASANDA, Mein.

- A. brevicornis*, Mein.—India (W. Himalayas, Madras Presidency²); Andamans; Socotra; Somaliland²; Arabia.²

Genus CORMOCEPHALUS, Newp.

- C. dentipes*, Poc.—India (Bengal).
C. philippinensis, Kraep.—Philippines.
C. pygmæus, Poc.—India (E. Himalayas, Bombay Presidency, Bengal, Assam, Madras Presidency); Burma.

¹ See Flower, *Journ Straits Asiatic Soc.*, No. 36, July, 1901; *R. carinulata*, Haase, includes *R. rugulosa*, Poc., according to Kraepelin.

² See Kraepelin, *Bull. Mus. Hist. Nat. Paris*, x, 1904.

C. dispar, Por., var. *sarasinorum*, Haase—Ceylon (Newara Eliya).

[*C. dispar*, Por., from S. Africa (Transvaal, Kafferia); Madagascar.]

C. inermipes, Poc.—Ceylon.

Genus *PSILOSCOLOPENDRA*, Kraep.

P. feæ (Poc.)—Burma (Carin Berge).

Genus *SCOLOPENDRA* (L.), Newp.

S. valida, Luc.—India (Punjab, Sind, Rajputana); Malay Peninsula; Canary Isles; Syria; Arabia; Djibuti; Socotra; E. coast of the Persian Gulf.

[var. *simonyi*, Att., Abd el Kuri Island off C. Guardafui.]

S. pinguis, Poc.—Burma (Carin Berge).

S. gracillima, Att.—Java.

S. morsitans, L.—Occurs in all lands of the tropical and temperate zones; centred in the Oriental and African regions.

S. cingulata, Latr.—Malay Peninsula; Andamans; S. Europe; Asia Minor; Syria; N. Africa and in E. Africa as far south as Tanga in German E. Africa (introduced?); Madagascar¹; Brazil.¹

S. subspinipes, Leach—Occurs in all lands of the tropical and temperate zones with the exception of those round the Mediterranean Sea where it is replaced by the allied *S. cingulata*; centre of distribution the Oriental region, where a series of varieties have been evolved.

var. *dehaani*, Brdt.—Chiefly from Sumatra, Java, Malay Peninsula, the whole of Further India (Burma, Siam, Anam) to China and India.

var. *hardwickei*, Newp.—India (Madras Presidency); Ceylon; Further India; Nicobars; Malay Archipelago.

var. *spinosissima*, Kraep.—Philippines.

var. *mutilans*, L. Koch—China; Japan.

var. *multidens*, Newp.—Sumatra¹; Java?; Tonkin¹; China; Japan.

[var. *japonica*, L. Koch, Japan.]

S. indica, Mien.—India (W. Himalayas, Punjab, etc.).

The region regarded as "Oriental" in drawing up the above list extends from the western boundaries of Sind, the Punjab and Kashmir to the eastern shores of Java, Borneo and the Philippines; and all the Chinese species have been included.

The centre of distribution of the Oriental Scolopendridæ seems undoubtedly to be the Malay Archipelago, 33 (excluding the

¹ See Kraepelin, *Bull. Mus. Hist. Nat. Paris*, x, 1904.

species from Singapore which is here regarded as belonging to the Malay Peninsula) out of the known 66 specifically identified forms occurring in these islands. Of these 33 species 14 are known from no other locality, nine of them—*Cryptops modigliani*, *Otostigmus longicornis*, *O. sumatranus*, *O. sucki*, *O. niasensis*, *O. nemorensis*, *Rhysida monticola*, *Anodontostoma octosulcatum*, and *Scolopendra gracillima*—being confined to the Sumatra-Java-Borneo group of islands, one—*Otostigmus punctiventer*—being common to these and to the Philippines, one—*Cormocephalus philippinensis*—being restricted to the Philippines, and three—*Paracryptops weberi*, *Otostigmus geophilinus* and *O. multident*—extending beyond the Oriental region to Flores, Timor and Celebes, respectively. Of the remaining 19 species found in the Oriental section of the Malay Archipelago, the distribution of 2 seems to extend eastwards only—that of *Otostigmus asper* from the Philippine to the Marianne Islands; and that of *Otocryptops melanostomus* from the Philippines and Java to Porto Rico and Argentina, though no records have yet been made between N. Guinea and Venezuela. It is perhaps worth noting here that the only other species of *Otocryptops* included in the above list of Oriental species, *O. rubiginosus*, has a parallel distribution further to the north, extending from China through Japan to N. America where, however, it has apparently only been recorded from the states of Minnesota and Indiana—more than half way across the Continent. There are 10 species found both east and west of the Malay Archipelago. Of these *Scolopendra morsitans* occurs throughout the tropical and temperate zones; *S. subspinipes* shares the same extensive area with the closely allied *S. cingulata* which replaces it entirely round the Mediterranean Sea; and *Rhysida longipes* occurs throughout the tropical zone, being found in India as far north as the Nepal Terai but not in the Himalayas. *Otostigmus politus* is found from China and the Eastern Himalayas to Australia; *Cryptops doriae* from Burma to New Guinea; *Rhysida nuda* from Burma and Ceylon to Australia (also in Paraguay); *Rhysida carinulata* from the Malay Peninsula to Australia; *Ethmostigmus platycephalus* from Eastern India (Madras Presidency) and Burma to New Britain; and *E. rubripes* from China and Java (no intermediate records as yet) to Tasmania and the Solomon Isles. And *Otostigmus astenus*, which extends from the Philippines to New Caledonia and Australia, has in addition been recorded from the Seychelles. Of the 7 remaining species occurring in the Malay Archipelago one—*Rhysida immarginata*—occurs throughout India, Burma and Oriental (not eastern) Malaysia; one—*Otostigmus insularis*—in the Philippines, E. Himalayas, Ceylon and the Seychelles; four—*Otostigmus aculeatus*, *O. spinosus* (found also in Algeria!), *Ethmostigmus bisulcatus* and *Cryptops inermipes*—have only been found in the Burma-Cambodia region on the mainland (there appears to be some doubt, however, as to the occurrence of *Cryptops inermipes* there at all) and in the Sumatra-Java-Borneo group of islands of the Archipelago; and the seventh—*Otostigmus*

metallicus—occurs in Sumatra and Sangir Island and also in Ceylon.

Of the remaining 33 Oriental species 4 are known from the Malay Peninsula, and 13 others from the Burma-Cambodia-Andaman region. Of the 4 Malay species one—*Ethmostigmus albidus*—is only known from Singapore. Another—*Scolopendra cingulata*—also occurs in the Andamans but is otherwise unknown from the Oriental region; it occurs, however, on the one side in Brazil, and on the other in Madagascar, E. Africa and the districts bordering the Mediterranean Sea in Africa, Asia and Europe. *Scolopendra valida* is found in north-west India (excluding the Himalayas), Persia, Syria, Arabia, Socotra and the Canary Islands, and *Otostigmus scaber* occurs in the Nicobars, Burma, Siam and China. Of the 13 additional species found in Burma, etc., one—*Rhysida calcarata*—is known from Cambodia and Siam only, and five—*Cryptops feæ*, *Otostigmus oweni*, *O. feæ*, *Psiloscolopendra feæ* and *Scolopendra pinguis*—from Burma only. *Otostigmus ceylonicus* occurs only in Burma and Ceylon, *O. morsitans* and *Ethmostigmus spinosus* in these two countries and in India. *E. pygomegas* extends from the Nicobars and Burma through Assam and the Eastern Himalayas; *Cormocephalus pygmæus* is probably to be found all over India and in Burma. And there are two species which have a more scattered distribution, *Otostigmus rugulosus* occurring in Siam, Burma and the Andamans, the Seychelles and Mauritius; and *Asanda brevicornis* in the Andamans, Madras Presidency of India, Arabia, Socotra and Somaliland—a distribution allied to that of *Scolopendra valida* described above.

There are 2 species which appear to be peculiar to China—*Mimops orientalis* and *Scolocryptops broelemanni*. The distribution of *Otocryptops rubiginosus* which is confined in the Oriental Region to China has been referred to above. Another 2 species—*Cormocephalus dispar* var. *sarasinorum* and *C. inermipes*—are confined to Ceylon, *C. dispar* (s. str.) being however only found in Madagascar and S. Africa.

The remaining 11 species are all Indian. *Otostigmus nudus*, *O. splendens* and *O. rufriceps* are only known from the Madras Presidency; *Rhysida crassispina* from the Madras and Bombay Presidencies; and *Otostigmus orientalis* from these two districts and the Seychelles. *Cormocephalus dentipes* is recorded only from Bengal, *Rhysida cuprea* from Bhutan and *Scolopendra indica* from the W. Himalayas, Punjab, etc. *Rhysida lithoboides* occurs in India and China, *R. paucidens* in India and Somaliland and *R. petersi* in India and S. Africa.

It would be futile to attempt to draw any far-reaching conclusions from the above records, for it is almost certain that many species will eventually be found in fresh localities as soon as these can be thoroughly examined. A few noteworthy facts may, however, be briefly noted here.

As stated above, the Oriental Scolopendridæ seem to be centred in the Malay Archipelago. Species found in the "Oriental"

portion of this Archipelago (excluding the three which occur in all longitudes) are found to extend eastwards through Polynesia and Central America to Porto Rico and Argentina; southwards to Tasmania; northwards to China; and westwards practically not beyond the boundary of the Oriental region, though one species occurs in Socotra and one, otherwise not known west of Burma, has been found in Algeria. Thus they appear as a whole to have a much wider distribution over the islands to the east than over the mainland to the west.

Again excluding the three most widely distributed species, we find that only two species are common to the Philippines and to the Sumatra-Java-Borneo group, the former having three additional species and a local variety of *Scolopendra subspinipes*, and the latter twenty-seven additional species. Thus these two groups of islands will probably be found to form separate zoogeographical subdivisions of Oriental Malaysia so far as the Scolopendridæ are concerned.

With regard to the mainland it is almost impossible to draw any satisfactory conclusions on account of the scrappy nature of our information. Several forms appear at present to have a very erratic and scattered distribution. Records of the altitude at which specimens were found are particularly scanty and very badly needed. It is not surprising to find that the habitat of several species occurring in the Archipelago extends into Burma. A few of these range through Assam to India and China, and there seems to be a tendency for such species to extend particularly along the Himalayas. As might well be expected, too. Further India and the Indian Peninsula (India Proper) have each several species which are not found in the other. It may be noted moreover that in the Indian Peninsula *Scolopendra subspinipes* (s. str.) and its var. *hardwickei* appear to be confined to the extreme south, var. *dehaani* being the dominant form in the northern parts.



XVII. NOTES ON DECAPODA IN THE INDIAN MUSEUM

I.—THE SPECIES OF *Gennadas*.

By STANLEY KEMP, B.A., Assistant Superintendent,
Indian Museum.

(Plates xiii and xiv.)

Among the vast collection of Decapods which has been made by the 'Investigator' thirteen examples of the genus *Gennadas* occur and, although the majority of these specimens have already been mentioned by Alcock,¹ it has now become necessary to submit them to revision. In 1901, when Alcock wrote, the characters by which the many closely-allied species of this genus were determined had not been fully appreciated and our knowledge of the extra-Atlantic forms was limited almost entirely to the wholly inadequate treatment which Spence Bate accorded them in his 'Challenger' Report.

Recently Bouvier has published a most valuable account² of the Atlantic species in which he draws attention to the importance of several characters which had previously been overlooked and, now that the 'Challenger' collections have been revised on the same lines,³ the determination of the material preserved in the Indian Museum presents a task of no great difficulty.

In the following descriptive notes all the more important characters suggested by Bouvier have been employed. It seems, however, that the Oriental species of the genus form a much more homogeneous group than those found in the Atlantic and, apart from the petasma and thelycum, little can be found which is of real systematic value. Useful indications are afforded by the antennular peduncle, the antennal scale and the second maxilla, but in other respects, such as the proportions of the mandibular palp and the respective lengths of the joints of the first three

¹ Alcock, *Desc. Cat. Ind. deep-sea Macrura*, 1901, p. 45.

² Bouvier, *Rés. Camp. Sci. Monaco*, fasc. xxxiii, 1908, p. 24.

³ Kemp, *Proc. Zool. Soc.*, 1909, p. 718. From the list of species of *Gennadas* given at the end of this paper (p. 728) two Pacific forms, *G. clavicarpus* and *G. pasithea*, are unfortunately omitted. Preliminary descriptions of these two species, which were obtained by the 'Siboga' expedition, have been given by Dr. J. G. de Man (*Notes Leyden Mus.*, xxix, 1907, p. 144). Both are, I believe, distinct from the 'Challenger' species and from those here described, but, until figures of the petasmata and thelyca are published, it is impossible to be quite certain.

pairs of peraeopods, a considerable amount of variation is sometimes to be found.

Three of the species in the collection are regarded as new, an interesting variation in the petasma of *G. scutatus*, Bouvier, is noticed and a fresh description is given of *G. carinatus*, Smith, a remarkable form which combines in one species the characters both of *Gennadas* and of the allied genus *Benthesicymus*.

The number of specimens examined is unfortunately small and this is doubtless due to the fact that the 'Investigator' collections were made almost entirely by means of trawls fishing on the bottom. The species of *Gennadas*, as far as is at present known, are entirely pelagic in habit and their occasional appearance in bottom hauls is explained by the fact that they are sometimes caught while the net is being hauled to the surface.

All the species mentioned in this paper possess podobranchs on the first three pairs of peraeopods and are in consequence members of the genus *Gennadas*, *sensu stricto*.

The measurements given represent the total length, and were taken from the apex of the rostrum to the tip of the telson, with the animal extended as nearly as possible in a straight line.

***Gennadas alcocki*, sp. nov.**

(Plate xiii, figs. 5—8.)

St. 111.—Bay of Bengal, $12^{\circ} 50' N.$, $90^{\circ} 52' E.$, 1,644 fathoms. One male, 36 mm.

St. 103.—Bay of Bengal, $15^{\circ} 14' N.$, $81^{\circ} 9' E.$, 1,260 fathoms. One female, about 25 mm.

St. 108.—Off C. Comorin, $7^{\circ} 4' N.$, $76^{\circ} 34' 15'' E.$, 1,043 fathoms. One male, 34 mm.

St. 309.—Near the Andaman Islands, $10^{\circ} 9' N.$, $93^{\circ} 2' 15'' E.$, 765 fathoms. One male, 34 mm.

The rostrum is well elevated above the dorsal carina of the carapace and bears the usual small tubercle behind the dorsal tooth. The antennary and infra-antennary angles are acute and the branchiostegal spine is small but evident. The cervical and post-cervical grooves of the carapace are well marked; dorsally, the distance between them is only about one-fifth of the distance from the post-cervical groove to the hinder margin. The median carina is visible throughout the length of the carapace.

The second joint of the antennular peduncle, measured dorsally, is fully two-thirds the length of the ultimate joint. The antennal scale (fig. 7) is a little more than three times as long as wide; the outer margin is somewhat convex and terminates in a spine which extends beyond the narrow apex of the lamella.

The ultimate joint of the mandibular palp varies in length, but is, in all cases, shorter than the greatest width of the basal joint. In the second maxilla the anterior lobe of the internal

lacinia is slightly broader at the apex than at the base and is a little narrower than the adjacent lobe of the external lacinia. The apex of the endopod is narrow and bears from three to five spines on its external aspect.

In the first maxillipede the third joint of the endopod is oval and very nearly twice the length of the second; the basal joint bears five stiff spines on its inner distal margin.

The carpus of the first pair of peraeopods is shorter than the chela and is only a little more than half the length of the merus. In the second pair the chela is seven-eighths the length of the carpus and the dactylus is equal to, or shorter than, the palm. In the third pair the merus and carpus are of the same length; the chela is half, or a little more than half, the length of the carpus and the dactylus is a trifle shorter than the palm.

The sixth abdominal somite alone is dorsally carinate and all the median tubercles on the abdominal sterna with the exception of the first are blunt and inconspicuous. The apex of the telson is truncate and bears four or five pairs of plumose setae, of which the middle pair is the longest, between the stout marginal spines.

The petasma (figs. 5, 6) bears some resemblance to that of *Genadas parvus*, but, judging by the dissimilarity which exists in regard to the other characters, more especially in the antennal scale and antennular peduncle, it does not seem likely that the two forms are allied to one another in any really close manner. The outstanding lobe on the anterior aspect varies considerably in shape; it is sometimes pointed apically and reaches as far as the distal margin.

I have associated this species with the name of Lieut.-Colonel Alcock who has given a very accurate description of the thelycum (*loc. cit.*, 1901, p. 47, sub "*G. parvus*"). His account, which may be compared with fig. 8, runs as follows:—"The thelycum consists of a horizontal, subtriangular plate or tubercle, placed between the third pair of legs, followed by two transverse bars between the fourth and fifth pairs. The first of these bars is somewhat W-shaped with the posterior notch of the W filled by a tooth in the middle of the anterior border of the second bar."

The specimen which Miss Rathbun¹ has attributed to *Genadas parvus*, remarking that the thelycum agrees exactly with Alcock's description, is certainly quite distinct from the species here described. The true female of Spence Bate's *G. parvus*, which I have recently discovered in a collection made by Dr. J. Stanley Gardiner, is, in respect of the thelycum, wholly different both from the present species and from that figured by Miss Rathbun.

¹ Rathbun, *Bull. U. S. Fish Comm. for 1903, 1906*, p. 907.

Gennadas praecox, sp. nov.

(Plate xiii, figs. 1—4.)

St. 320.—Off C. Comorin, $7^{\circ} 23' N.$, $75^{\circ} 44' E.$, 1,053 fathoms. One male, $32\frac{1}{2}$ mm.

The rostral crest is much the same as in the two preceding species, but the dorsal spine is more slender. The antennary and infra-antennary angles are acute, but rather bluntly rounded at the apex; the branchiostegal spine is minute. The cervical and post-cervical grooves of the carapace are deeply cut; they approach one another very closely in the mid-dorsal line, where the distance between them is scarcely one-sixth the distance from the post-cervical groove to the hinder margin. The mid-dorsal carina runs the whole length of the carapace, but is inconspicuous posteriorly.

The second joint of the antennular peduncle, measured dorsally, is about two-thirds the length of the ultimate segment. The antennal scale (fig. 1) is three and a quarter times as long as broad; it is widest basally and its outer edge, which is nearly straight, terminates in a small spine which falls far short of the narrow apex of the lamellar portion.

The ultimate joint of the mandibular palp is about as long as the greatest width of the penultimate joint. In the second maxilla (fig. 4) the anterior lobe of the internal lacinia is strongly constricted behind the apex and is a trifle narrower than the adjacent and similarly-constricted lobe of the external lacinia. In the latter lacinia the anterior lobe is fully one and a half times the width of the posterior. The third joint of the endopod of the first maxillipede is fully twice the length of the second; the fourth is extremely minute. Two stiff curved spines are situated on the inner distal margin of the joint.

The carpus of the first pair of peraeopods is about the same length as the chela and is two-thirds as long as the merus. In the second pair the chela is three-quarters the length of the carpus and the dactylus is shorter than the palm. The carpus of the third pair is about equal in length to the merus; the chela is only a little more than half the length of the carpus and the dactylus is fully as long as the palm.

The median spines on the abdominal sterna are blunt and inconspicuous; the sixth somite alone is dorsally carinate. The telson is squarely truncate at the apex and is furnished with spines and setae as in *G. alcocki*.

The petasma (figs. 2, 3) is most peculiar and utterly unlike that of any species hitherto described. In what appears to be its natural position each of the two halves is roughly triangular in shape and is provided with two long and narrow processes, one on its distal and inferior aspect and one, curved and directed inwards, which arises close to the superior inner margin. In place of the numerous small pleats, which are usually found near the line of connection of the right and left halves, there is, in this instance, a

single large fold involving nearly one-third of the whole plate. When this fold is opened out the structure presents the appearance shown in fig. 3.

***Gennadas sordidus*, sp. nov.**

(Plate xiv, figs. 1—3.)

St. 193.—North of the Laccadive Islands, $15^{\circ} 11' N.$, $72^{\circ} 28' 45'' E.$, 931 fathoms. One male, about 20 mm.

St. 194.—Off the Laccadive Islands, $13^{\circ} 47' N.$, $72^{\circ} 3' 45'' E.$, 891 fathoms. One male, 24 mm.

St. 198.—North-east of Ceylon, $8^{\circ} 55' N.$, $81^{\circ} 17' 30'' E.$, 764 fathoms. One male, $18\frac{1}{2}$ mm.

The rostral crest does not differ appreciably from that of the preceding species. The antennary and infra-antennary angles are acute, the former being bluntly rounded and the latter sharp; the branchiostegal spine is very small. The distance between the cervical and post-cervical grooves, measured dorsally, is less than one-fifth the distance from the post-cervical groove to the hinder margin of the carapace. The mid-dorsal carina is inconspicuous behind the latter groove.

The second joint of the antennular peduncle is very short; measured dorsally, it is less than half the length of the ultimate joint. The antennal scale is widest at the base; it is three times as long as wide and the outer margin terminates in a very small spine which does not extend as far forwards as the lamellar portion.

The ultimate joint of the mandibular palp is shorter than the greatest width of the basal joint. In the second maxilla (fig. 3) the anterior lobe of the internal lacinia is short, not wider at the apex than at the base, and is little, if at all, narrower than the adjacent lobe of the external lacinia. In the latter lacinia the anterior lobe is about one and a half times as broad as the posterior. The endopod is furnished with three curved spines near the narrow apex.

The third joint of the endopod of the first maxillipede is about one and a half times the length of the second and the basal joint bears two or three stiff spines on the inner distal margin.

In the first pereopods the chela, which is about as long as the carpus, is about two-thirds the length of the merus. The chela of the second pair is two-thirds the length of the carpus and the dactylus is equal to, or a trifle shorter than, the palm. In the third pair the carpus and merus are exactly the same length; the dactylus is as long as the palm, the whole chela being about half the length of the carpus.

The median spines on the abdominal sterna are not prominent; the sixth somite alone is dorsally carinate. The apex of the telson has much the same form as in *G. alcocki*.

The petasma (figs. 1, 2) is a rather complicated structure and is of much the same type as that of *G. parvus*, to which *G. sordidus*

is evidently very closely allied. The most distinctive character which it possesses is the spoon-shaped portion which is directed forwards from the middle of the distal margin of each lobe.

Gennadas scutatus, Bouvier.

(Plate xiii, figs. 9, 10.)

Gennadas scutatus, Bouvier, *Rés. Camp. Sci. Monaco*, xxxiii, 1908, p. 42, pl. viii.

Gennadas scutatus, Kemp, *Proc. Zool. Soc.*, 1909, p. 727, pl. lxxv, fig. 2.

St. 108.—Off C. Comorin, $7^{\circ} 4' N.$, $76^{\circ} 34' 15'' E.$, 1,043 fathoms. One male, about 29 mm.

St. 109.—Off C. Comorin, $7^{\circ} 1' N.$, $78^{\circ} 21' E.$, 738 fathoms. One male, broken.

With the exception of the petasma, these specimens agree closely with the example obtained by the 'Challenger' in the N. Pacific (Kemp, *loc. cit.*). They differ from Bouvier's description and figures in the following particulars:—

The ultimate joint of the mandibular palp is fully as long as the width of the basal joint. In the second maxilla (fig. 9) the anterior lobe of the internal lacinia, though not wider at the apex than at the base, is widely separated from the posterior lobe and is narrower than the adjacent lobe of the external lacinia. The third joint of the endopod of the second maxillipede is a trifle wider than in Bouvier's figure. The chelae of the third pair of peraeopods are longer; in one specimen they are three-fifths the length of the carpus, while in the other they are a trifle shorter, but still considerably more than half the length of the carpus.

The petasmata of the two specimens are as nearly as possible identical and, considering the great uniformity of outline which these structures usually present, show a considerable amount of divergence from the type. The principal points of difference, as will be seen by comparing fig. 10 with Bouvier's text-figure,¹ concern the development of the large median distal lobe. This is truncate and furnished with a small pointed process on the outward side in the type, while in the present specimens it is sharply pointed and the small process is entirely absent.

Gennadas scutatus is now known from the Atlantic (Bouvier), from the Pacific ('Challenger') and from the two localities mentioned above. When more extensive collections have been made, it will be possible to determine whether, in these widely distant localities, there really exist distinct races of this species, differing from one another in the form of the petasma, or whether there is in this respect merely an exceptionally large range of variation.

¹ Bouvier, *Bull. Mus. Océanog, Monaco*, No. 80, 1906, p. 11, fig. 13.

Gennadas bouvieri, Kemp.

Gennadas bouvieri, Kemp, *Proc. Zool. Soc.*, 1909, p. 726, pl. lxxiv, figs. 1—4; pl. lxxv, figs. 6 and 7.

St. 198.—North-east of Ceylon, 8° 55' N., 81° 17' 30" E., 764 fathoms. One female, about 25 mm.

This specimen agrees closely with the description of the type. The only important difference lies in the proportional length of the joints of the third pair of peraeopods, where the merus is only very slightly shorter than the carpus. Except for the fact that no spermatophores are inserted, the thelycum is practically identical with that figured in 1909 (pl. lxxv, fig. 6).

G. bouvieri was found by the 'Challenger' west of Manila and north of New Guinea.

Gennadas carinatus (Smith).

(Plate xiv, figs. 4—9.)

Benthescymus? *carinatus*, Smith, *Rep. U. S. Fish Comm.* for 1882, 1884, p. 396, pl. x, figs. 6 and 7.

Gennadas carinatus, Alcock, *Desc. Cat. Ind. Macrura*, 1901, p. 46.

Gennadas carinatus?, McGilchrist, *Ann. Mag. Nat. Hist.*, March, 1905, p. 236.

St. 128.—Off C. Comorin, 6° 58' N., 77° 26' 50" E., 902 fathoms. One male, 130 mm.

St. 306.—Off Travancore, 9° 20' N., 75° 24' E., 930 fathoms. One female, 148 mm.

This large species is of great interest and, although the two specimens in the Indian Museum have already been recorded by Alcock and McGilchrist, a fresh description drawn up on the lines of Bouvier's recent work may be found useful.

I have followed Alcock in placing the species in the genus *Gennadas*, though, in point of fact, it is almost exactly intermediate in character between that genus and *Benthescymus*. In habit, however, the two genera appear to be quite distinct, for *Gennadas*, as far as at present known, is entirely pelagic, whereas *Benthescymus* lives on the bottom. Now in *carinatus* the joints of several of the appendages are greatly flattened and expanded and closely resemble those of the former genus, and this modification, which is doubtless correlated with a free-swimming existence, has induced me to retain the species in its present position.

Alcock has, indeed, suggested that it might be best to regard *Gennadas* as a subgenus of *Benthescymus*, but from a practical point of view this cannot be recommended. It must be remembered that it is only in the present case that any difficulty arises in allocating the species to one or other genus.

Although the two specimens, on which the following account is based, are very macerated, all the appendages are represented with the exception of the last three pairs of peraeopods.

The rostral crest (fig. 4) is elevated well above the dorsal carina of the carapace and differs from that of all other known species of *Gennadas* in having the superior margin, between the apex and the small dorsal tooth, strongly convex. This margin also appears to lack the usual fringe of setae which occurs in the other species. The antennary angle of the carapace is rectangular, but the infra-antennary, as in Bouvier's *Gennadas alicei*, is entirely absent. The branchiostegal spine is prominent. The cervical and post-cervical grooves are rather strongly marked. Dorsally they are widely separate, the distance between them being at least one half the distance from the post-cervical groove to the posterior margin. The mid-dorsal carina extends the whole length of the carapace but is blunt posteriorly.

The eyes are large and appear to have been deeply pigmented in life; the conical process on the dorsal surface of the stalk is quite unusually small.

The second joint of the antennular peduncle is, measured dorsally, fully as long as the ultimate segment and is articulated to it by its entire margin and not merely by the inferior edge as in other species of the genus. The dilated portion at the base of the upper flagellum is as long as the two proximal joints of the peduncle. The antennal scale is unfortunately incomplete in every case. It was evidently little more than twice as long as wide and the very broad apex of the lamella appears to have extended far beyond the spine which forms the termination of the convex outer margin.

The ultimate joint of the mandibular palp (fig. 5) is longer than the greatest width of the basal joint. In the second maxilla (fig. 6) the anterior lobe of the internal lacinia is not wider at the truncate apex than at the base, and is not so broad as the adjacent lobe of the external lacinia. The endopod has almost exactly the same form as in *Benthesicymus* and bears from ten to fourteen curved spines on its external aspect near the apex.

In the first maxillipede (fig. 7) the exopod is provided with a terminal lash as in typical *Benthesicymus* and the third joint of the endopod is about twice the length of the second. The merus of the second maxillipede (fig. 8) is twice as long as wide and its anterior prolongation (the part which extends forward beyond the insertion of the carpus) is less than one-fifth the entire length of the segment. The dactylus is provided with a single apical spine.

In the first pair of peraeopods the carpus, which is about the same length as the chela, is two-thirds the length of the merus. In the second pair the carpus is as long as, or a little shorter than, the merus, the chela is only a trifle more than half the length of the carpus and the dactylus is about as long as the palm.

The rudimentary exopods, mentioned by Smith, are visible only in the case of the female specimen.

The merus of the second maxillipedes and the ischium and merus of the third maxillipedes and first three pairs of peraeopods are greatly expanded as in typical *Gennadas*.

The third, fourth, fifth and sixth abdominal somites are dorsally carinate. The telson is much longer than in other species of *Gennadas*, being only a little shorter than the outer uropod. It bears four pairs of lateral spines in its distal third and is sharply pointed apically.

The petasma (fig. 9) consists of a pair of simple leaves, as in *Benthescymus*.

The thelycum has been well described by McGilchrist in the following words: "Between the bases of the fourth pair of legs a prominent central papilla stands. Towards this papilla a hairy process passes inwards and backwards from the base of each of the third pair of legs and from the base of each of the fourth pair of legs a tongue-shaped process projects inwards and backwards posterior to the papilla. The papilla thus stands in the centre between the tips of these four processes."

Apart from the type, only the two specimens mentioned above are known. Smith's example, which was found off the east coast of the United States, $39^{\circ} 44' 30''$ N., $71^{\circ} 4'$ W., in 1,022 fathoms, measures only 74 mm. in length and is thus only about half the size of those from the Arabian Sea.

EXPLANATION OF PLATE XIII.

Gennadas praecox, sp. nov.

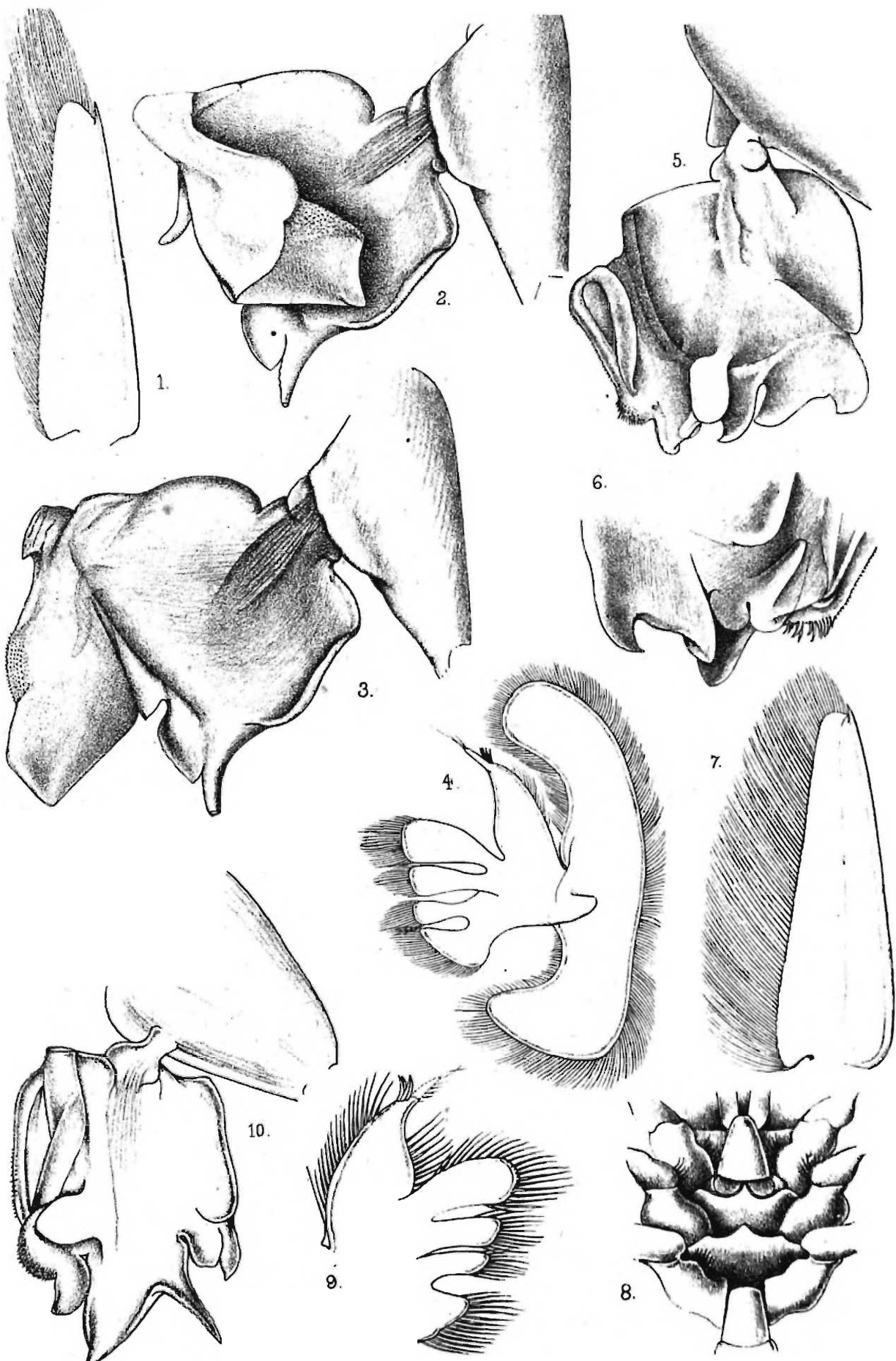
- FIG. 1.—Antennal scale, $\times 8$.
,, 2.—Right-half of the petasma, folded naturally, $\times 16$.
,, 3.—The same unfolded, $\times 16$.
,, 4.—Second maxilla, $\times 16$.

Gennadas alcocki, sp. nov.

- FIG. 5.—Left-half of the petasma, $\times 16$.
,, 6.—The apex seen from the other side, $\times 30$.
,, 7.—Antennal scale, $\times 8$.
,, 8.—Thelycum, $\times 16$.

Gennadas scutatus, Bouvier.

- FIG. 9.—Part of the second maxilla, $\times 70$.
,, 10.—Left-half of the petasma, $\times 30$.



1-4. *Gennadas praecox*.

5-8. *Gennadas alcocki*.

9, 10. *Gennadas scutatus*.

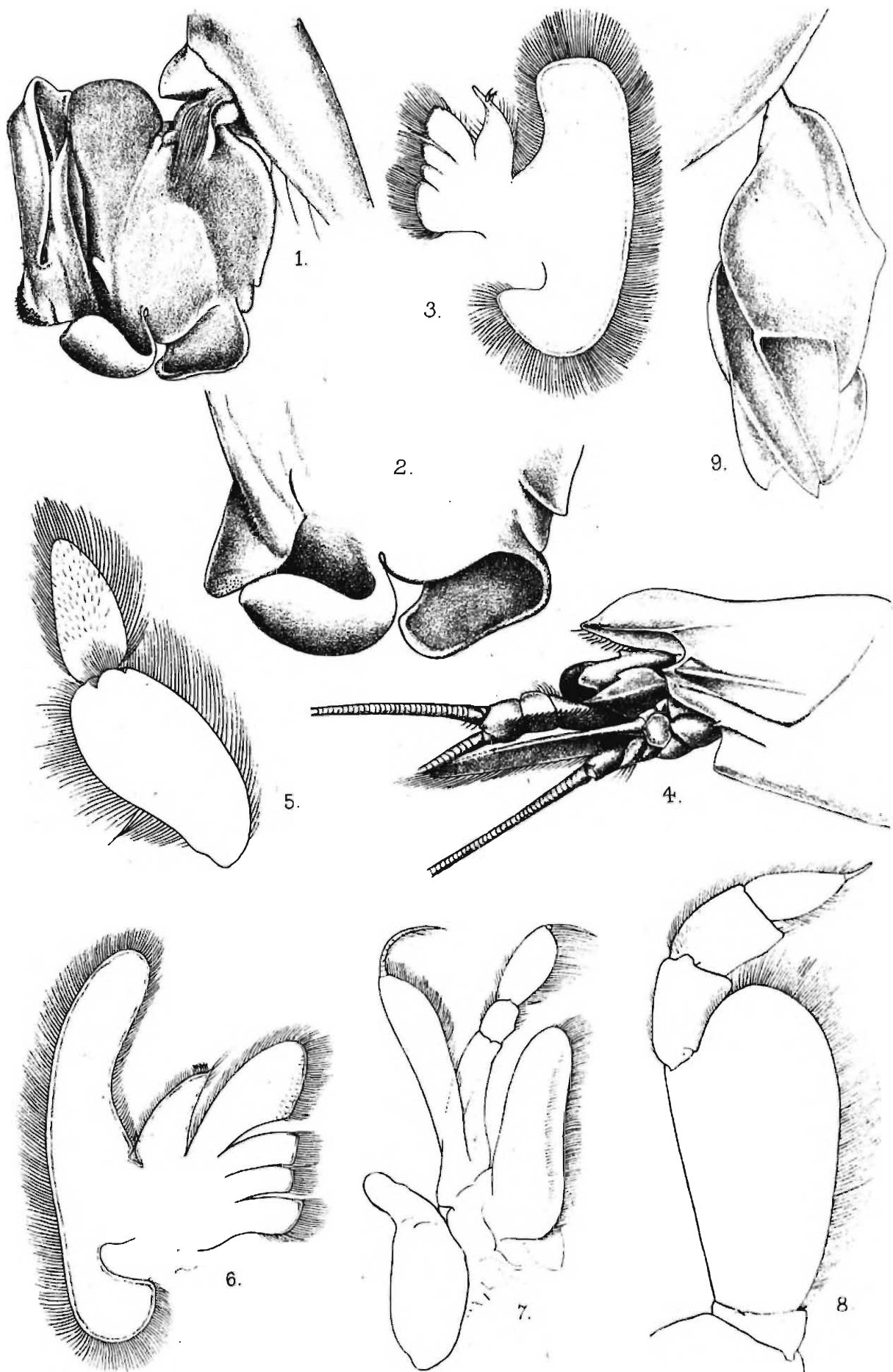
EXPLANATION OF PLATE XIV.

Gennadas sordidus, sp. nov.

- FIG. 1.—Left-half of the petasma, $\times 22$.
,, 2.—Apex of the petasma of another specimen, showing the
lobes reflected in a different manner.
,, 3.—Second maxilla, $\times 20$.

Gennadas carinatus (Smith).

- FIG. 4.—The front part of a female specimen seen laterally, $\times 1\frac{1}{2}$.
,, 5.—Mandibular palp, $\times 3$.
,, 6.—Second maxilla, $\times 3\frac{2}{3}$.
,, 7.—First maxillipede, $\times 3\frac{2}{3}$.
,, 8.—Endopod of the second maxillipede, $\times 3\frac{2}{3}$.
,, 9.—Right-half of the petasma, $\times 5\frac{1}{2}$.



1-3. *Gennadas sordidus*

4-9. *Gennadas carinatus*.

XVIII DESCRIPTION OF A NEW SPECIES
OF *NEMACHILUS* FROM NORTHERN
INDIA.

By B. L. CHAUDHURI, B.A., B.Sc., Assistant Superintendent,
Indian Museum.

Nemachilus mackenziei, sp. nov.

Br. III, D. II. 11-13, P. 12, V. 8, A. I. 6-7, C. 18.

Length of head 4, height of body $4\frac{4}{5}$, length of caudal $3\frac{1}{2}$ to 4 and the distance of cloacal opening from the root of caudal $3\frac{1}{2}$ in the total length. Breadth of body $1\frac{1}{5}$ in its height.

Head.—Upper profile a straight line from nape of neck to behind the nasal pits, from which point it curves and suddenly slopes down. Shape of head cylindrical, being almost of equal height and breadth, both of which measurements are contained $1\frac{1}{2}$ times in the length of head. There is a small slit or depression on each side in front of the eyes which in the male is bordered by a ridge extending like a small pad to below the eye on each side, where it terminates in a small rounded knob-like hanging flap.

Eyes comparatively large, being $3\frac{1}{2}$ to 4 diameters in the length of the head, $1\frac{1}{5}$ to $1\frac{1}{2}$ in the length of the snout and 1 to $1\frac{1}{5}$ diameters apart; the intraorbital space nearly flat.

Barbels.—6 in all, 4 rostral and 2 maxillary; the outer rostrals are the longest, reaching below the hind margin of the eye and the maxillary reaches beyond them; the inner rostrals reach below the anterior margin of the orbit.

Lips rather thin for the genus. The ends of the suctorial band meet at the middle of the lower lip. The ends are slightly expanded and curved up, thus making the lower lip look interrupted medially. No spine-like process projecting from the middle of the lower lip.

Fins.—The dorsal is in advance of the middle point as well as of the ventral fin. There is a short thick appendant in the angle between the outer margin of the ventral fin and the body. The length of the pectoral fin is contained $1\frac{2}{5}$ in the interval between pectoral and ventral fins while the lengths of the ventral and anal fins are contained $1\frac{4}{5}$ and $1\frac{1}{5}$ in the intervals between the ventral and the anal and the anal and the caudal, respectively. The outer margin of the caudal is rounded and is bilobed, being divided by a notch in the middle.

Shape of body.—Slightly compressed. The anterior end of the root of the dorsal fin is the highest point, the upper profile is almost a straight line with a slight concavity behind the dorsal fin

as the hinder part of the body gradually tapers a little towards the root of the caudal fin. The ventral profile is somewhat curved, with the convexity downwards, the lowest point being the anterior root of the ventral fin.

Lateral line.—Complete, generally follows the curvature of the ventral rather than that of the dorsal profile; in the anterior one-third it slightly curves downwards then upwards to reach the upper corner of the opercle.

Scales of moderate size, all over the body except on the head.

Air-bladder very much reduced and enclosed in paired osseous capsules placed dorsally behind the gills.

Colour.—Head down to the level of the eye dark brown or grey with black patches and spots interspersed irregularly. Body above the lateral line dark brown or grey divided by obliquely transverse thick black bands looping round the back and extending to below the lateral line, the interspaces being often quite as broad as the bands; 5 to 6 such bands in front of the dorsal fin, 4 to 6 below the fin and 5 to 6 behind it. The ground colouring of the sides of the abdomen below the lateral line is of lighter brown to pale yellowish white dashed with silver; the part of the sides immediately below the lateral line is characteristically marked with 12 or 13 wedge-shaped blackish brown or grey inverted-cone-like markings the apices of which reach some distance below the lateral line, along which the bases of these cone-shaped markings run. These markings appear to be in reality the intercepted terminals of the transverse bands mentioned above. The interspaces between the cones are broader than the breadth of their bases. About the middle of the interspaces a fainter and narrower series of grey or pale brown interrupted markings are noticed which are detached below the lateral line, and disappear above the apices of the cones. These faint markings make the darker cones still more conspicuous. Fins: the dorsal fin is pale brown or grey with five or less black or brown bands made up of spots; the caudal is also pale brown and is banded with six black or brown convex curves in some (one Naini Tal and one Champaran specimen) and wedge-shaped in others (Saran and Champaran specimens). The convexity of the curves and the apices of the cones, as the case may be, always pointing outwards (posteriorly). The pectoral, ventral and anal are not banded but are pale yellow to dull white, being somewhat similar to the lower abdomen. There is a black ocellus on the upper border of the root of the caudal fin.

Secondary sexual characters.—There are two male secondary sexual characters to be noticed in the type specimens from Cheriya-dhang (U. P.), firstly, a slit-like deep groove in front of the eye which bends round a small knob-like rounded flap of skin protruding below the anterior one-third of the orbit, the ridge above the groove appearing slightly swollen and cushion-like; secondly, there is a kind of padding and thickening on the upper surface of the pectoral fins, where, on the padding, minute hooked denticular outgrowths are noticed.

Two specimens (of which one is a sexually mature male measuring 7.5 cm.) were obtained by a Museum collector in a small stream at Cheriadhang near Kathgodam and one at Jaulasal, in the Naini Tal district (U. P.), at the base of the W. Himalayas. Seven specimens were collected by Mr. Mackenzie from the Jharai and the Jamwari Nadi near Siripur in the district of Saran (Bengal), and two specimens (the bigger being a sexually mature female measuring 7.4 cm.) were obtained by Mr. Walker from a *jhil* at Purnahia (P. O. Ghorasan) in the district of Champaran.

There is some superficial resemblance between this new species and *N. rubidipennis*, which is reported only from Tenasserim (Burma), and the type of which is in the Indian Museum collection. From *N. rubidipennis* the new species differs in many important characters, especially in the shape of the head; also in the number of fin rays, shape and markings of caudal fin, proportional lengths of barbels and in several other particulars.

XIX. NOTES ON THE LARVÆ OF *TOXORHYNCHITES IMMISERICORS*, Wlk.

By C. A. PAIVA, Assistant, Indian Museum.

In the course of a "census" of the mosquitoes of Calcutta that is being undertaken by the Indian Museum, I have been able to make the following notes on the larvæ of *Toxorhynchites immisericors*, Wlk., which are very common in some parts of the fringe area of the town, especially in the months of June and July. Large numbers of the larvæ and pupæ of this species have been found in earthen pots.

Mr. E. E. Green of Ceylon, in his paper on the development of this mosquito, on p. 161 of the *Spolia Zeylanica*, vol. ii (1905), mentions that its larva is carnivorous and feeds on the larvæ of *Culex*. He mentions also that the larva feeds on others of its own species, the largest and strongest being the only survivor. Mr. Green never found more than one larva at a time. The breeding places where he discovered these larvæ were hollow stumps of the giant bamboo and small pools in the angles of the branches of other trees. Larvæ of *Toxorhynchites* have not yet been found in such places in Calcutta, but in earthen pots not only single individuals have been found, but as many as nine and ten together. In such cases no larvæ of any other mosquito have been found.

As it was suspected that the larvæ must have devoured those of *Stegomyia fasciata* that are usually common in earthen pots, and to prove that *Stegomyia* larvæ were palatable to them, on the 16th July, 1910, a number of *Stegomyia* larvæ were introduced into a bottle containing about half a dozen *T. immisericors* larvæ. Not a minute elapsed after the former larvæ were put into the bottle, before each *T. immisericors* larva had seized one of them and was devouring it with apparent relish. The way the prey is seized seems interesting. It must first be remarked that the larvæ of *T. immisericors* are very sluggish and cannot swim very fast.

Mr. Green mentions that although he watched a larva of *T. immisericors* seizing a *Culex* larva he was unable to see the exact method of catching the larva. He, however, discovered that the falcate lamellæ, which are situated on each side of the head, were the organs of prehension. Each of these lamellæ, according to Mr. Green, is minutely toothed at its extremity. The mode of capture, as has been noticed in the specimens kept under observation in the Indian Museum, is as follows :—

The larvæ of *T. immisericors* lie quietly at the surface of the water, with their bodies generally in a vertical position, and the

Stegomyia larvæ move about quite rapidly. The moment a *Stegomyia* larva comes swimming about near a larva of *T immisericors*, the latter makes a slight, sharp, sideward jerky movement of the head, which enables it to seize its prey, if within reach. The captured larva struggles for some time to extricate itself.

The large larvæ are not always successful in catching the *Stegomyia* larvæ, as it often happens that the *Stegomyia* larvæ are quite prepared for the attack, and any slight movement on the part of their enemy is sufficient warning to make them sink below "catching range." Larvæ of *T immisericors* have been seen to devour each about half a dozen *Stegomyia* larvæ within an hour.

The *Stegomyia* larvæ do not leave their enemies in peace. They get near the body of the larger larva, especially the hind portion, and keep nibbling at the bristles that grow on each abdominal segment. This seems to annoy the other larva and with a jerky movement of its body it disperses the *Stegomyia* larvæ, which come back swimming over its head. The first *Stegomyia* larva that comes within reach is instantly seized and sucked quite dry. The empty larval skin is then rejected by the larva of *T immisericors* by a backward movement of the forepart of the body. This empty skin seems to be sought for by the other *Stegomyia* larvæ, who devour it quite greedily. So occupied was one *Stegomyia* larva in devouring one of these empty larval skins that it did not notice that it had drifted towards a larva of *T immisericors*. As soon as the former came within reach, the larva of *T immisericors* seized it and killed it. Many *Stegomyia* larvæ are killed by the larvæ of *T immisericors* simply because they come and annoy the larger larvæ when they are resting quietly at the surface of the water.

The larvæ of *T immisericors* do not usually only suck the larvæ of *Stegomyia*. When they are hungry they generally eat them up entirely. In the course of one night over one hundred *Stegomyia* larvæ, besides three larvæ of *T immisericors*, were eaten up by three other larvæ of *T immisericors*. In the evening of the 19th July, 1910, the same three larvæ were left in a finger-bowl of water with about twenty *Stegomyia* larvæ. Evidently during the night two of these larvæ of *T immisericors* had pupated, and the third larva, after it had finished all the *Stegomyia* larvæ, and finding nothing to eat the next morning, seized one of the pupæ and had sucked it nearly dry by 10 A.M. The pupa was seized on the left side of the head, nearer the eye, but between the eye and the respiratory syphon. The larva had got such a firm hold of it that it had some difficulty in getting rid of the empty case. It wriggled about a great deal, till at last it was able to cast away the empty pupal case.

Although it had had such a large supply of food at 10 A.M., it was again ready for some more. At 11 A.M. some twenty larvæ of *Desvoidea obturbans*, from a cess-pool, were introduced into the bowl, as well as another larva of *T immisericors*, which had been starving all the previous night. Within a couple of minutes each

larva of *T immisericors* had taken possession of a *Desvoidea* larva. They could not eat these larvæ as fast as they ate the *Stegomyia* larvæ, and although the greater portion of one *Desvoidea* larva had been sucked quite dry, its head and tail wriggled about as if it (the *Desvoidea* larva) wanted to extricate itself from the clutches of the other larva. In most cases the *Desvoidea* larvæ are seized just behind the head, which renders them helpless to attack their enemies, as these larvæ, too, have been observed to eat other mosquito larvæ.

The larvæ of *T immisericors* will eat any mosquito larva. Larvæ of *Culex* and *Myzomyia* were also put into the bowl together with eleven additional larvæ of *T immisericors* in different stages of growth and evidently hungry, for they seized whatever came in their way first. One small larva of *T immisericors* did not take more than a minute to finish a larva of *Myzomyia rossii*. On the evening of the 20th July, 1910, over fifty larvæ consisting of *Culex*, *Desvoidea* and *Myzomyia* were placed in the same bowl, with twelve larvæ of *T immisericors*. By 10 A.M. of the following day there was no trace of a single living larva of any of the three kinds in the bowl. Moreover, a large larva of *T immisericors* had also been half eaten by another of nearly the same size as itself. I have preserved it in this condition in alcohol, as well as another larva of *T immisericors* in the act of devouring a *Desvoidea* larva.

One peculiarity about the larvæ of *T immisericors* and their selection of their prey with regard to its size, is that if various sizes of larvæ are placed in the receptacle in which they are, the larger larvæ of *T immisericors* will first devour all the other large larvæ of other mosquitoes, leaving the smaller ones to the last. The smaller larvæ of *T immisericors* will seize those of the smaller kind, but they do not hesitate to tackle a *Desvoidea* larva, although they are very slightly bigger than *Desvoidea* larvæ themselves. I have not yet observed a larva of *T immisericors* devour another of its own kind when there is a plentiful supply of other larvæ in the receptacle in which it is. In fact it seems to be its last resource when no other larvæ can be had. Otherwise, when the larvæ of *T immisericors* are confined to small receptacles of water, they will eat any kind of larvæ they get. They display no choice with regard to their food, and as they are carnivorous in habit, they will readily eat whatever larvæ come in their way. If five or six specimens of this larva are put each into a pot or pan containing water and in which there are mosquito larvæ, it will be found that within one night all the other larvæ will be devoured. The carnivorous larvæ seem to be plentiful enough round Calcutta and may also be found within the limits of the town itself, as adult specimens have been found in numbers in a garden centrally situated in Calcutta.

It has been found, as is shown by these notes, that the larvæ of *T immisericors* feed greedily on the larvæ of *Stegomyia*, and as *S. fasciata*, the yellow fever mosquito, is very common in earthen

pots round Calcutta, one is justified in assuming that *T immiseri-*
cors plays an important part in its destruction, in a manner which
would be of great moment in the event of yellow fever being intro-
duced into this country.

XX DESCRIPTION OF A SOUTH INDIAN
FROG ALLIED TO *RANA CORRUGATA*
OF CEYLON

By N. ANNANDALE, D.Sc., F.A.S B., Superintendent,
Indian Museum.

Rana travancorica, sp. nov.

No glandular lateral fold. Vomerine teeth in two stout almost transverse groups behind the level of the choanæ; lower jaw with a pair of small tooth-like prominences in front; no free papilla on the tongue. Head large, flat; snout short, rounded, without canthus rostralis; upper eyelid very narrow; eyes prominent, turned upwards; tympanum hidden. Fingers short, blunt, first not extending so far as second; toes short, ending in small but distinct disks, three-quarters webbed; subarticular tubercles small; no outer tubercle; a broad tarsal fold. Hind limbs stout; the tibio-tarsal articulation barely reaching the ear. Skin of back corrugated, with strong but somewhat irregular transverse plaits; skin of throat longitudinally plicated. Dark grey above, obscurely spotted with a darker shade; a pale cross-bar between the eyes sometimes visible; throat and lower surface of thighs profusely clouded with brown. Male without vocal sacs.

Length from snout to vent 40 mm. ($1\frac{2}{3}$ inches).

This species evidently represents in Travancore the Ceylon species *R. corrugata*, from which it may be distinguished by its very much stouter vomerine teeth, less fully webbed hind feet, shorter hind legs and more strongly corrugated dorsal surface. I have examined several specimens taken by Mr. R. Shunkara Narayana Pillay of the Trivandrum Museum in April and May, 1909, at Eathancaud and at Anachardie in the Ariankavu Range near Shencottah on the Madras frontier.

XXI. CONTRIBUTIONS TO THE FAUNA OF
YUNNAN BASED ON COLLECTIONS
MADE BY J. COGGIN BROWN, B.Sc.,

1909—1910

INTRODUCTION.

*By J. COGGIN BROWN, B.Sc., F.G.S., Geological Survey of
India.*

The collections which form the subjects of these reports were made for the most part in the western districts of the province of Yunnan, in the years 1909-1910.

Yunnan is the most westerly province of the Chinese Empire, and comprises an area of about 150,000 square miles lying roughly between the 21st and 29th degrees of latitude north of the equator, and between the 98th and the 106th degrees of longitude east of Greenwich. It is bounded on the west by Burma, on the south by Tongking, on the east by the provinces of Kuang-si and Kwei-chou and on the north by the province of Ssu-chuan and by Tibet. The whole province is exceedingly mountainous, and its western part is sculptured by a series of great rivers, the Shweli, Salween, Mekong, and upper waters of the Black and Red rivers of Tongking. The basins of these rivers are separated by high mountain ranges, which towards the north-west often attain a height of 15,000 to 20,000 feet whilst the lowest river valleys have an elevation of about 7,000 or 8,000 feet. Orographically this region is connected with Western Ssu-chuan and Tibet, and it is not surprising to find a Tibetan mammalian fauna extending into it.¹ The climate is colder here than in other parts and snow is liable to fall at any time. Many of the mountain ranges are bare, but large forests of fir, cedar and other trees exist in places. Towards the south the heights decrease, until in the extreme south the tops of the hills run down to as low as 5,000 feet, and the bottom of the river valleys are sometimes below 2,000 feet. At the same time there are many exceptions to this rule and peaks of over 11,000 feet are known in the south-west. Further to the east the country opens out, and becomes more plateau-like, there are larger stretches of level ground and the ascents to the hill tops are not so steep or extended. At the same time it must not be supposed that this part of the province is not mountainous, though it is less so than the more western parts. Large plains of

¹ See "On the collection of mammals brought from Yunnan by Prince Henry of Orleans," by E. de Pousargues. Appendix B in "From Tonkin to India," by Prince Henri d'Orleans. English translation by Hamley Bent, London, 1898.

fluvial and lacustrine origin, often containing lakes and surrounded on all sides by mountains, prevail over this area and have been estimated to comprise one-fifteenth part of the province and to contain nearly half of the population. The general elevation of the plains may be taken as 5,500 feet with the mountain tops reaching another 3,000 or 4,000 feet above them.

The climate of these regions is excellent. During the dry season which lasts from November to May, there is no great heat. In the winter months frost is common at night, but snow rarely falls and all through the day the weather is usually bright and pleasant. The general precipitation of the rainy season, which lasts from June to September, is high, though the actual rainfall varies much locally. Long intervals of fine weather are, however, frequent enough in the rains. The plains of the west are all intensely cultivated, highly organised systems of irrigation bring the water from the mountain sides on to the fields, and incidentally prove a means of destruction of the young fish, which are swept down on to the fields and easily secured by the people. The principal crop is rice, which is reaped in October, after which the fields are planted again with the winter crops of poppy, wheat, beans and peas. Maize, hemp, sesamum and other oil producing seeds, tobacco, and in the warmer parts, sugar-cane and tea are also grown. Many of the mountain ranges have been denuded of all large trees, and are now covered with grass and bracken, forming admirable breeding grounds for pheasant, partridge and other game birds, though these are largely kept in check by foxes and various birds of prey.

In the more isolated mountain districts, the slopes are covered with pine woods, and further southwards with trees of a more tropical kind. A recent writer has well remarked, "To a traveller accustomed to the vast jungles of Burma, Yunnan would appear a bare country, but it would seem well wooded when compared to the barren hills of the north-west frontier of India."¹

Evergreen tropical forests exist in the extreme south-west, but further north along the frontier they give place to the evergreen temperate forests which characterise some parts of the Northern Shan States and of the Kachin Hills. In the extreme east of Yunnan and also in small isolated areas about the Burma-China frontier, limestone plateaux are found, which are dry and barren, owing to underground circulation of the water.

The border between the hilly areas of Upper Burma and Yunnan is purely a political and administrative one, ethnographically there is little difference between the indigenous tribes on either side, whilst the classical researches of Anderson have shown that the fauna is much the same. In the same way, north-western Yunnan belongs to the Tibetan region, and southern Yunnan has nothing to distinguish it geographically from those parts of the Southern Shan States and Upper Tongking which it adjoins.

¹ See "Yunnan, the link between India and the Yangtze," by H. R. Davies, pp. 311.

Mammals are by no means common in Yunnan owing to the destruction of the forests and food supplies, and to the extermination of the larger species by hunters. Few opportunities for collecting them arose.

Fishes are plentiful in the larger rivers and lakes, in the smaller streams they are rare, owing to the enterprise of the Chinese. Lake Erh-hai, from which various specimens were obtained, is a picturesque sheet of water 30 miles long and from 5 to 7 miles broad, bounded on the east by low bare hills, and on the west by a narrow but highly cultivated plain which quickly gives place to the Ts'ang Shan mountains rising to 14,000 feet above the sea. This plain contains the city of Ta-li Fu (Long. $100^{\circ} 5'$, Lat. $25^{\circ} 42'$), at an elevation of 6,900 feet above the sea. Along the greater part of the western shore the fields come down to the water's edge, but in places the waves beat up on to extensive shell banks which are largely made up of the remains of *Margarya*. Water-weeds flourish for many yards out from the shore and provide food and shelter for various forms of aquatic life. Fish are very plentiful and fleets of junks are always engaged in netting them. In the shallow waters near the shore, the smaller kinds are caught by the aid of a trained diving bird which appears to be a kind of cormorant. The fishing industry is in the hands of the Minchia, a tribe of aborigines who inhabit the Ta-li Fu plain. All round the shore wading birds find their food, while ducks of many kinds are to be seen on the waters. In the outlet of this lake near Hsia-kuan almost the only sponges found in Yunnan up to the present, are to be obtained. They consist of small rounded or irregular growths of a brilliant green colour, which grow on pieces of stone, wood or old shells.

In Western Yunnan insect life is not very abundant, probably on account of the temperate climate, but further southwards a great variety prevails.

Few reptiles were seen, the specimens which were obtained coming mainly from the rocky lava-covered downs of the Tengyueh district. Batrachians are common on the flooded fields in the early part of the year. The Salamander *Tylototriton verrucosus*, Anderson, is common in damp ditches and old walls around Tengyueh.

I wish to express my thanks to Dr. N. Annandale, Superintendent of the Indian Museum, who supplied me with a complete collecting outfit and through whose kind offices I was given a grant of Rs. 500 to meet expenses, without which it would have been impossible to have carried out this work.

LIST OF PRINCIPAL PLACES AND DISTRICTS FROM WHICH
SPECIMENS WERE COLLECTED.

Name.	District.	Longitude E.	Latitude N.	Elevation (feet above sea level).
Bhamo	In Upper Burma	97° 13'	24° 15'	361
Tengyueh ..	..	98° 33'	25° 2'	5,365
Yung-chang Fu ..		99° 5'	25° 7'	5,400
Chu-tung	Yung-ping Hsien	99° 26'	25° 27'	5,500
Yang-pi ..		99° 53'	25° 38'	5,200
Hsia-kuan	Ta-li Fu	100° 6'	25° 35'	6,700
Ta-li Fu	..	100° 5'	25° 42'	6,800
Yunnan Fu ..	..	102° 45'	25° 2'	6,400
Shan Kuan	Ta-li Fu ..	100° 9'	25° 55'	6,800
Pu-piao	Yung-chang Fu ..	98° 58'	25° 2'	4,600
Ma-chan-kai ..	Tengyueh	98° 30'	25° 20'	6,000
Pe-lien	Tengyueh ..	98° 34'	25° 11'	5,800
Ku-tung-kai	Tengyueh ..	Very close to Ma- chan-kai.		6,000
Lung-ling ..		98° 43'	24° 37'	5,100
Lahsa		97° 53'	24° 25'	4,500
Lo-po-ssu-chuang or Mong Hum.		98° 15'	24° 42'	5,100
Mong Wan or Lung-chuan	..	97° 59'	24° 20'	3,100
Man Hsien		97° 48'	24° 30'	2,800
Nan Tien or Mong Ti ..		98° 22'	24° 52'	3,800
Mong Hsa		99° 32'	23° 43'	4,550
Mong Pan	..	100° 23'	23° 7'	5,500
Lu-shui-ho ..	Hui-li Chou (in the province of Ssu- chuan).	102° 3'	26° 15'	6,200 ?
Kuan-ping ..	Yun-lung Chou ..	99° 31'	25° 51'	7,100
Ta-lu ..	Yung-pe Ting	100° 50'	26° 37'	7,800
Ta-shui-chai ..		A village in the Lo-po- ssu-chuang valley.		3,900
Wei-yuan Ting ..	..	100° 44'	23° 30'	3,200
Yun-Chou ..	..	100° 6'	24° 27'	3,800
Ssu-mao	..	101° 2'	22° 45'	4,900
Ching-tung Ting ..		100° 57'	24° 27'	3,900

Note.—With the exception of the two places noted, all the localities are situated within the province of Yunnan.

PART I.—SPONGES AND POLYZOA.

By N. ANNANDALE, D.Sc., F.A.S.B., Superintendent,
Indian Museum.

SPONGES.

1. *Spongilla* (*Euspongilla*) *proliferens*, Annandale.

A small dried specimen on a piece of stick from a lake full of weeds at Mong Pan (alt. 5—6,000 feet), W. Yunnan. This species was also taken by Mr. Coggin Brown at Prome in Upper Burma.

2. *Spongilla* (? *Euspongilla*) *yunnanensis*, sp. nov.

Sponge hard, coherent, light, forming small rounded masses of a dull greenish colour (dry); the surface smooth; no branches; the oscula conspicuous, level with the surface, circular, of moderate size, with well-defined borders; the external membrane adhering closely to the sponge, stretched over a con-



FIG. 1.—Skeleton spicules of *Spongilla yunnanensis*, Annand.

siderable part of each osculum; an ill-defined basal chitinous membrane present.

Skeleton moderately loose, not very regular; the radiating fibres well defined but slender; the transverse fibres distinct, situated somewhat widely apart; a considerable amount of spongin present.

Spicules.—Skeleton spicules (fig. 1) smooth, sharp, moderately slender, measuring on an average 0.246×0.016 mm., as a rule nearly straight but not infrequently bent at an angle. No flesh spicules.

Gemmules not observed.

Habitat.—South outlet of Lake Ta-li Fu (Erh-hai), Yunnan, W. China; alt. 6,900 feet. Specimens taken at the beginning of March, 1910.

It is always dangerous to describe specimens of Spongillidæ without gemmules as the types of species, but *S. yunnanensis* resembles *S. philippinensis* so closely in general structure that the two species must be closely allied. The former is distinguished by its smooth spicules and stronger skeleton. The type specimen measures $35 \times 35 \times 40$ mm. and is attached to a small stone.

3. *Spongilla* (? *Stratospongilla*) *coggini*, sp. nov.

Sponge not very hard, fragile, tomentose, of a brilliant green colour, forming irregular masses of moderate size, occasionally with short flattened branches; the oscula inconspicuous, usually situated in depressions on the surface; external membrane closely adherent to the sponge; a well-defined but delicate chitinous basal membrane present.

Skeleton close but not very coherent, forming an almost regular net-work with comparatively small meshes; radiating and transverse fibres of almost equal diameter; very little spongin present.

Spicules.—Skeleton spicules (fig. 2) moderately stout, measuring on an average 0.272×0.02 mm., pointed or rounded at the ends, as a rule straight or nearly straight; their surface minutely but not closely spined, the spines straight, becoming closer and slightly longer near the extremities, which usually

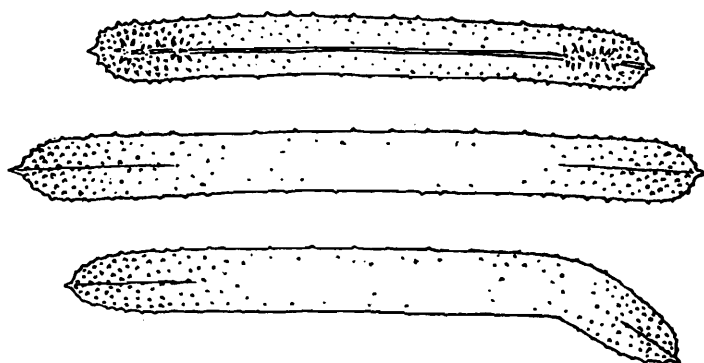


FIG. 2.—Skeleton spicules of *Spongilla coggini*, Annand.

terminate in a single spine of larger size than any of the rest.

Gemmules of moderate size, few in number, flattened at the base, dome-shaped above, with a central indentation or concavity; their chitinous coat thin and brittle, covered by a delicate outer membrane in continuity with the basal membrane of the sponge; no granular or cellular pneumatic coat; no foramen; no gemmule spicules.

Habitat the same as that of *S. yunnanensis*, together with which this species was taken.

The specimens of *S. coggini* vary considerably in size, but the largest does not measure more than $50 \times 40 \times 38$ mm. There are a great many of them, the majority being evidently complete. Many small stones and dead *Corbicula* and *Margarya* shells are included in their substance. I can find no trace of microscleres, but the gemmules seem to be fully formed, their outer coat being covered with diatoms, organic débris and small fragments of silica apparently of natural shape.

S. coggini is evidently a close ally of *S. clementis*, which was discovered, together with *S. philippinensis*, in Lake Lanao in the Philippines. *S. clementis*, however, has smooth skeleton spicules and the gemmule is armed with microscleres. It is interesting that the two sponges found in Lake Ta-li Fu should be so like the two from Lake Lanao, but our knowledge of the fauna of both lakes is still incomplete.

POLYZOA.

? *Plumatella javanica*, Kraepelin.

A dried specimen from Mong Pan, taken together with the specimen of *S. proliferens* referred to above, appears to belong to this form, which is common in northern India and Burma.



MISCELLANEA.

REPTILES.

NOTES ON THE DARJILING SKINK (*Lygosoma sikkimense*).—On several occasions during the "rains" I have found small lizard's eggs hidden in little pockets in the damp moss on tree-trunks near Kurseong, without being able to assign them to any species. There can now be no doubt that their parent is *Lygosoma sikkimense*. As most skinks are ovoviviparous, the fact is interesting. Two clutches of four eggs each were found at an altitude of 4,700 feet in the last week of June. Those of one were allowed to become dry, and shrivelled up. The embryos in them were in an early stage of development. The other clutch was brought alive to Calcutta and apparently lived for about a fortnight, without hatching. The eggs were dissected on July 12th and found to contain perfectly formed little lizards, dead but not decomposed. They had a stiff but not calcareous white shell and measured 10 mm. $\times$ 6 mm., the ends being equally rounded. The young lizards had bright red tails and measured about 37 mm. when stretched out.

I may here state that I obtained last year a specimen of Stoliczka's "*Mococa sacra*," the type of which is in the collection of the Indian Museum, from the top of Paresnath Hill in Chota Nagpur. An examination of the two specimens, which must have been found in closely adjacent spots, shows beyond a doubt that the species they represent is identical with *Lygosoma sikkimense*, as Boulenger stated it to be. But I have been able to obtain no evidence of the occurrence of this lizard in any locality intermediate between the Himalayas and Paresnath, which is separated from them by the whole breadth of the Ganges valley but is the only mountain in Bengal proper that reaches an altitude of over 4,000 feet.

N. ANNANDALE,
Superintendent, Ind. Mus.

INSECTS.

COCKROACHES AS PREDATORY INSECTS.—As actual records of cockroaches acting as predatory insects appear to be rare, the following note has some biological interest. On the evening of June 9th, during a heavy downpour of rain, numerous termites flew into my dining room in Calcutta and were borne to the floor by the currents of air set up by the electric fan. As they lay struggling many of them fell a prey to a lizard (*Hemidactylus flaviviridis*), while others were devoured by cockroaches (*Periplaneta*

americana). Each cockroach stood over one of the termites with its legs spread out and firmly planted and, seizing the struggling insect in its jaws, began to gnaw the abdomen. If disturbed the cockroach carried the termite away in its mandibles, making no use of its legs in seizing, holding or carrying the prey. Sometimes the whole body except the wings was devoured, sometimes only the abdomen. The termite lived for a considerable time after being attacked.

N. ANNANDALE,
Superintendent, Ind. Mus.

NOTE ON *Ædeomyia squammipenna*,¹ ARRIBALZAGA.—At the latter part of December, 1909, I paid a visit to Bhogaon and Katihar in the Purneah District, N. Bengal, and while I was engaged in examining the trunks of old mango trees in quest of Ascalaphid larvæ, my attention was attracted by some small insects which took to flight on the tree trunks being touched. I could not at first discover what these insects were, as I could not notice anything moving about on the portion of the bark before me. After a closer examination I discovered that several specimens of the above species of mosquito were resting on the bark and as their colour so much resembled the dirty colour of the tree bark, it rendered it difficult to see them. Apparently they took shelter on these old trees as a kind of protection from any injury. I examined younger trees with the bark comparatively smooth, but failed to find any specimens.

Although these mango trees are quite close to a house I found no specimens in the house at Bhogaon, neither by day nor at night.

Mr. Theobald states that it inhabits houses and bites, but according to Dr. Lutz it has not been observed to sting in South America. I found 6 females and 8 males resting on mango tree trunks at Bhogaon and 4 males resting on a wall inside a house by day at Katihar. All these specimens agree with the specimens in the Indian Museum collection which have been examined by Mr. Theobald. They also agree with Theobald's description. This species has previously been recorded from British Guiana, Brazil, Argentine, Madras, and Perak (*Theobald*), and the Museum possesses two ♀ specimens, one from base of Dawna hills, Lower Burma, "taken in bungalow," 2-iii-08 (*Annandale*), and the other at light on board ship, 4 miles off Tuticorin, S. India, 25-v-08 (*C. Paiva*). This species appears to be rare in India.

C. PAIVA,
Assistant, Ind. Mus.

NAMED SPECIMENS OF CHRYSOMELIDÆ IN THE INDIAN MUSEUM.—By request of the Superintendent I have examined

¹ Theobald, *Monogr. Culicid.*, ii, p. 219 (1901).

the Chrysomelidæ belonging to the divisions Eupodes, Camptosomes and Cyclica in the collection of the Indian Museum, and have drawn up the following list. In preparing it I have followed Jacoby's volume on the Chrysomelidæ of the "Fauna of British India," and have not attempted to identify the species not referred to therein. It is to be hoped that the list, though not exhaustive, will be of some use to students of geographical distribution by placing in their hands a catalogue of named specimens in the collection of the Indian Museum.

The numbers quoted after the name of each species are those of the "Fauna" volume on the Chrysomelidæ.

EUPODES.

Subfamily SAGRINÆ.

Sagra femorata, Drury (1).

Locality.—Mysore State, S. India.

It is distributed throughout India and China extending to Borneo and Java.

Sagra carbunculus, Hope (8).

Localities.—Mungphu and Kurseong, E. Himalayas (*Lynch*).

Also recorded from Sylhet, Assam. It is apparently confined to N. E. India.

Sagra multipunctata, Jac. (10).

Locality.—Sibsagar, Assam.

Jacoby records this species from Bhamo, Upper Burma.

Subfamily DONACINÆ.

Donacia æraria, Baly (12).

Geographical distribution.—India, Burma, Ceylon, Malay Peninsula, (?) Japan.

Jacoby doubts whether this insect has in reality the great geographical distribution attributed to it by Baly. All the specimens in the collection of the Indian Museum are from Calcutta. These were caught at light, 10-xii-07 (*Mus. collr.*).

Donacia recticollis, Jac. (14).

Locality.—Calcutta, 10—20-iii-07 and 25-vi-07 (*Mus. collr.*).

Also recorded from Berhampur District in Bengal.

Subfamily CRIOCERINÆ.

Lema globicollis, Baly (32).

Localities.—Bangalore, S. India (*J. Cameron*). Ranchi (*W. H. Irvine*) (*det.* Jacoby). Mandar, Bengal (*det.* P. Cardon). Allahabad, United Provinces, 14-viii-09 (*Lord*).

Lema lacordairei, Baly (38).

Localities.—Sibsagar, Assam (S. E. Peal). Calcutta, 7-vi-07 (*Mus. collr.*). Yunnan (? J. Anderson).

Jacoby records it from Southern India, Malabar and Burma. Evidently this species has a wide geographical distribution.

Lema coromandeliana, Fabr. (41).

Localities.—Calcutta. Bangalore, S. India (J. Cameron). The Andamans (*det.* Jacoby).

Some of the Calcutta specimens were obtained in October and November 1907 (*Mus. collr.*), and some in March 1907 (N. Annandale).

Also recorded from Ceylon, Sumatra and Java.

Lema atkinsoni, Jac. (46).

Locality.—Khulna, Lower Bengal, 10-iii-07 (J. Caunter).

Jacoby records it from Mungphu in Sikhim.

Lema palpalis, Lacord. (50).

Locality.—The Andamans (*det.* Baly).

Also recorded from Bengal, Western India, Sumatra and Java.

Lema impotens, Lacord. (65).

Localities.—Calcutta. Kurseong, E. Himalayas (*det.* Jacoby).

It has not been recorded from any other locality.

Lema lycaon, Jac. (84).

Locality.—Dum-Dum, near Calcutta, 29-viii-09 (Lord).

Also recorded from Belgaum, Bombay.

Lema lateralis, Jac. (90).

Locality.—Siliguri, base of E. Himalayas, 29-vi-06.

It has not been recorded from any other definite locality.

Lema bimaculata, Baly (103).

Locality.—The Andamans (*det.* Baly).

Apparently confined to the Andamans.

Lema quadripunctata, Oliv. (104).

Localities.—Sibsagar, Assam (S. E. Peal). Darjiling, E. Himalayas. N. Borneo. Tavoy. Dunsiri Valley, Upper Assam (Godwin-Austen).

Also recorded from Ceylon, Burma, the Andamans, Sumatra Java.

Lema femorata, Guérin (105).

Localities.—Khasi Hills, Assam (1,000 to 3,000 ft.).

The range of this species extends to Sumatra and Borneo.

Lema terminata, Lacord. (110).

Localities.—Calcutta. Ranchi, Chota Nagpur.

Also recorded from Coromandel.

Lema mandarensis, Jac. (132).

Locality.—Mandar, Bengal (*det.* P. Cardon).

Also recorded from Mahé in Malabar.

Lema nigricollis, Jac. (134).

Localities.—Sikhim (*E. T. Atkinson*). Buxar Duars, base of E. Himalayas.

Also recorded from Assam; Ruby Mines, Burma.

Crioceris impressa, Fab. (139).

Localities.—Calcutta, 1-vi-09. Purneah District, Bengal. Paresnath, W. Bengal, 4,000 ft., 12-vi-09 (*Annandale*). Rajmahal, Bengal, 6-vii-09 (*Annandale*). Siliguri, base of E. Himalayas, 18-vii-09. Damukdia Ghat, Bengal, 22-vii-09. Cachar and Sib-sagar, Assam (*S. E. Peal*). Khasi Hills, Assam (*Godwin-Austen*). Dunsiri Valley, Upper Assam. Sikhim. Sureil, Darjiling (*Alcock*). Yunnan. Shan Hills, Upper Burma (*J. C. Brown*). The Andaman and Nicobar Islands.

It is also recorded from China, the Malay Archipelago including the Philippines, Siam and Ceylon.

Crioceris semipunctata, Fabr. (140).

Locality.—Dehra Dun, base of W. Himalayas.

Also known from Ceylon and Java.

Crioceris semicostata, Jac. (148).

Locality.—Lebong, Darjiling, E. Himalayas, 5,000 ft., 1-x-08 (*H. M. Lefroy*).

Jacoby records it from Manipur only.

Crioceris quadripustulata, Fabr. (150).

Localities.—Sikhim. Sib-sagar, Assam, August 18 (*S. E. Peal*).

Also known from Tenasserim, Siam and Java.

Crioceris cruciata, Guér. (154).

Locality.—The Nilgiris.

This species has not yet been recorded from any other locality.

Pseudolema suturalis, Jac. (160).

Locality.—Mandar, Bengal (*det.* P. Cardon).

Also known from the Nilgiris.

CAMPTOSOMES.

Subfamily CLYTRINÆ.

Labidostomis humeralis, Schneider.

Locality.—Afghanistan.

All the specimens in the Museum collection are from Afghanistan.

Merilia lunulata, Fabr. (177).

Locality.—Bangalore (*J. Cameron*) (*det.* Jacoby).

Also known from Madras, Coromandel.

Miopristis bimaculata, Jac. (178).

Locality.—Pusa, Bengal (*Pusa coll.*).

Recorded by Jacoby from Chapra, Bengal.

Pseudoclytra plagiata, Duviv. (181).

Locality.—Mandar, Bengal (*det.* P. Cardon).

Also recorded from Madras.

Gynandrophthalma crassipes, Duviv. (199).

Locality.—Konbir, Bengal (*P. Cardon*).

It has been recorded from Konbir only.

A specimen labelled "type" is in the Museum collection.

Ætheomorpha nigropicta, Lefèv. (223).

Locality.—Calcutta, 1-vi-09.

Also known from Mandar, Bengal; Tranquebar, Kanara, Belgaum and Ceylon (*det.* Jacoby).

Aspidolopha rugosa, Jac. (246).

Locality.—Mungphu, Darjiling district.

Has not been recorded from any other locality.

Aspidolopha melanophthalma, Lacord. (254).

Localities.—Calcutta, 1-vi-09, 20-ii, 11-iii, 4-ix, 1907. Purneah, N. Bengal. Khulna, Lower Bengal, 11-viii-07 (*J. Caunter*). Rajmahal, 31-vii-07. Siliguri, base of E. Himalayas.

Also known from Tenasserim.

Epimela indica, Duviv. (257).

Locality.—Mandar, Bengal (*P. Cardon*).

Also recorded from Konbir-Nowatali, Tetara.

The specimens were probably identified by the author of the species.

Clytrasoma palliata, Fabr. (264).

Localities.—Bangalore, S. India, 28-viii-76. Kulu, W. Himalayas. Maldah, Bengal. Jhelum Valley (*det. Baly*).

Clytra succincta, Lacord. (267).

Localities.—Waltair, Madras (*E. P. Stebbing*). Mysore, Bangalore (*J. Cameron*). Karachi (*W. D. Cumming*).

It has also been recorded from Bengal; the range extends to China and Java.

Clytra lefevrei, Jac. (271).

Locality.—Mandar, Bengal (*P. Cardon*).

Also known from S. Bombay, Kanara, the range extending to the Nilgiris and Malabar.

Clytra insularis, Lefèv. (272).

Locality.—The Andamans.

It has been recorded from the Andamans only.

Clytra orientalis, Lefèv. (275).

Locality.—Bangalore, S. India.

Known from Bangalore only. Probably identified by the author of the species.

Diapromorpha quadripunctata, Jac. (287).

Locality.—Lahore, Punjab, 8-v-08 (*N. Annandale*).

Also known from the Nilgiris, Kanara, Travancore and Ceylon.

Diapromorpha dejeani, Lacord. (288).

Localities.—Soondrijal, Katmandu and Chonibal in Nepal. Sikhim. Bhim Tal, Kumaon, 4,500 ft., 25-ix-07.

Also recorded from Coromandel and the Malay Archipelago.

Diapromorpha melanopus, Lacord. (291).

Localities.—Calcutta. Rajmahal, Bengal, 5-vii-09 (*Annandale*). Hughli, Bengal, 6-ix-09 (*J. B. Richardson*). Kankandiggi, Sundurbunds, 21-viii-09 (*J. T. Jenkins*). Berhampur, Bengal. Birbhum, Bengal. Mungphu and Kalimpong, Darjiling district.

Also recorded from Siam.

This species is a pest of the mango and *Litchi*. It is also a well-known tea pest in Assam, Cachar and Sylhet.

Diapromorpha pallens, Oliv.

Locality.—Sikhim.

As the specimens were identified by Baly, I include this species in the list.

Diapromorpha turcica, Fab. (293).

Localities.—Bangalore, S. India (*J. Cameron*). Mysore, 4-xi and 6-x, 1876. Trivandrum, Travancore, 13-xi-08 (*Annandale*).

Jacoby records it from Ceylon. This species is apparently confined to Southern India and Ceylon.

Diapromorpha balteata, Lacord. (294).

Locality.—Madras.

Recorded from Southern India only.

Ceratobasis nair, Lacord. (296).

Locality.—Bangalore, S. India (*J. Cameron*) (*det. Jacoby*).

Also known from Bombay, Malabar and Nilgiris.

Coptocephala dimidiatipennis, Baly (300).

Localities.—Jhelum Valley, Kashmir. Assam (*det. Baly*).

Coptocephala dubia, Baly.

Locality.—Murree, W Himalayas (*det. Baly*).

For description and other notes see *Rec. Ind. Mus.*, vol. ii, p. 406 (1908).

Subfamily CRYPTOCEPHALINÆ.

Cryptocephalus posticalis, Jac. (345).

Locality.—Bangalore, S. India (*J. Cameron*) (*det. Jacoby*).

Cryptocephalus konbirensis, Duviv. (346).

Localities.—Konbir and Mandar in Bengal (*det. P. Cardon*).

Cryptocephalus sikhimensis, Jac. (355).

Locality.—Darjiling, E. Himalayas, 7,000 ft., 8-viii-09 (*J. T. Jenkins*).

Jacoby records it from Sikhim.

Cryptocephalus pusaensis, Jac. (374).

Locality.—Pusa, Bengal (*Pusa coll.*).

Recorded from no other locality.

Cryptocephalus dimidiatipennis, Jac. (397).

Locality.—Lebong, E. Himalayas, 5,000 ft.

Also recorded from Mungphu in Sikhim.

Cryptocephalus deficiens, Suffr. (400).

Locality.—Kurseong, E. Himalayas, 4,000 ft. 6-ix-09 (*Anandale*).

Also known from Assam (*Doherty*). This species is attracted to light.

Cryptocephalus sehestedti, Fabr. (404).

Localities.—Madras (*Pusa coll.*). Goalbatham, E. Bengal, 10-vii-09 (*R. A. Hodgart*). Puri, Orissa, 21-i-08. Bandal, Hughli, Bengal, 5-vii-08 (*C. Paiva*). Dum-Dum, near Calcutta, 29-vii-09 (*Lord*).

Also recorded from Southern Bombay, Nilgiris, Malabar and Ceylon.

Cryptocephalus vittipennis, Suffr. (407).

Locality.—Calcutta (*det. Jacoby*).

Also recorded from Mussoorie, W. Himalayas, 7,500 ft., and Patna district in Behar.

Cryptocephalus tricinctus, Redtenb. (419).

Locality.—Kurseong, E. Himalayas, 5,000 ft., 21-v-06 (*Anandale*).

Also recorded from Kashmir and Mussoorie, 7,500 ft., W. Himalayas.

Cryptocephalus sexsignatus, Fabr. (425).

Localities.—Calcutta, 27-vi-08 (*J. B. Richardson*). Patna district, Behar. Rajmahal, Bengal, 31-vii-07. Gopkuda Island, Lake Chilka, N. E. Madras, 7-viii-07. Siliguri, base of E. Himalayas, 30-vi-06. Bangalore, S. India.

Also recorded from Ceylon.

Cryptocephalus analis, Oliv. (433).

Locality.—Kulu, W. Himalayas (*det.* Baly).

Also recorded from Bengal, Nilgiris, Coromandel, Tranquebar.

Cryptocephalus colon, Suffr. (445).

Locality.—Pegu, Burma.

Also known from Assam, Siam.

Cryptocephalus senarius, Suffr. (452).

Locality.—Igatpuri, Western Ghats.

Also known from Surat and Kasara.

Cryptocephalus interjectus, Baly.

Localities.—Southern India. Jhelum Valley and Murree, W Himalayas (*det.* Baly).

For description and other notes regarding this species see *Rec. Ind. Mus.*, vol. ii, p. 406 (1908).

CYCLICA.

Subfamily EUMOLPINÆ.

Nodostoma concinnicolle, Baly (538).

Locality.—Jhelum Valley (*det.* Baly).

Also recorded from Mandar in Bengal and Kashgar.

Nodostoma plagiosum, Baly (543).

Locality.—Murree, W Himalayas (*det.* Baly).

Also recorded from the Khasi Hills, Assam, and Kashgar.

Nodostoma variabile, Duviv. (583).

Locality.—Mandar, Bengal (*P. Cardon*).

Also known from Sikhim and Kurseong, E. Himalayas.

Pagria kanaraensis, Jac. (637).

Locality.—Calcutta (*det.* Jacoby).

Also recorded from S. India, Belgaum, Bombay and S. Kanara.

Scelodonta vittata, Oliv. (675).

Localities.—Berhampur, Bengal. Maldah, Bengal. Rajmahal, Bengal, 6-vii-09 (*Annandale*). Tavoy. The Andamans (*det.* Jacoby).

It has been recorded also from Bombay and Cochin China.

Scelodonta indica, Duviv. (678).

Localities.—Calcutta. Mandar, Bengal (*P. Cardon*). Konbir, Bengal.

Scelodonta dillwyni, Stephens (680).

Locality.—Rajmahal, Bengal, 6-vii-09 (*Annandale*).

Jacoby records it from Tenasserim, Borneo and Singapore.

Trichochrysea vestita, Baly (690).

Locality.—Sikhim (*det.* Baly).

Also known from the Khasi Hills in Assam, Bhamo in Burma, and Tenasserim.

Trichochrysea clypeata, Jac. (694).

There is a single specimen in the Museum collection which has no locality. Jacoby records it from Bhamo.

Aoria nigripes, Baly (701).

Locality.—Nongpoh, Khasi Hills, Assam.

Also recorded from Malabar, Burma, China, Sumatra.

Aoria bowringi, Baly (703).

Locality.—The Andamans (*det.* Baly).

Also known from Nepal, the Khasi Hills, Burma, Sumatra and Northern China.

Colasposoma albovillosum, Duviv. (768).

Locality.—Mandar, Bengal (*P. Cardon*).

Also known from Konbir, Tetara, Bengal.

Colasposoma downesi, Baly (772).

Localities.—Sikhim. Darjiling, E. Himalayas. Bangalore, S. India (*det.* Jacoby and Baly).

Also recorded from Burma.

Colasposoma metallicum, Clark (779).

Locality.—Bangalore, S. India (*J. Cameron*) (*det.* Jacoby).

Also recorded from Southern Bombay, Bhamo in Burma, the Andamans and Penang.

Colasposoma cæruleatum, Baly (781).

Localities.—Sibsagar, Assam. Dunsiri Valley, Upper Assam. Maldah, Bengal.

Also known from Southern Bombay, Ceylon, Burma and China.

Colasposoma ornatum, Jac. (791).

Localities.—Calcutta, 16-vii-07. Maldah, Bengal. Nagpur, Central Provinces.

Also known from Belgaum, Southern Bombay.

Colasposoma auripenne, Motsch. (792).

Localities.—Pusa, Bengal. Calcutta and Maldah, Bengal. Southern India. The Andamans.

The distribution extends to Burma, the Malayan subregion, Hong-Kong and China (*det.* Baly).

Colasposoma aureovittatum, Baly (793).

Localities.—Sikhim. Darjiling, E. Himalayas.

Jacoby records it from Assam.

A variety recorded from the Andamans in the collection has been identified by Baly.

This species extends from N. E. India to the Andamans.

As specimens of the following two species were determined by Jacoby I include them in the list, although they are not described in his volume of the "Fauna" series.

Colasposoma nitida, Fabr.

Locality.—Bangalore, S. India (*J. Cameron*) (*det.* Jacoby).

Colasposoma affine, Lefèv.

Locality —Ranchi, Chota Nagpur (*W. H. Irvine*) (*det.* Jacoby).

Abirus angustatus, Lefèv. (795).

Locality.—Southern India.

This specimen was probably identified by the author of the species.

Abirus andamansis, Lefèv. (798).

Locality.—The Andamans.

This specimen was also probably identified by the author of the species.

Pachnephorus bretinghami, Baly (801).

Locality.—Calcutta (*det.* Jacoby).

Also known from Bhamo in Burma, and Sumatra.

Eurypelta modesta, Fabr. (806).

Localities.—Calcutta. Murshidabad, Bengal.

Also known from Mysore.

Corynodes pyrophorus, Parry (852).

Localities.—Sikhim (*de Nicéville*). Darjiling, E. Himalayas. Sibsagar, Assam (*S. E. Peal*). Rungpo in Sikhim, 1,400 ft., 6-ix-09.

Also recorded from Nepal, Burma and China.

Corynodes undatus, Oliv. (854).

Locality.—Rangoon, Burma.

The range of this species is from Burma, Siam, Malacca, Penang to China. It has not been recorded from India.

Corynodes peregrinus, Fuessly (855).

This species is distributed throughout India, Ceylon, Burma, Siam and Malacca.

Corynodes amethystinus, Marshall (856).

Locality.—Igatpuri, Western Ghats, Bombay.

Also known from Kanara, S. Bombay, the Nilgiris and Wal-lardi in Travancore.

Corynodes pyrospilotus, Baly (858).

Locality.—Upper Tenasserim (*det.* Baly).

Jacoby records it from Siam.

Corynodes sheppardi, Baly (861).

Locality.—Mercara, Coorg.

Also recorded from the Nilgiris and Kanara in Bombay.

Corynodes andamanensis, Lefèv. (874).

Locality.—The Andamans.

Heminodes unicolor, Duviv. (889).

Locality.—Mandar, Bengal (*P. Cardon*).

Also known from Bombay and Burma.

S. MAULIK,

Temporary Assistant, Ind. Mus.

CRUSTACEA.

TWO BARNACLES OF THE GENUS *Dichelaspis* NEW TO INDIAN SEAS.—In my recent account of the Indian Lepadidæ (*Mem. Ind. Mus.*, vol. ii, p. 98) I described ten species of the genus *Dichelaspis* as having been obtained in the Bay of Bengal and the Arabian

Sea. Two additional species have since been taken in the Bay, namely, *D. orthogonia*, Darwin, and *D. nierstraszi*, Hoek. Both these species are fully described and figured in Hoek's account of the Cirripedia Pedunculata taken by the "Siboga" Expedition in the Malay Archipelago (1907). My specimens of *D. nierstraszi*, which through the kindness of Prof. Max Weber I have been able to compare with some of Hoek's original specimens, were found on the stem of a hydroid brought ashore in a seine-net on the beach at Puri on the Orissa coast. A single specimen of *D. orthogonia* accompanied them, while another specimen of that species was recently dredged by the "Investigator" off the coast of Burma in a depth of between 40 and 50 fathoms. Both species are common in the Malay Archipelago, and I have recently received specimens of *D. orthogonia* from Mr. J. J. Simpson, who took them on the coast of Portuguese East Africa.

N. ANNANDALE,
Superintendent, Ind. Mus.

MOLLUSCA.

NOTE ON SLUGS FROM THE EASTERN HIMALAYAS.—As a result of a recent visit to Kurseong, situated at an altitude of 4,700—5,000 feet in the Darjiling district, the following notes were made. My visit took place in the latter fortnight of June, during the rainy weather usual at that time of year.

Austenia sikkimense var. *mainwaringi*, G. A.

I found this form common on the leaves of shrubs in the jungle in the morning and evening. The colour of the living animal, which measured 25 mm. in length when fully extended, was almost black with a faint marbling on the shell lobes and occasionally with a thin brownish line on the right edge of the right shell lobe; the sole slate-grey. The visceral hump was very distinctly separated from the foot behind and appeared laterally angulate when viewed from the right side. The fresh shell was whitish and opaque at the apex, glassy and faintly tinged with brown elsewhere. The foot behind the visceral hump was relatively longer than it is in specimens preserved in spirit.

Austenia annandalei, G. A.

Godwin-Austen, *Mol. Ind.*, vol. ii, pt. xi, p. 288, pl. 128, figs. 15, 15a; pl. 130, figs. 1—1d (1910).

Two specimens of this species, which is probably by no means scarce, were obtained. One was found with its tentacles retracted, adhering tightly to a garden wall in a shady place during the day, the other was crawling in a ditch by the side of the road at dusk.

The latter was brought, the day after its capture, to Calcutta alive, but died in the act of ovipositing on the day of its arrival. Thirteen eggs were produced, but more were contained in the oviduct. They were covered with a pure white translucent membranous shell clothed with a mucilaginous coat and were ovoid or pear-shaped, the narrower end bearing a short filament in the position of a stalk. When laid each egg had a large depression on one side, but the concavity disappeared in formalin and the egg became turgid and plump. In this condition it measured, without the terminal filament, 6 mm. $\times$ 5 mm.

The shape of the living animal when in a state of repose is well shown in the accompanying figure. The upper tentacles were long and slender and the shell was almost entirely concealed. The



Austenia annandalei in the act of oviposition, $\times \frac{2}{3}$; with single egg, $\times 2$.

colour was a dark slate-grey more or less distinctly marbled with black, the shell lobe sometimes having a brownish tinge; the sole was paler grey than the upper surface and the edge of the foot was marked vertically with white; the tip of the tentacles was white. The colour of the shell was different in the two specimens, being brownish in one (as in the type), but distinctly greenish in the other.

Cryptaustenia succinea (Rve.).

This species was common in roadside ditches during the fall of rain. The animal was of a whitish colour, which darkened on the shell lobes and the tip of the foot to grey.

N. ANNANDALE,
Superintendent, Ind. Mus.

Miscellaneous Zoological Publications.

	Rs.	As.		Rs.	As.
Account of the Deep-sea Brachyura collected by the R.I.M.S. "Investigator." By A. Alcock, M.B., C.M.Z.S. ..	6	0	the R.I.M.S. "Investigator." By R. Koehler and C. Vaney ..	2	0
Account of the Deep-sea Madreporaria collected by the R.I.M.S. "Investigator." By A. Alcock, M.B., C.M.Z.S. ..	4	0	Echinoderma of the Indian Museum: Deep-sea Ophiuroidea collected by the R.I.M.S. "Investigator." By R. Koehler ..	10	0
Account of the Triaxon (Hexactinellid) sponges collected by the R.I.M.S. "Investigator." By F. E. Schulze, Ph.D., M.D. ..	16	0	Echinoderma of the Indian Museum: Shallow-water Ophiuroidea collected by the R.I.M.S. "Investigator." By R. Koehler ..	4	0
Account of the Alcyonarians collected by the R.I.M.S. "Investigator." Part I. By J. Arthur Thomson, M.A., and W. D. Henderson, M.A., B.Sc. ..	16	0	Echinoderma of the Indian Museum, Part V: An account of the Deep-sea Asteroidea collected by the R.I.M.S. "Investigator." By R. Koehler ..	12	0
Account of the Alcyonarians collected by the R.I.M.S. "Investigator." Part II. By J. Arthur Thomson, M.A., and J. J. Simpson, M.A., B.Sc. ..	20	0	Echinoderma of the Indian Museum, Part VI: An account of the Shallow-water Asteroidea. By R. Koehler ..	20	0
Aids to the identification of Rats connected with Plague in India. By W. C. Hossack, M.D. ..	0	8	Figures and Descriptions of nine Species of Squillidæ from the Collection of the Indian Museum. By J. Wood-Mason, F.Z.S., etc., edited by A. Alcock, M.B., C.M.Z.S. ..	2	0
Catalogue of Indian Crustacea. Part I.—Introduction and Brachyura Primigenia. By A. Alcock, M.B., LL.D., F.R.S. ..	7	0	Guide to the Zoological Collections exhibited in the Bird Gallery of the Indian Museum. By F. Fynn, B.A., F.Z.S. ..	0	12
Catalogue of the Indian Decapod Crustacea. Part II.—Anomura. Fasciculus I.—Pagurides. By A. Alcock, M.B., LL.D., F.R.S., C.I.E. ..	14	0	Guide to the Zoological Collections exhibited in the Fish Gallery of the Indian Museum. By A. Alcock, M.B., C.M.Z.S. ..	0	8
Catalogue of the Indian Decapod Crustacea. Part III.—Macrura. Fasciculus I.—The Prawns of the Penæus Group. By A. Alcock, M.B., LL.D., F.R.S., C.I.E. ..	7	0	Guide to the Zoological Collections exhibited in the Invertebrate Gallery of the Indian Museum. By A. Alcock, M.B., C.M.Z.S. (<i>Out of print.</i>)		
Catalogue of Indian Deep-sea Crustacea: Decapoda Macrura and Anomala in the Indian Museum. By A. Alcock, M.B., LL.D., C.M.Z.S. ..	10	0	Guide to the Zoological Collections exhibited in the Reptile and Amphibia Gallery of the Indian Museum. By A. Alcock, M.B., C.M.Z.S. (<i>Out of print.</i>)		
Catalogue of Indian Deep-sea Fishes in the Indian Museum. By A. Alcock, M.B., C.M.Z.S. ..	5	0	Hand List of Mollusca in the Indian Museum, Parts I and II, and Fasciculus E. By G. Nevill, C.M.Z.S., etc. Index, Parts I and II. By W. Theobald ..	7	4
Catalogue of Mammalia in the Indian Museum, Part I. By J. Anderson, M.D., LL.D., F.R.S. Part II. By W. L. Sclater, M.A., F.Z.S. ..	6	0	List of Batrachia in the Indian Museum. By W. L. Sclater, M.A., F.Z.S. ..	1	0
Catalogue of Mantodea in the Indian Museum, Parts I and II. By J. Wood-Mason, F.Z.S., etc. ..	2	0	List of Birds in the Indian Museum. Part I.—Corvidæ, Paradisidæ, Ptilonorhynchidæ and Crateropodidæ. By F. Fynn, B.A., F.Z.S. ..	1	0
Catalogue of Moths of India, Parts I to VII. By E. C. Cotes and C. Swinhoe, F.L.S., F.Z.S., etc. ..	5	12	List of Snakes in the Indian Museum. By W. L. Sclater, M.A., F.Z.S. ..	1	0
Echinoderma of the Indian Museum: Account of the Deep-sea Holothurioidæ collected by the R.I.M.S. "Investigator." By R. Koehler and C. Vaney ..	16	0	Monograph of the Asiatic Chiroptera and Catalogue of the Species of Bats in the Indian Museum. By G. E. Dobson, M.A., M.B., F.R.S. ..	3	0
Echinoderma of the Indian Museum: Littoral Holothurioidæ collected by			Monograph of the Oriental Cicadidæ, Parts I to VII. By W. L. Distant, F.E.S. ..	31	14

The above can be obtained from the Superintendent of the Indian Museum, Calcutta, and from Messrs. Friedlander & Sohn, 11, Carlstrasse, Berlin.

Other Publications edited and sold by the Superintendent of the Indian Museum (also obtainable from Messrs. Friedlander & Sohn) issued by the Director of the Royal Indian Marine.

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