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XVIII ON SOME LITHOBIOIDEA (CHILOPODA) FROM INDIA

By F. SILVESTRI (*Portici, Italy*).

Among the Chilopoda kindly sent me for examination by the Director of the Zoological Survey of India, there are a few species of Lithobioidea which I describe in this note, together with a species of Henicopidae that was collected at Trichinopoli and is considered the type of a new genus.

Only three species of Lithobiidae from India (including Burma) and the Malay Peninsula have been described up to date, *viz. Lithobius* (*s. s.*) *hardwickei*, Newp., from Singapore, *Lithobius* (*s. s.*) *feae*, Poc., and *Lithobius* (*Archilithobius*) *birmanicus*, Poc., both from Burma.

The specimens examined by me are referred to *L. feae*, Poc., to three new species and to a new variety.

The fauna of India appears very poor in Lithobiidae as in all tropical countries, but it is possible that careful collecting in temperate zones in the north will discover many other species.

In the few known species the small number of the ocelli of each eye is noticeable, and also the relatively small number of the joints of the antennae.

Fam. LITHOBIIDAE.

Lithobius (*s. s.*) feae, Poc.

Ann. Mus. Genova, X, p. 408 (1891).

Corpus supra fulvo-latericium, subtus fulvo-testaceum, pedibus maxillaribus fulvo-ferrugineis, pedibus testaceis articulis 2-4 macula nonnulla atro-violacea variegatis.

Caput subaeque longum atque latum; oculi ocellis magnitudine et dispositione vide fig. I, 12; antennae breves, 20-articulatae, articulis elongatis, omnibus breviter et sat dense setosis, articulo decimo fere duplo longiore quam latiore, articulo ultimo *c.* 2/3 longiore quam latiore (in exemplo alio antenna altera rigenerata breviore, 12-articulata, articulis a quarto brevioribus, articulo ultimo parum longiore quam latiore).

Pedes maxillares (fig. I, 11) subcoxarum margine antico lato, subrecte truncato dentibus 8 – 9 + 8 – 9 (vel 8 + 10).

Lamina dorsualis 6ª angulis posticis parum productis et rotundatis, laminae dorsuales 9, 11, et 13 angulis posticis gradatim magis

productis et acutis, lamina dorsualis 15 longa, aliquantum longior quam latior, postice sinuata.

Pedes primi paris spinis $\frac{0, 0, 3, 0, 1}{0, 0, 1, 3, 2}$, octavi paris $\frac{0, 0, 3, 2, 1}{0, 0, 1, 3, 2}$, paris decimi quarti $\frac{1, 0, 3, 1, 1}{0, 1, 3, 3, 2}$, paris ultimi $\frac{1, 0, 3, 1, 0}{0, 1, 3, 3, 2}$, subcoxis pedum 13-15 calcare laterali auctis, pedes 13-15 ab articulo tertio facie interna poris numerosis glandularibus instructis, ungue terminali (fig. I, 13) unguicula laterali interna (vel postica) sat longa et seta spiniformi laterali infera externa (vel antica) brevi, in pedibus 14-15 minima aucta.

Pori subcoxales 6, 7, 7, 6-7, 8, 7, 7 (6).

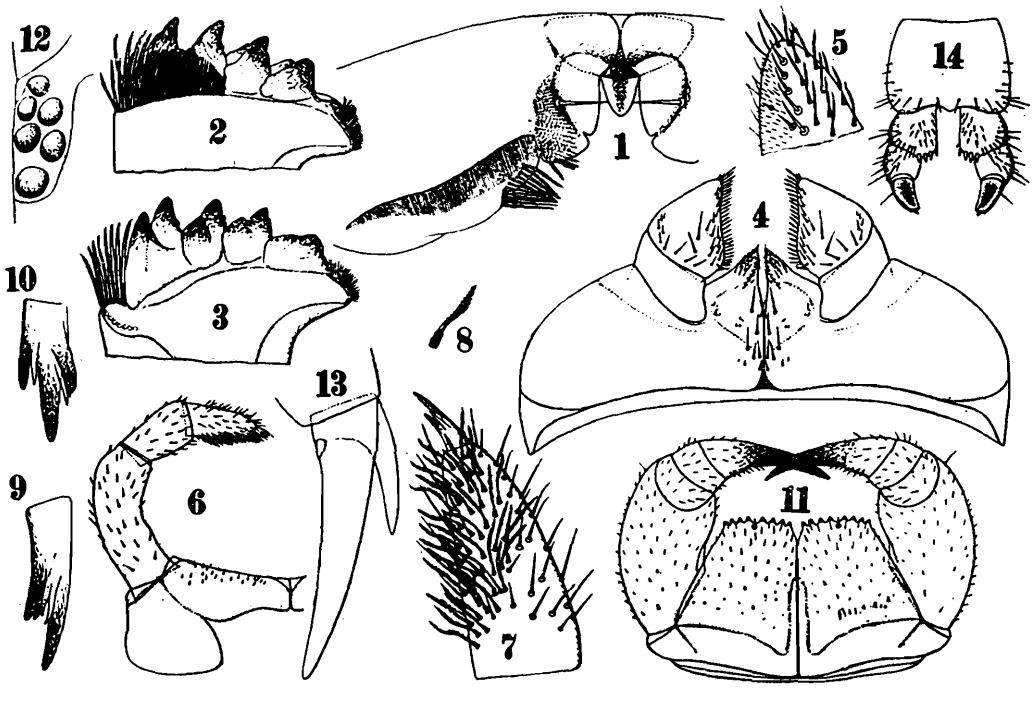


FIG. I.—*Lithobius* (*s. s.*) *feae:* 1. Labrum (parum magis quam dimidia pars); 2. mandibulae dexterae apex subtus inspectus; 3. idem supra inspectus; 4. maxillae primi paris; 5. earumdem lobi interni apex; 6. maxillae secundi paris; 7. earumdem articulus tertius cum ungue terminali; 8. seta ejusdem articuli: 9. maxillarum secundi paris unguis terminalis lateraliter inspectus; 10. idem pronus; 11. pedes maxillares; 12. oculus laevus; *O.* ocelli; *T.* Tömösvaryi organum; 13. pedum paris ultimi pars apicalis; 14. *Lithobius feae* v. *percalcarata*; feminae appendices genitales.

Appendices genitales ungue integro, calcarium utrimque quatuor, quorum internum perparvum est.

Long. corp. mm. 17, lat. 2·5; long. antennarum 6·6, pedum paris primi 3, decimi 4, ultimo 10.

Immaturus. Pori subcoxales subrotundi 5, 6, 6, 5. Long. mm. 15.

Habitat.—Rotung, alt. 1,300 ft. (Abor Exp.), under stones; Kobo, alt. 400 ft. (Abor Exp.), under bark.

Observatio.—Exempla a me ad *Lith. feae*, Poc., relata ab exemplo typico differunt pedum maxillarium dentium numero majore, antennis semper 20-articulatis, statura parum minore.

Lithobius (*s. s.*) **feae,** Poc. var. **percalcarata,** nov.

Pedes primi paris spinis $\frac{0, 0, 3, 1}{0, 0, 1, 2}$, decimi paris $\frac{0, 0, 3, 2, 2}{0, 0, 2, 3, 2}$, decimi quarti paris $\frac{1, 0, 3, 1, 1}{0, 1, 3, 3, 2}$, vel $\frac{1, 0, 3, 2, 0}{0, 1, 3, 3, 1}$.

Pori subcoxales 6, 7, 8, 7-6, 8, 8, 7, subcoxis pedum paris 14 ét 15 supra et lateraliter spina armatis.

Genitalium femineorum (fig. I, 14) unguis trilobus, calcaria utrimque 4-5, quorum internum parvum spiniforme est.

Long. corp. mm. 17, lat. 2·5, long. antennarum 6, pedum paris primi 3, decimi 4, pedum paris decimi quarti 8·6.

Habitat.—Renging, 2,150 ft. (Abor Exp.), in rotten wood; Janakmukh, alt. 600 ft. (Abor Exp.), under bark; Soom to Birch Hill (Darjiling dist.), 5,000–6,000 ft.

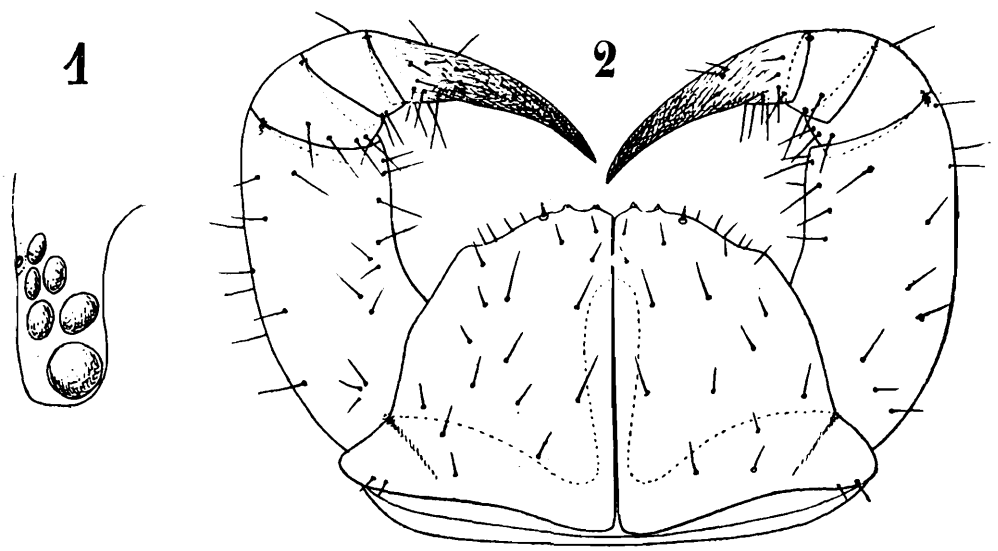


FIG. II.—*Lithobius* (*s. s.*) *kempi:* 1. Oculus laevus: 2. pedes maxillares.

Juvenes. Kobo, 400 ft. (Abor Exp.), in rotten wood, exempla duo, long. corp. 13.

Antennae 20-articulatae. Pedes maxillares dentibus 6+6; pori subcoxales 3, 5, 5, 4-4, 5, 6, 5; genitalium femineorum unguis trilobus, calcaria utrimque 4.

Observatio.—Variatio haec ab exemplis formae typicae genitalium femineorum ungue trilobo et calcaribus magis numerosis vel robustioribus distincta est.

Lithobius (*s. s.*) **kempi,** sp. nov.

Corpus testaceum ventre et pedibus parum pallidioribus.

Caput paullum longius quam latius, lateribus anticis aliquantum convergentibus; oculi ocellis 6, magnitudine et dispositione vide fig. II, 1; antennae 19-articulatae (altera certe haud integra 17-articulata), articulis elongatis, parce et breviter setosis, articulo decimo parum magis quam duplo longiore quam latiore, articulo ultimo tenui, circa quadruplo longiore quam latiore.

Pedes maxillares (fig. II, 2) antice lati, margine aliquantum convexo medio parum sinuato, dentibus 2+2.

Laminae dorsuales 6, 7, 8 angulis posticis haud productis, laminae dorsuales 9, 11, 13 angulis posticis triangularibus, acutis, retrorsum bene productis; lamina dorsualis 15 paullum latior quam longior, postice vix sinuata.

Pedes primi paris calcaribus $\frac{0, 0, 1, 1, 1}{0, 0, 0, 1, 1}$, paris decimi $\frac{0, 0, 1, 2, 2}{0, 0, 2, 2, 2}$, paris decimi quarti $\frac{0, 0, 3, 1, 0}{0, 1, 2, 1, 0}$, paris decimi quinti $\frac{0, 0, 3, 0, 0}{0, 1, 2, 1, 0}$, ungue terminali unguicula interna sat longa et unguicula externa infera minima aucto, poris glandularibus parce numerosis ab articulo quarto incipientibus.

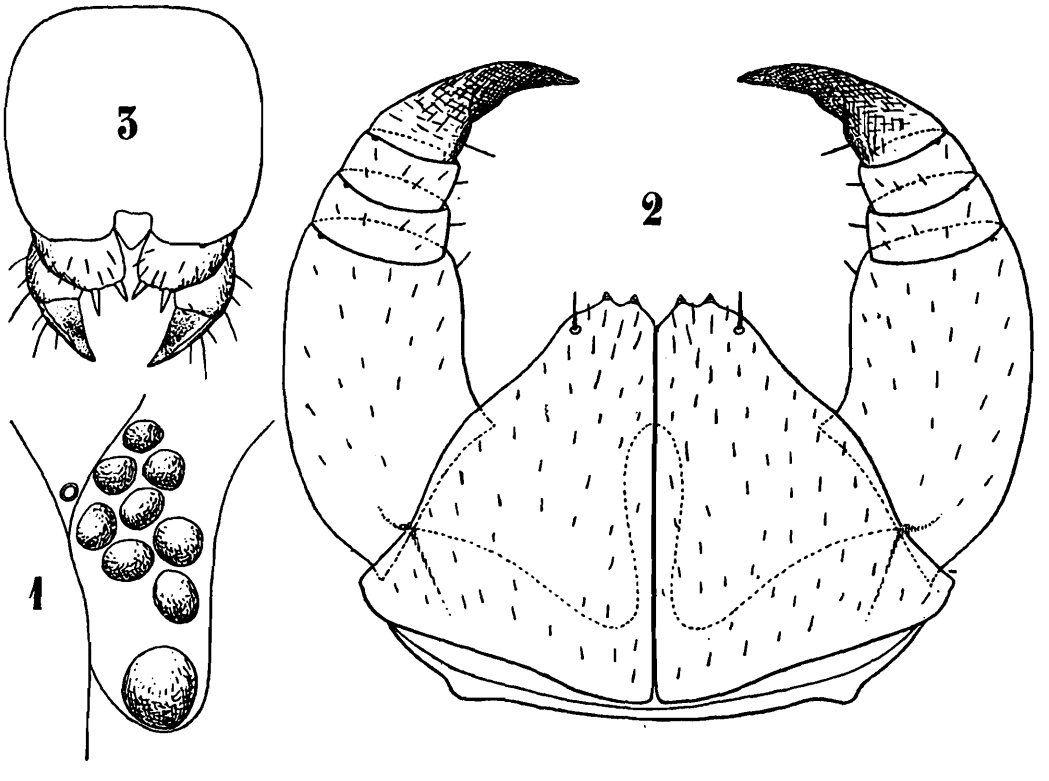


Fig. III.—*Lithobius* (*Archilithobius*) *tactus*: 1. Oculus laevus; 2. pedes maxillares; 3. feminae appendices genitales.

Pori coxales 4, 4, 4, 4.

Appendices genitales ungue distincte bilobato, lobo minore dentiformi externo, calcaribus utrique duobus robustis.

Long. corp. mm. 16, lat. 2, long. antennarum 6, pedum paris primi 3, paris decimi 4·3, paris ultimi 6·7.

Mas ignotus.

Habitat.—Rotung 1,400 ft. (Abor Exp.).

Observatio.—Species haec, quae honoris causa Clarissimo Mr. S. W. Kemp dicata est, a *Lithobius feae*, Poc. pedum maxillarium dentium, subcoxarum 12–15 pororum et calcarium appendicium genitalium numero praesertim facile distinguenda est.

Lithobius (Archilithobius) tactus, sp. nov.

Corpus subtestaceum totum.

Caput paullum latius quam longius lateribus anticis aliquantum convergentibus; oculi ocellis 9 compositi magnitudine et dispositione vide fig. III, 1; antennae 20-articulatae, articulis parum elongatis, setis numerosis brevibus instructis, articulo decimo *c.* 1/3 longiore quam latiore, articulo ultimo *c.* duplo longiore quam latiore.

Pedes maxillares (fig. III, 2) subcoxis antice augustatis, margine antico medio angulatim sinuato dentibus 2+2 et seta brevi praemarginali externa instructo.

Laminae dorsuales angulis posticis subrectis vel rotundatis, lamina dorsualis 15 aliquantum longiore quam latiore, lateribus postice aliquantum convergentibus, margine postico subrecto.

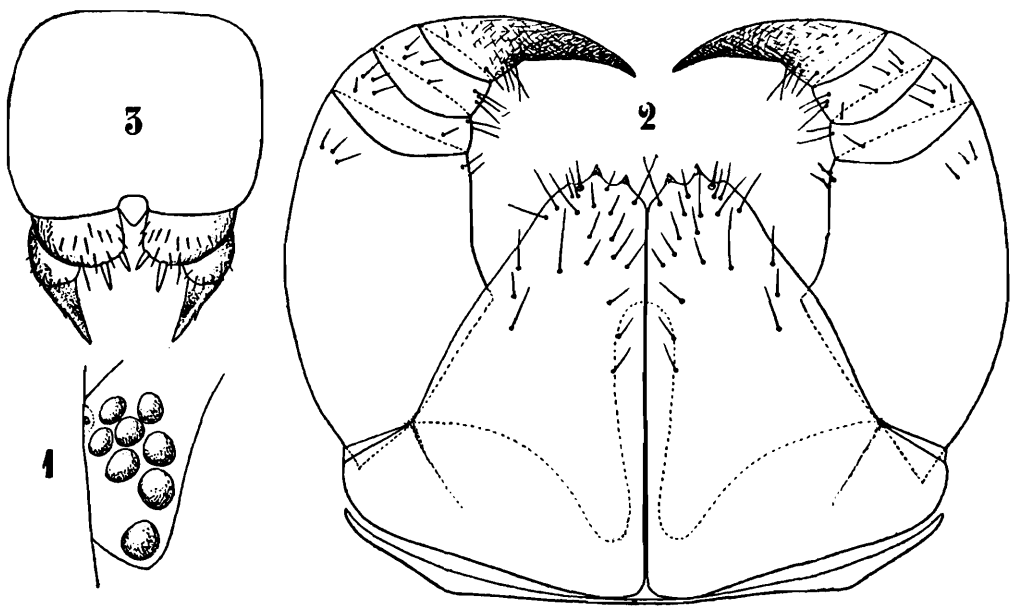


FIG. IV.—*Lithobius* (*Archilithobius*) *erraticulus*: 1. Oculus laevus; 2. pedes maxillares; 3. feminae appendices genitales.

Pedes primi paris $\frac{0, 0, 1, 2, 2}{0, 0, 2, 3, 2}$, decimi paris $\frac{0, 0, 3, 2, 2}{0, 0, 3, 3, 2}$, decimi quarti $\frac{1, 0, 3, 1, 1}{0, 1, 3, 3, 2}$, paris ultimi $\frac{1, 0, 3, 1, 0}{0, 1, 3, 2, 1}$, subcoxis pedum 12 et 13 etiam spina dorsuali instructis; pedes paris 14 et 15 ab articulo quarto interne poris glandularibus numerosis instructi, pedes paris ultimi ungue terminali unguicula interna brevi et unguicula externa minima instructi.

Pori subcoxales 3, 5, 5, 5, parvi et rotundi.

Appendices genitales feminae (fig. III, 3) breves ungue integro ad basim externe incisione spiniformi instructo, calcaribus utrimque duobus.

Long. corp. mm. 13, lat. 1·8, long. antennarum 4, pedum paris primi 2, decimi 2·6, ultimi 4·10.

Habitat.—Specimina duo vidi ex loco haud certo probabiliter ex N. Bengal cum *Mecistocephalo spisso*, Wood et *Iulidis* collecta. Var. Exemplum alium ad eamdem speciem refero ex Katihar [Purneah distr., N. Bengal (Bihar)], quod ab exemplis typicis oculi ocellis 10 et poris subcoxalibus 4, 5, 5 tantum differt.

Observatio.—Species haec a procedente magnitudine, ocellorum et pororum subcoxalium numero, genitalium femineorum appendicibus brevioribus facile distinguenda est.

Lithobius (Archilithobius) erraticulus, sp. nov.

Corpus testaceum totum.

Caput aeque longum atque latum; oculi ocellis 8, magnitudine et dispositione vide fig. IV, 1; antennae breves, 20-articu-

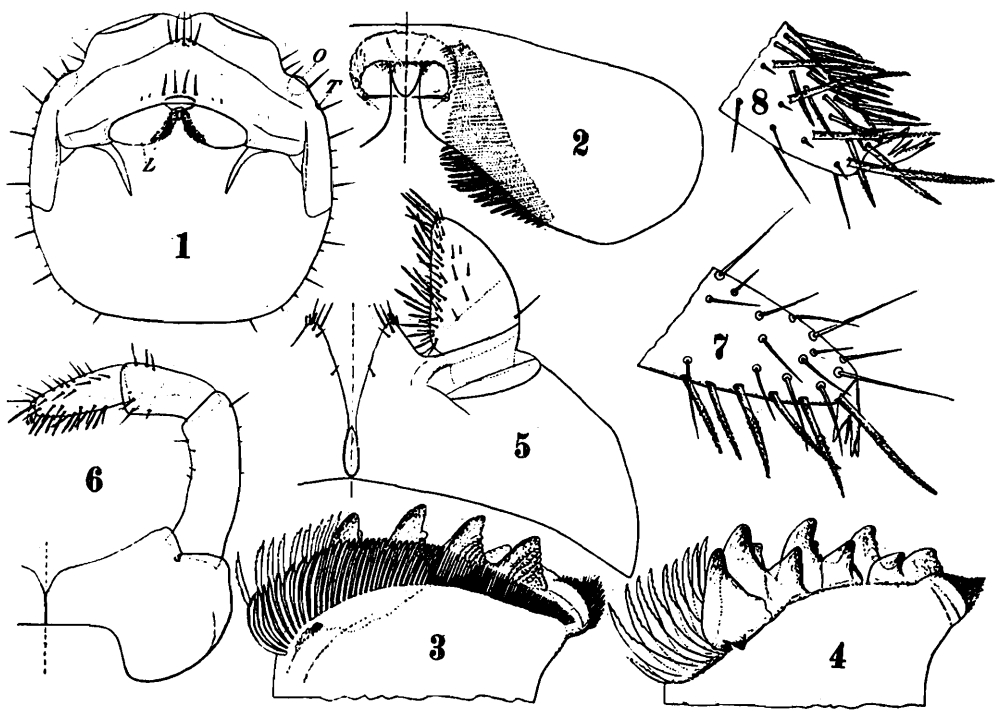


FIG. V.—*Triporobius newtoni*: 1. Caput supinum appendicibus ablatis; 2. labrum (parum magis quam dimidia pars); *O.* oculus; *L.* labrum; *T.* organum Tömösvaryi; 3. mandibulae dextarae apex subtus inspectus; 4. idem supra inspectus; 5. maxillae primi paris; 6. maxillae secundi paris; 7. ejusdem pars apicalis subtus inspecta; 8. eadem supra inspecta.

latae, articulis parum elongatis, setis sat numerosis brevibus instructis, articulo decimo fere 1/3 longiore quam latiore, articulo ultimo tenui, *c.* 2/3 longiore quam latiore.

Pedes maxillares (fig. IV, 2) subcoxis antice angustatis, margine antico medio angulatim sinuato, dentibus 2+2 et seta sublaterali externa longa aucto.

Laminae dorsuales omnes angulis posticis plus minusve rotundatis; lamina dorsualis 15 subaeque longa atque lata, margine postico paullum sinuato.

Pedes omnes tarso biarticulato, primi paris calcaribus $\frac{0,0,0,1,1}{0,0,1,2,1}$, decimi paris $\frac{0,0,2,1,1}{0,0,2,2.2}$, decimi quarti $\frac{1,0,3\ 1,0}{0,1,3,2,1}$, paris ultimi $\frac{1,0,3,2,0}{0,1,3,2,1}$, subcoxis pedum 12-13 etiam calcare supero instructis, pedes paris 14 et 15 ab articulo quarto interne poris glandularibus numerosis instructi, ungue terminali unguicula interna brevi et unguicula externa infera minima.

Pori subcoxales 2, 3, 3, 3 parvi et rotundi.

Genitalium femineorum (fig. IV, 3) unguis longus attenuatus, externe ad basim parva incisione dentiformi affectus, calcaria utrimque duo.

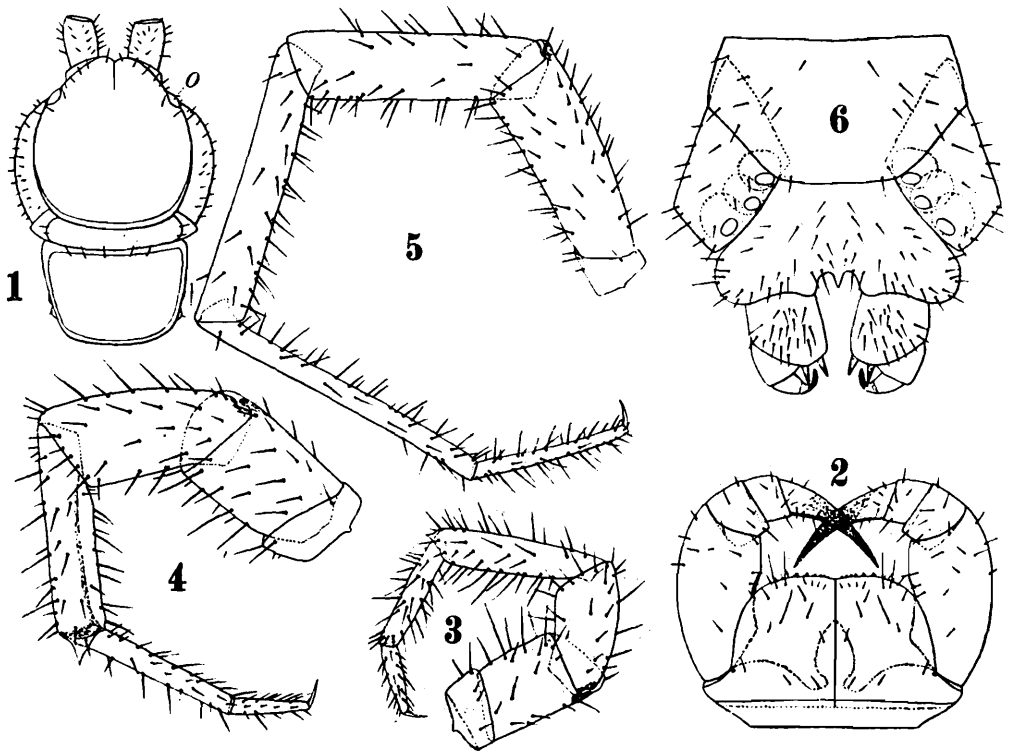


FIG. VI.—*Triporobius newtoni:* 1. Caput et trunci segmenta 1um et 2um prona; 2. pedes maxillares: 3. pes paris primi; 4. pes paris decimi; 5. pes paris ultimi; 6. feminae segmentum ultimum pediferum et segmentum genitale supina.

Long. corp. mm. 11, lat. 1·5, long. antennarum 3·5, pedum paris primi 1·30, decimi 2, ultimi 3·7.

Mas immaturus poris subcoxalibus 2, 2, 3, 2.

Habitat.—Chitral (N.W. Frontier Province, 5,000 ft., G. M. Giles legit).

Observatio.—Species haec a *L.* (*A.*) *birmanicus*, Poc. ocellorum numero et genitalium femineorum ungue integro saltem distincta est.

Fam. HENICOPIDAE.

Gen. **Triporobius**, nov.

Caput (fig. V, 1 et VI, 1) contractum laminam basalem fere omnino obtegens, lamina cephalica aliquantum longiore quam

latiore antice media longitudinaliter sulcata. Oculi ocello singulo magno compositi; Tomosvaryi organum marginale parum pone oculos situm. Antennae breves, articulis elongatis, in specie typica 17-articulatae. Labrum (fig. V, 2) profunde unidentatum; mandibulae, maxillae primi et secundi paris vide fig. V, 3-8.

Pedes maxillares (fig. VI, 2) subcoxis longis et latis, antice tantum lateraliter paullum excisis, mediis paullum sinuatis, dentibus 5+5 sat parvis armatis, ungue terminali longo acuto.

Tergita 9, 11 et 13 angulis posticis gradatim parum magis acutis, tergitum 15 subaeque longum atque latum, margine postico vix sinuato.

Stigmata in segmentis pediferis 1, 3, 5, 8,10, 12 et 14 sita.

Pedes (fig. VI, 3-5) omnes, ungue incluso, 8-articulati, setosi, spinis destituti, parium 1-13 articuli quinti apice antice in processum sat longum triangularem acutum producto, ungue terminali utrimque ad basim unguicula brevi aucto.

Pori subcoxales in segmentis pediferis 13, 14 et 15 sistentes et in pede singulo 3 adsunt rotundi, sat magni.

Appendices genitales (fig. VI, 6), ungue incluso, 4-articulatae. ungue simplici, articulo primo calcaribus duobus.

Pori anales quo magni.

Mas ignotus.

Observatio.—Genus hoc a genere *Paralamyctes*, Poc. pedibus paris 12[i] poris subcoxalibus destitutis facile distinguendum est.

Triporobius newtoni, sp. nov.

Corpus subtestaceum pedibus maxillaribus fulvo ferrugineis, pedibus ambulatoriis testaceis, tarso fulvo-ferrugineo.

Characteres ceteri in generis descriptione et in figuris manifesti.

Long. corp. mm. 17, lat. 2, long. antennarum 7, pedum paris primi 3·4, decimi 4·6, ultimi 8·9.

Habitat.—Exempla duo vidi ad Trichinopoli a Cl. Newton, cui species grato animo dico, collecto et mihi donata.

XIX DESCRIPTION OF SOME SPECIMENS OF *PLEUROTOMA CONGENER*, E A SMITH, FROM THE ANDAMAN SEA, WITH SPECIAL REFERENCE TO CERTAIN PECULIARITIES OF THE APERTURE

By E W. VREDENBURG, *B.L., B.Sc., F.G.S., etc., Superintendent, Geological Survey of India (communicated with the kind permission of the Director, Geological Survey of India).*

(Plate XII).

Pleurotoma congener, one of the most beautiful amongst the Pleurotomidae of the Indian Ocean, was first described in 1894 by Mr. E. A. Smith from specimens in the collections obtained during the cruises of H.M. Indian Marine Survey Steamer "Investigator" from the depth of 128 fathoms in the Bay of Bengal, and between 142 and 400 fathoms west of Colombo off the coast of Ceylon.

As is so frequently the case in consequence of the fragility of the aperture in the Pleurotomidae, the edge of the outer lip is missing in the original types described by Mr. E. A. Smith. Since the publication of the original description, further specimens have been obtained by the Marine Survey from the Andaman Sea (in Lat. 13° 17′ 15″N., Long. 93° 10′ 25″E.), in depths of 185 fathoms. Many of the shells are partly overgrown by organisms and were apparently dead at the time when they were dredged up, but in two of them the aperture is practically perfect and exhibits, along the outer lip, features of such a singular nature that they have been thought worthy of special notice. As the specimens differ in several details from the original type, it will be useful to give a complete description.

Pleurotoma (Gemmula) congener, E. A. Smith.

1879. *Pleurotoma coronifera*, Martin, *Tertiaerschichten auf Java*, p. 61, pl. xi, fig. 2.
1884. *Pleurotoma coronifera*, Martin, *Samml. des geol. R. Mus. in Leiden*, 1st ser., III, p. 58, pl. iv, fig. 58.
1894. *Pleurotoma congener*, E. A. Smith, *Ann. Mag. Nat. Hist.* (6), xiv, p. 160, pl. iii, figs. 4, 5.
1895. *Pleurotoma (s. sti.) coronifera*, Martin, *Samml. des geol. R. Mus. in Leiden* (new series), I, p. 38.
non Pleurotoma coronifera, Bellardi, *Moll. terr. terz. Piem. e Lig.*, 2d part, p. 34, fig. 20 (1877).

Fairly large, of a variable but moderate degree of elongation, with rather broad slightly conoidal spire measuring about five-ninths of the total height, with broad body-whorl somewhat abruptly contracted anteriorly into a rather short stem corresponding to the terminal canal.

The protoconch, when fully preserved, constitutes a remarkably beautiful object. It is slightly oblique to the axis of the remainder of the shell. It is shaped like a *Turbo*, broadly conoidal in outline. It consists of a minute, highly glazed, slightly excentric nucleus followed by four spire-whorls of which the two first are very low and very broadly conical, the two last much taller and rather strongly convex. The first whorl is smooth. The three others are covered with very delicate sharply angular ribs stretching from suture to suture, slightly curved, with forward directed concavity, and most of them very oblique and anteriorly antecurrent except on the last half of the last whorl when they become practically vertical. In some specimens the transition to the spire proper is quite abrupt, while in other cases a gradual shortening of the protoconch ribs establishes a transition into the crenulations of the sinus band. The protoconch is followed by seven and a half spire-whorls, the height of which is generally equal to two-fifths of their width or slightly more in the case of specimens with a relatively narrow spire; the maximum thickness being situated nearer to the anterior than to the posterior margin of the whorls, and coinciding with the zone of accretions to the apertural sinus.

The sutures are rather deeply incised and are surrounded by a prominent broad ridge or swelling, while another ridge of the same character, corresponding with the zone of accretions to the apertural notch, occupies a more anterior position upon the whorls. The anterior margin of the whorls forms a deeply sunken zone between the sinus ridge of one whorl and the circumsutural ridge of the next whorl, proportionately scarcely broader than that between the two ridges of one whorl; and, in many specimens, as both ridges are equally prominent, the spire usually assumes the appearance of a cone very evenly encircled at close intervals, the grooves being of about the same average width as the ridges. In a few specimens, the circumsutural ridge is decidedly less prominent than the sinus band, and the spire thereby acquires somewhat more of a stepped appearance. Both ridges are bifid, the two component spiral threads being both equal in the case of the sinus ridge, while, in the case of the circumsutural swelling, the more anterior thread, to a degree varying in different specimens, is more prominent than the posterior thread which either immediately adjoins the suture, or is separated from it by one or two fine raised spiral lines. Three raised spiral lines or minor threads, of which the more posterior one is usually much thinner than the two others, are observed along the floor of the groove separating the two main ridges of each whorl Two more spiral threads may occur along the depressed zone anteriorly to the sinus ridge, or else, there may be but one, as the more anterior of the two may

be entirely concealed by the posterior margin of the following whorl. The interval between these two anterior threads may carry an additional fine revolving line. Two more or less distinct revolving lines may bound the sinus ridge externally to its two main threads, one on either side. The sinus ridge is crenulated at close and even intervals by short straight ribs, practically vertical or very slightly oblique and anteriorly retrocurrent, swelling into blunt granules across the two main spiral ridges. The circumsutural ridge is also denticulated, but at less regular intervals, by thickened lines of growth. The course of the lines of growth is steeply antecurrent or practically normal to the posterior suture, antecurrent at about 45° to the anterior suture, strongly retrocurrent from either side to the sinus ridge.

The broad body-whorl measures from nearly five-eighths to nearly two-thirds of the total height. Anteriorly to the sinus-ridge it contracts with a hemispherical or somewhat flattened convexity, connected by a rather broad and rather shallow concavity with the rather short terminal stem, which is rather bluntly truncated and very distinctly dorsally deflected at its extremity. The ornaments of the last spire-whorl are continued upon the corresponding portion of the body-whorl, with a tendency towards an increase in the number of minute spiral raised lines of the lowest order. In those specimens in which the spire-whorls exhibit two main spiral threads anteriorly to the sinus ridge, the convexity of the base, anteriorly to the level of the suture, carries two more main spiral threads. In those specimens in which there is only one main thread clearly visible on the anterior part of the spire-whorls, the next one, concealed by the suture, becomes clearly disclosed at its termination, and is followed on the anterior convexity by only one more main thread. Consequently, anteriorly to the sinus ridge, the convex portion of the body-whorl carries three or four main spiral threads or keels conspicuously granulated at their intersections with the raised lines of growth. From one to three fine spiral raised lines are observed in each of the intervals between these granulated keels. Another similar granulated keel occurs at the junction of the anterior concavity and of the terminal stem. A number of thin raised spiral lines, either all of one size or else more or less regularly alternating, decorate the concavity. The terminal stem carries numerous spiral threads at first alternating in three sizes and afterwards, more or less regularly in two, as far as the zone of accretions of the terminal truncation; the threads of the first order being at first distinctly granulated and but slightly inferior in thickness to the above-described main granulated keels of the anterior part of the body-whorl, and afterwards gradually decreasing anteriorly while the granulations become fainter. The terminal zone of accretions which causes the terminal dorsal deflection of the stem carries very fine, rather blunt spiral lines crossed at irregular intervals by the somewhat rugose accretions. The lines of growth become vertical at the junction of the convex and concave portions of the base, and maintain that

direction up to the margin of the terminal zone of accretions when they finally become retrocurrent.

The somewhat small aperture is lanceolar, posteriorly terminated by a narrow channel, while anteriorly it contracts gradually into the rather short oblique canal. The junction of the columella with the base of the last spire-whorl is curved though rather abrupt. Anteriorly to the base of the last spire-whorl the course of the columella is, on an average, straight as far as the commencement of the canal, and slightly oblique, the direction being anteriorly towards the left of the shell. Not far from the base of the last spire-whorl it exhibits a blunt, broad revolving swelling, clearly visible when the outer lip is incomplete. At the commencement of the canal the columella becomes more strongly oblique, but it extends anteriorly only for a very short distance as a distinctly differentiated structure, the anterior portion of the canal being formed merely by the thin shell-wall without any differentiated columellar margin or columella. The columellar margin is almost everywhere very thin: it has a very slightly raised edge at the commencement of the canal, posteriorly to which it is quite flush with the adjoining outer surface, except at its posterior termination where it exhibits a small button-like callous thickening resembling that of a *Drillia*, which contributes to contract the posterior channelled termination of the aperture. The outer lip which is very thin terminates normally to the suture. The sinus is moderately broad, very deep without any raised edge. The convexity of the outer lip, anteriorly to the sinus, does not project much further forward than its posterior termination. The internal walls of the shell are lirate, but the internal lirae cease at a considerable distance from the aperture.

In the two specimens in which the outer lip is complete, or almost complete, it exhibits a most peculiar structure which does not appear to have been noticed or described in any other Pleurotomid shell. The two anterior main threads of the convexity of the base, on approaching the aperture, grow into extremely prominent trumpet-like hollow expansions which, nevertheless, do not breach the margin of the outer lip whose outline is continuous, the hollow expansions being, in the present condition of the shells, quite shut off from the interior of the shell. It is evident, however, that this was not so at the time of their formation, and that they must have originated from a more or less siphon-like fold of the mantle with the formation of a deep sinus which was afterwards obliterated. This peculiar growth was evidently several times repeated, for there are several of these trumpet-shaped foliaceous expansions fitting inside one another, the last ones becoming gradually smaller on approaching the present aperture. It is moreover to be noticed that the growths are not simultaneous on the two main threads which are affected by them. On one of the specimens, it is upon the most anterior of the main threads of the convexity of the base that this structure is first observed; then, without any closing of the temporary sinus thus produced, the

mantle-fold which originated the structure shifted its position to the next principal thread posteriorly to the one upon which the structure was first developed. Consequently the expansion shifts its position forward (towards the aperture) and at the same time posteriorly from the one main thread to the other, enclosing the next similar structure produced presumably after a temporary arrest of growth. In the other specimen it is observed that the growth commenced on the more posterior of the threads concerned, shifted to the anterior one, and once more meandered back to its original position. As has already been mentioned, the successive expansions fitting inside one another become finally smaller on approaching the aperture till the sinus is obliterated and the outline of the outer lip becomes regularised in this part of the shell; but, when this happens, it would appear as though the supposed mantle-fold had once more shifted its position still further forward, for now a distinct stromboid sinus appears as an expansion of the spiral thread at the limit of the concave neck and terminal canal, representing what might be the initial stage of a structure similar to the curious expansions above described. These structures evidently result from some hitherto unrecorded anatomical peculiarity.

Dimensions.

Height	31 mm.	36 mm.	37 mm.	41 mm.
Thickness	11 ,,	13 ,,	14 ,,	17 ,,
Height of spire	17 ,,	20 ,,	21 ,,	24 ,,
Height of body-whorl	20 ,,	22 ,,	23 ,,	25 ,,

Of the specimens, the measurements of which are above tabulated, the first is the smallest of those available, the last the largest. The two others are those exhibiting the peculiar apertural features above described.

Remarks.—Compared with the original types, the Andaman specimens above described are generally somewhat smaller, with a more evenly conical, less conoidal spire, the apex, in particular, being much more pointed instead of blunted as it is in the originally figured specimen. The circumsutural rim at all stages of growth and the revolving main keels of the body-whorl anteriorly to the sinus-band are also much more distinctly granulated in the case of the Andaman specimens.

A fossil variety of this shell occurs in the lower and upper Miocene and Pliocene formations of western India, the same variety also occurring fossil in the upper Miocene formations of Java and Sumatra from which it was described by Martin (*loc. cit.*) as *Pleurotoma coronifera*, a name pre-employed in the zoological nomenclature by Bellardi for a fossil species from the Miocene of Piedmont. The blunt posterior swelling of the columella, clearly visible in the fossil specimens from India and from Java, has not been observed in any other species of *Pleurotoma* fossil or recent.

In all the fossil specimens from India and Java the outer lip is incomplete. Judging from an illustration published by Sacco

(*Moll. terz. Piem. e Lig.*, part XXX, pl. xi, fig. 35), there are indications of a similar structure in the case of a fossil from the Pliocene of Zinola near Savona, described as *Pleurotoma monile*, Brocchi, var. *granocostata*, Sacco, which seems related to *Pleurotoma congener*, from which it is distinguished principally by its less distinctly bifid circumsutural rim and by the differently disposed crenulations of its sinus band, which are much wider-spaced and are elongated in the direction of the spiral ornaments instead of being constituted by axial ribs.

In conclusion, I wish to express my best thanks to Dr. N. Annandale for the favour of enabling me to study these interesting specimens, and to M. R. Ry. Sethu Ram Rao of the Geological Survey of India and Babu S. C Mondul of the Zoological Survey of India, for preparing the beautiful photographs illustrating their structures.

EXPLANATION OF PLATE XII.

FIGS. 1, 2.—*Pleurotoma (Gemmula) congener*, E. A. Smith.

a, *b*, *c*, ventral, dorsal, and profile aspects, natural size; *d*, *e* details of aperture, × 3·5.

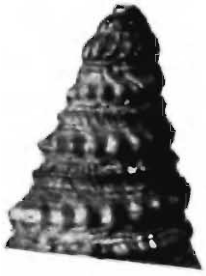
FIG. 3.—*Pleurotoma (Gemmula) congener*, E. A. Smith.

a, *b*, *c*, ventral, profile, and dorsal aspects of protoconch, × 6.

FIG. 4.—*Pleurotoma (Gemmula) congener*, E. A. Smith.

Protoconch of another specimen to illustrate its obliquity, × 6.

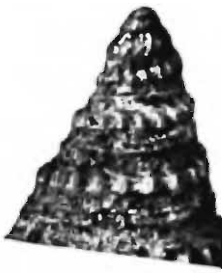
All the specimens were obtained from 185 fathoms, in Lat. 13° 17′ 15″ N., Long. 93° 10′ 25″ E. in the Andaman Sea.



3 *a*.

3 *b*.

3 *c*.



4.

1 *d*.

1 *a*.

2 *a*.

2 *d*.

1 *b*.

2 *b*.

1 *e*.

y Sethu Rama Rao, Photo.

1 *c*.

2 *c*.

2 *e*.

Photo-engraved & printed at the Offices of the Survey of India, Calcutta, 1917.

PLEUROTOMA CONGENER, E. A. SMITH.

XX. A LIST OF THE DRAGONFLIES RECORDED FROM THE INDIAN EMPIRE WITH SPECIAL REFERENCE TO THE COLLECTION OF THE INDIAN MUSEUM.

PART II. THE FAMILY AGRIONINAE.

A. The sections Podolestes, Platycnemis, Platysticta and Protoneura.

By F. F. Laidlaw, *M.A.*

(Plates XIII—XV.)

Introduction.

The following account deals with four sections (or legions to use Selys' term) of the Agrionidae (=Coenagrioninae of Kirby's Catalogue.)

The family is the largest of the sub-order Zygoptera; it consists of insects which are for the most part small and delicate, and its species are numerous and often exceedingly abundant in individuals. It is in fact a dominant family of existing Odonata.

In the Eastern tropics, so far as my observations go, and probably in most parts of the world this holds good, the members of the family falling into one or other of two great biological groups:—

I. Those which appear not to be affected adversely by human activities, have a wide distribution as species, and are abundant in cultivated country; and probably pass their larval stages in still or stagnant water. Such for example are the species of the genus *Ischnura* and of *Agriocnemis*, which thrive in the environs even of a great city like Calcutta.

II. Forms whose habitat is uncleared forest and uncultivated land, which tend to disappear with the advent of cultivation; whose larvae probably live for the most part in running water. It is noteworthy that such forms as a rule retain certain characters that may be regarded as primitive, though, beyond question, many of them exhibit extreme specialization in certain directions.

The sections of the family dealt with in the present paper may be grouped mainly in the latter of these biological divisions.

Many of them are rare, or dwell in regions difficult of access, so that it is not surprising to find amongst them a considerable number of new species.

In discussing these and other members of the group, most of which are but little known, I have found it advisable to suggest certain modifications in the accepted classification. Hence this part is more lengthy than that dealing with the Calopterygidae.

I have again to acknowledge my thanks to Messrs H. and F. W Campion for admirable wing-photographs. I am also indebted to the former for much helpful advice and criticism.

References to Selys' systematic writings on the Agrioninae are given where necessary, for the sake of brevity, as follows :—

Synopsis=*Bull. Acad. Belg.* (2) x, p. 12 *seq.* (1860).
Revision=*Mém. Couv.* xxxviii, p. 8 *seq.* (1886).
Odonates de Birmanie=*Ann. Mus. Civ. Genova* (2) x, p. 433 *seq.* (1891).

I hope to complete this account of the Agrionidae in a subsequent paper dealing with the section or legion "Agrion," with as little delay as possible.

Family AGRIONIDAE.

Genus.	*Species.*	*Range.*
	I. Legion PODOLESTES.	Tropical continental lands, New Caledonia.
1. *Argiolestes.*		Himalaya to Burma, Australia, New Caledonia.
	1. *melanothorax*, Selys.	Himalaya to Burma.
	II. Legion PLATYCNEMIS.	Old-world Temperate and Tropical lands to New Guinea.
2. *Coeliccia.*		Himalaya, Indo-China to Formosa, Malaya.
	2. *renifera*, Selys.	Himalaya to Assam.
	3. *didyma*, Selys.*	Himalaya.
	4. *bimaculata*, Laidlaw.	Assam.
3. *Calicnemis.*		Himalaya to Burma and Tonkin.
	5. *eximia*, Selys.	Kumaon to Tonkin.
	6. *miles*, n. nov.*	Burma.
	7. *erythromelas*, Selys.*	Burma, Tonkin.
	8. *miniata*, Selys.	Himalaya.
	9. *pulverulans*, Selys.	Himalaya to Assam.
	10. *chromothorax*, Selys.*	Burma.
	11. *mortoni*, n. sp.	Himalaya.
4. *Indocnemis.*		Himalaya, W. China, Malay Peninsula.
	12. *kempi*, n. sp.	Himalaya.
5. *Copera.*		Oriental region to Damascus and Madagascar.
	13. *annulata*, Selys.	India, Burma to Formosa.
	14. *vittata* (races), Selys.	India, Assam, Tonkin, Malaya to Borneo.
	15. *marginipes*, Ramb.	India, Indo-China, Malaya.

Genus.	*Species.*	*Range.*
III. Legion PLATYSTICTA.		Tropical America, Tropical Asia to New Guinea.
6. *Platysticta.*		Ceylon, S. India.
	16. *maculata*, Selys.*	Ceylon.
	17. *apicalis*, Kirby.*	Ceylon.
	18. *deccanensis*, Laidlaw.	Deccan.
7. *Drepanosticta.*		India, Indo-China, Malaya, Papua.
	19. *carmichaeli* (Laidlaw).	Himalaya.
	20. *tropica* (Selys).*	Ceylon.
	21. ? *montana* (Selys).*	Ceylon.
	22. *digna* (Selys).*	Ceylon.
	23. *hilaris* (Selys).	Ceylon.
	24. *quadrata* (Selys).*	Burma, Malay Peninsula.
8. *Protosticta.*		India, Malaya, Celebes.
	25. *gravelyi*, Laidlaw.	Deccan.
	26. *himalaiaca*, n. sp.	Darjiling to Assam.
IV. Legion PROTONEURA.		Tropical America, Africa, Oriental Region, Papua, Australia.
9. *Chloroneura.*		Central India.
	27. *quadrimaculata* (Ramb.).	Central India.
10. *Disparoneura.*		
	28. *tenax.**	Ceylon.
	29. *caesia* *	Ceylon.
	30. *pruinosa.**	Ceylon.
	31. *occlusa.**	Ceylon.
	32. *tetrica*, n. sp.	Deccan.
	33. *nigerrima*, n. sp.	Central India.
	34. *atkinsoni*, Selys.*	Burma.
11. *Disparoneura.*	35. ? *westermanni* *	Nilgiri Hills.
12. *Indoneura.*		W. Penisular India.
	36. *gomphoides* (Ramb.)	
13. *Caconeura.*		Ceylon, Burma, Malaya.
	37. *sita* (Kirby).*	Ceylon.
	38. *verticalis* (Selys).*	Burma to Borneo.
	39. *interrupta* (Selys).*	Burma to Singapore.

Species marked with an asterisk are not in the Indian Museum collection. I have, however, been able to examine examples of most of these either in the collection of the British Museum or elsewhere.

Legion I. PODAGRION, Selys.

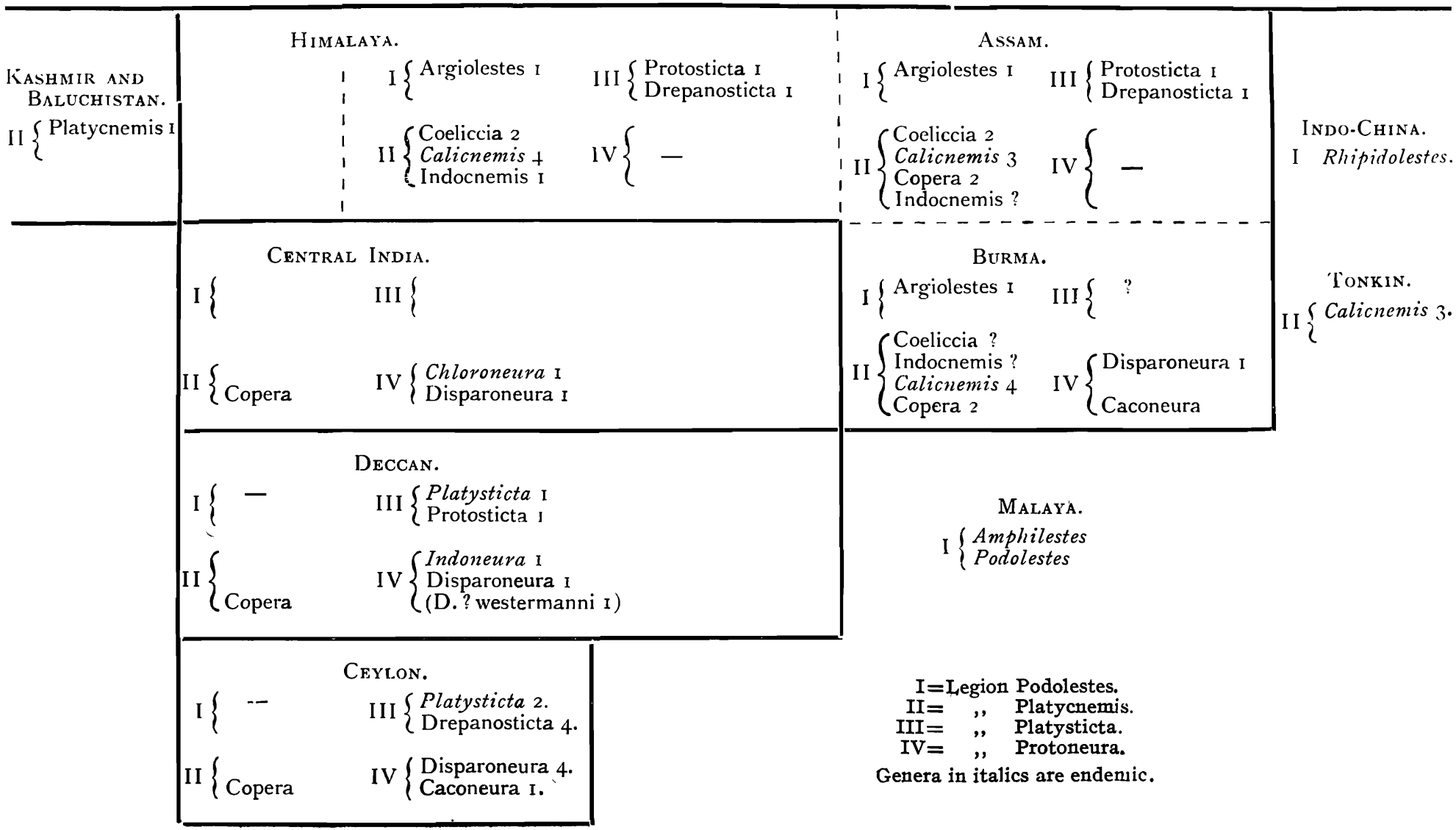
Genus **Argiolestes**, Selys.

Argiolestes melanothorax, Selys.

(Pl. xv, fig. 1).

Argiolestes melanothorax, Selys, *Ann. Mus. Civ. Genova* (2) x, p. 500 (1891).
,, ,, Ris, in *Nova Caledonia, (Zoologie)*, Vol. II, L. 1, No. 4 (1915).
See also Calvert, *Proc. Acad. Nat. Sci. Philadelphia*, 1913, p. 260.

3 ♂ 1 ♀ Darjiling district.
2 ♂ 1 ♀ Gopaldhara, Darjiling district (*H. Stevens*).


KASHMIR AND BALUCHISTAN.
II Platycnemis 1
HIMALAYA.
I Argiolestes 1
III Protosticta 1
Drepanosticta 1
II Coeliccia 2
Calicnemis 4
Indocnemis 1
IV —
ASSAM.
I Argiolestes 1
III Protosticta 1
Drepanosticta 1
II Coeliccia 2
Calicnemis 3
Copera 2
Indocnemis ?
IV —
INDO-CHINA.
I Rhipidolestes.
CENTRAL INDIA.
I
III
II Copera
IV Chloroneura 1
Disparoneura 1
BURMA.
I Argiolestes 1
III ?
II Coeliccia ?
Indocnemis ?
Calicnemis 4
Copera 2
IV Disparoneura 1
Caconeura
TONKIN.
II Calicnemis 3.
DECCAN.
I —
III Platysticta 1
Protosticta 1
II Copera
IV Indoneura 1
Disparoneura 1
(D. ? westermanni 1)
MALAYA.
I Amphilestes
Podolestes
CEYLON.
I —
III Platysticta 2.
Drepanosticta 4.
II Copera
IV Disparoneura 4.
Caconeura 1.
I=Legion Podolestes.
II= ,, Platycnemis.
III= ,, Platysticta.
IV= ,, Protoneura.
Genera in italics are endemic.

Under Calvert's rubric (*loc. cit.*) this species should fall into the genus *Wahnesia* of Forster. This genus cannot stand : its type species has not been described. As, moreover, Dr. Ris is not disposed to subdivide the genus *Argiolestes* on our present imperfect knowledge, the present species is best left as before, though it is probably generically apart from the Australian species.

No other representative of the 'Legion' has been recorded within the limits of the Indian Empire ; and S. India and Ceylon are at present, I believe, the only large tropical continental areas without such representation.

Legion II. PLATYCNEMIS.

Diagnostic table for the Indian genera.

A. Upper side of quadrilateral shorter than lower side by at least one-fifth of the length of the latter in the fore-wing, usually by more than this.

i. Wing petiolated to the level of Ac.

Wing relatively long and narrow ; usually 2 or 3 cells between the quadrilateral and the sub-nodus.

COELICCIA, Kirby.

Type : *Coeliccia membranipes* (Ramb.).
Distribution : Himalaya, Formosa, Malaya.

ii. Wing ceasing to be petiolated before the level of Ac.

Wing [1] relatively long and narrow, 4 cells between the quadrilateral and sub-nodus. Reticulation very dense (over 300 cells on the hinder-wing).

INDOCNEMIS, n. gen.

Type : *Indocnemis kempi*, n. sp.
Distribution : Assam, ? W. China.

Wing [2] relatively broad and rounded, 3 cells between the quadrilateral and sub-nodus. Reticulation on the fore-wing not so dense (not more than 250 cells on the hinder-wing).

CALICNEMIS, Selys.

Type : *Calicnemis eximia*, Selys.
Distribution : Himalaya, Burma, Tonkin.

B. Upper and lower sides of quadrilateral nearly equal.
Third joint of antennae equal in length to second joint.

COPERA, Kirby.

Type : *Copera marginipes* (Ramb.).
Distribution : Oriental Region, Madagascar.

It may be added that the larvae of A (probably) inhabit quick running streams, of B, so far as is known, slow moving or still water.

Genus **Indocnemis**, nov.

The genus is to some extent intermediate between *Coeliccia* and *Calicnemis*, and probably more primitive than either.

---

[1] *Indocnemis*, hind-wing length to breadth, 68 : 12.
[2] *Calicnemis*, hind-wing length to breadth, 57 : 12 (in *C. pulverulans*).

Indocnemis kempi, sp. nov.

(Pl. xv, fig. 2).

1 ♂ Cheerapunji, Assam, 4000 ft , 2-9-x-14 (*S. W Kemp*).

Wings hyaline, slightly smoky, pterostigma black, one and a half times as long as broad, covering one and a half cells. Post-nodals on fore-wing 22. Length of abdomen 51 mm.; of hinder-wing 38 mm.

Head entirely black save for a pair of small, oval, post-ocular marks on the occiput, which are blue.

Prothorax and *thorax* black, the latter with a pair of ante-humeral bands of blue, extending for about two-thirds of the length of the dorsum of the thorax, pointed at both ends and broader below.

Abdomen, legs and anal appendages entirely black, save that the basal two-thirds of the lower pair of appendages are brown. The upper pair are about three-quarters the length of the lower pair, triangular when viewed from above, carrying each two teeth at the ends of a crescentic projection on their under surface. Lower pair slender, rather cylindrical but broad at the base; incurved at their free extremities, and hooked downwards (text-fig. 1).

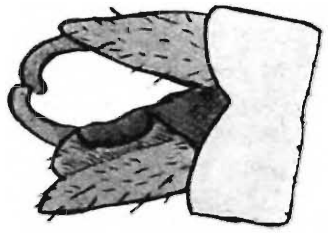


FIG. 1.—*Indocnemis kempi*, sp. nov.
Anal appendages ♂, from above.

RIS (*Supplementa Entomologica*, Berlin, No. I, 1912, p. 67) notes a female probably of this species from Tsa-Yui-San, in Kwangtun, under the name *Coeliccia? orang* (Forster).

Forster's species *Trichocnemis orang* [Forster, in Laidlaw, *Fasc. Malay.* (*Zool.*), Pt. 4, p. 2 (1907)—Perak, coll. Forster] is distinctly smaller.

Its dimensions according to Forster are :—

Length of abdomen 46 mm., of hinder-wing 33 mm.
,, ,, ,, 43 mm. ,, ,, 32 mm.

I do not know the species, which is probably congeneric with *I kempi*.

Type (male) in the Indian Museum, No. 8200/20.

With this species I have associated the name of Mr. S. W. Kemp of the Zoological Survery of India.

Genus **Calicnemis**, Selys.

Calicnemis mortoni, sp. nov.

1 ♂ Pashok, Darjiling district, 5500 ft., June, 1916 (*F. H. Gravely*).

Wings hyaline, pterostigma black, covering one and a half cells.

Post-nodals on fore-wing 21. Length of abdomen 36 mm., of hinder-wing 29 mm.

Body slender when compared with that of the three common species discussed below. Colouring almost entirely black, with the following exceptions:—

Head.—A small oblique yellow mark on either side of the posterior ocelli, and a narrow transverse line of the same colour on either side of the occiput.

Prothorax.—A minute yellow spot on either side of the middle lobe of the dorsum.

Thorax.—The interalar space is cherry red.

Abdomen.—Segment 1 is dull brown. Dorsum of segment 2 and the base of segment 3 cherry red.

Legs and anal appendages black.

Anal appendages.—Upper pair two-thirds the length of the lower pair, twice as long as the tenth segment; nearly straight, digitiform, each with a small tooth downwardly directed near its base on the under side. Lower pair slender, cylindrical, slightly uncurved, and with a slight downward hook at their apices.

Type (male) in the Indian Museum, No. 3463/H.I.

I have named this species after Mr. K. J Morton of Edinburgh.

Calicnemis chromothorax, Selys.

Calicnemis chromothorax, Selys, *Ann. Mus. Civ. Genova* (2) x, pp. 70-71 (1891).

This handsome Burmese species is, I imagine, more closely related to *C. mortoni* than to other species of the genus.

The anal appendages of the male appear very similar to those of *C. mortoni*, and in both the abdomen can be described as slender.

Selys' statement as to the length of the hind-wing of the female seems to be a misprint. For the male it is given as from 22-26, for the female 38-40 mm.

Calicnemis eximia, Selys.

Calicnemis eximia, Kirby, *Cat. Ordonata*, p. 131 (1890).
,, ,, Selys, *Ann. Mus. Civ. Genova* (2) x, p. 72 (1891).
,, ,, Martin, *Mission Pavie* [Nevroptères] (sep.), p. 18 (1904).
Calicnemis atkinsoni, Selys, *Ann. Mus. Civ. Genova*, (2) x, p. 72 (1891) ♀

Kumaon is probably near the western limit of the genus.

The female described by Selys as that of *C. atkinsoni* is a female of the present species. Hence a new name is required for the male referred to that species: it appears distinct from any of the other members of the genus. The female referred to *C. eximia* by Selys in his synopsis belongs really to the next species, *C. miniata*, Selys.

I give below an account of a female of *C. eximia* taken *in copula* with a male.

Head.—Lower and anterior surfaces yellow, as far as the level of the anterior ocellus, with a black line running from eye to eye at the level of the base of the antennae; the two basal joints of the antennae yellow, the remainder black. The yellow colour of the frons has a distinct greenish tinge. The occiput is black with a narrow linear yellow mark lying transversely on either side.

FIG. 2.—*Calicnemis eximia*, Selys. Abdomen ♀ seen from above.

The eyes are yellow for their lower two-thirds, the upper third is brown; the brown colour is separated from the yellow by a darker margin which runs latitudinally, and joins the black transverse band on the frons at the level of the base of the ocelli.

Prothorax.—Dorsally black, yellow at the sides and below.

Throax.—Dorsum black with rather broad yellow antehumeral bands; sides and under-surface yellow with a black band at the level of the second lateral suture.

Abdomen yellow; the first segment with a fine black basal triangle; the remaining segments all with a broad bronze-brown longitudinal band dorsally occupying their whole length. On segments 2–6 this band is narrowed at the base of the segment, so that each of these segments has a small pair of basal yellow lunules when looked at from above; segment 7 has a similar narrowing apically, whilst segments 8–9 show both basal and apical lunules. The sternal plates of segments 2–7 are also brown, except at their extremities (text-fig. 2).

The legs are yellow; the two anterior pairs have a slight orange tinge, and the posterior surfaces of the femurs have each a brown line. The pterostigma is brown. Superior anal appendages yellow.

Calicnemis miniata, Selys.

Calicnemis miniata, Kirby, *Cat. Odonata*, p. 131 (1890).
Calicnemis eximia, Selys, *Synopsis*, p. 160 (♀)?

♂ ♂ ♀ ♀ Gopaldhara, Darjiling district (*H. Stevens*).
♂ ♂ ♀ ♀ Darjiling district.

The female of this species does not appear to have been described fully.

Head.—Lower and upper lip, ante- and post-clypeus yellow; the ante-clypeus with a pair of black spots, the post-clypeus with

a rectangular black mark, genae and frons as far as the level of the base of the antennae greenish-yellow, the rest of the head black, with a transverse yellow band from eye to eye at the level of the anterior ocellus, and a fine yellow line on either side of the occiput, the lower two-thirds of the eyes greenish-yellow, the upper third black.

Prothorax.—Dorsum black, the sides and under surface yellow.

Thorax.—Black above, with greenish-yellow antehumeral bands, rather narrower than those of *C. eximia*; sides and under surface yellow with a black line on the second lateral suture.

Abdomen reddish-brown, segments 1–6 with a terminal black band, becoming broader on segment 6. Segment 1 with a black triangle dorsally occupying its whole length (in mature females). A fine black line runs along the mid-dorsal carina of the first six segments, it is however scarcely evident on segments 5 and 6 of fully mature females. The remaining abdominal segments are entirely black, save for some traces of reddish-brown at the base of 7. Superior appendages black.

Legs yellow, the posterior surfaces of the femurs with broad black line, and the posterior parts of the tibias brown, tarsi black.

Pterostigma very dark brown, almost black.

Calicnemis pulverulans, Selys.

(Pl. xv, fig. 3).

Calicnemis pulverulans, Kirby, *Cat. Ordonata*, p. 131 (1890).

♂ ♂ ♀ ♀ Darjiling district.

♂ ♂ ♀ ♀ Gopaldhara, Darjiling district (*H. Stevens*).

♂ Young. *Head.*—Lower lip yellow, upper lip black with yellow margin, genae and lower two-thirds of eyes pale greenish-yellow, the rest of the head black save for a narrow yellow band running across the frons immediately in front of the anterior ocellus, and a pair of narrow linear yellow marks on the occiput behind the eyes.

Prothorax black dorsally, sides and under surface pale yellow.

Thorax black above with broad pale yellow antehumeral bands; pale yellow at the sides and below with a black line on the second lateral suture.

Abdomen yellowish-brown, paler below, the posterior segments becoming progressively darker, the last three being entirely black. Sutures marked with a black ring, the apices of segments 2–6 with a very fine pale yellow ring, incomplete in the mid-dorsal line. Anal appendages yellowish-brown, legs black, base of femurs yellow, especially anteriorly.

As the male becomes mature its colouring becomes rapidly darker.

A fully adult male has the margin of the upper lip and genae still yellow; the yellow markings on the frons and occiput are replaced by blue primrose marks. The yellow of the prothorax, and

the yellow antehumeral thoracic marks are similarly altered ; the sides of the thorax are more extensively marked with black. The abdomen is almost entirely black, segments 4–5 showing some dark brown colour. The anterior segments especially have a blue pruinescence ; the legs are entirely black, pulverulent like the abdomen.

Lastly, an old male is almost entirely black, the only colouring being on the extreme of the upper lip, which still remains yellow, and the lower two-thirds of the eyes, which are of a bluish-green colour. The sides of the thorax have become entirely black, the pruinescence is retained on the top of the head, and on the antehumeral bands of the thorax. The black of the abdomen is intense and metallic.

♀ *Young.*—Colouring almost identical with that of the young male, the chief difference seems to be that the yellow margin of the upper lip is more extensive than in the male sex.

The first indication of approaching melanism is the appearance of a narrow, very dark brown band, running longitudinally on the dorsum of abdominal segments 2–4, whilst the remaining distal segments pass progressively from very dark brown to black.

It may be remarked that at this stage the female bears some resemblance in colour pattern to that of *C. eximia.*

A female coloured thus was taken *in copula* with a male in the ' all black ' stage.

More adult females pass through the same colour change as the males, reaching ultimately the condition of blackness relieved only by the pale yellowish-green of the lower part of the eyes ; in this state also they are taken mating.

The three species noted above are evidently at least locally abundant, and presumably occur together, as I have before me bottles containing spirit specimens of two or in some cases three species apparently collected indiscriminately and in considerable numbers.

The remaining species of the genus must be very rare on the Himalayan range, or more probably do not occur there at all, as they are unrepresented in the Museum collection and in Mr. Stevens' series.

Calicnemis miles, nom. nov.

The synonymy involved here is as follows :—

(1) *Calicnemis eximia,* Selys, *Synopsis,* 1863.
,, ,, race *atkinsoni* ♀ *Revision,* 1886.
,, ,, *atkinsoni* ♀, *Odonates de Birmanie,* 1891.
(2) *Calicnemis miniata,* Selys, *Revision,* 1886.
,, *eximia* ♀, *Synopsis,* 1863.
(3) Sp. *innominata* = *miles.*
Calicnemis atkinsoni ♂, *Odonates de Birmanie,* 1891.

TABLE OF THE SPECIES OF *CALICNEMIS.*

♂ A. Legs yellow or orange.
i. Abdomen entirely scarlet ... ... *C. eximia,* Selys.
ii. Abdomen with black articular rings, segments 9, 10 dark.
C. miles, n. n.

B. Legs largely black.
  i. Abdomen slender, 35 mm. or more in length.
    a. Thorax black (in *adult* male) ... *C. mortoni*, sp. n.
    b. Thorax largely brilliant chrome yellow.
      C. chromothorax, Selys.
  ii. Abdomen stout, about 30 mm. long or less.
    a. Abdomen of young males yellow marked with black, of adult males brownish-black or entirely black.
      C. pulverulans, Selys.
    b. Abdomen dark carmine-red marked with black.
      1. Upper lip red-brown, lower anal appendages longer than upper pair ... ... *C. miniata*, Selys.
      2. Upper lip black, lower anal appendages not longer than upper pair ... ... *C. erythromelas*, Selys.

♀ A. Legs yellow.
  Dorsum of abdomen bronze-green (in adult). *C. eximia*, Selys.

B. Legs largely black.
  i. Abdomen yellow with black marks.
    a. Terminal segments black (or whole abdomen black in fully adult specimens ... *C. pulverulans*, Selys.
    b. Terminal segments marked with yellow.
      C. chromothorax, Selys.
  ii. Abdomen crimson with black marks.
    a. Upper lip black ... ... *C. erythromelas*, Selys.
    b. Upper lip red-brown ... ... *C. miniata*, Selys.

Genus **Coeliccia**, Kirby.

I regret to find that I have caused considerable confusion in the synonymy of this genus. It is one where adequate material is very necessary, as the species are decidedly difficult. I take the opportunity here of correcting my previous mistakes.

Species of the genus will probably prove numerous; from Borneo I have seen several undescribed forms. The structure of the anal appendages of the male and of the prothorax of the female are of especial importance in discriminating the species.

The genus has been divided by Selys with two sections dependent on the position of the sectors M3, RS, with regard to the subnodal cross vein.

It is possible that some use may be made of the thoracic colour pattern in grouping the species according as to whether :—

(*a*) Males and females both have an 'antehumeral' band (as in *C. membranipes*).

(*b*) Males have round or oval spots on either side of the thoracic carina, females with antehumeral band (*e.g. C. renifera*, Selys).

(*c*) Both sexes have round or oval spots on either side of the thoracic carina (*e g. C. flavicauda*, Ris).

Presumably those species falling under (*c*) are the most specialized, at any rate as regards colour.

The thoracic colour pattern is certainly very interesting; species of the genus have apparently evolved, within the limits of the genus, an arrangement widely different from their allies. But

the whole 'Legion' is characterized by a tendency to originality in colouring.

The grouping of the species adopted by Selys, which depends on the position of M3, RS, relative to the subnodal cross-vein, seems to be a natural one as it is supported by the geographical distribution of the species.

Thus the species agreeing with *C. renifera* in this respect are all found in the Himalaic mountain complex and its outlying spurs; those akin to *C. membranipes* are more definitely Malayan with their headquarters in Borneo. In the accompanying table I have attempted to give the chief characteristics of the *C. renifera* group so far as they are known to me. The table is, of course, largely compiled from Dr. Ris' article on species of the genus (*Supplementa Entomologica*, No. 1, 1912, pp. 61–67; Berlin).

Martin has recorded *C. octogesima* (Selys), *C. renifera* (Selys), and *C. membranipes* (Ramb) from Tonkin (Martin, *Mission Pavie* (Nevroptères), 1904). I think it possible that the Tonkinese form of *C. renifera*, at any rate, may prove to be distinct from species of the type locality.

TABLE.

M_3 proximal to nodus, MS distal.
Costal side of quadrilateral of fore-wing about one-third shorter than anal side.
Space between quadrilateral and subnodus normally with two cross-veins (*i.e.* 3-celled).
a. Costal side of pterostigma about one-third shorter than anal side.
♂ segments 9, 10 blue; thorax of ♂ and ♀ similar.
C. brachysticta, Ris.—Philippine Is.
b. Costal and anal sides of pterostigma sub-equal.
i. ♂ segments 9, 10 orange; anal appendages orange; thorax of ♂ and ♀ similar.
C. flavicauda, Ris.—Formosa.
ii. ♂ segments 9, 10 black (marked with blue), anal appendages black; thorax of ♀ with complete antehumeral band.
C. erici, n. sp.—Malay Peninsula.
iii. ♂ segments 9, 10 largely blue, anal appendages brown; thorax of ♀ with complete antehumeral band.
C. simillima, n. sp.—Malay Peninsula.
Costal side of quadrilateral of fore-wing about one-fifth shorter than anal side.
I. Space between quadrilateral and subnodus normally with one cross-vein.
C. bimaculata, Laidlaw.—Assam.
(? = *C. didyma*, Selys).
II. Space between quadrilateral and subnodus normally with two cross-veins.
i. ♂ segments 9, 10 and anal appendages blue; thorax of ♀ with narrow antehumeral band.
C. cyanomelas, Ris.—Formosa.
ii. ♂ segments 9, 10 (adult) and anal appendages black; thorax of ♀ with complete antehumeral band.
C. renifera (Selys).—Himalaya.

A specimen in the British Museum from the Chin Hills labelled *Coeliccia didyma* is certainly quite distinct from *C. bimaculata.* I

have not been able to satisfy myself that this specimen is certainly the true *didyma*, but as I had no sufficient time to examine it fully I can give no reason for supposing that it is not correctly referred to that species.

Coeliccia renifera, Selys.

(Pl. xiii, figs. 1–3; pl. xiv, fig. 3).

Coeliccia renifera, Kirby, *Cat. Odonata*, p. 128 (1890).

9 ♂ ad., 4 ♂ juv., 4 ♀ ad. Pashok, 2000-4000 ft., Darjiling dist., 7—14-vi-16 (*F. H. Gravely*).

♂ Abdomen 44 mm., hind-wing 27·5 mm.

♀ ,, 40 mm., ,, ,, 27·5 mm.

♂ *Adult.*—Lower lip and lower two-thirds of eyes yellowish-green. Rest of head and upper surface of eyes black, except the anteclypeus and genae which are silvery blue, and a small yellow transverse post-ocular mark.

Prothorax entirely black.

Thorax black with a pair of oval-oblong, silvery blue spots on either side of the mid-dorsal carina, extending from below for about half its length; and a large mark of the same colour laterally divided into two by a black line along the second lateral suture.

Abdomen brownish-black, paler below; at the apex of each segment from the third to the eighth is a paired ventro-lateral spot of a bluish-white colour.

Legs white. Posterior surfaces of femurs, anterior surface of tibias black, likewise tarsi and spines.

Anal appendages white, the tips of lower pair black.

♂ Juv.—Black marks on head not nearly so developed as in adult. The upper lip is yellowish-white, and there is a broad yellowish band running from one eye to the other across the head at the level of the anterior ocellus. Upper third of eyes abruptly darker than lower parts.

Prothorax entirely yellow, with the exception of the anterior and posterior margins which are marked with black.

Thorax brownish-black dorsally, with well-marked antehumeral stripes, exactly matching those of the female, and internally to these are the oval markings of the adult male; these along their border coalesce with the antehumeral band. Sides and under surface of thorax pale yellow, with vestige of black stripe along the second lateral suture.

Abdomen pale brown, darker at articulations. Segments 9 and 10 whitish-yellow.

♀ *Adult.*—Coloured much as the young male, but with the anteclypeus black, and the dorsum of the thorax entirely without the oval markings characteristic of the male. The dorsal parts of segments 4, 5 are more darkly coloured than in the young male, and the posterior half of 9 and the whole of 10 is of a whitish-yellow.

Coeliccia erici, sp. nov.

Trichocnemis renifer, Laidlaw (nec. Selys), *Fasc. Malay.* (Zool.) IV, p. 2 (1907).

1 ♂ 2 ♀ ♀ Bukit Besar, Jalor, Malay Peninsula, 2500 ft.

♂ Abdomen 45 mm., hind-wing 26 mm.
♀ ,, 40 mm., hind-wing 27 mm.

♂ *Head* (damaged).—Upper lip metallic black, genae ? blue. Rest of dorsal surface black, with a pair of small wedge-shaped post-ocular blue spots.

Prothorax (damaged).—Largely black, probably a yellow spot on either side.

Thorax.—Dorsum black as far as first lateral suture, marked in front on either side of the mid-dorsal carina along its lower two-fifths with a very large almost circular spot of bright blue. This spot appears to be homologous not only with the oval spot of *C. renifera*, but also to include the persistent lower end of the ante-humeral band. Sides and lower surface pale yellow with an incomplete black band at the second lateral suture.

Abdomen.—Segments 1, 2 black above; 3–8 brown, darker at the articular rings; 9, 10 black (probably) marked with blue dorsally; anal appendages blackish-brown. Upper pair longer than lower pair, and when viewed from above flattened and truncate. In profile they appear shaped rather like the blade of a table knife, and each carries two small downwardly directed teeth separated from one another by a concave edge. Lower pair stout, of the shape characteristic of the genus, curved inwards to meet each other at their extremities, and at the same time hooked downwards (text-fig. 3).

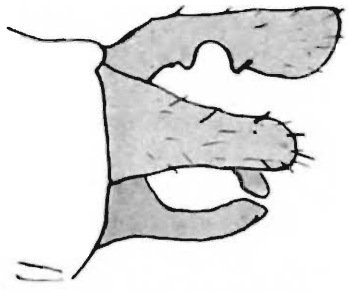


FIG. 3.—*Coeliccia erici*, sp. nov. Anal appendages ♂, obliquely from above.

♀ (much damaged). Head as in male?

Prothorax with a very large yellow mark on either side of middle line separated by fine back line, anterior and posterior lobes black. Posterior margin gently concave, with minute projection backwards in the middle line.

Thorax with broad yellow antehumeral bands.

Abdomen dark brown, passing to black-brown apically. Segments 8, 9 with apical dorsal, crescentic yellow mark.

I have named this species after a soldier who fell in 1915 and also after my little son his cousin.

Coeliccia simillima, sp. nov.

Trichocnemis octogesima, Laidlaw (nec Selys), *Fasc. Malay.* (Zool.) IV, p. 4 (1907).

4 ♂ ♂ 1 ♀ Bukit Besar, April, May, September, 2000 ft.

♂ Abdomen 40 mm., hind-wing 26 mm.
♀ (much shrivelled) ,, 25·5 mm.
" Thorax sky-blue and black ; abdomen black with blue tip."

♂ *Adult.*—Head black, anteclypeus and genae blue. Post-ocular marks of the same colour, almost circular.

Prothorax black, with a pair of small lateral spots which are blue.

Thorax black above, a pair of oblong-oval blue spots on either side of the mid-dorsal carina, extending to about the lower two-fifths of its length, and above these a much smaller pair of linear blue marks. Sides and under surface yellow with black line along second lateral suture.

Abdomen.—Segments 1–2 black, with some yellow at the sides, and a small median dorsal blue line on 2 ; 3–8 brownish-black, each with a very small pair of yellow spots laterally at its apex ; 9–10 blue above, basal third of 9 black. Anal appendages : upper pair black, tipped with yellowish-white at the extremity ; with a fine black basal tooth, and a larger hook-like projection at the end of the middle third, both directed downwards ; apex subacute. Lower pair brown, pincer-like, a little longer than the upper pair.

♀ In poor condition, immature and shrivelled. The thorax shows a pair of yellow antehumeral bands.

It is evident that this species strongly resembles *C. octogesima* (Selys). I have not access to any authentic example of the latter species and the published descriptions are not very full. It would appear to be smaller than *C. simillima*, and to differ in details of colouration. Granting the venational characters to be constant there should be no difficulty in separating the two species.

Coeliccia didyma, Selys.

Coeliccia didyma, Kirby, *Cat. Odonata*, p. 123 (1890).

I have not seen an authentic example.

Coeliccia bimaculata, Laidlaw.

Coeliccia bimaculata, Laidlaw, *Rec. Ind. Mus.* VIII, iv, p. 341, pl. xvi, fig. 1 (1914).

1 ♂ Abor Expedition.

The specimen is rather immature. The statement that the space between the quadrilateral and nodus is occupied by a single cell is true only for one wing, the right hind-wing, the other wings in each case have two cells in the space, *i.e.* one cross nerve, the latter condition is probably normal.

Unfortunately the account of *C. didyma* is not very full, and it is not possible at the present time to see the type specimen. I note the following differences between the description of *C. didyma* and the type of *C. bimaculata*.

	C. didyma.	*C. bimaculata.*
Prothorax ...	Black with large light round spot on each side.	Yellow with anterior and posterior margins black.
Thorax ...	An upper pair of small blue spots near the wings on the dorsum.	Upper pair of spots absent.
Abdomen ...	Segment 1 black above, yellow at the sides.	Segment 1 yellow with semicircular brown mark anteriorly.
Size ...	Hind-wing 24 mm.	... Hind-wing 22 mm.

It must be noted that the anal appendages of the described specimens are very similar.

Coeliccia albicauda (Forster).

Trichocnemis octogesima albicauda, Forster (as race).
Trichocnemis borneensis, Laidlaw (nec. Selys), *loc. cit.*

Some time ago I re-examined the male specimen which I had regarded as probably belonging to Selys' species. I found it to agree with the form described by Forster as a race of *octogesima*, and now believe it to have been identical with that form, which is certainly distinct from the true *octogesima* and worthy of specific rank. Unfortunately the two specimens, male and female, taken *in copula* at Kwala Aring have been destroyed in the meantime.

I have examined specimens of several species from Borneo, male and female, and find so much resemblance amongst the females that in my opinion it will be a matter of no little difficulty to determine in the future what is the male of the real *borneensis*.

The present species differs then obviously from *C. octogesima* in that the female has no antehumeral band; and is also almost certainly distinct from *C. borneensis*.

It is to be hoped that material from the type locality may be forthcoming, which will settle the question.

I have been able to identify a larval form from Kalimpong as belonging to *Calicnemis* (No. 85/H.I., April-May, 1910, F. H Gravely). It is very different in appearance from the larva of *Copera annulata*, its legs are relatively short, the body stouter and instead of the very long gill lamellae of *Copera* there are very short strongly ridged lamellae, shaped like a spear-head, triradiate in transverse section, not so long as the mask. The differences between the two larvas are so striking as to suggest that the two genera are not really closely related, but show a convergent similarity in their venation. A point of interest and one that will perhaps help to throw light on the question is that in the *Calicnemis* larva I have been able to determine that the tracheae which supply *RS* and M_3 rise from a common stalk from the main trunk of *M*. This feature may be the explanation of the remarkable venation found in *Prionocnemis*.

Genus **Copera**, Kirby.

(= *Psilocnemis*, Selys).

Copera annulata (Selys).

Copera annulata, Kirby, *Cat. Odonata*, p. 129 (1890).
Copera annulata stevensi, Laidlaw, *Rec. Ind. Mus.* VIII, iv, p. 341, pl. xvi, fig. 2 (1914).

1 ♂ North Lakhimpur, foot of hills, Upper Assam (*H. Stevens*) (type of *stevensi*).

1 ♂ with larval skin, from Museum tank, Calcutta, emerged April 4th, 1915, No. 3015/21.

Selys (*Revision*) expresses the opinion that there is but a single species ranging from Japan to Sumatra and Assam which includes perhaps varieties and not local races. He observes that the females cannot be distinguished. The 'races' named are :—

C. subannulata (Selys).—Tenasserim, Calcutta.
,, *ciliata* (Selys).—Malacca.
,, *serapica* (Selys).—Nicobars.
,, *stevensi* (Laidlaw) —Assam.

It is evident that the species is one of which long series are necessary for determining the value of the differences which exist between individuals.

The larval skin is incomplete and lacks the mask. I hope later to publish an account of the larval forms of Indian dragonflies, so will not attempt an account here beyond that the legs are long and slender, and the caudal lamellae are linear-lanceolate, occupying about two-fifths of the total length of the larva.

Copera marginipes (Ramb.).

(Pl. xiv, fig. 2).

Copera marginipes, Kirby, *Cat. Odonata*, p. 129 (1890).
,, ,, Martin, *Mission Pavie* [Nevropteres] (sep.), p. 18.
Psilocnemis marginipes, Kruger, *Stettin Ent. Zeit.* 1898, p. 102.

1 ♂ Parambikulam, 700–3200 ft., Cochin State, September, 1914 (*F. H. Gravely*). No. 8265/H.I.

2 ♂ ♂ 2 ♀ ♀ Nagpur, C.P., 1000 ft., August, 1915 (*E. D'Abreu*).

1 ♂ Mormugao, Portuguese India, August 1916. No. 4369/H.I.

This species is characterized by the moderate dilatation of the two hinder pairs of tibias in the male, and by the very short superior anal appendages of the same sex These are about one-quarter as long as the stout lower pair This well-known species shows striking age variations.

Young males and females are white, the abdominal segments ringed with black, giving a very striking, almost ghostly, appearance to the living insect. Adult specimens appear almost black, the legs bright orange.

The eyes as seen in spirit specimens have a remarkable appearance. The upper and lower poles are of pale gray ; there is a fine equatorial belt of the same colour and on either side of this a narrow zone of brownish-black. The upper of these zones is continuous with the dark transverse line on the frons.

Locally this species, which is widely spread, seems to vary but little. Specimens from the Malay Peninsula, with which I have been able to compare Indian examples, have perhaps a more pronounced white mark at the apex of abdominal segment 8. Otherwise there seems to be no differences of importance.

Copera vittata (Selys).

Copera vittata, Kirby, *Cat. Odonata*, p. 129 (1890).
,, ,, see Förster in Laidlaw, *Fasc. Malay.* (Zool.) iv, 2, p. 7.
,, ,, Laidlaw, *Rec. Ind. Mus.* VIII. iv, p. 342.

The males of this species are characterized by the absence or slight indication of dilatation of the four posterior tibias, and by the length of the upper pair of anal appendages, which equals one half (roughly speaking) that of the lower pair.

In the case of this species it is possible to recognize a certain number of races which appear to be quite clearly defined.

I have been able to compare specimens from three localities only, from Borneo, Assam, and Cochin State, S. India; the adult of the typical race from the Malay Peninsula is unknown to me. Also I regret I have not more than a few specimens available in each case, and no females from Assam.

The Bornean race *C. vittata atomaria*, Selys, is very distinct, the upper surface almost entirely black; in the adult the antehumeral bands of the thorax are obsolescent, segment 10 of the abdomen remains yellowish-white, and the upper surfaces of the anal appendages are of the same colour. The legs are of a rich orange-brown and the tibias show no indication of lateral dilatation.

Length of hind-wing 19 mm., of abdomen 32 mm.

The Assam race *C. vittata assamensis*, Laidlaw, is largely russet-brown in colour, notably the vertex which in the other two races noted here is intense black. Likewise the upper surface of the abdomen is dark brown, and the white apical mark begins on segment 9. The legs are brown, quite different from the reddish legs of *C. atomaria*, or the bright yellow legs of the next race.

Copera vittata deccanensis, subsp. nov.

2 ♂ 1 ♀ Parambikulam.

♂ Adult. *Head.*—Upper lip, genae and anteclypeus greenish-white, frons and occiput black, with a broad creamy-white transverse band covering the ocelli. A pair of linear post-ocular lines.

Prothorax black above, with lateral yellow marks, bright lemon-yellow below.

Thorax black dorsally, creamy white antehumeral bands present, sides yellow, mottled with black.

Abdomen black, segment 2 with fine longitudinal yellow line dorsally; 4–7 with small apical bluish-white lunules, 9 white above, 10 entirely white.

Anal appendages.—Upper pair white, lower pair white tipped with black.

Legs lemon-yellow, the posterior pairs of tibias distinctly though slightly dilated.

Length of hind-wing 16·5 mm., of abdomen 29 mm.

The female is coloured as the male, though duller, the legs and under surface of the thorax being of a dull white. On segment 9 of the abdomen is a square apical white mark. Segment 10 is

brown below, and the general colour of the abdomen is rich brown, not black.

The adult of the Bornean race is very distinct in appearance. In fact it bears at first sight a close likeness to certain species of *Caconeura* (especially to *Caconeura verticalis*, Selys) with which I have more than once received it. The rich brown-red colour of the legs and the almost entirely black body give it an appearance strikingly unlike that of other species of the genus.

Specimens from Kwala Aring in the Malay Peninsula identified by me as *C. atomaria*, Selys (*Proc. Zool. Soc. Lond.*, 1902, p. 356) are all immature and their proper designation must remain doubtful.

Legion III. PLATYSTICTA, nov.

Rather large or moderate-sized Agrionid dragonflies, with a long and rectangular quadrilateral, without supplementary sectors. *Ab* absent, or (probably) represented by a nerve descending *from the lower side of the quadrilateral* to join *Ac* or the hinder margin of the wing. Cu_2 represented only by Cu_{2b}. Cu_1 normal or reduced. Pterostigma trapezoidal. Wings falcate, a supplementary basal post-costal nerve always present. Body generally very slender, legs with long cilia.

Distribution :—Tropical America, Tropical Asia to New Guinea.

The distinctness of the forms included in this new ' Legion from the *Protoneura—Disparoneura* series, can scarcely be questioned, especially when the more primitive members of each series are compared together.

The following are the genera of the ' Legion with their differentiating characters :—

A. Cu_1 extending beyond half the wing length.

PALAEMNEMA, Selys.

Type: *P. paulina* (Drury).
Distribution : Tropical America.

B. Cu_1 not reaching half the length of the wing.

I. *RS* markedly fractured.
Ab present, joining *Ac*. Sectors of arculus not stalked.

PLATYSTICTA, Selys.

Type : *P. maculata*, Selys.
Distributions : Ceylon, S. India.

II. *RS* straight.
a. *Ab* present, joining *Ac*, or hinder margin of wing sectors of arculus ' stalked.

DREPANOSTICTA, nov.

Type: *D. carmichaeli* (Laidlaw).
Distribution : Ceylon, India, Burma, Tonkin, Malaya to New Guinea.

b. *Ab* absent.

PROTOSTICTA, Selys.

Type: *P. simplicinerois*, Selys.
Distribution : S. India, Himalaya, Mala Peninsula, Borneo, Celebes.

The distinction between *Drepanosticta* and *Protosticta* is not of great importance, and is liable in individual cases to break down.

The two genera may, however, be retained at least as a matter of convenience.

I have not found it possible to hit on a good character to further sub-divide the genus *Drepanosticta* though it is likely that the genus can be further broken up. I have been able to examine some seven species of the genus, for the purpose of defining the genus, and I find that the point of attachment of '*Ab*,' and likewise the point of origin of M_3 and *Ms*, shows a certain amount of individual variation.

On the whole the Ceylon species have the least reduced venation. I have selected *D. carmichaeli* as type of the new genus because it is a well-characterized species, and with a fair number of specimens at hand I have been able to deposit a paratype in the British Museum and in my own collection.

Genus **Platysticta**, Selys.

Platysticta deccanensis, Laidlaw.

Platysticta maculata deccanensis, Laidlaw, *Rec. Ind. Mus.* XI, p. 388, text-fig. 1 (1915).

Length of hind-wing 34 mm., of abdomen 46 mm. Post-nodals on fore-wing 22–23. Pterostigma one and a half times as long as it is broad, covering more than one cell, brown with a fine white margin.

Head.—Upper surface black, basal half of upper lip, ante- and post-clypeus bluish-white.

Prothorax brown, its anterior lobe yellowish-white.

Thorax rich cinnamon-brown, paler below, the mid dorsal carina and alar sinuses black.

Abdomen.—Segments 1–2 dark brown with lighter brown marks on the sides, 3–7 very dark brown, black at the articular rings, 8–9 pale blue above, black below, 10 black.

Anal appendages black. Upper pair more than twice as long as segment 10, sharply bent down at the middle. Lower pair nearly straight, hooked inwards at their extremity.

Legs brown, articulation of the femurs yellow, cilia brown.

The Museum collection also includes a female belonging to this genus and probably to the present species from Cochin State (Forest Tramway: mile 10–14, alt. 0–300 ft., 28-ix-14, No. 8272/20, taken by Mr. Gravely). The colouring of the head and prothorax agrees with that of the males described above. The thorax is black above, with bluish-white antehumeral bands; brown at the sides and paler below. The abdomen is brown with lilac coloured lateral spots on segment 10.

Length of hind-wing 28 mm., of abdomen 36 mm.

Platysticta maculata, Selys.

Platysticta maculata, Kirby, *Cat. Odonata*, p. 132 (1890).

A species apparently confined to Ceylon. A specimen in the British Museum labelled *Platysticta tropica*, from Ceylon, is also a true *Platysticta*. I have not had opportunity to satisfy myself as to the correctness of the specific determination, but it appears distinct from *P. maculata*, Selys, and *apicalis*, Kirby.

Platysticta apicalis, Kirby.

Platysticta apicalis, Kirby, *Journ. Linn. Soc. Lond.* (Zool.) XXIV, p. 561, pl. xlii, fig. 1, ♀ (1893).

Like the last confined to Ceylon. The only old-world species of the Legion with coloured wings.

Genus **Drepanosticta**, nov.

Drepanosticta carmichaeli (Laidlaw).

(Pl. xiv, figs. 1, 4; pl. xv, fig. 5)

Protosticta carmichaeli, Laidlaw, *Rec. Ind. Mus.* XI, p. 390, fig. 3 (1915).

Kalimpong, 500–4,500 ft., No. 74/H.I., April 1915 (*F. H. Gravely*).

Pashok, 2,500 ft., Nos. 3410/H.I., 3441/H.I., 3801/H.I., 3411/H.I., May-June, 1916 (*F. H. Gravely*).

The type specimen and others secured with it were in a bad state of preservation and give no idea of the beautiful colouring of the living insect. Fortunately fresh material enables me to remedy the defective description given in my first notice of the species.

Venation.—Vestige of *Ab* entirely separated from *Ac*. Sectors of arculus with long stalk. M_3 descending from subnodal vein. *RS* distal 13–16 postnodals on front wing.

Head.—Upper lip, genae and anteclypeus pale blue. Postclypeus and frons to level between the anterior ocellus and posterior pairs black, second joint of antennae pale blue. Irregular pale blue band across vertex from in front of posterior ocelli to occiput, the latter black. Eyes pale blue, with an equatorial band of grey, wider in front.

Prothorax olive-green dorsally, becoming laterally pale blue, sides and under surface rich brown-black.

Thorax olive-green dorsally, fading to pale blue humeral stripes, succeeded by golden-brown colour at the sides. This in passing ventrally becomes intensified to brown-black. A pale, silvery blue line on the second lateral suture.

Abdomen brown, segment 2 with a longitudinal, blue band dorsally. Segments 3–6 have a narrow, pale blue mark at the base and a dark ring apically; 7 except for a bright blue spot at the base dorsally is black, 8–9 brilliant light blue, 10 black with dorsal blue mark.

Anal appendages black. *Legs* yellowish-white.

Length of hind-wing 24 mm., of abdomen 36 mm.

The female specimens are teneral and in bad preservation. The colouring appears to be similar to that of the male, except that segment 8 of the abdomen is dark coloured.

A male (No. 3410/H.I.) has a remarkable abnormality of the vestigial *Ab* on the right hind-wing. On this wing the vestige consists of two transverse nerves united by a minute cross-vein so as to be **H**-shaped.

A second male (No. 3801/H.I.), in poor condition, has lost this vestige altogether on the right hind-wing, so that evidently the distinction between *Drepanosticta* and *Protosticta* occasionally breaks down in this species at least.

Genus **Protosticta**, Selys.

Protosticta gravelyi, Laidlaw.

Protosticta gravelyi, Laidlaw, *Rec. Ind. Mus.* XI, p. 390, text-fig. 2 (1915).

1 Talewadi, near Castle Rock, N Kanara District, 3-x-16 (*S. Kemp*). No. 4389/H.I.

♀ Adult. *Head* as in the male; it should be added that the dorsal surface of the eyes is black, the rest a grayish-white.

Prothorax and *thorax* as in the male.

Abdomen black, segments 3–8 each with a white basal ring relatively small on segments 1–7, but occupying about one-half of the length of segment 8; increasing gradually from segments 1–7 on the last of which it is actually larger than on segment 8. These rings are more extensive on the sides and ventral surface of the segments than they are dorsally. Segment 9 is entirely black. Length of hind-wing 20·5 mm., of abdomen 40 mm.

The nerve referred to as Cu_2 in the original description of the male is the nerve I now regard as *Ac*.

Protosticta himalaiaca, sp. nov.

(Pl. xv, fig. 6).

Kalimpong, Darjiling district, 500–4,500 ft.

Pashok, 5,500 ft., May-June, 1916. No. 3465/H.I.

Kalimpong, teneral and in bad condition.

The representatives of this fine large species are unfortunately all somewhat immature, so that it is possible that the colouring of the male when quite adult may differ from the description given below. As the species should be very readily refound, I think it worth while to give it a name.

♂ Juv. *Head.*—Upper lip whitish edged with black, anteclypeus and genae creamy-white, the rest of the upper surface metallic black, with green reflex.

Prothorax black above, with indications of pale lateral lines, creamy-white below.

Thorax metallic black as far as first lateral suture, sides and under surface creamy-white with broad black lateral band along second lateral suture.

Abdomen brown, each of segments 2–9 with black apical ring, and 3–7 with whitish apical ring (probably blue in the adult), widening on the sides. Apical half of 8–9 whitish (or blue in the adult); 10 entirely brown.

Anal appendages.—Upper pair about equal in length to segment 10, light brown, curved downwards, the distal half blade-like. Lower pair white, slender, cylindrical, a little longer than the upper pair, incurved at the extremity. Each carries a small inwardly directed spur at its middle.

♀ Colouring as in male, but segments 8–10 of the abdomen entirely brown

Length of hind-wing 30 mm. Post-nodals 15–17 on forewing.

I have examined an imperfect, immature male of this species sent to me by Mr. H. Stevens.

The species of the genera *Drepanosticta* and *Protosticta* will in all probability turn out to be numerous and I am inclined to think that the habitats will also prove quite restricted. *Drepanosticta quadrata* (Selys) is recorded from the Malay Peninsula and Burma; I cannot feel sure that the Burma specimen is co-specific with the Peninsular insect.

Legion IV. PROTONEURA, Selys (restricted).

Agrionid dragonflies, with a long and rectangular quadrilateral without supplementary sectors.

Ab normal, vestigial or absent; never attached to the quadrilateral.

Cu_2 represented only by Cu_{2b}, or absent. Cu_1 normal, reduced or absent. Pterostigma rhomboidal. No supplementary basal post-costal nerve. Wings not falcate. Size moderate, body slender, or very slender. Legs with long cilia.

Distribution:—Africa (excl. Madagascar ?), Tropical Asia, and Australasia, Tropical America.

I have but little acquaintance with American forms of the Legion. I take their relationship to Old World forms as a matter of course.

The following table shows the grouping of regional genera which I suggest, and indicates the characters on which I rely to establish them:—

A. *Ac* lies at a level about midway between the two costal antenodal nerves.
  I. *Ab* normal (*i.e.* meeting the nerve descending from the distal end of the quadrilateral (Cu_{2b}).
    Hinder margin of prothorax of female crenate or dentate.
    a. Wings broad (length to breadth 4 : 1). Cu_1 reaching hinder margin of wing beyond half the wing length. Body rather stout. Wings of males coloured.

CHLORONEURA, gen. nov.

Type: *C. quadrimaculata*, Ramb.
Distribution: Central India.

b. Wings narrow (length to breadth 9 : 2). Cu_1 reaching hinder margin of wing before half the wing length. Body slender. Wings of male uncoloured.

DISPARONEURA, Selys.

Type: *D. frenulata*, Selys.
Distribution: Africa, Tropical Asia to Borneo.

II. *Ab* reduced or absent (*i.e.* when present not meeting Cu_{2b}).
a. *Ab* present, Cu_1 reaching to half the wing length on the hinderwing. Posterior prothoracic margin of female simple.

INDONEURA, gen. nov.

Type: *I. gomphoides* (Ramb.).
Distribution: W. Peninsular India.

b. *Ab* present as a vestige or absent. Cu_1 not reaching half the wing length of hinder wing. Posterior prothoracic margin of female not simple.

CACONEURA, Kirby.

Type: *C. dorsalis*, Selys.
Distribution: Ceylon, Burma, Malaya.

B *Ac* lies at about level of first antenodal or proximal to it.
Nososticta and other Papuan and Australasian genera; not regional.

Disparoneura westermanni, Selys, is not represented in the Museum collection, and is not known to me.

Genus **Chloroneura**, nov.

This monotypic genus, which is peculiar to Central India, ranges apparently from the neighbourhood of Bombay, through the West Ghauts as far at any rate as Nagpur in the Central Provinces, but the limits of its distribution are not at all known.

It is perhaps more primitive than the true *Disparoneura*, to which it is very closely allied. The form of the anal appendages of the male and of the posterior prothoracic margin of the female of the two genera are extremely similar.

Chloroneura quadrimaculata, Ramb.

Disparoneura quadrimaculata, Kirby, *Cat. Odonata*, p. 133.
,, ,, Laidlaw, *Rec. Ind. Mus.* XI, p. 391 (1915).

Medha, Yenna Valley, Satara District.
Nagpur, C. P. (*E. D'Abreu*).

Genus **Disparoneura**, Selys.

The type of the genus was a species identified by Selys in his *Synopsis* as the *Agrion glaucum* of Rambur. Unfortunately Rambur's species turns out to be an *Enallagma* (see Calvert, *Trans. Amer. Ent. Soc.*, XXV, p. 40; 1898).

Hence at the present time some doubt exists as to the type species of the genus. Selys, however, gives *Agrion frenulatum*, of

Drégé, as a synonym for his type, and remarks of his second species of the genus, *Disparoneura frenulata*, that it is difficult to separate it from *Disparoneura glauca*. Hence we cannot be very wide of the mark in taking *Disparoneura frenulata*, Selys, as the provisional type of the genus.

The definition given above encloses a group of species ranging from Africa through peninsular India, Burma, the Malay Peninsula, to Sumatra and Borneo, which is, I think, a very natural one.

Besides the type species, of which we have fortunately admirable figures, given by Dr. Ris (*Sitzungsberich. d. Kais. Akad. d. Wissensch. in Wien*, mathem.-naturw. Klasse, Bd. CXXI, Abt. 1, Apr. 1912, pp. 12–14, text-figs. 7–9), there are probably other African species. In Asia there are in addition to the two new species described below, *D. analis*, Selys, ranging from the Malay Peninsula to Sumatra and Borneo, the closely allied *D. atkinsoni*, Selys, from Burma and lastly *D. aurantiaca*, Selys, from Borneo. All these species, in addition to the generic characters given above, have rather dull colouring, mostly black and yellow, with the anal appendages of the males very similar in structure, the upper pair being provided in each case with a large ventral spur or tooth.

There are, besides, three or four species from Ceylon, which may form a small group within the genus.

Disparoneura tetrica,[1] sp. nov.

3 ♂ 2 ♀ Talewadi, N. Kanara Distr., Oct. 1916, No. 4389/H.I. (*S. W Kemp*).

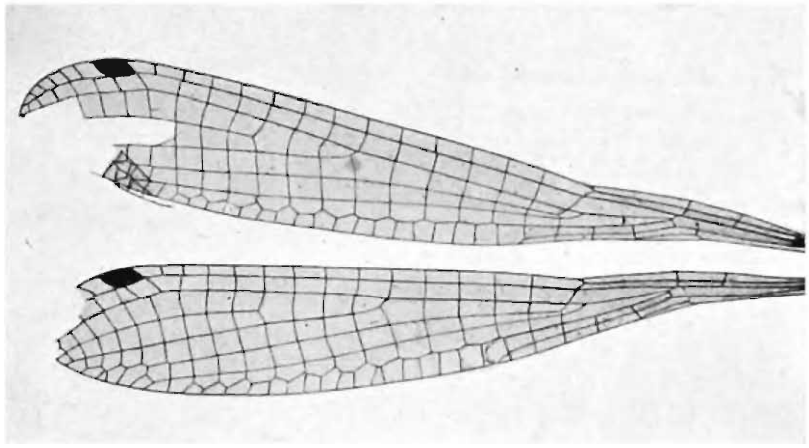


FIG. 4.—*Disparoneura tetrica*, sp. nov.
Wing photograph of ♂.

Length of hind-wing 18·5 mm., of abdomen 27–28 mm.

Post-nodals on fore-wing 12–13. Cu_1 reaching the hinder margin of the wing 3 cells beyond the sub-nodus on the hind-wing.

[1] Tetricus = sombre.

Pterostigma brownish-black, rather large covering one and a half cells.

♂ Adult. *Head.*—Genae and anteclypeus bluish-white, the rest of the dorsal surface velvety black. Eyes with a black equatorial belt, below this pale bluish-white, immediately above it a zone of the same colour, upper pole grey-black.

Prothorax.—Dorsum and sides entirely black, under surface yellowish-white, posterior margin simple.

Thorax.—Dorsum black as far as the level of the first lateral suture; sides and under surface yellowish-white, with an irregular black band along the second lateral suture, not enclosing the stigma.

Abdomen dark brown, with a yellow mark on the sides of segments 1–2, and a black terminal ring on 3–7, preceded by a small, ill-defined postero-lateral lunule of whitish-blue colour on either side of these segments, 8–10 black. Posterior margin of 10 projecting a little in the middle line.

Anal appendages brown, upper surface and extremity of upper pair white. Viewed from above the upper pair have each a prominent white projection at their outer extremities, their inner margins are crescentic; in profile they are obliquely truncate, with a strong downwardly directed ventral tooth. Lower pair rapidly tapering and incurved at their extremities (text-fig. 5).

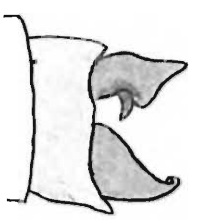


FIG. 5.—*Disparoneura tetrica*, sp. nov. Anal appendages ♂.

Legs yellowish-white. Posterior surface of femurs, lateral margins of tibias, spines and tarsi black.

♀ Adult. Resembles adult male, but the abdominal colours are more vivid, and there is a yellowish-white lateral spot on abdominal segments 8–9.

♀ Juv. Upper lip brown, also brown markings on the postclypeus and a narrow brown band running traversely from eye to eye across the base of the antennae. There is also a brown spot on either side of the middle lobe of the prothorax and distinct traces of brown antehumeral bands occur on the thorax. Otherwise as in the adult female. The hinder margin of the prothorax carries two small projections directed upwards and a little forwards.

Types in the Indian Museum. Paratype in my own collection.

Disparoneura nigerrima, sp. nov.

1 ♂ Nagpur, Central Provinces 1,000 ft., September, 1916 (*E. D'Abreu*).

Length of hind-wing 16·5 mm., of abdomen 25 mm.

Post-costals on fore-wing. Cu_1 reaches hinder margin of hind-wing 2 or 3 cells beyond the sub-nodus. Pterostigma brown, small, covering about one-half of a cell.

♂ Adult. Colouring black, with the following exceptions :—

Head.—Upper lip with a narrow white margin, genae bluish-white, eyes of the same colour, darkening towards the upper pole.

Prothorax and *thorax.*—Ventral surfaces yellowish-white.

Abdomen.—Segments 1–2 brownish-white; 3–5 with small postero-lateral whitish lunules on either side of the segment.

Anal appendages.—Apex of the upper pair white, lower pair dark brown. Viewed from above the upper appendages are triangular, the outer margins parallel to each other, and the apices are prolonged to form a fine projection. In profile they appear bifid (text-fig. 6).

The lower pair are relatively more massive than in the last species.

This is the smallest member of its genus; it is also the first recorded from Central India.

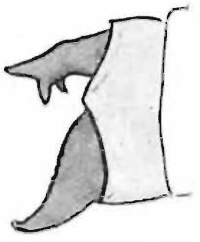


FIG. 6.—*Disparoneura nigerrima*, sp. nov. Anal appendages ♂.

Disparoneura atkinsoni, Selys.

Disparoneura atkinsoni, Kirby, *Cat. Odonata*, p. 133 (1890).

The Burmese representative of the genus. Closely allied to *D. analis*, Selys, from Malacca, Sumatra and Borneo, but larger.

Genus **Indoneura**, Kirby.

Unless, as is not unlikely, *D. westermanni*, Selys, is congeneric with *Indoneura gomphoides* (Ramb.), the genus is monotypic.

The simple structure of the hinder margin of the prothorax of the female is I think an important character, though a sexual one. The type species is very considerably larger than any of the species of the genus which stands next to it (*Caconeura*), and the dense reticulation of the wings points, I think, to the genus being a primitive one.

Indoneura gomphoides (Ramb.)

(Pl. xv, fig. 7).

Disparoneura gomphoides, Kirby, *Cat. Odonata*, p. 134 (1890).

1 ♂ 1 ♀ Talewadi, S. Kanara Distr., No. 4376/H.I.

Length of hind-wing 26 mm., of abdomen 38 mm.

,, ,, ,, ,, 29 mm., ,, ,, 39 mm.

Both specimens are fully adult. The female has not been described.

♀ Adult. *Head.*—Upper lip metallic black, edged with brown. Ante- and post-clypeus metallic black; genae blue. The rest of the dorsal surface dull black. Eyes, lower two-thirds blue, upper third dull black.

Prothorax black, its anterior lobe blue, blue marks on the sides of the middle lobe.

Thorax.—Dorsum bronze-black as far as the level of the first lateral suture, with narrow blue antehumeral bands. Sides blue with a black band along the second lateral suture. Under surface yellowish-white.

Abdomen bronze-black. Segment 1 light blue above, with a large square black mark, segments 8–10 each with a blue mark on the dorsum.

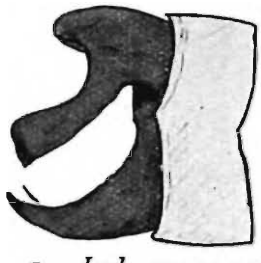


FIG. 7.—*Indoneura gomphoides* (Ramb.). Anal appendages ♂.

Legs black.

The specific name is given, I imagine, on account of the gomphonic-like appearance of the anal appendages of the male (text-fig. 7).

The female type will be returned to the Indian Museum, with the male specimen.

Genus **Caconeura**, Kirby.

Caconeura sita, Kirby.

Disparoneura sita, Kirby, *Journ. Linn. Soc.* (Zool.), XXIV, p. 563 (1893).

I have examined the specimens in the British Museum. The species appears to be a true *Caconeura*.

[In Mr. Laidlaw's previous papers in this Journal (vol. xii, p. 135 and vol. xiii, pp. 31 and 39) the localities "Gopal, Assam" and "Gopaldhara in Assam" should read "Gopaldhara in the Darjiling district."—*Ed.*]

EXPLANATION OF PLATE XIII.

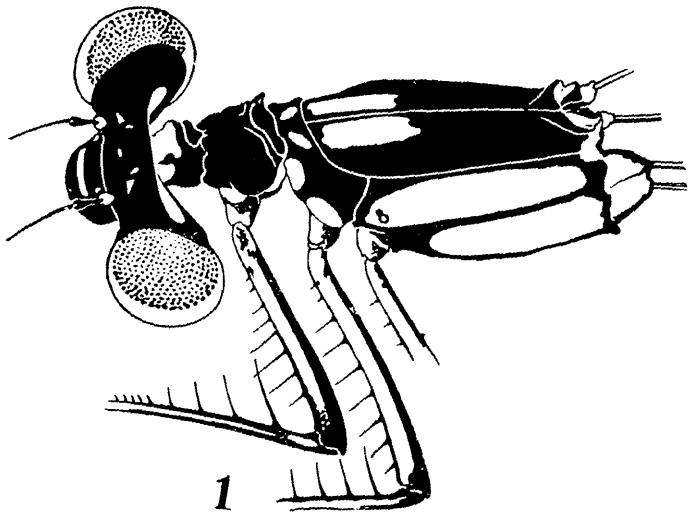
Coeliccia renifera (Selys).

FIG. 1.—Head, prothorax and thorax of adult male.

,, 2.—Head, prothorax and thorax of young male.

,, 3.—Head, prothorax and thorax of female.

(Drawn from specimens in spirit collection of Indian Museum).



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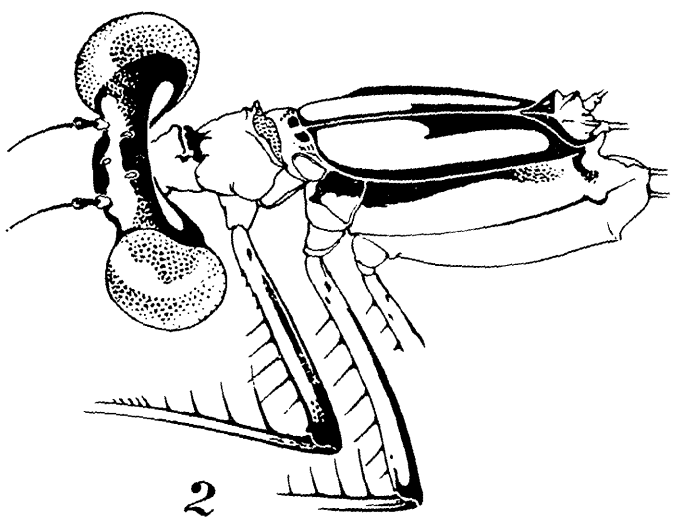

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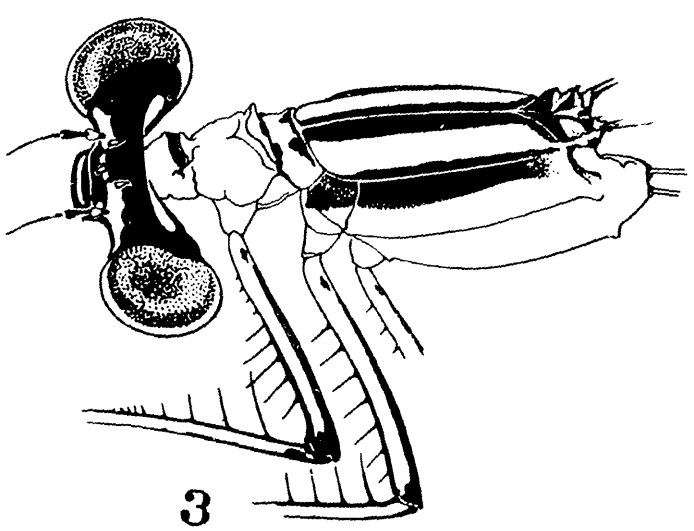


3

INDIAN AGRIONINAE

EXPLANATION OF PLATE XIV.

FIG. 1.—Head, prothorax and thorax of *Drepanosticta carmichaeli* (Laidlaw), ♂. Unshaded parts of thorax and prothorax bright blue, dotted parts olive-brown.

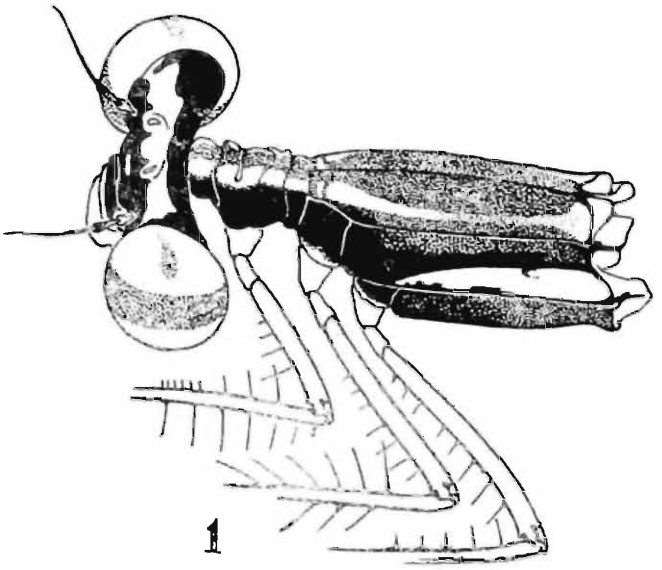
(Drawn from spirit specimen in collection of Indian Museum.)

FIG. 2.—Head, prothorax and thorax of *Copera marginipes* (Ramb.), ♂.

(Drawn from spirit specimen in collection of Indian Museum).

FIG. 3.—Anal appendages of *Coeliccia renifera* (Selys), seen from the side.

,, 4.—Terminal segments of abdomen of *Drepanosticta carmichaeli* (Laidlaw), from above and from the side.



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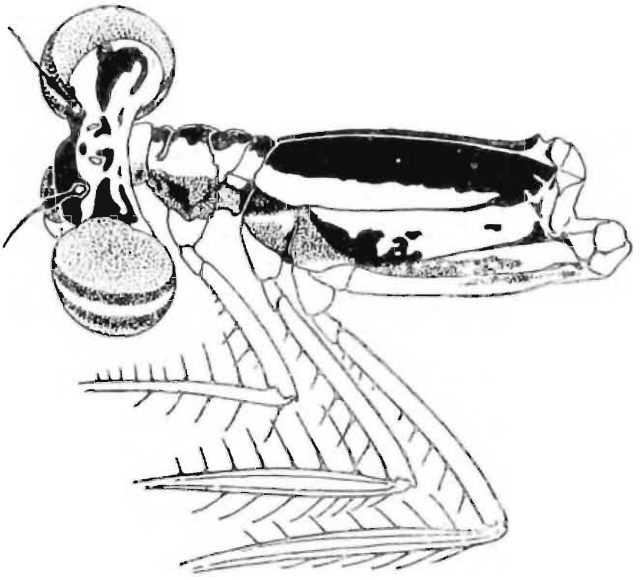

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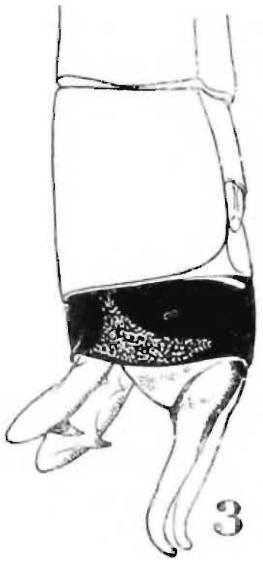

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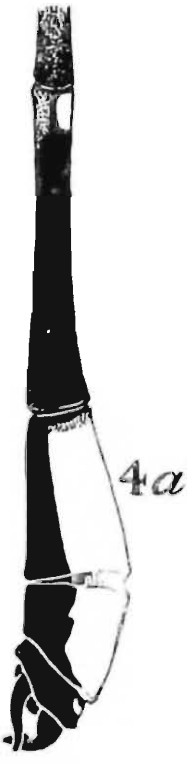

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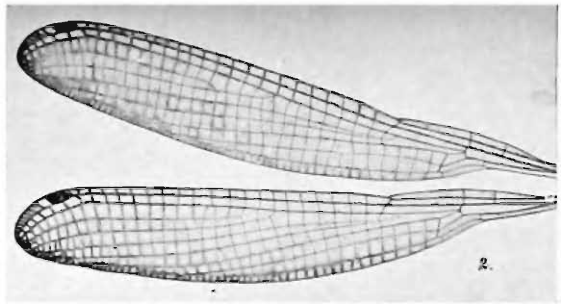
4

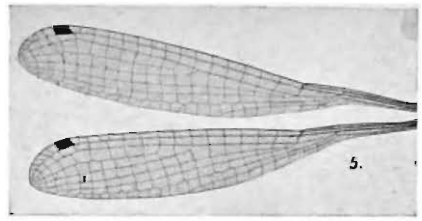
INDIAN AGRIONINAE

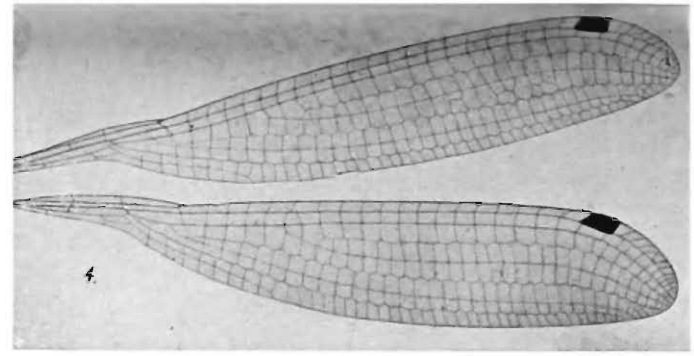
EXPLANATION OF PLATE XV.

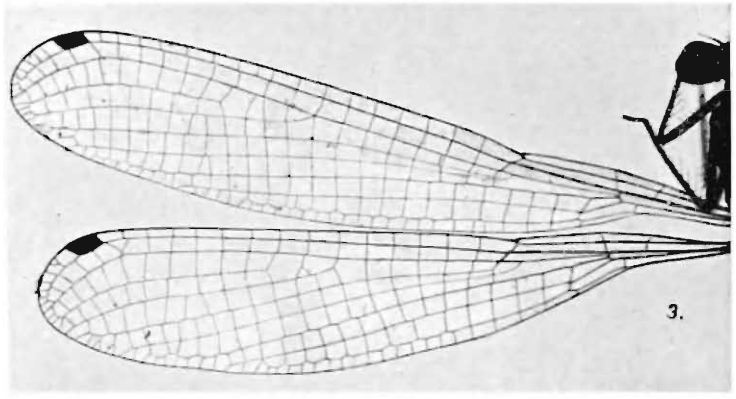
Wing photographs, by Messrs H. and F. E. Campion.

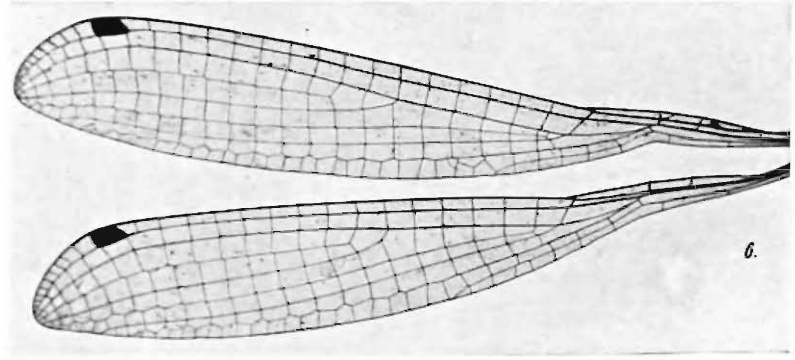
FIG. 1.—*Argiolestes melanothorax*, Selys, ♂.
, 2.—*Indocnemis kempi*, n. sp., ♂.
,, 3.—*Calicnemis pulverulans*, Selys, ♂
,, 4.—*Platysticta deccanensis*, Laidlaw, ♂.
,, 5.—*Drepanosticta carmichaeli* (Laidlaw), ♂.
,, 6.—*Protosticta himalaiaca*, n. sp., ♀.
,, 7.—*Indoneura gomphoides* (Ramb.), ♀.
,, 8.—*Chloroneura quadrimaculata* (Ramb.), ♂.

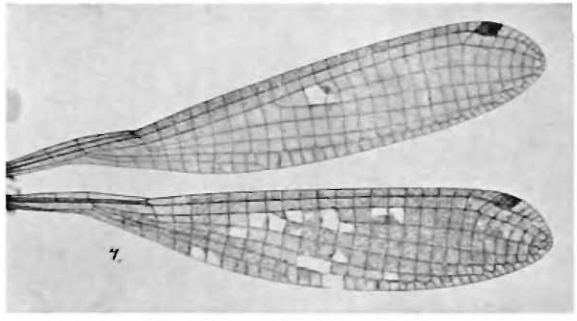


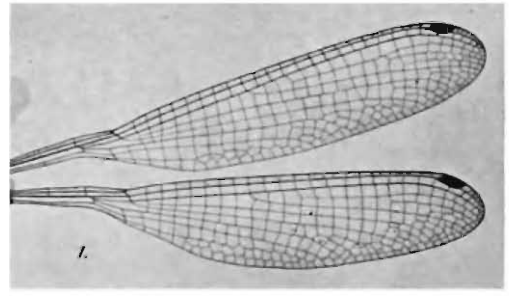


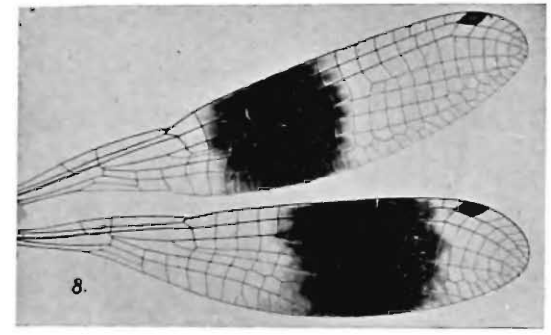












INDIAN AGRIONINAE.

Photo-engraved & printed at the Offices of the Survey of India, Calcutta, 1917.

XXI. THE LAND MOLLUSCA COLLECTED ON THE ISLAND OF BARKUDA IN THE CHILKA LAKE, GANJAM

By LT.-COLONEL H. H. GODWIN-AUSTEN, *F.R S., etc.*

Dr. Annandale, Director of the Zoological Survey of India, and Mr. F. H. Gravely, Asst. Superintendent, have very recently (July, 1916) been investigating the fauna of this island, and obtained there three species of land shells, which Dr. Annandale has kindly sent to me for examination. The specimens are well preserved in spirit. One turns out to be a most interesting species both from its history, habitat and morphological characters. It proves to be a species described by W Blanford in 1866 (*Journ. As. Soc. Bengal*, XXXV (2), p. 36) as *Nanina* (*Macrochlamys*) *infausta*, and occurred among Captain Beddome's Anamullay collections, but in the *Fauna of British India*, *Mollusca* vol. I, p. 134, Blanford says: "The locality originally assigned to this species, the Anaimalai Hills, appears to have been given in error, as in the case of *M. lixa.*" He compared it in 1866 with *Helix vitrinoides*, Desh., which at that date included several distinct species such as *hardwickei*, G.-A.; *indica*, G.-A.; *petrosa*, Hutton; *perplana*, G.-A. and *pedina*, Bs.; all differing widely in their anatomy. At that period the animals of Indian molluscs had received little attention. Wm. Blanford led the way to a better state of things by the copious notes he made in the field of the outward form of the animal, and the examination of the radula, while it was Stoliczka who gave us the first insight into the internal anatomy of many Indian genera. In the *Fauna of British India*, *Mollusca* vol. I (1908), p. 133, nothing being known of its anatomy, it was on shell character placed in *Macrochlamys*. The species now described shows conclusively that it belongs to the genus *Ariophanta*, of my section *Nilgiria*, a group of the land mollusca, together with *Euplecta* and *Eurychlamys*, not hitherto found outside Peninsular India, with one exception. *Ariophanta interrupta*, Bs. is common in Calcutta and in 1865 I found it in Jessore. This extension into the delta from the side of Orissa is however probably due to the agency of man.

Ariophanta infausta, W. Blf.

Forbes and Hanley, *Conch. Ind.*, pl. clix, figs. 2, 3 (*Helix*).
W. T. Blanford, *Journ. As. Soc. Bengal*, XXXV (2), 1866, p. 36 [*Nanina* (*Macrochlamys*)].
W. T. Blanford and H. H. Godwin-Austen, *Faun. Brit. Ind.*, *Moll.* I 1908, p. 133 (*Macrochlamys*).

Locality.—Banks of Chilka Lake.

Sculpture very finely decussate.

Animal (fig. 1, A, B, C). The spirit specimen is colourless, with the exception of a darkish narrow patch on the right dorsal lobe near the rectum, and a conspicuous long narrow black line on the visceral sac bordering the renal organ (fig. 1, B).

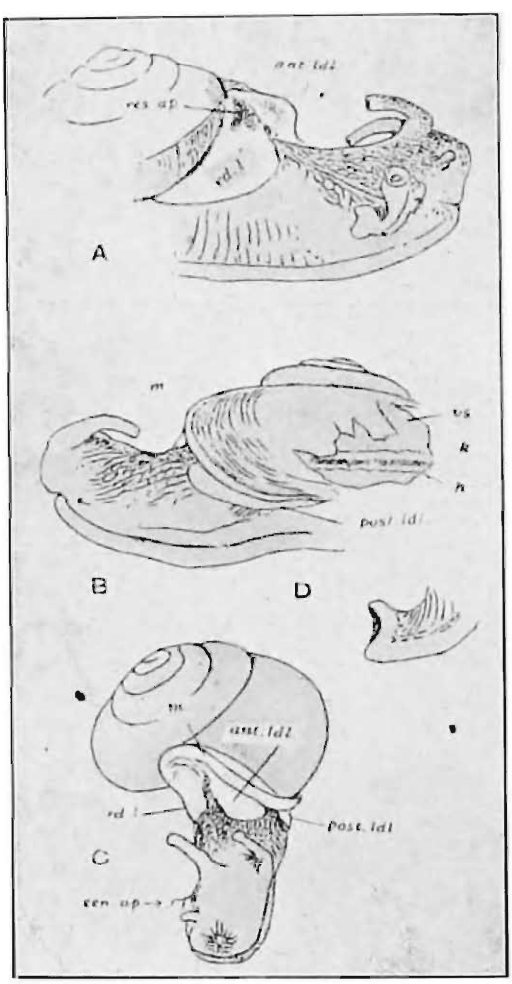


FIG. 1.—*Ariophanta infausta*, W. Blf.
A, B, C. Animal.
D. Extremity of foot.

The sole of the foot is divided and wide V-shaped segments cross it. The peripodial margin is broad with the usual two grooves above it; they are indistinctly seen in these specimens. The mucous gland at the extremity of the foot is large and vertical (fig. 1, D).

The edge of the peristome is overlapped slightly by the mantle edge (*m*), and there is a thin, narrow separate expansion of this for a short distance backwards over the shell on the upper margin, a character I have never yet met with in any other species. It is due no doubt to the very perfect state of preservation and freshness of these specimens. The right dorsal lobe (*rd. l*) is large triangulate, the left in two parts, quite separate; the anterior part is small in comparison with the right dorsal, and a posterior (*post. ldl.*) which is narrow and elongate and extends narrowing to the hinder part of the shell. From this it is clear that the position of this mollusc is in the Ariophantinae and certainly not in the Macrochlamyinae, which section of it only the generative organs will show.

Generative organs (fig. 2, A). The species has a long caecum or diverticulum (*crp.*) at the end of which the retractor muscle is given off. The kalc-sac or flagellum (*fl.*) is short, the spermatheca (*sp.*) is globose and sessile; the amatorial organ

(*am. or.*) very long. In every respect the genitalia are similar to those of the subgenus *Nilgiria*, as represented by *N. bistrialis*, Beck., vide *Moll. India*, vol. II, p. 80, pl. lxxxi, fig. 4-4*a*.

The radula differs very considerably from that of *Nilgiria bistrialis* both in the form of the marginals and in the formula, which is 38. 2. 12. 1. 12. 2. 38 or 52-1-52, the marginals being unevenly bicuspid, the inner cusp the longest. It thus falls into the group B δ, vide *Moll. Ind.* p. 82, with *solata*, *tranquebarica*, *maderaspatana* and *ligulata*, species with very different shells, *tranquebarica* being the nearest to *infausta*. The jaw (fig. 2, B) is rather straight in front with a central projection, similar to that of *bistrialis*.

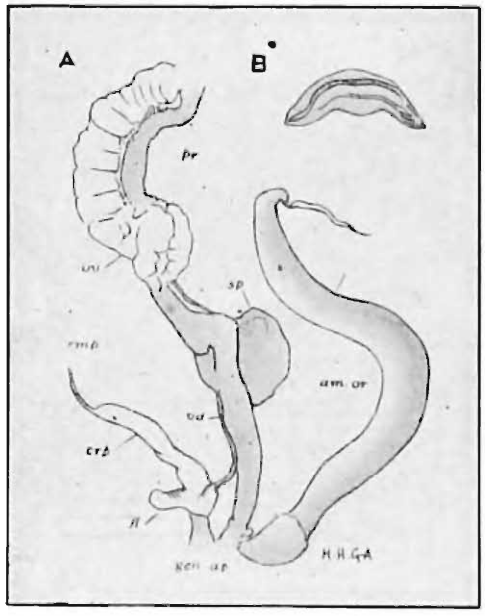


FIG. 2.—*Ariophanta infausta*, W. Blf.
A. Generative organs × 9.
B. Jaw × 9.

The other two land shells from this small island are *Rachisellus praetermissus*, W. T. & H. F. Blf. and *Opeas gracilis*, Hutton. I have compared this last, a single specimen, with some from the typical locality Mirzapur, described by Captain Hutton. There are points of difference, but a series from the Chilka Lake is wanted. The genitalia of both genera appears to be unknown and the specimens will be most useful when the time comes to examine them.

[The *Ariophanta* and the *Rachisellus* are both abundant on the leaves of shrubs in the rainy season. In periods of temporary drought they secrete a false operculum of mucus, but remain in exposed positions. The *Opeas*, on the other hand, was found in the earth under a log of wood.—*N. A.*].

As the original blocks for the two text-figures have been lost in transit, they have had to be reproduced from the proofs.

XXII ON A COLLECTION OF OLIGOCHAETA FROM VARIOUS PARTS OF INDIA AND FURTHER INDIA

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(Plates XVI—XVIII.)

CONTENTS.

INTRODUCTION.

The greater part of the present communication deals with a number of specimens of Oligochaeta, many of them of considerable interest, which have lately been added to the collection of the Indian Museum; my thanks are due to Dr. Annandale, Director of the Zoological Survey of India, for the opportunity of examining them. I have also added records, and sometimes notes or descriptions, of the worms which have come into my hands from elsewhere during the past year or so.

The chief localities which have yielded material of interest have been the following:—

(1). Murree, in the Himalayas of the N. Punjab. The list of the earthworms of the Punjab is still a short one, and the addition of even two species is an event of some local interest. One of these two species is *Drawida japonica*, a peregrine species which has been found in China, Japan, and the Bahamas, but which has not, curiously, hitherto been certainly identified from India. Also from Murree I have received a *Helodrilus* which to the best of my knowledge is new; though as the records of this genus are scattered, and in part inaccessible to me, I ought to express myself with caution; this perhaps represents one of the outposts of the Lumbricidae in their southward extension from Palaearctic regions, another being possibly *Helodrilus* (*Bimastus*) *indicus*, Mchlsn. (*cf.* Michaelsen, 13), from Calcutta.

(2). Rangamati, in the Chittagong Hill Tracts, Bengal,—near the head of the Bay of Bengal,—is quite a nest of species of *Drawida*. I need only point out that the occurrence of a number of endemic species in this region emphasizes what I wrote formerly, on the geographical aspect of the facts of distribution of the genus *Drawida*, after describing a number of new species of the genus from the Abor country (17).

(3). New species of *Perionyx* from the Eastern Himalayas are in accordance with what we should expect from the known geographical distribution of the genus.

(4). From Portuguese India and the neighbourhood Mr. Kemp has collected a number of interesting species; these include *Erythraeodrilus kinneari*, recently described by me (19), and no fewer than five species of a genus which I believe to be that of which Bourne's *Perichaeta stuarti* is the type, and which is now known as *Hoplochaetella*; we might indeed speak of a "nest" of these species in this region. As the discussion of this material is complicated, I propose to devote an introductory chapter to it, instead of interrupting the systematic portion of the paper by an excursus of such an extent,—one which, in addition, touches on points of somewhat wider interest.

THE GENUS *HOPLOCHAETELLA*.

In 1886 Bourne published, in a "Preliminary notice of Earthworms from the Nilgiris and Shevaroys" (7), a short description of a species which he called *Perichaeta stuarti*. Beddard in 1890 (1) established for this worm the genus *Hoplochaeta*; but, in 1895 (3) he thought that it might be referable to Benham's genus *Plagiochaeta*, and that the name *Hoplochaeta* had perhaps better be withdrawn, pending further investigations by the discoverer of the species; the worm does not find a place at all in his systematic account of species and genera. Michaelsen, however, in 1900 (10) retained the genus under the name *Hoplochaetella* (*Hoplochaeta* having been found to be preoccupied), and it has since figured in his lists of Indian Earthworms (13, 14). The worm has played a part in zoogeographical discussions, since Michaelsen (13) has referred to this genus several species described by Benham from the South Island of New Zealand as *Plagiochaeta* (4), and has thus illustrated the connection between the Oligochaete fauna of New Zealand and India.

All that we know of the anatomy of the Indian *Hoplochaetella*, however, is derived from Bourne's original account. Though Bourne subsequently expanded the descriptions of the Moniligastridae enumerated in his preliminary account, he did not do so for *Perichaeta stuarti* nor for most of the other Megascolecidae. I venture therefore,—since the ascription of five species obtained by Mr. Kemp to the genus of which *Perichaeta stuarti* is the type requires some justification,—to transcribe Bourne's words.

"*Perichaeta stuarti*, sp. n.

The clitellum extends over somites xiv, xv, and xvi; it is very well marked.

There are two pairs of male pores in somites xvii and xix respectively; these are all four placed upon a whitish, slightly depressed patch, which thus extends over the greater portion of

somite xvii, the whole of somite xviii, and the greater portion of somite xix. Connected with each of these pores is a large coiled prostatic gland, which extends backwards in each case through some 8 or 9 somites.

There is a single median oviducal pore in the anterior portion of somite xiv.

There are two pairs of spermathecae, situated in somites vii and viii respectively. They do not possess any appendages, but present a sort of frilled appearance around the base.

The gizzard is situated in somite x.

In somites xxiii-xxvi (?) there are four pairs of special diverticula on the dorso-lateral portions of the intestine.

I have not observed any nephridia.

There are about 52 setae in each somite, arranged with small dorsal and ventral gaps ; setae are present on the clitellum.

There are no special setae in somite xviii ; but in the anterior portion of somite viii (i.e., between the anterior and posterior pair of spermathecae) there are two groups of large modified setae. Where these project on the surface, there is a papilla which in some specimens becomes very well marked.

Length 148 mm., circumference 15 mm. ; number of somites 111.

Hab. Yercaud, at an elevation of about 5,000 ft.[1], and also down the ghaut as low as Salem (1,000 ft.). I have specimens from Salem.

This is an exceedingly common worm in this region. It occurs in dry ground, and often under large stones."

The only other remark Bourne makes about the worm is a reference to the two pairs of male pores as establishing a difference between it and other species of *Perichaeta*.

It will be seen at once that there are striking similarities between *Perichaeta stuarti* and the group of species described in the body of the present paper under the genus *Hoplochaetella*. Besides such general features as size, setal numbers and distribution, situation of prostatic and female apertures, the two pairs of long coiled prostates, etc., there are the special setae in segment viii, dis placed out of the line and seated on papillae ; and the frill of diverticula at the base of the spermathecae, which is exactly paralleled in several species here described.

The differences are however not negligible. Thus the gizzard is said to be in segment x ; this is anomalous,—I do not recall any single Megascolecid in which it occurs in this position, *i.e.* in a

[1] With regard to the locality, Bourne in a subsquent publication says, "I have stated that *Perichaeta stuarti* is to be found at an elevation of 5000 ft., and also at one of 1000 ft., but this has proved to be a mistake which arose from my collector having mixed specimens from the two localities. I cannot find *P. stuarti* at any great distance down the ghaut." (On certain Earthworms from the Western Himalayas and Dehra Dun, *P. As. Soc. Bengal*, vol. lvii, 1889). Michaelsen has overlooked this correction.

testis segment, and certainly not in any of the subfam. Octochaetinae. Michaelsen does not seem quite clear what to make of it; in the generic characters which he attributes to *Hoplochaetella* (10) he has "1 Muskelmagen vor den Hoden-Segm."; while in the specific diagnosis of *H. stuarti* he says "Muskelmagen im 10 Segm." I think we may fairly suspect an error in Bourne's statement.

The four pairs of dorso-lateral intestinal caeca may or may not be more than the usual segmental bulgings of the intestinal walls, commonly best marked in the dorso-lateral region, carried to an unusual degree.

These are the only differences between *Perichaeta stuarti* and the group of species described below that could possibly be of generic importance;—I mean, the only differences that unequivocally follow from the description. Michaelsen in his generic and specific diagnoses in the "*Tierreich*" gives other points, which rest on inference.

The first of these is the (doubtful, for he queries it) position of the male pore (*i.e* the ending of the vas deferens, as distinct from the prostatic pores) on segment xviii. Bourne does not mention this; in so far as we can infer anything, I think we must infer the absence of pores on xviii.; since in his introduction he brings forward the presence of two male pores, on segments xvii and xix, as a distinction between *P. stuarti* and ordinary species of *Perichaeta*, which have "a pair of laterally-placed male pores in somite xviii."

The second is the position of the spermathecal apertures in furrows 7/8 and 8/9. Bourne makes no reference of any kind to the apertures, saying only that the spermathecae are in segments vii and viii. The apertures often are in the furrows just mentioned in the Octochaetinae, but not always; in *Erythraeodrilus*, and in some species of *Octochaetus*, they are on the segments, not between them.

The third and most important is the condition of the nephridial system. All that Bourne says is, "I have not observed any nephridia." Michaelsen naturally takes this to mean that the system is micronephric throughout. I hope I shall not be going too far if I suggest that *Perichaeta stuarti* may have possessed both mega- and micronephridia, and that the meganephridia as well as the micronephridia may have been overlooked by Bourne. It is to be remembered that (1) in the group of species which I describe in the body of the paper the meganephridia only begin in segment xx; if a similar condition existed in *P. stuarti* it *might* not have attracted attention in a dissection of the anterior part of the worm (though I admit that Bourne must have dissected one or more specimens back to at least the level of the hinder ends of the long prostates). (2) Bourne's observations on the nephridia of other species described in the same paper are extraordinarily various; thus "I have found no nephridia," (*Perichaeta lawsoni*); "there are two pairs of groups of small nephridia opening on the posterior edges of somites vii. and viii," (*P. gracilis*,—nothing about nephri-

dia elsewhere) ; " I am at present unable to say anything about the nephridia " (*P. burliarensis*); " no nephridia were observed " (*P. hulikalensis*) ; " nephridia seem to be present in certain anterior segments only" (*P. mirabilis*); " the nephridia occur in, at any rate, most of the somites; they are very large and present rosettes of tubules in certain anterior somites" (*P. salettensis*). We can only conclude that Bourne's observations on the nephridia of his various species are inadequate in respect of present-day requirements, and are not of much help in identifying his forms; one can hardly accept his statements, for example, with regard to the nephridial distribution in *P. gracilis* and *P. mirabilis*. (3) The ease or difficulty of determining the nephridial condition depends largely on the condition of the specimen; it is easiest in a well-preserved spirit specimen, as the nephridia are then opaque, but in badly preserved material it may be impossible. Even much later than Bourne's day the most experienced investigators have at times been under the necessity of revising their accounts of the nephridial conditions; so Benham (4, 6,—*Plagiochaeta ricardi* and *montana* at first supposed micronephridial, later recognized as meganephric) ; Michaelsen (11, 14,—*Eudichogaster ashworthi* at first supposed micronephridial, later recognized as having both mega- and micronephridia).

Thus I do not think it is unfair to leave aside the nephridia of *Perichaeta stuarti* altogether. When Bourne says "I have not observed any nephridia," it may simply have been for want of sufficiently close observation, or the specimen may have been badly preserved ; in any case we are dealing with the early days of Oligochaete research, with a preliminary communication which was only meant to be a first survey of the field, and written at a time it was not known even what characters were of generic value. We must admit that we know nothing about the nephridia, even by inference.

I have, I think, shown that there is pretty certainly a mistake in Bourne's statement concerning the position of the gizzard; that there is no ground at all for supposing a separate male pore in segment xviii, or that the spermathecal apertures are necessarily in furrows 7/8 and 8/9 (though this last point is relatively unimportant) ; the intestinal caeca, whether they were accidental inflations of the gut-wall or not, would not be of generic importance; and, finally, we are in the dark as regards the nephridia. In all other respects the worms in the present collection resemble *Perichaeta stuarti* ; and I have therefore, after much hesitation, decided to unite them in the same genus, the diagnosis of which now runs as follows :—

Genus *Hoplochaetella*, Mchlsn. emend. Stephenson.

Setae in rings. Calcareous glands four pairs, in x-xiii. Micro nephridia throughout the body ; meganephridia in addition from xx onwards, one pair per segment. Two pairs testes, free in x and xi. Two pairs long coiled prostates, opening on the posterior part of xvii and the anterior part of xviii, or in grooves 17/18 and 18/19. Vasa

deferentia open in common with the ducts of the anterior pair of prostates. One unpaired female pore. Two pairs spermathecae with apertures on viii; accessory glands in the neighbourhood. No penial setae; displaced and modified setae on one or more of segments vii, viii, ix.

ON OTHER SUPPOSED SPECIES OF THE GENUS *HOPLOCHAETELLA*.

In 1909 Michaelsen (13) united with the genus *Hoplochaetella* as defined by him (Acanthodriline arrangement of posterior male organs, setae in rings, micronephridia) three species of worms originally described by Benham from New Zealand,—*Plagiochaeta rossii*, *P. ricardi*, and *P. montana* (the last two however with an element of doubt, owing to the fact that Benham had revised his earlier statement concerning the nephridial system).

Plagiochaeta is a genus of the subfamily Acanthodrilinae of which the type was described by Benham in 1892; the originally paired setae have undergone the perichaetine increase, the posterior male organs have the original Acanthodriline arrangement, the testes and funnels are enclosed in testis-sacs; the type of the genus is meganephric, with nephridiopores alternating in position in successive segments; there are penial setae, and the gizzard is rudimentary. Benham (4) subsequently described four new species; three of these were micronephric, but he did not at the time consider this peculiarity sufficient to warrant a generic separation. It was these three species which Michaelsen, with different views on the value of the nephridial condition, united with *Hoplochaetella*.

Benham, however, had already found that two of the three species were in reality meganephric (5); but this Michaelsen had not been willing to accept at its full value; he did so afterwards for *P. ricardi*, and Benham has since shown that his statement regarding the presence of meganephridia was correct also for *P. montana*. This leaves only *P. rossii* to be added to the genus *Hoplochaetella* (Benham and Cameron, 6).

Now the type of the genus *Hoplochaetella* is *Perichaeta stuarti*, and if my former arguments are correct, *Plagiochaeta rossii* differs from *Hoplochaetella* in two of the three points of cardinal importance,—setae, nephridial condition, and arrangement of posterior male organs. It cannot then go into, or even very near, *Hoplochaetella*, and it is necessary to separate it under another name as a new genus. I may add that while the general facies of *Perichaeta stuarti* agrees, so far as can be judged, with that of the species which I describe below as *Hoplochaetella*, there is nothing in the original description of *Plagiochaeta rossii* to remind us of *Perichaeta stuarti*; in *Plagiochaeta rossii* the prostates are confined to their proper segments, in which they are coiled into a ball, the spermathecal ducts have groups of botryoidal diverticula, and there are prominent porophores with spermatic ridges leading from the anterior to the posterior prostatic pore of each side.

THE SYSTEMATIC POSITION AND RELATIONSHIPS OF THE GENUS *HOPLOCHAETELLA*.

That *Hoplochaetella*, as here defined, is the direct ancestor of *Erythraeodrilus* seems certain. It happens that *Erythraeodrilus* (both batches,—the original specimens collected in 1913, as well as the example in the present collection) and the five species of *Hoplochaetella* here described (though not the type species, *Perichaeta stuarti*), come from within a few miles of each other. The general facies is similar; and the two genera agree in such peculiarities as the point where the meganephridia begin, the position and relative sizes of the calcareous glands, the length and disposition of the prostatic ducts, the presence of accessory spermathecal glands, and the vascular commissure of segment xiv; some of these are so special (*e.g.* the accessory spermathecal glands, the vascular commissure in xiv) that they cannot be regarded as other than marks of close affinity.

The differences are :—the fusion of the septa in the region of the testes in the one, and the presence of testis-sacs of the usual type in the other; the three pairs of seminal vesicles and the absence of displaced setae in the spermathecal region of *Erythraeodrilus*; the (sometimes, apparently) common opening of the spermathecae of the same side in *Erythraeodrilus*; and especially,—the essential point,—the total disappearance of the posterior pair of prostates in the latter genus. What we have, in fact, in these two genera, is two successive stages in the reduction of the original Acanthodriline male apparatus.

This may be illustrated by the figures on page 360. Text-fig. 1 gives a diagrammatic representation of the primitive condition, as found in *Notiodrilus* (I use the name in the sense in which it was used, for example, by Michaelsen in his "Geographische Verbreitung der Oligochäten"); the testes are free in segments x and xi, the vasa deferentia open on xviii, the two prostates independently on xvii and xix, the spermathecae in grooves 7/8 and 8/9. In the Megascolecinae the reduction takes place by the union of prostatic and proper male apertures in segment xviii,—in the situation of the opening of the vas deferens (text-fig. 2). In the Octochaetinae, however, a different process is at work, which ends in *Eutyphoeus* in the amalgamation of the opening of the vas deferens with the anterior prostatic pore in xvii, and disappearance of the posterior prostates; at the same time the two pairs of spermathecae are reduced to one, and similarly the two pairs of testes (text-fig. 5). The concomitant reduction of the prostatic and spermathecal apertures is related to the fact that the prostatic apertures of one worm are apposed in copulation to the spermathecal apertures of another.

In *Hoplochaetella* we have the condition shown in text-fig. 3. The opening of the vas deferens has fused with that of the anterior prostate; the prostatic apertures themselves seem previously to have approached closer together, since they are found, not on the middle of segments xvii and xix, but in or almost in the grooves 17/18 and 18/19,—almost as if the first impulse was to follow the Megascolecine mode of reduction. But (if I may continue to use

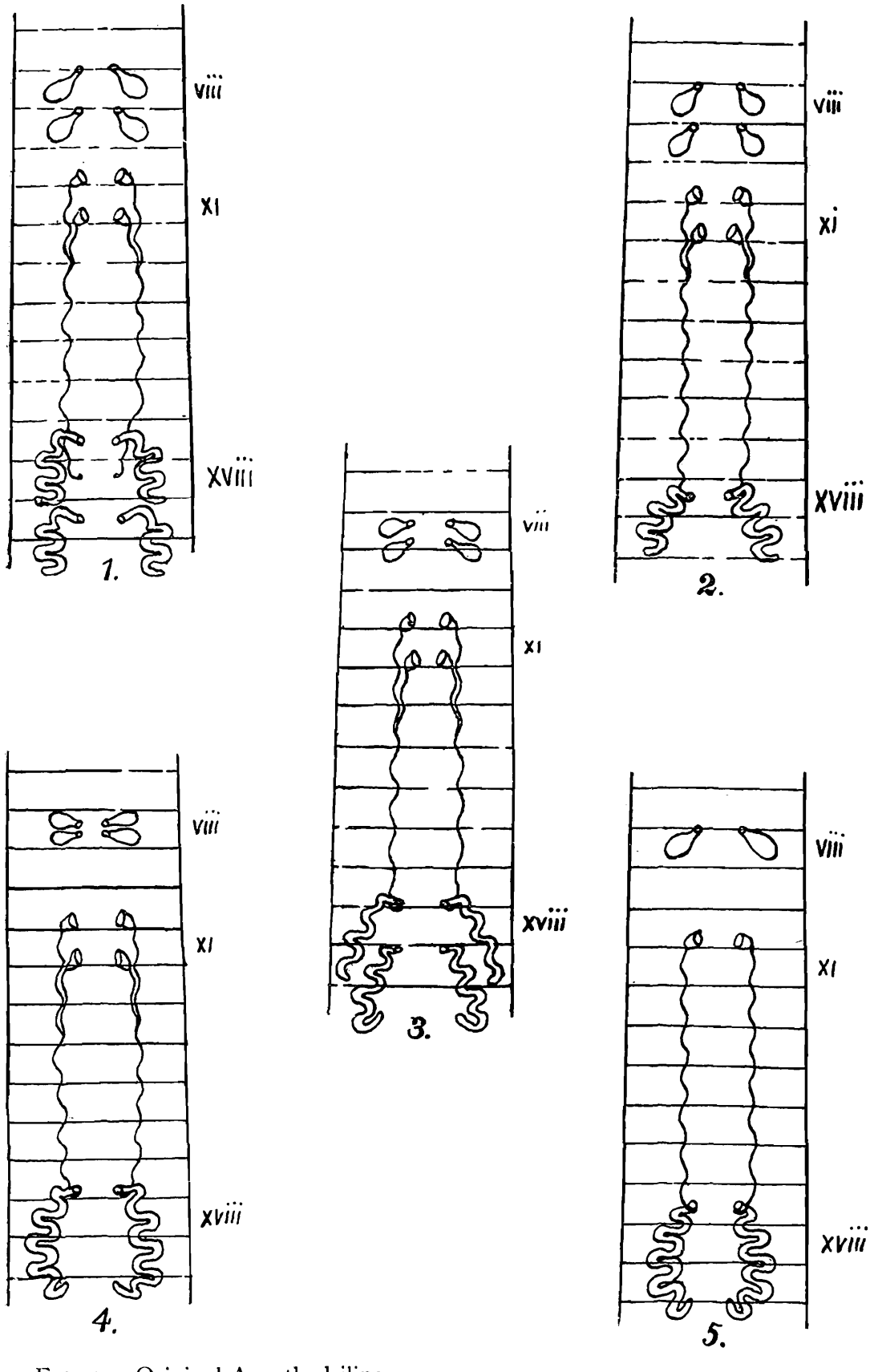

FIG. 1.—Original Acanthodriline.
,, 2.—Megascolecine. (The number of spermathecae is variable in the Megascolecinae).
,, 3.—*Hoplochaetella.*
,, 4.—*Erythraeodrilus.*
,, 5.—*Eutyphoeus.*

such expressions) when the prostatic pores reached this position, the ending of the vas deferens was able to jump the interval, and united itself with the prostatic pore in furrow 17/18.

The next stage is *Erythraeodrilus* (text-fig. 4). Union between the end of the vas deferens and the anterior prostatic pores having been accomplished, the posterior prostates suddenly disappear. Two pairs of spermathecal openings are now superfluous, and the ducts of the spermathecae of the same side approach each other; various stages of this are met with in the several specimens of *Erythraeodrilus kinneari* that have been studied (*v. post.*); in one, the two ducts of the same side appear to open practically at the same spot, on the middle of segment viii. We may suppose that the course of evolution is leading, first to the union of the spermathecal apertures, then to the disappearance of one spermatheca on each side; then (if we may take a clue from *Eutyphoeus*) the remaining prostatic apertures will advance again to their original position on the middle of segment xvii, and the now single spermathecal apertures to their original position on furrow 7/8.

I need scarcely guard myself from misconstruction by saying that *Hoplochaetella* and *Erythraeodrilus* are not, of course, in the ancestral line of *Eutyphoeus* at all, since *Eutyphoeus* retains the primitive paired setae. But the same change which has led to *Eutyphoeus* appears to be going on in a parallel line of forms with the perichaetine setal arrangement.

Erythraeodrilus being thus the descendant, can we particularize regarding the immediate ancestors of *Hoplochaetella*? In a previous paper (19) I supposed *Erythraeodrilus* to be a descendant of *Howascolex* (which has lumbricine setae, acanthodriline male organs and mixed mega- and micronephridia) by a process of microscolecine reduction of the male organs and perichaetine increase of setae. *Hoplochaetella* would thus show us the stage in which increase of setae has taken place, but not as yet the microscolecine reduction; this is however being prepared for, since the male ducts already open in common with the anterior prostates; thus *Hoplochaetella* would be intermediate between *Howascolex* and *Erythraeodrilus*. There is perhaps some little difficulty with regard to the nephridial system. It is true it is of a mixed nature,—meganephridia and micronephridia co-existing,—in both. But while in *Hoplochaetella* and *Erythraeodrilus* micronephridia exist throughout the body, and meganephridia only from segment xx onwards, in *Howascolex* meganephridia exist throughout, and micronephridia only make their appearance behind the anterior region, in the middle portion of the body. I do not, however, think that we yet know enough of the exact way in which the change from mega- to micronephridia has taken place (it has quite possibly taken place in more than one way) to enable us to say that this difference prevents our deriving the one from the other; the condition in *Howascolex* is at any rate apparently less modified than that in *Hoplochaetella* and *Erythraeodrilus*.

There is another possibility as regards the derivation of *Hoplo-*

chaetella. It might be derived from *Plagiochaeta*,—or rather from *Perieodrilus*, a genus under which Michaelsen has placed those species, originally grouped as *Plagiochaeta* by Benham, which have the nephridiopores in the same line on each side (the type of the genus *Plagiochaeta* has them in two rows, alternating in successive segments). *Perieodrilus* has the acanthodriline arrangement of the posterior male organs and is meganephric, but has the perichaetine arrangement of the setae; it is in fact removed from *Notiodrilus* only by the development of the setae in rings instead of in pairs. From such a form *Hoplochaetella* differs in the partial breaking up of the nephridial system and the amalgamation of the openings of the vas deferens and anterior prostate.

If we take the first hypothesis, as I did for *Erythraeodrilus* previously, we find that we are in the presence of an element of our fauna which has relations with Madagascar [1] (the home of *Howascolex*). To some extent this is confirmed by the localities where *Hoplochaetella* and *Erythraeodrilus* have been found,—on the west coast of India. Bourne's *Perichaeta stuarti* was found, certainly, about 160 miles from the Malabar coast,—indeed nearer to the east than the west coast of the peninsula; but some of the present species were discovered actually on the shore, and seem to be euryhaline,—able to withstand the action of salt water,—and hence, probably, to endure a journey by sea (*cf.* the discussion by Michaelsen of the possible spread of *Microscolex* by the West-wind drift in the Southern Ocean, 12, 15, 16); the South-west monsoon blows steadily in the required direction for several months of every year. There is of course also the possibility that the introduction is of comparatively ancient date, by means of the land connection during the earlier Tertiary period.

On the second hypothesis *Hoplochaetella* will have had an Australasian origin. This is the present view; hitherto *Hoplochaetella* and *Octochaetus* have been the two genera common to India and New Zealand,—the indications of a communication between the two lands which probably at one period did not include Australia. The position is not very different if we suppose *Hoplochaetella* to be non-existent in New Zealand but to be derived from the New Zealand genus *Perieodrilus*.

Merely from the point of view of practical convenience, the first arrangement of the phylogenetic tree is preferable. As I have previously pointed out (19), the *Erythraeodrilus* branch can thus without difficulty be included in the Octochaetinae, by making the

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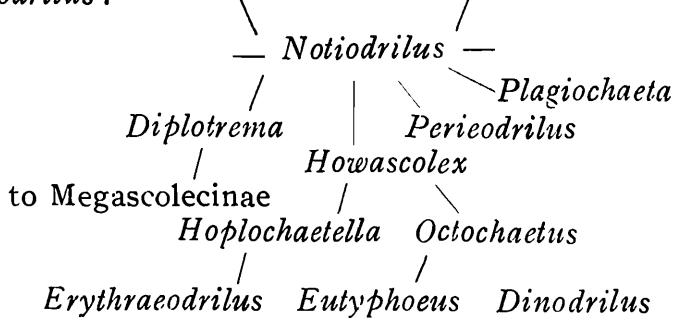
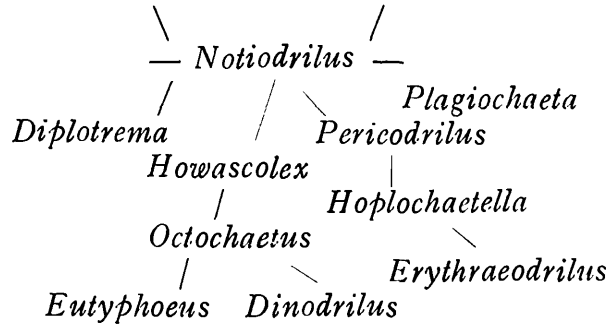
[1] Though Wallace, as is well known, gave up the theory of the existence of a former "Lemuria,"—a large tract of land including Madagascar, India, and Malaya,—and came to believe in the comparative fixity of the great land-masses of the globe (compare the view in his "Malay Peninsula" and "Island Life") later authors are not so conservative. Thus Gadow (9) supposes a permanent connection between Madagascar and India from Primary times up to the Oligocene, breaking up in late Oligocene; Depéret (8) supposes the connection between India and Madagascar to have been broken towards the end of the Cretaceous, but re-established during the Tertiary period; for the geological argument see, for example, Suess (21, vol. i, p. 417).

Octochaetinae begin with *Howascolex*; they then retain the character of a monophyletic and compact subdivision of the family. If however we derive *Hoplochaetella* from *Perieodrilus*, we have either to include *Hoplochaetella* and *Erythraeodrilus* in the Acanthodrilinae, or to make a separate subfamily for them. As Michaelsen has pointed out (13) " the family Megascolecidae is a much-branched tree, which took its origin from the acanthodriline primordial form, that is to say, from *Notiodrilus* (*Eodrilus*). The greater branches of this tree, the different subfamilies, are well defined in their distal parts." The original form, with the small branches clustering round the base of the tree, constitute the group Acanthodrilinae; on the present supposition one of these small branches, scarcely large enough to form a separate subfamily, consists of *Perieodrilus—Hoplochaetella—Erythraeodrilus*.

The finding of additional intermediate forms between the various genera will establish the lines of filiation more certainly. The Megascolecidae are an especially favourable group for the working out of phylogenetic relations, because we still possess what we might paradoxically call a living Palaeontology. We can, for example, trace the main line of descent of the Megascolecinae, from the original Acanthodriline to *Pheretima*, with hardly a break, by means of actually existing genera; it is as if *Phenacodus* and the subsequent stages in the phylogeny of the Horse were all alive today. In giving rise to descendants, the older genera have themselves lived on, scarcely modified; and what we have to hope for is the discovery of the still missing intermediate forms. Some of them, at least, we may reasonably expect to find, still alive and accessible to a complete investigation.

The two following schemes represent the alternative possibilities regarding the position and descent of *Hoplochaetella* and *Erythraeodrilus* :—





SYSTEMATIC ACCOUNT.

Fam. ENCHYTRAEIDAE.

Gen. **Fridericia.**

W. 88/1. Kierpur, Purneah Dist., Bihar. Sept. 1915. C. Paiva. A single specimen, not fully mature (or over-mature ?).

The specimen, diagnosed by the arrangement of the setae as belonging to this genus, but indeterminable as regards species, is mentioned here because the family is rarely met with in India.

Fam. MONILIGASTRIDAE.

Gen. **Drawida.**

Drawida kanarensis, sp. nov.

W. 132/1. Talewadi, near Castle Rock, N. Kanara Dist., Bombay Pres., October 1916. S. Kemp. Three specimens.
W. 133/1. Castle Rock, N. Kanara Dist., October 1916. S. Kemp. Three specimens.

External characters :—Length 60-70 mm.; maximum diameter 3½ mm. Colour pale grey, anterior end rather lighter. Segments 150-173, all very short behind the clitellum.

A prostomium is difficult to see in some cases; in one specimen it might be called zygolobous, though very small; in another it is perhaps prolobous.

Dorsal pores absent.

The setae are small and closely paired; *aa* is slightly less than, or in some regions appears about equal to, *cd*; *dd* is approximately equal to four-sevenths of the circumference.

The limits of the clitellum are rather indefinite, as the alteration in the body-wall is not great; it is saddle-shaped, and extends over x-xiii, and perhaps partly on to xiv (=4 or more).

The male apertures are in furrow 10/11, external to the line of setae *b*, but considerably nearer to *b* than to *c*; the lips of the groove are swollen here, and in one specimen papillae project from the groove at the site of the apertures.

The female apertures are in 11/12, in the line *b*.

The spermathecal apertures are in groove 7/8, just below *c*.

On segment xi are a pair of slightly raised and thickened patches, oval in shape, and one and a half times as broad as long; they take up nearly the whole length of the segment, and are better marked in front, where they are continuous with the swollen lip bounding the male aperture; their surface is rather ridged, and they are each limited by a slight groove. They approach fairly near each other towards the middle line, so that the setae *ab* are on the inner portion of the patch; the outer border is some distance below *c*. These patches were not found in the second batch of specimens.

Internal anatomy.—Septa 5/6 to 8/9 are thickened, especially the first three; the rest are thin.

There are three large, hard, subspherical gizzards in segments xv, xvi, and xvii respectively; the softer zones between them are little marked, a gizzard taking up a whole segment. In xiv is a much smaller gizzard, softer than the others, and narrower from side to side,—in other words the alimentary canal is not as broad here as it becomes in the next segment. In a specimen of the second batch which was dissected, there were four gizzards, in xiii-xvi, the first rather smaller.

The testis-sacs are attached to septum 9/10 in such a way that the larger part of the sac depends into segment x. A considerable portion however projects forwards into ix on the right side, though only a very small part does so on the left. The septum causes no constriction of the sac. The testis appears to be a diffuse proliferation of the inner wall of the sac. The vas deferens is a fine, much coiled tube on septum 9/10; the terminal portion is rather broader, and joins the prostate at its anterior and inner side.

The prostate is of moderate size, sessile on the body-wall, hemiovoidal in shape, with its transverse diameter greater than the antero-posterior; its surface is soft and yellowish, not smooth and shining.

There is no ovarian chamber, or in other words segment xi is opened into on opening the worm in the ordinary dissection, and masses of eggs fall out. The ovary is bushy, on septum 10/11. The funnel is a groove between two lips or ridges which curl upwards and inwards from below on septum 11/12. The ovisacs, large and ovoid, are contained in segment xiv, but a neck passes forwards to connect them with septum 11/12.

The spermathecal ampullae are large, and meet in the middle line, thus covering the rest of the contents of the segment; in shape they are irregular, and in the dissected specimen were filled with a shining white opaque mass, doubtless spermatozoa. The duct is considerably coiled, and passes down on the posterior face of septum 7/8; its first part is narrower than the rest; it joins the atrium without piercing the septum. The atrium is a cushion-like swelling, several times as thick as the end of the duct, which joins it in the centre of its upper surface; it is partly embedded in the body-wall, and projects slightly into segment viii; the septum can be separated forwards from over it, so that no part of the atrium is in segment vii, the septum being attached to the parietes in front of it. When opened, the atrium is found to be a hollow chamber.

Remarks.—This species is perhaps related to *D. barwelli*; but the latter has dorsal pores, no eggsacs (?), no distinct spermathecal atrium, and pear-shaped prostates From the *pellucidus* group the present form is distinguished by the character of the surface of the prostate.

Special genital marks are not common in the Moniligastridae; the "glandular" areas on segment xi are therefore of value for identification.

Drawida japonica (Mchlsn.) f. typica.

(Pl. xvi, fig. 1).

Murree, N. Punjab; alt. 7000 ft., 19-iv-1916. S. Gobind Singh. Numerous specimens.

External characters.—Length of a good average specimen 60 mm.; breadth 2 mm., or in the genital region may be 2·7 mm. Colour a greenish-grey, slightly darker dorsally. Segments 142.

Setae closely paired; *aa* is slightly less than *bc* behind the genital region, about equal to it in front; *dd* is equal to half the circumference. The setae are very small on segment ii, if indeed all of them are present; they are large on the genital region.

The nephridiopores may be present in three situations,—in line with setae *cd*, or at the level of the ventral pair of setae, or lastly not far from the middorsal line; but there is no rule, and no regular alternation. They are in all cases immediately behind the intersegmental groove.

The genital papillae,—a characteristic of the species,—are variable in their situation, but seem to be always present in the sexual animal. Each is an oval area slightly raised above the general surface, with its long axis transverse, and with a circular groove in its centre; the middle of each area is thus marked off from the peripheral portion, and is perhaps a little, but not much, raised above the level of the oval area in general. Fig. 1 will give an idea of the appearance of the areas; they are never in the same position in two specimens; in number they may be two, three or four; and they occur on segments vii, viii, ix, and xii. They may be situated on either the anterior or the posterior part of the segment, or more rarely at the middle of its length; they may be either to the right or the left of the middle line, or seldom midventral.

With regard to the *internal anatomy*, it need only be stated that there are two gizzards, in segments xii and xiii; they are annular thickenings of the gut-wall, separated by a thin-walled section of the tube.

Remarks.—This species is the most markedly peregrine member of the genus; it has been found in Japan, China (f. *siemsseni*), and the Bahamas (f. *bahamensis*, = *Moniligaster bahamensis*, Beddard). The immature *Drawida* from Simla, said by Michaelsen "probably, or rather doubtless" to belong to *M willsi* (13), may with at least equal likelihood be referred to the present species.

Drawida hodgarti, sp. nov.

(Pl. xvi, fig. 2).

W. 70/1. Rangamati, Chittagong Hill Tracts, Bengal. 11-vii-1915. R. Hodgart. Four specimens.

External characters.—Length 113 mm.; maximum diameter 3·75 mm. Colour a uniform grey, nonpigmented. Segments 164; no secondary annulation. The rings of possibly sensory papillae found

in some species are only very faintly indicated, and only in the anterior segments.

Prostomium prolobous.

Dorsal pores absent.

The setae are small and closely paired ; *aa* is less than *bc*, and *d* is below the lateral line of the body.

The nephridiopores appear to be in line with the setae *c*.

No clitellum was visible on any of the specimens.

The male pores are slits with swollen anterior lip, in the intersegmental groove 10/11, with their centre just outside the line *b*.

The female apertures are doubtfully in *ab* or *b*.

The spermathecal apertures, with slightly swollen lips, are in 7/8 in or just internal to *c*.

There are no other genital markings.

Internal anatomy.—Septa 5/6, 6/7, 7/8, and 8/9 are considerably thickened, the rest all thin.

The gizzards are four in number, in segments xv to xviii ; the alimentary tube is also slightly strengthened in segment xiv. There are softer annuli behind each gizzard in each of the four segments.

The last heart is in segment ix.

The testis-sacs are kidney-shaped, in segment x, the anterior end projecting slightly into ix on the left side in the specimen dissected but not on the right.

The prostates are small and tubular, with a smooth and shining surface (hence probably muscular) ; each is slightly coiled, and the free end, which points inwards, is somewhat dilated (fig. 2).

The closely convoluted vas deferens forms a soft mass below the testis-sac on the anterior face of septum 9/10 ; below it joins the anterior face of the prostate not far from its free ental end (fig. 2).

In the dissection segment xi appears open above,—not closed dorsally by the apposition of septa 10/11 and 11/12 to form an ovarian chamber ; the floor of this space, above and at the sides of the alimentary canal, is formed by a membranous sheet which passes from the anterior to the posterior septum, so that the alimentary canal is excluded from the space which contains the ovaries and funnels.

Each ovary appears as a fringe on the posterior surface of septum 10/11, crescentic in form, tapering upwards nearly as far as the dorsal vessel. The ovisacs are small and finger-shaped, and (in the specimen dissected, at least) are confined to segment xii.

The spermathecal ampulla is small, roundly ovoid ; from it is given off the somewhat wavy or coiled duct, which wanders down on the posterior face of septum 7/8, reaching the body-wall before becoming connected with the atrium. The atrium does not appear in segment viii at all ; it is a finger-like process altogether in front of septum 7/8. It shows no dilatation at its base, *i.e.* there is no atrial chamber apart from the process itself. The spermathecal duct joins the atrium at its ectal end, within the body-wall.

Remarks.—The finger-like upwardly projecting atrium relates the present form to *D. travancorensis* and *D. jalpaigurensis* ; the

similarity to the former is increased by the absence of any other widening at the termination of the spermathecal duct, and to the latter by the coiled form of the prostate. It differs from both in the number or in the position of the gizzards, as well as from *D. jalpaigurensis* in the absence of genital markings.

Drawida affinis, sp. nov.

W. 131/1. Rangamati, Chittagong Hill Tracts, Bengal, 11-vii-1915. R. Hodgart. A single specimen.

External characters.—Length 37 mm.; maximum diameter 3 mm. Colour a uniform medium gray. Segments 107, with, in addition, a small zone of regeneration consisting of eight very small segments; all the segments are very narrow from front to back.

The prostomium was small and could not be accurately examined, owing to its being withdrawn within the first segment.

Dorsal pores are absent.

The setae are closely paired; there is a relatively narrow interval between the ventral bundles, so that *aa* : *bc* : : 3 : 5, or 4 : 7. The lateral bundles of setae are at the level of the lateral line of the body (*dd* = half the circumference).

The nephridiopores are in line with the setae *cd*.

No clitellum was visible, nor are there any genital markings.

The male apertures are in groove 10/11, with their centres in *b*; they are inconspicuous and slit-like.

The female pores were not visible.

There was possibly a slight indication of the spermathecal apertures in grooves 7/8 slightly ventral to *c*.

Internal anatomy.—Septa 5/6 to 8/9 are moderately thickened.

The gizzards are three in number, in segments xiii-xv, with softer annuli intervening.

The last hearts are in segment ix; they run freely, not being connected to the septa by mesentery, as is usually the case.

The testis-sacs are attached to septum 9/10, and are ovoid in shape and contained wholly in segment x. The vas deferens is narrow, and constitutes a coiled mass in x, on the posterior face of septum 9/10. The prostate is tubular, and consists of several closely applied coils or loops (more than in the last species); it is rather shiny in appearance, and becomes progressively narrower towards its ectal end; the vas deferens joins it at a point above (ental to) the middle of its length.

The ovarian chamber,—segment xi,—is constituted as in the last species; the alimentary canal is excluded by means of a membranous connection between septa 10/11 and 11/12 which arches over the gut, but the septa are not united together dorsally near their junction with the parietes. No ovaries or ovisacs were visible.

The spermathecae were small, empty and transparent; they were flattened against septum 7/8, and approximately circular in shape. A narrow coiled duct leads downwards. The atrium has

the same shape and relations as in the last species; there is no swelling at its base.

Remarks.—This species is also one of the group which comprises *D. travancorensis*, *D. jalpaigurensis*, and the last described form (as well as several which follow), characterized by the elongated prostate and much elongated spermathecal atrium. The prostate has the simplest form in *D. travancorensis*, where it is simply pear-shaped; but others of the group are apparently less modified as regards the ovarian chamber.

The relatively narrow interval between the ventral setal bundles is rather characteristic of the present species.

Drawida rangamatiana, sp. nov.

(Pl. xvi, fig. 3).

W. 82/1. Rangamati, Chittagong Hill Tracts, Bengal. 17-vii-1915. R. Hodgart. A single specimen.

External characters.—Length 137 mm.; maximum breadth 7·5 mm. Nonpigmented, light grey in colour. Segments 237; in the posterior third of the body the segments are very short.

There is apparently no prostomium.

Dorsal pores are absent.

The setae are closely paired. In the anterior segments *aa* is equal to *bc*, behind the genital region *aa* is two-thirds of *bc*, but in the middle of the body and towards the hinder end it is distinctly less than half *bc*; *d* is in the lateral line of the body, so that *dd* is half the circumference. All the setae are relatively very small, considering the large size of the worm.

The nephridiopores are in the line of the lateral setal bundles.

No clitellum was distinguishable.

The male apertures are in groove 10/11, with their centres between *b* and *c*, but nearer to *c*; the borders of these segments are much swollen where they are in relation with the apertures.

The female apertures are in 11/12, between *b* and *c*, but nearer *b*; the position is marked on one side by a thickening and whitening of the posterior lip of the groove.

The spermathecal pores are in 7/8, their centres just below *c*; the lips of the groove are swollen here, the swelling of the anterior lip extending upwards beyond *d*.

Internal anatomy.—Septa 5/6, 6/7, 7/8, and 8/9 are very stout and strong, especially the first two; 8/9 is the thinnest of the four; the rest are thin.

The oesophagus, thin-walled and filled with reddish powder, was in the single specimen available bulged alternately on the two sides in successive segments. The gizzards are four in number, in segments xvi to xix, and are separated by softer annuli.

The last hearts are in segment viii; there are two commissures on each side in this segment.

The testis-sacs are rather similar to those of *D. ghatensis*; though to be looked on as derived from septum 9/10, they occupy

a much more posterior position than usual; on the one side the sac was situated in segment xii, bulging back septum 12/13; on the other it extended back into xiii. The forward connection of the sac with its place of origin is by means of a neck, as in *D. ghatensis*; but I could not isolate the neck cleanly from the surrounding structures, for example from the septa through which it passes; there was certainly a continuity of structure between it and septum 11/12. One testis-sac was opened and an attempt was made to turn out its contents and to identify the testis and funnel, but it was not successful; the contents were very firm, and not separable from the inner surface of the wall of the sac.

The vas deferens leads forwards from the testis-sac, and forms a very fine and tightly coiled tube, which joins the prostate rather lower down than its middle, *i.e.* rather nearer its ectal than its ental end. The prostate is a softish white, not shiny, closely curled cylindrical structure, of about the same diameter throughout, of moderate size and without any differentiated duct; it is contained in segment x.

The ovarian chamber does not reach the dorsal body-wall. The ovisacs are small and finger-shaped; they extend back into segment xiii.

The spermathecal ampulla is small and globular; the duct, thin and much coiled at first, and afterwards with a wavy course, runs downwards on the posterior face of septum 7/8. Where it pierces the body-wall there arises a long stalked appendage, the most conspicuous part of the whole apparatus; it stands erect in segment vii, free from and in front of the septum; its ental portion is dilated in the form of an elongated cone with rounded tip; the stalk which connects this with the body-wall is fairly stout, somewhat curved, smooth and slightly shiny, and longer than the dilated ental portion. Fig. 3 represents the appearance of this atrial appendage under the low power of the microscope; the lumen of the dilated portion was empty.

Remarks.—The relationships of this form are with the former group. The coiling of the prostate is as marked as in *D. affinis*, and the atrial appendage of the spermathecal apparatus is more marked and of a more characteristic shape. The resemblance of the testis-sac to that of *D. ghatensis* (14) has been mentioned. It is curious that the last heart is in segment viii (not ix, as usual), and that viii should contain two pairs of hearts.

Drawida papillifer, sp. nov.

W. 83/1. Rangamati, Chittagong Hill Tracts, Bengal. 11-vii-1915. R. Hodgart. A single specimen.

External characters.—Length 70 mm.; thickness 3·75 mm. Colour light grey, nonpigmented. Segments 148.

Prostomium damaged, perhaps prolobous.

Dorsal pores absent.

Setae closely paired; *aa* is rather less than *bc*, *dd* is equal to half the circumference.

Nephridiopores apparently in line with setae *d*.

The male apertures are indistinct, in groove 10/11, between *b* and *c* their centre rather nearer to *c*; they are slit-like, and their lips are not swollen.

I could not distinguish the female apertures.

The spermathecal apertures are in groove 7/8, their centre just below the line of setae *c*.

The clitellum takes up segments x-xiii=4; its hinder end is ndistinct.

There are a few very slightly marked darkish papillae on the genital region, distributed as follows:—On segment vii a pair, dorsal to *d* and just behind the level of the setal bundles; on x a pair, below *c* and just in front of the level of the setae; on xi a single papilla, just behind groove 10/11 and between the lines *b* and *c* but nearer to *c*.

Internal anatomy.—Septa 5/6 and 6/7 are much strengthened; 7/8 and 8/9 much less so,—only moderately stout; 8/9 is bulged forward by the testis-sacs. Septum 9/10 is thin, and is attached to the body-wall at the middle of segment x (according to the external grooves).

The gizzards are three in number, in segments xv, xvi, and xvii; they are separated from each other by soft annuli.

The last heart is in segment ix; on one side in this segment, deeply situated on the intestine, there was an additional commissure.

The testis-sacs are irregular in shape, and asymmetrical, the right being rather anterior to the other, and extending across the middle line in front, while the left extends considerably further back; they are suspended by septum 9/10, but the greater part of the right sac is in ix, and of the left in x,—indeed the hinder end of the left sac is on a level with groove 11/12. On opening one of the sacs the flocculent matter was found to be very adherent to the inner surface of the wall; it would seem that the inner surface proliferates over the greater part of its extent, the testis being diffuse. A folded mass on the wall, at the place where the vas deferens leaves the sac, probably represents the funnel along with compacted spermatozoa.

The vas deferens is narrow and much convoluted; it leads down from the testis-sac to the prostate, which it joins at about the middle of its length. The prostate is soft and glandular-looking; it is elongated, and bent with the angle directed forwards; the ental end is wider than the ectal, so that if it were straight it would be described as club-shaped.

Septa 10/11 and 11/12 are separate from each other at the periphery by the ordinary length of a segment; hence on opening the worm the ovarian chamber is opened up, and numerous small ova fall out; the chamber is closed below (around the alimentary canal),

so that a needle can be passed from segment xii forwards into x along the side of the gut underneath the floor of the chamber.

The ovary is fringe-like, curving round the alimentary tube on the anterior wall of the ovarian chamber. The funnel on the posterior wall is an elongated groove with white lips, and with a similar curve. The ovisacs are large; the right extends back to septum 15/16; the left is curved ventrally so as to pass underneath the intestine, and is confined to segment xii, bulging back septum 12/13.

The spermathecal ampulla is an ovoid sac in the usual situation; the duct is long and convoluted, and leaves the ampulla rather below the middle of its greatest length, passing down to pierce the septum and join the base of the atrium. The atrium is of relatively large size; its upper part is constituted by an elongated ovoid sac, thin-walled, of regular shape, with a smooth surface and in size longer than, but not so broad as, the spermathecal ampulla; the lower part is a duct, half as wide and slightly more than half as long as the upper sac-like portion. The atrium is either erect in segment vii or lies forwards on the ventral body-wall.

Remarks :—This species again belongs to the same group as the former; but while the atrium of the spermatheca has developed still further, the elongation and coiling of the prostate is less than in the two forms immediately preceding. It is unfortunate that the species is represented by only one example, and that hence the value of the genital papillae as a distinguishing character is not easy to appraise.

Drawida nepalensis, Mchlsn.

(Pl. xvi, fig. 4).

W. 72/1. Rangamati, Chittagong Hill Tracts, Bengal. 13-vii-1915. R. Hodgart. Four specimens, one larger than the rest, and sexually mature.

W. 80/1. Kierpur, Purneah Dist., Bihar; under iron tub in open field. 10-ix-1915. C. Paiva. Nine specimens, the majority mature.

External characters.—Length 123 mm. (70 mm. Kierpur); diameter 5 mm. Colour light grey, almost white, nonpigmented. Segments 149.

Prostomium prolobous.

Dorsal pores absent; but the longitudinal muscular coat shows an interval middorsally behind each furrow, easily visible through the superficial layers; these gaps are well seen from the inner side of the body-wall, where they quite give the impression of dorsal pores (Michaelsen, " dorsal pores apparently absent "). The gaps are probably to be looked on as the remnants of pores. In a specimen of the second batch, on stripping off the cuticle and pressing on the body-wall, the spirit inside the body cavity welled out, in several regions, through these pores, as seen by the diffraction lines in the water in which the animal was lying; probably in addition to the longitudinal muscular coat being absent, the other

layers of the parietes were thinned and easily gave way on slight manipulation. The series could be followed forwards to furrow 4/5.

The setae are small and closely paired ; in front of the clitellum *aa=bc*, while in the rest of the body *aa* is rather less than *bc*. In the anterior half of the body *dd* is greater than half the circumference but rather less than two-thirds ; behind the middle it is equal to half the circumference. The relations were almost the same in the Kierpur specimens.

The nephridiopores are in line with the lateral setal bundles.

In the Kierpur specimens a slightly marked clitellum was present on segments x-xiii (possibly xiv should be included).

The male apertures are in groove 10/11, on very prominent papillae which have their centres rather nearer to the line *b* than to *c* ; the papillae are bluntly conical on a circular or transversely elongated oval base ; the height of the papilla is about equal to the diameter of the base ; each is encircled by a groove, and the lips of furrow 10/11 are swollen in front of and behind the papilla for an extent equal about to the interval *bc*.

The female apertures are small, on groove 11/12, in line with *b*.

The spermathecal apertures, difficult to recognise, are in furrow 7/8 just below the line of seta *c*.

Internal anatomy.—Septa 5/6 to 8/9 are much strengthened ; 9/10 is excessively tenuous, and apparently attached well behind the corresponding groove ; all behind are very thin.

There are three gizzards in the dissected specimen of the first batch, in segments xv, xvi, and xvii, separated by softer annuli ; the oesophagus is bulged in ix (or ix and x), but not markedly, and there are no lamellae internally. The specimen of the second batch which was examined had four gizzards, in segments xiv-xvii.

The last heart belongs to segment ix, but is displaced backwards with septum 9/10 so as to lie at the level of the hinder end of the prostate.

The testis-sac of the left side is large and conspicuous, and lies entirely behind septum 9/10, in the space between this and the conjoined septa 10/11 and 11/12 ; it is bent with its convexity inwards, and extends across the middle line. The testis-sac of the right side is much further back ; its hinder end is at the level of septum 15/16, septa 12/13, 13/14 and 14/15 all being bulged backwards and constituting an investment for the sac ; perhaps 11/12 is so also, but this cannot be disentangled from the sac in the same way as the others ; the sac is connected with 9/10 (from which it must be supposed to originate) by a membranous expansion above the alimentary tube and heart. In the Kierpur specimen the sacs were also asymmetrical, that on the right side passing back beneath the ovarian chamber.

On opening the testis-sac the greater part of the flocculent mass which fills it can be dislodged from its walls, leaving only the thin transparent membrane. At one part of the wall is the much folded

funnel with iridescent spermatozoa adhering, from which the vas deferens originates; anterior to the funnel, on the inner wall of the sac, the flocculent mass cannot be cleanly dislodged,—this patch represents the testis, a proliferation of the sac-wall

The vas deferens is a fine and excessively coiled tube, the scores of convolutions forming a large mass which lies against the testis-sac on its outer side. The first portion of the vas, which lies internal to the rest, is excessively fine,—much finer than the main mass; the general direction of the tube is forwards and downwards, and it terminates by joining the ental end of the prostate.

The prostate is a white cylindrical organ, bent in a loop on the left side with its convexity backwards and the ental end upwards, forming an **S** with the ental end of the **S** backwards on the right side; the ental end of the organ is slightly wider than the rest.

The ovarian chamber, enclosed above by the fusion of septa 10-11 and 11/12, is not opened into on opening the animal; there is apparently a free passage underneath the chamber by the side of the alimentary canal. The ovisacs arise from the posterior wall of the chamber; they are subcylindrical, with crenulated margins, and lie on the intestine one on each side of the middle line

The spermathecal ampulla, in the usual situation, is globular in form; a thin duct leads down in several loose coils on the septum, and after piercing the septum joins the base of the atrium in segment vii. The atrium (fig. 4) is very large, and, in the dissected specimen of the first batch, somewhat triangular in shape; in the natural condition the atria encircle the gut so that their straight dorsal edges almost meet in the middle line. In this specimen the organs are empty and laterally compressed, and a deep depression exists in its dorsal border; by manipulation this pit can be seen to be an invagination of the sac-wall which, when its lips are separated, appears funnel-shaped; if the pit were evaginated the atria would overlap the middorsal line. The lower end of the atrium narrows gradually to form a somewhat twisted duct. On opening the sac the inner surface is seen to be elevated into a number of transverse ridges, irregularly disposed and not distinctly annular; but there is no external annulation or grooving such as Michaelsen notes for his specimens. In the specimen from Kierpur, however, transverse ridges and folds were visible on the atrium, though not regularly disposed; and its margins were crenulated irregularly; the upper end was not invaginated.

Remarks.—I was kindly allowed to inspect the types of the species belonging to the Indian Museum; but unfortunately they arrived in such a damaged condition that I was unable to make any use of them.

I have given a complete description of the mature example from Rangamati, with notes on one of those from Kierpur, since they differ in details from Michaelsen's specimens. The two distinct parts of the vas deferens (which I think Michaelsen would have mentioned), the differences in the spermathecal atria, and details concerning the testis and funnel, are of minor importance; but I

am inclined to attribute more value to the position of the testis-sacs (Michaelsen, "on septum 9/10, depending from it, forwards and backwards, into the 9th and 10th segments"), and perhaps also to the absence of copulatory organs (though these were not present in all of Michaelsen's specimens).

The asymmetry of the testis-sacs in the specimens described above is remarkable; on one side there is an approach to the condition of *D. ghatensis* and *D. rangamatiana*. The indications of dorsal pores are also interesting.

I do not myself think that there is sufficient ground for suspecting an identity between *D. nepalensis* and Bourne's *D. uniqua*. Michaelsen (13) says at the beginning of his description that the two may perhaps prove to be identical; and at the end, that "this species comes near to *D. uniqua* (Bourne), if it is not identical with it." But after mentioning the large and peculiar spermathecal atrium he adds: "I do not believe that Bourne could have overlooked the above-described very characteristic structure or that he would have abstained from mentioning it had it been present in his species." I fully agree that Bourne would certainly have given an unmistakable description of this peculiar structure, had it been present; moreover, the prostates in the present species are far too long, and too twisted or bent, to be conceivably described as "teat-like" (as Bourne does for his form); nor are the ovaries free in the present species, as Bourne says for *D. uniqua*, but enclosed in a typical ovarian chamber (Michaelsen, "apparently enclosed"). At the time that Michaelsen wrote, it was doubtful whether any (endemic) species of the genus existed elsewhere than in South India, and it was reasonable to look with suspicion on species which contradicted conclusions otherwise apparently well established.

Fam. MEGASCOLECIDAE.

Subfam. *MEGASCOLECINAE.*

Gen. **Pontodrilus.**

Pontodrilus bermudensis, Bedd. f. **ephippiger** (Rosa).

W. 66/1. Near Chiquilim Point, Mormugao Bay, Portuguese India; under stones at edge of brackish water. 29-ix-1916. S. Kemp. A number of specimens.

W. 126/1. Mormugao Bay, in small bay between Goa and Vasco, shore collecting, under stones. Sept. 1916. S. Kemp. Several specimens.

Gen. **Perionyx.**

Specimens belonging to this genus, unidentifiable because of immaturity, were found at Kalimpong and Pashok, in the Darjiling District, E. Himalayas.

Perionyx excavatus, E. Perrier.

W. 69/1. Rangamati, Chittagong Hill Tracts, Bengal. 11-vii-1915. R. Hodgart. Six specimens of moderate size and one very small one.

W. 81/1. Phagu, near Simla, alt. 9000 ft.; in very wet earth at edge of spring. 11-v-1916. N. Annandale and S. W. Kemp. Four specimens.

The specimens from Phagu are noted as having been, when captured, deep purple above with strong green iridescence, and much paler below.

There was really no gizzard; in segment vi the oesophagus was rather swollen, but the walls when cut into were not thickened. There was no widening of the oesophagus in segment xiii.

There were no diverticula on the spermathecae (examined microscopically also); this was not apparently due to the specimens being in an early stage of sexual maturity, since all the other parts of the genital system are well developed; the ovaries are large, and the seminal vesicles of segment xii reach backwards as far as septum 13/14. I have previously found the diverticula absent in a specimen from Dibrugarh, N. E. Assam (17).

Specimens which were immature, but referable with more or less of probability to this species, were obtained from the following localities:—

Kasauli, W. Himalayas. Baini Prashad. 31-vii-1916.
Talewadi, near Castle Rock, N. Kanara District, Bombay Pres. Oct. 1916. S. W. Kemp.

Perionyx pallidus, sp. nov.

(Pl. xvi, figs. 5, 6).

W. 89/1. Kalimpong, Darjiling Dist., E. Himalayas; alt. 600-4500 ft. 24-iv to 10-v-1915. F. H. Gravely. Several specimens, one mature.

External characters.—Length 80 mm.; thickness 3·25 mm. Colour pale, with purplish tinge dorsally at anterior end, and purple median stripe throughout the body. Body slightly depressed in the anterior portion. The mature specimen was regenerating the hinder end; another of the same size showed 118 segments.

Prostomium epilobous $\frac{1}{2}$; the sides of the tongue parallel.

Dorsal pores from furrow 4/5.

The setae are in rings which are quite closed ventrally, and almost closed dorsally. The middorsal interval varies slightly; in the anterior part of the body *zz* averages $1\frac{1}{2}$ *yz*, further back about $1\frac{1}{4}$*yz*. The setae are set closer together ventrally than laterally or dorsally; there is no difference in the size of the setae in different segments. The following numbers were counted:—53/v, 72/ix, 52/xi, 64/xii, 52/xix, and in the middle of the body 70.

The clitellum extends over segments xiii-xvi = 4; the body is slightly swollen here, and buff in colour; setae are present as elsewhere.

In segment xviii the midventral region is slightly depressed, and running across it in the position of the setal line is a groove, sharply cut and narrow, though rather wider and deeper at the position of the male pores; these are small cracks, one-tenth of the circumference apart, or with an interval of about seven intersetal

spaces. A few black spots in the bottom of the groove represent the slightly modified penial setae; the other setae begin some little distance outside the groove.

The female aperture seems not to have developed.

The spermathecal apertures are in the furrows 6/7 and 7/8; they are small and slit-like, separated by a space equal to about seven intersetal intervals, or about the same as in the case of the male pores.

Internal anatomy.—Septa 5/6 and 6/7 are thin, 7/8, 8/9 and 9/10 are slightly thickened, and the rest thin.

There is a rudimentary gizzard in segment vi, slightly firmer and paler, through the presence of muscle fibres, than the rest of the oesophagus. The tube is swollen in segments xiii and xiv, and on opening it longitudinal lamellae were found in this region, but they were of no great height and might rather be called foldings than lamellae. The intestine begins in xvii; there is no typhlosole (in the anterior part).

The last heart is in segment xiii.

The excretory system is meganephric; I saw no difference between the nephridia of different segments, and the ducts terminate at the same level.

Testes and funnels are free in segments x and xi. The seminal vesicles are of moderate size, in xi and xii; they are fused in each segment dorsally over the alimentary canal; their contour is smooth, not cut up into lobes.

The prostates, of the *Pheretima*-type, are very small, and confined to segment xviii; the duct runs straight inwards.

The spermathecae are two pairs, in segments vii and viii, opening forwards into furrows 6/7 and 7/8. They are small, with a sac-like ampulla which is rather constricted at its middle, the upper portion being the wider. The duct is scarcely separately distinguishable, and is hardly more than the narrower end of the sac; it is short and half as wide as the ampulla. There is a fairly well-marked bulging on one side of the lower part of the sac in one of the organs which was mounted for microscopic examination (fig. 5); this may represent the beginning of a seminal chamber. A connective tissue strand passes upwards from the summit of the ampulla.

The penial setae (fig. 6) are scarcely modified, and represent a very early stage in their evolution (*cf. P. nainiana*, Michaelsen, 13). They have the ordinary form; in length they measure ·175 mm., in thickness 17μ; with the high power a few fine sculpturings are seen on the distal half of the shaft.

Remarks.—Of the species of this genus which have the spermathecal apertures in furrows 6/7 and 7/8, perhaps *P. aborensis* resembles the present form most closely; but the colour, the intervals between the male and spermathecal apertures respectively, the position of the last heart, and the fusion of the seminal vesicles of each of the two segments, seem sufficient to distinguish them. Differences in the male field separate the present species from *P.*

kempi, *pincerna*, *inornatus*, and *sikkimensis*; the last mentioned has also thickened septa and characteristic penial setae.

Perionyx gravelyi, sp. nov.

(Pl. xvi, figs. 7, 8).

W. 79/1. Pashok, Darjiling Dist., E. Himalayas; alt. 5500 ft. 26-v to 14-vi-1916. F. H. Gravely. A single specimen.

External characters:—Length 48 mm.; maximum breadth 2 mm. Colour dorsally a light purple, more marked at the anterior end, with a darker middorsal stripe, pale ventrally. Segments 89.

Prostomium epilobous $\frac{2}{3}$, tongue broad, cut off behind.

Dorsal pores begin at furrow 6/7.

The setae are in rings, which are almost closed dorsally and ventrally; the middorsal and midventral intervals are perhaps equal to $1\frac{1}{4}yz$ and $1\frac{1}{4}ab$ respectively in front of the genital region, and to $1\frac{1}{2}zy$ and $1\frac{1}{2}ab$ behind it. There are no noteworthy differences between the intersetal intervals. The following numbers were counted: 34/v, 40/ix, 40/xii, 32/xix, and 32 in the middle of the body.

The clitellum is very indistinct; it includes perhaps xiii or $\frac{1}{2}$xiii-xvi = $3\frac{1}{2}$ or 4; setae and dorsal pores are present.

The male apertures are on segment xviii, in the form of slit-like transverse cracks just behind the level of the setae and between setae *a* and *b* on each side (fig. 7). Seta *a* is particularly black; *b* is slightly further out than the *b* of other segments, and *c* of segment xviii corresponds to *d* of other segments in position. The apertures and setae *a* and *b* are situated on papillae which meet and fuse in the middle line; there is a transverse groove in front of and behind the conjoined papillae, so that a strip of segment xviii is left unmodified at the anterior and posterior borders of the segment.

The female aperture was not visible.

The spermathecal apertures are in furrows 6/7 and 7/8, between the lines of setae *a* and *b*. They are thus, like the male pores, very near the midventral line.

Internal anatomy.—Septa 7/8, 8/9, and 9/10 are slightly strengthened; there is perhaps some slight thickening of the septa as far back as the prostatic region.

The gizzard is small, cylindrical, and moderately firm, in segment v. The oesophagus is somewhat swollen in xiv and xv,—in the latter segment transverse vascular channels are visible on the dorsal wall. The intestine begins by a gradual widening in segments xvii to xix; there is no typhlosole in the anterior portion.

The last heart is in segment xii.

Testes and funnels are free in segment x; funnels were seen in xi but testes were not identified. The vesicula seminalis of segment xi is large and single, extending across the middle line and down on each side of the oesophagus, taking up the whole length and breadth

of the segment. In segment xii the vesicles may be described as a pair, but fused in the middle line behind septum 11/12, and thence depending back on each side so as to bulge septum 12/13 back nearly to the level of 13/14. All the vesicles are of simple outline and not lobed.

The prostates occupy segments xvii to xix, and are cut up into three lobes, corresponding to the three segments; they are however relatively small structures. The duct originates at the middle of the gland, and passes at first backwards to the level of septum 18/19, then obliquely forwards and inwards; the angle is perhaps characteristic; each duct is rather thin, soft, and broader towards its ectal end.

The spermathecae are situated in segments vii and viii, and their ducts are directed forwards. The ampulla is sac-like and irregular in shape; the duct is half as thick and nearly as long as the ampulla, from which it is not sharply marked off; there is no diverticulum.

The penial setae,—those on each side of the male apertures, *a* and *b* of segment xviii,—are but little modified. They are ·4 mm. in length, and 21μ broad at the middle; there is a slight curve in the proximal part of the shaft, and the tip is slightly bent; the tip is pointed, and near it there are a few fine dot-like sculpturings arranged more or less in transverse rows (fig. 8).

Remarks.—The present form belongs to the same group of species as the last; the characters of the male field and the penial setae are probably sufficient to distinguish it, though its characters are on the whole negative rather than positive.

Perionyx aborensis, Stephenson var. **heterochaetus**, nov.

(Pl. xvi, fig. 9).

W. 138/1. Pashok, Darjiling Dist., E. Himalayas; alt. 5000 ft. 26-v to 14-vi-1916. F. H. Gravely. A single specimen.

External characters.—Length 60 mm.; breadth 2·5 mm. Colour on dorsal surface dark purple anteriorly, brownish with darker median stripe behind; pale ventrally. The body is depressed, the ventro-lateral angles being fairly pronounced and the ventral surface slightly concave. Segments 100.

Prostomium epilobous $\frac{1}{3}$; tongue broad, not closed behind.

Dorsal pores from furrow 5/6.

The setae, in rings, have a rather peculiar arrangement. In the first thirty-four segments the setae on the dorsal surface are much larger, and set more widely apart, than behind; the change is sudden, and coincides with a change in pigmentation, which is darker and purpler in front, lighter and browner behind. In the anterior part of the body *zz* is a little greater than *yz*,—about $1\frac{1}{4}$ *yz*; behind there is hardly any difference. The ventral setae are comparatively small and close together throughout, and the ring is closed (*aa* = *ab*). The following numbers were counted :—30/v

31/viii, 30/ix, 31/xii, 33/xix, and about 50 in the middle of the body.

The clitellum appeared to extend over segments xiii-xvii = 5, but was most marked in xiv-xvi; it is light in colour, and the setae and dorsal pores are retained.

The male area, on xviii, is a whitish patch which takes up the whole length of the segment; the lateral margins are rather swollen, and its centre is rather more concave than the rest of the ventral surface The apertures are transverse grooves in line with the setae; the centre of each is about opposite to the setal interval *de*, the interval between the centres of the grooves being thus equal to $\frac{2}{15}$ of the circumference; the interval between the inner ends of the grooves is equal to the length of one of the grooves. Slight depressions, also transverse in direction, are present in front of and behind the grooves, which thus are bounded by slightly marked anterior and posterior lips. The setae begin on the outer margin of the male area.

The female aperture is on segment xiv,—a small transverse slit in the midventral line, surrounded by a whitish oval patch, the whole of which is included between the line of setae and the anterior border of the segment.

The spermathecal pores are situated in furrows 6/7 and 7/8, one-sixth of the circumference apart and about in line with seta *e*.

Internal anatomy.—Septa 6/7, 7/8, and 8/9 are slightly thickened.

There is a rudimentary gizzard in segment v, the oesophagus being somewhat swollen and its walls thickened. The oesophagus is also swollen in segments xi, xii, and xiii, where transverse vascular channels are to be seen in its wall; the interior here is rugose merely. The intestine begins in xix, behind the prostate; there is no typhlosole in its anterior part.

The last heart is in segment xii.

Testes and funnels, the latter included in large masses of iridescent spermatozoa, are present in segments x and xi; a mass of coagulum fills up segment x[1], very much resembling the seminal vesicles in the two succeeding segments, and differing only in being more easily detachable.

The seminal vesicles, in segments xi and xii, are large, and fill out their respective segments; they are flocculent masses, with simple outline, which meet in the middle line dorsally but do not fuse there with their fellow of the other side (doubtfully so in the case of the posterior pair).

The prostates are squarish blocks, confined to segment xviii. The duct is not very stout, and only slightly muscular apparently; it lies in a hilus of the gland for the most part, where it is curled

[1] I have little doubt that the seminal vesicles which I stated to be present in segment x in *P. depressus*, and said to be more intimately attached to septum 9/10 than to 10/11 (17) are really only masses of coagulum. These masses are mainly composed of spermatozoa, making their way, presumably, from the seminal vesicles, where they have been ripening, to the mouths of the funnels.

and twisted; if straightened out it would be of moderate length. Its ectal portion is rather stouter than the rest; it joins the body-wall at the outer margin of a slightly raised whitish cushion. No penial setal sacs were seen.

Ovaries and funnels were well developed, in segment xiii.

The spermathecae are situated in segments vii and viii, opening forwards into grooves 6/7 and 7/8. The ampulla is irregular in shape, and about as broad as long; the duct is very broad,—two-thirds as wide and two-thirds as long as the ampulla, so that the whole organ has a stumpy appearance. There is a single diverticulum, sessile on the inner side of the upper part of the duct; a few indistinct seminal chambers are visible on its surface (fig. 9).

Remarks.—The present form presents some similarities to *P. depressus*, in the depressed form, the general character of the male field, the prostatic duct, and the relations of spermathecal ampulla and duct. It appears to be even more closely related to *P. aborensis*; the differences are the numbers of setae (about 30 per segment in the anterior part of the body as against more than 60 in *P. aborensis*), the setal distribution (the peculiar arrangement in the present form is not, apparently, found in *P. aborensis*, where it is noted that the setae of segments viii and its neighbours are the largest), and the absence of spermathecal diverticulum in *P. aborensis*; the apertures are rather closer together in the present form.

As in so many cases, it is difficult to know quite what to do with a single specimen; had there been a number of specimens for examination its position could probably have been settled with some degree of certainty. The erection of a variety offers a temporary refuge; the varietal may be advanced to a specific name or may be dropped altogether, as subsequent specimens come under examination.

Perionyx nanus, sp. nov.

(Pl. xvi, fig. 10).

W. 78/1. Pashok, Darjiling Dist., E. Himalayas; 5000 ft. alt. 26-v to 14-vi-1916. F. H. Gravely. Two specimens, one mature.

External characters.—Length 53 mm.; diameter 1·5 mm. Colour brownish-purple dorsally, pale ventrally. Ventral surface flattened. Segments 100.

Prostomium epilobous ½, tongue not closed behind.

Dorsal pores begin from furrow 5/6.

The setal ring is almost closed dorsally; and entirely closed ventrally in the anterior part of the body, but behind the anterior third a slight break can be distinguished. The following numbers occurred: *ca.* 36/ix; about the same, but too small to count accurately in xii; 35/xix, and in the middle of the body 34.

The clitellum extends over xiv-xvii = 4; it is well marked, and rather lighter in colour than the rest of the surface, smooth, the setae quite distinct but the intersegmental grooves less well marked than elsewhere.

The male apertures are on segment xviii, in line with *g* or the interval *gh*; they are wide apart, this interval representing a distance equal about to a quarter of the circumference; the pores are slightly behind the line of the setae, and are prolonged inwards towards the middle line by slight grooves. Surrounding each aperture is a whitish oval opaque thickened patch, which is itself surrounded by a more translucent lip; the aperture is situated excentrically in the oval patch, between the centre and the outer margin. The whole takes up the entire ventral surface of segment xviii, the lip on each side forming a prominence at the lateral margin of the ventral surface of the animal (fig. 10). There are no setae between the male apertures.

The female aperture was not actually visible, but was indicated by a very slightly paler transversely oval patch taking up the space between furrow 13/14 and the setal ring of xiv.

The spermathecal apertures are large and patent, widely apart (not quite one-third of the circumference) and near the lateral margin of the ventral surface, in furrows 6/7 and 7/8; they are bounded by distinct lips, and a gelatinous matter was protruding from them.

Internal anatomy.—No septa are notably thickened; 8/9 and 9/10 seemed slightly strengthened, and perhaps 7/8 and 10/11 very slightly so.

A rudimentary gizzard is situated in segment v, the outline of the thickening of the oesophageal wall being somewhat Y-shaped, the posterior portion is narrower, and the wall between the limbs of the Y is soft. The oesophagus is bulged in segment ix, with marked transverse striations (vascular channels). The intestine begins in xix.

The last heart is in segment xii.

Testes and funnels are free in segments x and xi (testes not certainly identified in xi; the funnels are conspicuous through the adherent iridescent spermatozoa). Segment x is filled with coagulum, as in the last species. The vesiculae seminales, large loose flocculent masses with only slightly indented margins, take up the whole length of segments xi and xii; those on xi fuse dorsally over the gut, while those in xii meet but are apparently still separable.

The prostates take up part of segment xvii and all of xviii and xix, and are indented by the septa. The duct is thin, soft, not muscular, of the same diameter throughout, and bent once on itself, the convexity of the loop being forwards; there is no modification of the body-wall where the duct joins it. No penial setal sacs were seen.

Ovaries and funnels were present in segment xiii.

The spermathecae are two pairs, in segments vii and viii; they are very simple in form,—roughly pear-shaped with a thick stalk. The ampulla is of some size, and fills out the whole length of the segment; each was, in the present specimen, full of a coagulated yellow gelatinous material. The duct is broad and short, —half as broad and a quarter as long as the ampulla, from which

it is not sharply marked off. There is a single diverticulum, sessile and wart-like,—in one case hardly noticeable,—on the inner side at the junction of ampulla and duct; it contains glistening spermatozoa, but is not, apparently, chambered.

Remarks.—This species also belongs to the group of *P. aborensis* (spermathecal apertures in 6/7 and 7/8, simple form of spermathecae, and absence of penial setae); but its special characters,—small size, lateral position of the male and spermathecal apertures, characters of the spermathecal diverticulum and male field,—render it perhaps the most distinct of the group.

Perionyx m'intoshi, Bedd.

W. 87/1. Nepal Valley, alt. 4500—6500 ft. 26-vi-1916. Col. J. Manners-Smith. Two specimens, the larger softened.

Little is known about this interesting species, though it was one of the earliest of the genus to be described. The first worm to be described by Beddard under this name was represented by a single immature specimen from Akyab in Burma; this was later considered of doubtful validity by the author himself (3), as also by Michaelsen (10, 13). Our only other source of information is a second short account by Beddard (2); Vaillant, in his *Hist. nat. des Annelés* (1889), which I have not been able to consult, refers to the species, but apparently only from the point of view of classification and without having had any fresh material. It is therefore worth while to give an account of the specimens which have now come to hand.

External characters.—Length 230 mm.; diameter average 10, maximum 12·5 mm. (the softer specimen measured 280 mm. in length, and was of a maximum diameter of 17 mm., but in the condition of the worm these figures are not reliable). The colour is a lighter or darker purple dorsally (the two specimens differ), with the clitellum of a buff tint and the ventral surface pale. The segments of the longer worm were 225 in number; there was no secondary annulation.

The prostomium is epilobous ½; the tongue being open behind.

Dorsal pores are present from furrow 5/6.

The relatively small setae are in rings which are, often at any rate, closed both dorsally and ventrally; there are numerous gaps in various places on the dorsal surface, but since complete rings can be found the gaps may be accidental. The setae are closer together on the ventral than on the dorsal surface; the intersetal spaces are often very irregular. The following numbers were counted: 78/v, 72/ix 76/xii (but there were long gaps in each of these three series), *ca.* 90/xxiii, and 112 in the middle of the body.

The clitellum is not sharply delimited; it extends over ½xiii-xx=7½; the furrows are still well marked, and setae are present.

The male area is a midventral depression on segment xix, which in the more mature of the two specimens is rather longer than broad; it takes up the whole of the length of the segment,

and encroaches in front and behind on the adjacent segments; the depression is rectangular in shape, and has a well marked border, —rather less well marked however at the sides, near the male pores. These are round pits with distinct lips, situated very close together slightly behind the middle of the segment, the line of the setae bends forwards in front of the apertures.

The female aperture is single, and appears as a small transversely elongated pit, on segment xiv, midway between the line of the setae and the anterior limiting furrow.

The spermathecal pores are situated in furrows 7/8 and 8/9, fairly close together, but not, apparently, as close as the male pores.

There are no other genital marks.

Internal anatomy.—Septum 4/5 is thin, 5/6 slightly and 6/7-11/12 somewhat or moderately thickened; a number of those that follow, as far perhaps as 18/19, are slightly thickened. A large number of Nematode parasites were found in some of the anterior segments, in x and especially in xi.

The gizzard, in segment vi, is of fair size even relatively to the large size of the animal; it is moderately firm though not hard; the anterior end is the broader, and there is a constriction not far behind the anterior end, where a transverse sheet of muscle (not a septum) is inserted round the organ. There are no calcareous glands. The intestine begins in segment xviii.

The meganephridia are disposed in the same longitudinal line throughout the body.

The last heart is in segment xiii.

Free funnels were found in segments x and xi, and testes in the former segment; testes were not identified with certainty in xi but the condition of the specimens left something to be desired, and this segment was packed with the Nematode parasites mentioned above. Vesiculae seminales are present in xi and xii; they are large, soft, and somewhat cut up into lobes at their surfaces; those in xii are large enough to bulge back the septum; in one specimen those of the same segment had fused together over the intestinal canal, in the other those of the two sides were separate. There appears to be, in addition to the above, a small empty rudimentary seminal vesicle in segment xiii, attached to the posterior face of septum 12/13.

The prostate, of the *Pheretima*-type, is confined to segment xix; it is cut up by indentations into lobes, and the short and stout though soft duct runs from the hilus transversely inwards to its exit.

Ovaries were present in segment xiii, attached to the posterior face of septum 12/13; the funnels were not seen. In both specimens rudimentary ovisacs were seen in xiv.

The spermathecae have the simplest possible form,—almost spherical sacs, prolonged into a short thin duct. There are no diverticula, though the ampullae themselves show a warty prominence or two

There are no penial setae.

Remarks.—A curious feature of both the specimens is the shifting backwards of the male apertures one segment, to xix ; this is accompanied by an extension of the clitellum also (Beddard describes the clitellum as including segments xiii-xix). There is some doubt as to the locality from which Beddard's (second and well characterized) specimens were obtained ; in his paper he says Seebpore, but subsequently (3) states that he had mislaid his notes and that it might be from Darjiling ; the locality of the present specimens renders this second supposition perhaps the more likely of the two.

Genus **Lampito.**

Lampito mauritii, Kinberg.

W. 136/1. Vareeg Islet, S. side of Mormugao Bay, Portuguese India ; shore collecting, under stones. August, 1916. S. W. Kemp. A single specimen.

Genus **Pheretima.**

Pheretima posthuma (L. Vaill.).

It is scarcely necessary any longer to particularize concerning the distribution of this almost ubiquitous worm, at any rate in those provinces where it has already been found. I have lately received, in the present collection belonging to the Indian Museum and otherwise, specimens from Ludhiana (Punjab), Allahabad, Agra, Lucknow (United Provinces), Rangamati (Bengal), Kierpur (Bihar), as well as from Ajmere in Rajputana, a part of the country of whose Oligochaete fauna we are still in ignorance.

A specimen from Kierpur, Purneah Dist., Bihar, showed a peculiarity which is worth passing mention. This was the accessory papilla on segment xvii on the right side. The accessory papillae are as a rule present on segments xvii and xix, almost in line with and somewhat resembling the papillae which bear the male pores on segment xviii ; this particular papilla however seemed so exactly like the true porophores that I opened the worm, and found that it represented the opening of an accessory prostate, instead of as usual a small bunch of cutaneous glands. This prostate was small, and attached by a strand of tissue to the septum in front ; but it had a well-developed duct, coiled and almost as thick as the one in segment xviii.

Pheretima houlleti (E. Perrier).

Allahabad, United Provinces. L. Karam Narain Bahl.

Pheretima heterochaeta (Mchlsn).

W. 139/1. Rangamati, Chittagong Hill Tracts, Bengal. 11-vii-1915. R. Hodgart. A single specimen.

Pheretima hawayana (Rosa).

W. 74/1. Nepal Valley, E. Himalayas; 4500-6500 ft. Col. Manners-Smith. A single specimen.

Pheretima annandalei, sp. nov.

(Pl. xvi, fig. 11).

W. 8/1. Casuarina woods at Singgora, Tale Sap, Siam. 20-1-1916. N. Annandale. A single specimen, the first four segments damaged.

External characters.—Length 58 mm.; thickness 4 mm. Colour varied, rather blotchy, generally pale, with a greenish tinge behind the clitellum; anteriorly buff, with a brownish pigmentation dorsally in the first few segments; clitellum drab-grey. Segments 63.

Prostomium ?

Dorsal pores not distinguishable in front of the clitellum; there may be one at the anterior border of the clitellum, in furrow 13/14.

The setae are in rings; the dorsal interval is small and rather irregular (*zz* = 1½*yz* in front of the clitellum, less behind); the ring is almost or quite closed ventrally. The setae in front of segment x are rather larger than the average size, and those situated dorsally on segments x and xi are markedly small. There is in general no marked difference in the setal intervals in different parts of the ring, though they are closer ventrally in some of the anterior segments, *e.g.*, viii and ix. The following numbers were counted: 43/v, 59/ix, 55/xii, 51/xix, and 53 in the middle of the body.

The clitellum extends over segments xiv-xvi = 3; it is smooth and rather swollen, without setae or dorsal pores.

The male apertures are situated ventro-laterally, widely apart on segment xviii, the interval between them being about equal to one-third of the circumference; twelve setae intervene. The apertures are transverse slits, not much raised, with much puckered lips, in the line of the setae.

The female pore or pores may be represented by a small slightly raised white patch on segment xiv, near the anterior border of the clitellum.

The spermathecal apertures are small, with slightly tumid lips, in furrows 5/6, 6/7, 7/8 and 8/9; they are situated rather above the lateral line of the body, the interval between those of a pair, measured across the dorsum, being five twelfths of the circumference.

Genital markings are present as small papillae in the male and spermathecal regions. The posterior cluster, about a dozen in number, is situated midventrally on segments xviii and xix. The anterior, seven in number, is midventral on viii, in front of and behind the line of the setae.

Internal anatomy.—Septum 4/5 is thin; 5/6 and 6/7 are somewhat thickened, and have a dense fur of micronephridia on their

anterior faces; 7/8 is thin. No more septa are to be distinctly recognized till 11/12, which is thin, as are all the rest. Septum 10/11 is probably represented by a thin membrane which covers the anterior seminal vesicle; this can be stripped forwards off the vesicle, by which it is much bulged forwards, and seen to get an attachment to the body-wall.

The alimentary tube is much bent on itself in segment v; in vi it is thin-walled and dilated. The gizzard is situated behind septum 7/8, and is large, firm, and squarish. The intestine begins in segment xv. A pair of simple conical diverticula arise in segment xxvii (probably, but the septa are very indistinct). The typhlosole begins at the level of the caeca; it consists of a vertical lamina, the sides of which are folded into a series of vertical ridges. Paired lymph-glands are situated on the intestine.

The last heart is in segment xiii.

The excretory system is micronephridial.

Testis-sacs contain the testes and funnels; the sacs are two pairs, those of a pair being quite separate, but those of the same side appear to communicate; the anterior is also connected with the anterior, the posterior with the posterior seminal vesicle. Both pairs of vesicles are very conspicuous, large and white; the anterior, which probably belongs to segment x, extends forwards to impinge on the hinder end of the gizzard; the posterior, in segment xii, extends backwards carrying before it septa 12/13, 13/14, and also to some extent 14/15. The posterior is of simple form, while the front margin of the anterior is slightly lobed.

The prostates take up segments xvii to xx; they are deeply indented into lobes, and in the normal position almost meet dorsally over the intestine. The shining and muscular duct is coiled circularly; it is of moderate stoutness, except at its ectal end, where it narrows, and then joins a copulatory pouch; the whole,—duct and pouch,—are contained in a membranous (probably muscular) sac, through which the duct can be seen, but which has to be torn through before it can be properly displayed. Duct, pouch, and sac form a large flat elevation on the body-wall, which impinges upon and rather bulges forwards and backwards the septa limiting segment xviii in front and behind.

The ovaries have the usual situation.

The spermathecae (fig. 11) are four pairs. The ampulla is irregular or of an elongated triangular shape; the stout duct, long and bent on itself, is nearly twice the length and half the thickness of the ampulla. The single diverticulum is a small ovoid iridescent sac attached by a thin wavy stalk to the duct at its extreme upper end, just below its junction with the ampulla. The loop formed by the duct is bound together by connective tissue, which has to be torn through before the various parts of the apparatus can be nicely laid bare.

Corresponding to the external papillae there is seen on the inner surface of the body-wall, on both sides of the ventral nerve cord, and between and behind the copulatory sacs, a group of

small stalked glands, sometimes rather mushroom-like; a similar group exists in the spermathecal region.

Subfam. *OCTOCHAETINAE.*

Gen. **Hoplochaetella.**

Hoplochaetella suctoria, sp. nov.

(Pl. xvi, fig. 12; pl. xvii, figs. 13, 14).

W. 67/1. Sanvordem, Portuguese India; under stones near river subject to tidal influences. 11-ix-1916. S. Kemp. Five specimens.

External characters.—Length 140 mm.; thickness 6 mm. Colour a light brown dorsally, with rather darker median stripe; pale ventrally; setal rings on whitish lines. Segments 145.

Prostomium epilobous $\frac{2}{3}$, tongue not closed behind.

Dorsal pores from furrow 4/5.

The setae are disposed in rings; the middorsal interval is small,—about *2yz*, but it varies somewhat, and may be less than *2yz* in the anterior part of the body; the midventral interval is similar to the middorsal. The setae of some of the anterior segments are enlarged, more especially those of segments iii-viii; in general, the ventral setae are set more closely than those on the lateral and dorsal aspects; this is especially noticeable in the posterior part of the body. The following numbers were counted:—66/v, 66/ix, 63/xii, 60/xxi, and 58 behind the middle of the body.

The clitellum was not distinguishable.

The external genital markings vary somewhat; it will perhaps be most convenient to describe the first specimen in some detail, and then briefly to allude to the differences in the others.

In the first specimen examined (fig. 12) the male field embraced segments xvii-xix, the most striking feature being the presence of three circular or obliquely oval clean-cut depressions with flat bottoms, which from their sucker-like appearance suggested the specific name; of these a pair were situated on segment xvii, their length antero posteriorly being equal to the length of the segment, and the distance between the inner margins of the depressions being about equal to twice their longest diameter, the outer and anterior wall of each depression is steeper than the rest of the circumference. A similar depression is present on segment xix, but this is single, and to the right of the middle line, which it almost reaches by its inner margin; in this one it is the outer and posterior part of the circumference which is the best defined. The whole area which includes these three depressions, as well as the prostatic apertures to be mentioned immediately, is sunk below the general surface; the sunken region is triangular in shape, in accordance with the disposition of the sucker-like depressions, but the triangle is not symmetrical about the middle line.

The prostatic apertures are represented by two pairs of small transversely elongated, almost linear, pits in furrows 17/18 and 18/19 respectively; the anterior pair is situated rather internal to

the depressions on xvii, which they almost touch by their outer ends; the right aperture of the posterior pair has its centre in line with that of the hinder sucker-like depression, and is situated tangentially to it (fig. 12).

The female aperture is situated midventrally on segment xiv, in front of the line of the setae.

The spermathecal apertures are two pairs, situated on segment viii, the anterior in the line of the setae, the posterior just in front of furrow 8/9. Each aperture appears as a small transverse slit with slightly raised whitish lip; the inner ends are not far from the middle line. In none of the specimens could I make out any actual pore within the transverse grooves; and this was commonly the case in other species of the genus also, so that the communication of the spermatheca with the exterior apparently takes place only for a limited interval.

A series of genital marks in the neighbourhood of the spermathecal apertures is visible on close examination of this region. These consist of a number of minute papillae, whitish, each with a black central dot. These dots are displaced setae: on delicate manipulation they can be felt to grate against a needle; I isolated some of them, and describe them below. The disposition of the displaced setae in this particular specimen is shown in fig. 13; briefly, there were three on segment vii, arranged more or less transversely near the midventral line behind the middle of the segment; a transverse row of six on the anterior half of segment viii; and five on the anterior half of ix, three to the right and two to the left of the middle line. An examination of the figure will show that the displaced setae correspond in position to gaps in the regular setal line, and further that the number in each group corresponds to the number of setae missing from the regular line; this is the case in the other species of the genus also.

There is considerable variation in these external genital characters. The sucker-like depressions may be more or less distinct; the single posterior depression may be accurately in the middle line; or it may be rather further back than in the specimen described above, over furrow 19/20; or finally the triangle may be reversed,—there may be one anterior and two posterior depressions. In the spermathecal region the anterior pair of spermathecal apertures (or the grooves which are to contain them) may be just in front of, rather than in the line of, the setae; and displaced setae may be absent on segment vii.

Internal anatomy.—The disposition of the septa in the anterior part of the body was not at first clear to me; the difficulty arises from the extreme tenuity of some of the septa, and the fact that others are fused together in the manner to be described. Dissection of more than one specimen was necessary; the result given below was found to hold, in general terms, for the other species of the genus also.

Septum 4/5, behind the pharyngeal mass, is thin, but shows the presence of a few muscular strands, and so is rather stronger

than those which follow. Septa 5/6, 6/7 and 7/8 are very thin indeed,—the extreme of delicacy and transparency; 6/7 is really behind the gizzard, since it can by gentle manipulation be peeled backwards from off its wall as far as its hinder end. Septum 8/9 is scarcely thickened; ix is a wide segment containing the anterior seminal vesicles and posterior spermathecae; 9/10 is slightly thickened, and is united peripherally with the following septum 10/11, and the next after, 11/12, in such a way that at first the three together appear as if they constituted one enormously thickened septum; after separating them 10/11 and 11/12 are seen to be in reality not much thickened. Segments x and xi, enclosed between these fused septa, are narrow segments which contain the testes and funnels, as well as two pairs of hearts and calcareous glands. Septum 12/13 is somewhat thickened, and 13/14 and 14/15 perhaps slightly.

The gizzard, in segment vi, is large and subspherical; the immediately preceding part of the alimentary tube is also fairly firm. Calcareous glands are present in segments x, xi, xii and xiii; they lie within the arch of the heart, are kidney-shaped, well set off from the oesophagus, and compressed antero-posteriorly; the two posterior pairs are larger than the two anterior. The typhlosole is a strongly marked vertical ridge. There are lymph-glands similar to those of *Pheretima* on the septa middorsally over the dorsal vessel; these become more or less distinctly paired towards the hinder end of the animal.

The last heart is in segment xiii; but there is a pair of commissural vessels, smaller than the hearts, though quite obvious, in xiv. The dorsal vessel is single.

The excretory system is mixed mega- and micronephridial. Meganephridia exist as far forward as segment xii, but are quite small in front of xx,—indeed are hardly recognizable in xviii and xix. From segment xx backwards the meganephridium, in the form of a thin tube, is disposed in a large loop which reaches outwards on the body-wall to not very far from the middorsal line; the micronephridia are numerous, arranged in a transverse row along the middle of each segment. The condition is the same towards the hinder end of the body,—a long fine loop behind the septum stretching to near the middorsal line, its ventral end about two-ninths of the half-circumference from the ventral nerve cord, and the micronephridia in a transverse row behind the meganephridium. In the anterior part of the body the micronephridia lose their transverse arrangement, and become scattered on the body-wall (from about segment xvii forwards) and very numerous; there are the usual large tufts at the hinder end of the pharynx, and other similar but smaller tufts on each side in the most anterior segments of all.

Testes and funnels are free, in segments x and xi (the testes were rather doubtfully identified in xi); these segments are enclosed between the fused septa, as previously explained, and contain much coagulum,—probably masses of sperm-morulae and

developing spermatozoa. There are two pairs of seminal vesicles, both of moderate size and both slightly lobed in outline; the anterior are in segment ix, attached to septum 9/10, the posterior in xii attached to 11/12.

The prostates are two pairs, together extending from segment xvii to xxv. Each is a long and convoluted tube thrown into a number of loops in each segment through which it passes. The posterior, after occupving segments xxv-xxii, suddenly in segment xxi, becomes thin,—a quarter of its former diameter; and so continuing through xx, becomes in xix a fusiform shining muscular tube, which turns obliquely inwards to end near the middle line at the anterior border of the segment; the thickest part of the duct (the fusiform swelling near its termination) is about as wide as the main portion of the gland. The anterior prostate begins on each side in segment xxi, thus overlapping the thin anterior portion of the posterior gland; it maintains its initial thickness through xx and xix, becomes thin in xviii, and the fusiform duct, of the same character as that of the posterior gland, curves inwards in xvii to open near the middle line at the hinder border of the segment.

The vas deferens comes down on each side to join the end of the ducts of the anterior pair of prostates on their outer sides. No such arrangement can be seen in connection with the posterior prostates.

Underneath the prostatic ducts in segments xvii and on the right side in xix, and therefore corresponding to the sucker-like depressions seen externally, are circular white cushions or elevations of the body-wall. This region (segments xvii, xviii and xix in their ventral portions) is characterized by dense clusters of micronephridia, which however are absent from the circular cushions just mentioned.

The ovaries are in segment xiii.

The spermathecae are two pairs; the ampulla is sac-like, broadly ovoid with pointed tip; the duct is broad and short, and not set off from the ampulla, of which it is merely a narrower continuation. There are numerous diverticula, about fifteen to a score, arranged as a complete circle round the lower part of the ampulla; each is a small rounded protuberance, broadly sessile (fig. 14). The ducts of the anterior pair of spermathecae run backwards under the peritoneal and connective tissue layers of the body-wall, becoming narrower as they do so, and ultimately pierce the parietes not far from the middle line at about the middle of the length of segment viii; this corresponds with the surface-marking previously described.

A number of accessory glands are associated with the spermathecae. These project into the coelom near the spermathecal apertures, are club-shaped in general form, and about a millimetre or a little more in length; they are not hollow diverticula from the base of the spermathecae, but solid masses of cells. A large nephridial tube is closely associated with each spermatheca; and in addition there are copious micronephridia all round them.

The displaced setae of the spermathecal region are not visible from inside, since their sacs are wholly imbedded in the body-wall. The only way to obtain them for examination is therefore to cut out a piece of the body-wall containing some of them, and to tease it out with needles on a slide. The ordinary setae of this region are ·44 mm. in length and 25μ in thickness below the nodulus; they have the usual curve, the tip is blunt, the nodulus is distal to the middle of the shaft; there are a few extremely fine sculpturings, —short transverse rows of dots,—scattered near the tip. The displaced setae are rather longer and slenderer,—·49 mm. in length and 24μ in thickness; the tip is sharper, the distal portion tapers gradually, there is no distinct nodulus, and the proximal end of the shaft is bent in the opposite way from that of the normal seta, *i.e.* the curve is in the same direction as the distal curve, not in the opposite as usual; transverse sculpturings, well marked and extending for some distance along the shaft, ornament the distal end, but these transverse markings are not arranged in regular rings.

Hoplochaetella kempi, sp. nov.

(Pl. xvii, figs. 15, 16).

W. 68/1. Talewadi, near Castle Rock, N. Kanara Dist., Bombay Pres., October 1916. S. Kemp. Nine specimens.

External characters.—The largest specimen was 103 mm. long and 4·5 mm. in thickness. Colour a rich brown above with darker middorsal stripe; pale ventrally, the setae on whitish rings. Segments 106.

Prostomium very variable, epilobous $\frac{2}{5}$ to $\frac{4}{5}$; broad and triangular, or narrow and with parallel sides.

Dorsal pores commence from furrow 6/7.

The setae in rings; ventrally *aa* = 2½*ab* behind the clitellum, and about 2*ab* in front,—but *ab* itself is somewhat variable; dorsally *zz* = 2 to 3*yz*, but here again the middorsal interval and intersetal spaces are irregular, and this is the case laterally too. The intersetal spaces are greater, on the average, dorsally than ventrally throughout the body. The following numbers were counted:—52/v 56/x. 45/xx, and 44 in the middle of the body.

The clitellum extends over segments ½xiii–xvi = 3½; it is darker in colour than the general surface, and is smooth, but setae and dorsal pores are present.

The ventral surface is concave over segments xvii–xix. The prostatic pores are two pairs of well-defined pits, in furrows 17/18 and 18/19; these are fairly deep, transversely oval in shape, and in length from side to side about equal to two intersetal intervals; the midventral interval between the pits of the same pair is greater than the long diameter of the pits, but less than twice the diameter; the actual apertures are probably at the bottom of the pits,—this was seen to be the case in the posterior pair.

Conspicuous on the male field, in the specimen first examined, are two large broadly oval papillae, each surrounded by a deep

clear-cut groove, the flat surface of the papilla being about on a level with the general surface. Of these the anterior is midventral, in furrow 16/17 ; the posterior has its centre on the anterior part of segment xx, but its size is such that it encroaches forwards on to segment xix, and so partially obliterates groove 19/20 (fig. 15) ; it is to the left of the middle line, and takes up in transverse extent a space equal to the distance between seta *a* and *f*. The antero-posterior length of each papilla is almost equal to the length of a segment. Setae are absent from xvii and xix midventrally, and from xx in the region of the papilla. The whole area of the male pores and papillae is whitish and thickened.

The female aperture is situated midventrally on segment xiv, in the centre of a small circular area in front of the line of the setae.

The spermathecal apertures are represented by two pairs of small elevations on segment viii ; of these the anterior are situated between the row of setae and the anterior margin, the posterior just in front of furrow 8/9 ; all are pretty close to the middle line. There appear to be a few displaced setae on each of the anterior pair of papillae ; but the curious thing is that there is no actual pore, no definite opening, either on the papillae or elsewhere ; I looked for apertures carefully in the grooves, but there are certainly none there. This peculiarity seems to characterize all the species of the genus ; and one is driven to suppose that the spermathecal apertures form only when actually required, at the time of copulation and oviposition ; at any rate the openings are only virtual or potential at other times.

In this region there are other small elevations which bear setae ; a pair on segment ix, just in front of the setal line, and a pair on vii actually in the line of the setae (in this latter case the special setae are therefore not " displaced ").

In this species also the appearances on the genital region vary somewhat in different specimens. Thus it is commoner to find the anterior of the two papillae of the male area on the right side, balancing the posterior, as it were, which is on the left ; or both anterior and posterior papillae may be midventral or almost so ; or there may be only one papilla, posterior and on the right side. In the spermathecal region the special setae on their papillae are usually in line with the ordinary setae of segments vii and ix.

Internal anatomy.—The disposition of the septa is so similar to what has been described for the last species that nothing further need be said.

The gizzard, squarish in form and of moderately large size, is in segment vi. Calcareous glands, of large size, stalked and set off from the oesophagus, are present in segments xii and xiii ; they are over-arched by the hearts, and in xii overlaid by the seminal vesicles ; similar glands are also present in x and xi, but smaller and more deeply placed in the segment. The intestine begins in xvi ; the typhlosole is a simple longitudinal vertical lamina, of

relatively large size. Lymph-glands are again present on the intestine from its beginning, appearing as a row of minute lobules lying transversely across the dorsal vessel and attached to the posterior septum of each segment.

The first transverse vascular commissure is in segment viii, the dorsal vessel, though continued forwards over the gizzard, not giving off any regular series of branches in front (*cf. Erythraeodrilus*). The last vessel that can properly be called a heart is in segment xiii; but, as in the last species, there is a pair of very obvious commissures in xiv. The "hearts" are light in colour,—*i.e.* muscular and contractile; they are narrowed at their entry into the dorsal vessel, and in segments xii and xiii appear to have a connection with the supraintestinal also. The commissures of segment xiv are about half the diameter of the hearts, and do not sweep out so far in the segment; they are dark in colour, and are not contracted at their entry into the dorsal vessel.

The meganephridia are first plainly visible in segment xx; as in the last species they are long thin loops stretching outwards on the body-wall to near the middorsal line; each lies along the middle of the segment, and appears to be quite free from the septum in front. The micronephridia are numerous, arranged in a transverse band in each segment, though not in a single series; they form a dense fur all over the inner surface of the body-wall in the clitellar segments; and in front of this also they are densely set and without regular arrangement; there are considerable tufts at the hinder angles of the pharynx in segment v, as well as in the most anterior segments in front of this.

In segments x and xi, ventrally situated and (in xi at least) continuous across the middle line, there were seen fairly large iridescent lobed masses, not enclosed in a membrane, and representing clumps of spermatozoa round the funnels. The testes were not distinguished, and may have atrophied. The vesiculae seminales are two pairs, of moderate size, slightly lobed, in segments ix and xii.

The prostates are tubular; the two pairs have the same general arrangement as before. The anterior pair reaches back to segment xx or xxi, the posterior to xxiv. The ental end of the anterior gland is somewhat narrower than the main mass of the gland; in segment xix the main mass becomes a narrow shining duct, which crosses segment xviii, twisting about as it does so; the duct ends, widening rather rapidly, by getting into xvii and piercing the body-wall at the posterior border of the segment. In the posterior pair there is not much difference in the thickness of the glandular part throughout its extent; each becomes a narrow shining duct at the anterior border of segment xxi; this duct is convoluted as it crosses xx, widens as it enters xix, and, as seen from inside, pierces the body-wall at about the middle of the length of the segment. In both the anterior and posterior glands the terminal portion of the duct is directed inwards towards the middle line.

The vas deferens was identified on the outer side of the termination of the anterior duct; it ends by entering the body-wall just behind and external to the prostatic duct.

Firm white cushions are seen on the inside of the body-wall, in situations corresponding to the large flat papillae seen externally. Except where occupied by the cushions the midventral region on the inner side of the body-wall in segments xvi–xxi is densely covered by rather large micronephridia.

Ovaries are present in segment xiii.

The spermathecal ampulla (fig. 16) is sac-like and ovoid in shape; the duct is only slightly set off from the ampulla, is somewhat less in length than the ampulla broad, especially at its upper end, but narrows considerably towards its termination. On the duct, at about the middle of its length, are two to four diverticula, small rounded knobs filled with white shining matter. In addition, the accessory glands are here numerous and conspicuous; each is an elongated cylindrical structure, solid, soft, and white, with a short narrow stalk (fig. 16); on one side there were seven,—three in front of the anterior spermatheca, three between the two, and one near the posterior spermatheca; on the other side there were six, one in front of the anterior, three between the two, and one behind the posterior spermatheca.

Hoplochaetella inornata, sp. nov.

(Pl. xvii, fig. 17).

W. 130/1. Talewadi, near Castle Rock, N. Kanara Dist., Bombay Pres., October 1916. S. Kemp. A single specimen.

External characters.—Length 101 mm.; maximum thickness 6 mm. Colour light brown dorsally, pale ventrally; the white circles on which the setae are implanted are a conspicuous feature. The anus is a vertical slit. Segments 79.

The prostomium is epilobous; the tongue, with parallel sides, is bounded by grooves of which that on the right side goes back only through half of the first segment, while that on the left is continued on to segment ii.

Dorsal pores begin from furrow 6/7.

The setae are on rings which are closed dorsally, and almost closed ventrally ($aa = 2ab$ or less); there is no regular variation in the intersetal intervals between the dorsal and ventral surfaces, or between one region of the body and another. The setae of segments viii–xii are very small. The following numbers were counted :— 84/v, 80/ix, *ca.* 84/xii, 85/xx, and 91 in the middle of the body.

The clitellum extends over segments $\frac{1}{2}$xiii–xvi $= 3\frac{1}{2}$; it is smooth, brown, and markedly constricted; setae are visible and the intersegmental furrows are indicated, but there are no dorsal pores.

The prostatic apertures are two pairs, on segments xvii and xix, at the hinder and anterior borders of these segments respec

tively. They are in the form of small pits, fairly close together, the anterior rather closer than the posterior; each pit has a distinct lip, the outline of the whole being not quite circular, but broadly oval in a transverse direction; the lip in each case extends over the adjacent intersegmental furrow, obliterating it for a short distance, but the pits are just within the boundaries of their respective segments.

The female aperture is represented by a small pit in a small white circular area, midventrally situated on segment xiv in front of the line of the setae.

The spermathecal apertures are represented by two pairs of small papillae on segment viii, the anterior pair midway between the setal line and the anterior furrow, the posterior midway between the setae and the posterior furrow; the papillae are transversely oval in form, and not far from the middle line, the posterior pair being closer together than the anterior; a slight darkening of the centre is all that represents the end of the spermathecal duct. It is interesting to notice how exactly the position of the prostatic apertures corresponds to that of the spermathecal papillae; segment xviii, which intervenes between the pairs of prostatic pores, is a much shorter segment than viii; and the smaller interval between the posterior pair of spermathecal apertures answers to the smaller interval between the anterior prostatic pores when the worms are facing in opposite directions in copulation.

The setae of segment viii are absent ventrally; they begin external to the line of the outer margins of the spermathecal papillae. There are a few dark dots in the posterior spermathecal papillae which may be displaced setae.

Internal anatomy.—The arrangement of the septa is exactly as before.

The pharyngeal mass is in front of septum 4/5; in segment v the oesophagus becomes broader and fairly firm; the gizzard is in vi, barrel-shaped and limited in front and behind by a firm annular ridge. Calcareous glands, kidney-shaped and attached by the hilus, are present in segments x–xiii, small in the two anterior, larger in the two posterior segments. The intestine begins in xvi; lymph-glands lie across the dorsal vessel. In segment xv a large yellowish kidney-shaped mass lies dorsally on the oesophagus and dorsal vessels, its convexity backwards; it is firm, with a slightly rough surface, takes up the whole length of the segment, and is considerably wider than the alimentary tube at this point; it is probably a lymphoid mass. The typhlosole is as before.

The last heart is in segment xiii, and the first in viii; the dorsal vessel is continued forwards over the gizzard as in the foregoing species, and there is the same distinction between the heart in xiii and the stout vascular commissure in xiv as was noted there.

The meganephridia are first visible in segment xx; the nephridia have throughout the same arrangement as in the last species.

Testes and much folded iridescent masses representing the funnels covered with ripe spermatozoa are free in segments x and xi. The anterior seminal vesicles, in segment ix, are large, yellowish and very conspicuous masses, very slightly lobed ; the posterior pair in segment xii are not so large and are more cut up into lobes, though still not deeply.

The anterior prostate on each side extends back to segment xxiii ; the glandular part becomes in segment xx a thin coiled duct which passes forwards through xix, swells gradually in xviii, becoming broad, firm and muscular, and curving inwards towards the middle line ends in segment xvii. The posterior gland, beginning behind in segment xxviii, passes forwards to xxiv, where similarly it becomes a thin coiled duct ; this becomes gradually thicker in xxi and xx, and ends in xix, the final portion of its course being almost straight.

The two vasa deferentia of the right side were identified in their course backwards underneath the peritoneum ; they pass the duct of the anterior prostate on its outer side, and end curving rather inwards behind it.

Ovaries and funnels are present in segment xiii. A minute lobulated appendage of septum 13/14 on its posterior face is probably a small ovisac.

The spermathecal ampulla (fig. 17) is an irregular sac, narrower below, and continued into the duct without any sharp demarcation. At about the place where the one passes into the other is a ring of small white shining sessile diverticula, about a score in all ; but these do not form a single circle all round,—they are arranged two deep on each side of the duct, where they are more closely set than in front or behind. Beyond the diverticula the duct is stout, shining, and narrows slightly towards its ectal end ; in length the portion below the diverticula is about half that of the ampulla.

Between the openings of the spermathecae of the same side, and so about the middle of segment viii, is a group of five rather twisted accessory glands, implanted quite near each other ; they are similar to those previously described, each with a narrow cylindrical duct which is much shorter than the elongated glandular portion.

A character of this specimen which was not noted in the previous species is the presence of accessory glands in the region of the prostatic apertures also. There are three pairs, in segments xvii, xviii and xix respectively. Those in xviii are the largest ; they are massive and solid-looking, rather rectangular in shape, take up the whole length of the segment, and nearly touch each other in the middle line. Those in xvii and xix are only about half the size of those in xviii ; they are on the inner side of, and rather conceal the end of, the prostatic ducts. All have short stout stalks ; the stalks of the glands in xvii and xix appear to become continuous with that of the gland in xviii by passing through the septa where these are attached to the parietes.

Hoplochaetella bifoveata, sp. nov.

(Pl. xvii, fig. 18).

W. 129/1. Talewadi, near Castle Rock, N. Kanara Dist., Bombay Pres., October 1916. S. Kemp. A single specimen.

External characters.—Length 82 mm. ; diameter at the clitellum, which is bulged, $5\frac{1}{2}$ mm., behind this 4 mm. Colour light brown above, with a darker middorsal stripe; pale below; setae on slightly whiter transverse rings. Segments 62; possibly the specimen has been damaged, since the last segment is of full size, and is not followed by any zone in which differentiation of new segments is going on.

Prostomium epilobous $\frac{1}{2}$, very broad,—perhaps somewhat distorted, as the buccal cavity is everted.

Dorsal pores commence from furrow 5/6.

The middorsal setal interval is irregular in front of the clitellum, perhaps because a number of setae have dropped out here and there; normally *zz* may be equal to *2yz*; a short distance behind the clitellum the setae become very small and difficult to see on the dorsal surface, but the interval is perhaps about the same. Ventrally they can be better distinguished against the paler background; *aa* = *2ab* throughout the greater part of the body, = $2\frac{1}{2}$*ab* for some distance behind the clitellum, and is irregular or = *2ab* in front of the clitellum. On the whole the setae are more closely set ventrally than laterally or dorsally; this is best seen behind the middle of the body. The following numbers were counted: 49/v, 62/x, 60/xii, *ca.* 50/xxii.

The clitellum extends over segments $\frac{1}{2}$xiii-xvi = $3\frac{1}{2}$; segments xvii and part of xviii are also somewhat modified. The clitellar region is smooth, brownish in colour both dorsally and ventrally, and much swollen; setae are visible, but no dorsal pores.

The conspicuous features in the male area (fig. 18) are two large depressed areas, shallow and saucer-like, with only slightly raised rim. These are situated midventrally in the position of grooves 16/17 and 19/20, but in each case the depression extends further onto the posterior of the two segments (as far as the setal line) than on the anterior. From side to side each takes up approximately a space equal to the interval between the prostatic pores of the same pair; and in each case the anterior margin of the depression is the better defined, and is rather straighter.

The prostatic apertures are two pairs of small transversely oval shallow depressions with raised lips, in furrows 17/18 and 18/19, not very far from the middle line; the actual openings of the ducts are however invisible, or are perhaps represented by dark dots near the inner and anterior margin of the depressions. It might be more accurate to say that the posterior pair of pits are on the most anterior part of segment xix rather than in groove 18/19; grooves do not really exist here, and the pits are rather nearer to the setal line of xix than to that of xviii.

The female aperture seems to be situated just in front of the line of the setae midventrally on segment xiv, on a small white transversely oval papilla.

The spermathecal papillae are two pairs, on segment viii, the anterior pair midway between the setal ring and the anterior intersegmental furrow, the posterior just in front of the posterior furrow. Setae are absent from the midventral region of segment viii, but displaced setae are found on all the spermathecal papillae. A pair of small papillae are also present in segment ix, in or slightly in front of the setal ring and in line with the spermathecal papillae ; on these too displaced setae are seen.

Internal anatomy.—The specimen was in poor condition internally ; it is however remarkably similar to the last species. The septa, circulatory system, and nephridia require no comment. The barrel-shaped gizzard is in segment vi ; of the four pairs of calcareous glands those in segments xii and xiii are smaller than in the preceding species.

The testes and funnels are as before ; the two pairs of vesiculae seminales are yellowish, of fair size and slightly lobed. Each of the prostatic ducts is extremely thin in its course from the end of the glandular portion to its terminal swelling. The vasa deferentia pass by the outer side of the termination of the anterior duct while still separate, then turn behind it, unite, and end. There are small accessory glands in the neighbourhood of the prostatic apertures, in front of and behind the termination of each of the ducts. In addition, two large white cushions occupy the middle line in positions corresponding to the external depressions.

The ampulla of the spermatheca is of a longer or shorter ovoid form, narrowing below where its outline is more irregular. On this lower narrower part are situated two, three or four seminal chambers, of moderate size, sessile, white and shining. Below this the sac is continued into the duct, narrow and almost wholly within the body-wall. There are a number of accessory glands, of the former type, in the neighbourhood of the spermathecae. The whole is very like the organs in *H. kempi* (fig. 16).

Hoplochaetella affinis, sp. nov.

(Pl. xvii, figs. 19, 20).

W. 128/1. Mormugao Bay, Portuguese India (Donna Paula Bay and vicinity) ; shore collecting. August, 1916. S. Kemp. Six specimens.
W. 125/1. Mormugao Bay, Portuguese India (Vareeg Islet, S. side of Mormugao Bay) ; shore collecting, under stones. August, 1916. S. Kemp. Two specimens, one damaged.
W. 127/1. Mormugao Bay, Portuguese India (small bay on S. W. side of Mormugao Head) ; shore collecting. September, 1916. S. Kemp. Two specimens, in rather poor condition internally.

The description is based on the first batch of specimens, which are to be considered as the types. The other batches differ slightly from the first, and are referred to subsequently.

External characters.—Length 140 mm.; maximum diameter 7 mm. Colour brown dorsally, with a darker middorsal stripe; pale ventrally; setae on white circular ridges. Segments 130.

Prostomium comparatively small, epilobous ¾.

Dorsal pores begin from furrow 5/6.

The setal rings show an irregular dorsal break; in the anterior part of the body $zz = 2—3yz$, for some distance behind the clitellum $= 4—5yz$, and more posteriorly $2—3yz$. The ventral break is smaller and more regular; in front of the clitellum $aa = 1\frac{1}{2}ab$, and behind $2ab$ The intersetal distances are also more regular on the ventral side than on the dorsal; in some regions the setae on the dorsal side are arranged distinctly as couples, with a fair interval between the couples,—equal to twice the space between the individuals of a couple. The numbers counted were :— 72/v, 80/ix (including 8 displaced), 74/xii, 65/xix, and 60 in the middle of the body.

The clitellum is very indistinct; it is marked by a slight reddish tinge on the dorsal surface, and extends over ½xiii—½xvi, or perhaps xiii-xvi,—three or four segments.

The male area (fig. 19) saucer-like and depressed, with a thickened lip; in one case the inner margin of the lip, instead of sloping into the central depression, is much sharper, and actually overhangs. The shape of the area is oval, with its long axis antero-posterior; it covers (without the thickened lip) segments xvii-xix, and its breadth is two-thirds of its length.

In this depression are situated the prostatic apertures,—small darkish transversely oval spots, with perhaps a rather whiter border, on segments xvii and xix respectively, near the posterior and anterior borders; those of a pair are roughly distant from each other about one-third of the width of the ventral surface as seen on looking down on it. In addition, contained within the depressed area, are two transversely oval dark-coloured slightly sunken patches, midventrally (or very slightly asymmetrically) situated on segments xvii and xix; they are rather on the posterior portions of their respective segments, and do not reach the anterior border of these, but on the other hand they may transgress the hinder limit of the segment and encroach on the one behind. The anterior of these sunken patches is between the anterior pair of prostatic pores, and the posterior rather behind the posterior pores; the transverse extent of each is about equal to the interval between the prostatic pores of a pair. In an earlier stage these markings are narrower antero-posteriorly; the one seems to originate in groove 17/18, in line with the anterior prostatic apertures, and the other in the line of the setae of xix, and so behind the posterior pair of pores. The whole area is not at first delimited by a raised lip.

The female aperture is a small depression midventrally situated between the setal ring and the anterior margin of segment xiv.

The spermathecal pores are represented by two pairs of small papillae on segment viii, one pair near the posterior border of the

segment and the other in front of the setal ring, slightly nearer to the ring than to the anterior margin of the segment. The distance between the papillae of a pair appears to be rather less than that between the prostatic apertures of the same pair; longitudinally, the interval between successive spermathecal apertures is equal to that between successive prostatic apertures. There are no actual pores on these spermathecal papillae, but their centres are slightly darker.

The displaced setae of the spermathecal region had in one of the specimens the following disposition: in segment ix the setae *abcd* on each side were displaced forwards so as to lie in a line near the furrow 8/9; on segment viii *ab* on each side are similarly displaced, and *cd* appear to be in close association with the spermathecal papillae; on segment vii three setae near the mid-ventral line are displaced backwards towards the intersegmental groove.

Internal anatomy —The septa, alimentary tract, circulatory and nephridial systems are as in the last two species

Testes and funnels are free in segments x and xi. The anterior seminal vesicles, in segment ix, are of very large size and irregular shape, wedged in between the other organs, and indented in front by the posterior spermathecae; the hinder pair of vesicles, in segment xii, are of moderate size, with a lobulated margin; they extend inward dorsally towards the middle line.

The anterior prostates extend backwards to segment xx or xxi; the glandular part of the posterior occupies segments xxii to xxiii or xxiv. Succeeding to the glandular part in each is a fine much-coiled narrow duct of some length, which widens into a fusiform shining dilatation at its termination; this end portion may have a longitudinal direction, or may bend inwards with a gentle convexity towards the front. Two rather indefinite soft white cushions occupy on the inside of the body-wall the position of the dark sunken area on the male genital field.

The ovaries are in segment xiii; there were no ovisacs in xiv.

The spermathecal ampulla (fig. 20) is somewhat conical in form, with rounded apex and rather constricted at its base: below this constriction are a number of diverticula or seminal chambers, oval in shape with their long axis in the same direction as that of the ampulla, glistening, sessile, and arranged in an incomplete circle; the gap in the circle is on the outer side; in number there were 9 on each anterior spermatheca, and 10 and 12 on the two posterior. The duct, which may be considered as beginning at the constriction mentioned above, has the form of an inverted cone, its base upwards, narrowing very considerably towards the body-wall; it is rather shorter than the ampulla. Accessory glands are present in the neighbourhood, the largest being situated between the posterior pair of spermathecae

The third batch of specimens differs from the first markedly in colour; they are pale, and for the most part nonpigmented, though there is a slight brown colouration dorsally over the ante-

rior end, and a pale brown middorsal stripe throughout the whole length. The dorsal pores begin one segment earlier, in groove 4/5.

The setae appeared to me to be much smaller than those of the specimens first examined; but this might be due to the different state of preservation,—they might seem smaller in a softer specimen, and might appear to project more in a harder and more contracted one. The dorsal interval is equal to *2yz* or less in front of the clitellum, and is on the average $2\frac{1}{2}yz$ behind this. The ventral interval is equal to $2\frac{1}{2}ab$ in the anterior part of the body (irregular however in the preclitellar segments), and to *2ab* in the posterior half. The setae are rather wider apart dorsally than ventrally, but I did not notice any pairing of the setae. The largest setae are those on the ventral surface in the preclitellar region.

The sunken pigmented patches on the male genital field are here sunken flat papillae, dark in colour but with a whitish margin, and surrounded by a groove; they are situated on furrows 16/17 and 19/20 respectively,—the anterior further forwards and the posterior further back, than in the type specimens. In one of the two worms in this batch the anterior papilla was double, one on each side over the position of groove 16/17, the centre of each in a line with the outer edge of the anterior prostatic pit; thus the whole male area, being widened anteriorly, becomes triangular instead of oval.

There were no distinct diverticula on the spermathecae, probably because there was no glistening mass of spermatozoa contained within.

I should perhaps have separated the specimens described above from the type as a distinct variety characterized by the different colour, the different position of the genital markings and first dorsal pore, and perhaps the setal characters. The second batch of specimens enumerated at the head of the account of this species (Vareeg Islet) however decided me against this; here the brown colouration was well marked, as in the type specimens, but the dorsal pores began from groove 4/5 as in the examples just commented on; the setae, too, appeared to be similar in size to those of the latter, while the position of the anterior genital "papilla" was intermediate,—on the anterior part of xvii, neither so far forward as in the one nor so far back as in the other of the previous batches. It seems best therefore to regard the species as a variable one, but not to attempt to divide it.

Genus **Erythraeodrilus.**

Erythraeodrilus kinneari, Stephenson.

(Pl. xvii, fig. 21).

W. 65/1. Castle Rock, N. Kanara Dist., Bombay Pres. Oct. 1916. S. W. Kemp. A single specimen, mutilated posteriorly.

Before giving a few notes on the specimen in the present collection I may add some remarks on the type specimens of the

species, which were kindly sent for re-examination and comparison with the example now obtained, by the Director of the Zoological Survey. This is the more necessary as owing to a regrettable accident in the post, the tube containing the specimens was broken on the return journey, and the types are now practically valueless.

The specimen which I previously (19) took as the basis of my description, with the well-marked papillae on segment xviii, has spermathecae and spermathecal diverticula as shown in the figure (19, fig. 8); the diverticula are numerous and in two groups, the individual chambers being very fairly independent of each other. The " accessory spermathecae ", as I called them in my previous account, are not hollow sacs, but stalked glands similar to those in the various species of *Hoplochaetella* described in the present paper. The manner of opening of the spermathecae is correctly described; externally there appears a slight whitening in the setal line of segment viii at two places, one on each side of the middle line, the interval between them being about equal to that between the male apertures. The prostates are in the form of a series of loops. There is, as stated, no heart in segment xiii; but in xiv there is a vascular commissure similar to that described in *Hoplochaetella* (*cf.* p. 390 *ant.*).

In the other dissected specimen there is only one accessory spermathecal gland on each side (as against two and three in the type). The anterior pair of spermathecae cannot be followed so far back as in the former specimen, and the duct really seems to pierce the body-wall in front of the groove 7/8; the posterior pair as before pierce the body-wall at the level of the setal ring in viii. The ampulla of the spermatheca is irregular in shape; the duct is about as long as the ampulla, broad at its origin, still further swollen at the level of origin of the diverticula, and contracting considerably towards the external aperture. The diverticula are about ten in number, arranged more or less distinctly in two groups of about five each; though distinct enough, the separate diverticula are not stalked (they might almost be called stalked in the previous specimen), and rather resemble the chambers which so commonly surround, more or less completely, the base of the ampulla in species of the genus *Eutyphoeus*. The ectal portion of the duct is distinctly muscular. The gizzard is barrel-shaped. There is no heart in segment xiii, but the commissural vessel is present in xiv, as in the previous example. Externally, the male apertures are further apart than in the type specimen,—about a quarter of the circumference instead of one-seventh. In the spermathecal region there are slight papillae which seem to correspond to the apertures; these are (i) in the setal ring of segment viii, about at the situation of setae *e* on each side and (ii) just in front of groove 7/8, in line with the same setae; these correspond to the sites at which the ducts of the spermathecae seem to pierce the parietes as seen from the inside. There is a fifth papilla in this region, also in the setal ring of segment viii, at the site of seta *b* on the left side.

In the third, undissected, specimen of the original batch, the male papillae are not more than one-seventh or one-eighth of the circumference apart. There is one pair of slightly marked spermathecal papillae,—slight whitenings of the surface rather than definite papillae,—in the line of the setae of segment viii, the interval between them corresponding to that between the male pores; no second pair is indicated. This specimen was probably not as fully mature as the others.

I may now briefly describe the specimen in the present collection

External characters.—Length 40 mm.; diameter 2 mm. Colour grey (original colour ?). Segments 64.

Prostomium ? (buccal cavity everted).

Dorsal pores from furrow 3/4.

Setae in rings; middorsal interval small, = 2*yz* or less; midventral also small, = about 1½*ab*. There appear to be about 34-36 setae per segment both in front of and behind the clitellum, and 28 towards the end of the fragment.

Clitellum smooth, brown in colour, extending over ½xiii-½xvi = 3; setae indicated.

The male apertures, on segment xvii, are not very close together,—about a quarter of the circumference apart; they are situated on whitish papillae which take up the whole of the space between the line of the setae and the furrow which limits the segment posteriorly.

The female aperture is single and conspicuous, on segment xiv, in a whitish circular patch situated between the line of the setae and the anterior border of the segment.

The only signs of apertures in the spermathecal region are a pair of small pale papillae, not very easily distinguishable, in the line of the setae, about in the situation of seta *d*.

There are no other genital marks

Internal anatomy.—The septa are all thin.

The gizzard is large and barrel-shaped. Calcareous glands are present in segments x, xi, and xii; there is no marked difference in size throughout the series.

The last heart is embedded in septum 13/14, which is bulged backwards, so the heart at first appears to be in segment xiv; it really however belongs to xiii.

The meganephridia begin from segment xx.

Testes and funnels are present in segments x and xi; in xi they are contained within testis-sacs,—large soft structures, much resembling seminal vesicles; in segment x they are also probably in sacs, though this was not so clearly demonstrated. The vesiculae seminales are in segments ix, x and xii; they are large, soft, and not much cut up into lobes; those in xii meet over the alimentary canal.

The tubular prostates are one pair; each is a series of simple loops which begins behind about segment xx, passes forwards to xvi, and then bends back again; succeeding the glandular part is a

thin tube, short and twisted, which becomes stout and shiny near its termination, just before it pierces the body-wall

Ovaries and funnels are present in segment xiii.

The spermathecae (fig. 21) are two pairs; the ampulla is sac-like, and set off from the duct; the duct is about as long as the ampulla, fairly stout, shiny, and narrowing somewhat towards the ectal end; from its upper end are given off two diverticula, rounded in form, each containing more than one chamber (2-4). The anterior spermathecae seem to end between segments vii and viii; the posterior appear to be implanted in the body-wall, one just behind the setal ring, the other in the line of the setae. There is only one small accessory gland, just in front of the ending of the posterior spermatheca; it has a narrow stalk, and is about as long as the duct of the spermatheca.

Genus **Octochaetus.**

Octochaetus fermori, Mchlsn.

Kasauli, W. Himalayas, 6000 ft ; under stones. 20-vii-1916. Baini Prashad. A single specimen.
Hoshiarpur, Punjab. 14-vii-1916. Ibrahim.

Octochaetus barkudensis, Stephenson.

(Pl. xviii, figs. 25-27).

W. 13/1. Barkuda Island, Chilka Lake, Ganjam Dist., Madras Pres., 16 to 22-vii-1916. N. Annandale and F. H. Gravely. A number of specimens, some mature.

As this species is known from only one mature example (20), I may add here a description of the features of the present more ample batch of specimens.

External characters.—Length of the largest specimen 91 mm., and thickness 3 mm.; average length and thickness 60 mm. and 2 mm. respectively. Colour a medium grey, no difference between dorsal and ventral surfaces. Segments 136, triannulate from segment vii as far as the clitellum.

Prostomium epilobous $\frac{1}{2}$, tongue not cut off behind.

Dorsal pores from furrow 12/13.

From the anterior end to some distance behind the clitellum $aa = 3\frac{1}{2}ab = 1\frac{1}{4}bc$; $cd = 1\frac{1}{2}ab$ and so is slightly greater than $\frac{1}{2}bc$. Further back *aa* and *bc* become progressively narrower relatively to the intervals between the two setae of a bundle; so that *aa* is less than $3ab$, and $bc = 2ab$; *dd* is rather more than half the circumference.

The genital markings (fig. 25) present several points of difference as compared with the previous specimen. On segment viii, pretty constantly in sexual specimens, are a pair of transversely oval cushion-like elevations, which include the setae *ab* on each side; they do not take up quite the whole length of the segment, and do not quite meet in the middle line. On segment xvi also are

typically a pair of circular or roundly oval papillae, meeting or almost meeting in the middle line and extending outwards to beyond the line of seta *b*,—that is, to the outer border of the ventral surface; they are quite flat, and take up the whole length of the segment, encroaching also on to segment xv; they may be scarcely raised above the general surface; and, in one instance at least, could be distinguished into a central whitish portion surrounded by a darker groove with a whitish lip outside all. On segment xviii there may be a pair of similar, even larger papillae extending forwards on to xvii, and meeting in the middle line with only a narrow groove between them; these obviously correspond to the approximately rectangular cushions on this segment, which also are separated from each other in the middle line by a narrow groove, described in the original account. In one specimen there was present on segment xxii midventrally a large transversely oval papilla, taking up the whole length of the segment and extending to between setae *a* and *b* on each side

The female apertures are small, and placed near each other in a darker patch rather in front of the middle of the length of segment xiv. The spermathecal apertures seem not to be visible externally.

Internal anatomy.—The first septum may be 4/5, as stated in the previous account; but here its attachment seemed, in two specimens dissected, to be either at 5/6 or between 4/5 and 5/6.

The calcareous glands are large, but asymmetrical; on the left side the gland is mostly in segment xv, on the right in xvi,—the disposition being such that the anterior part of the left gland gets in front of the posterior part of the right, the dorsal vessel passing obliquely between them; the opening of the glands seems to be in xv on both sides; the glands are lobed, and septum 14/15 is markedly bulged forwards on the left side.

In the former account I stated that the testes and funnels were free; the statement has now to be modified, at any rate for the present specimens. Testis-sacs are present; that in segment xi is large, single, and extending dorsally covers over the hearts and alimentary tube; in one of the dissected specimens it was constituted by a fine membrane stretching between septa 10/11 and 11/12, while in the other it was free from both septa, with a slightly lobed border. The anterior sac in one case resembled the posterior in being constituted by a membrane stretching between the septa; in the other it was, like the posterior in that specimen, free from the septa, and indeed narrow from front to back.

The prostates are of moderate size, and are composed of a number of closely apposed coils; the duct is thin and twisted, of considerable length when extended, and without any thickening in its course.

The shape of the spermathecal ampulla varies very considerably. The diverticula may be absent, or there may be one, or two; again they may be sessile, or narrowed at the base, or even definitely stalked; three or four chambers may be indicated in the diverticulum, or the surface may be smooth without any lobula-

tion ; some of these variations are shown in the figures of spermathecae from the dissected specimens (fig. 26)

The penial and copulatory setae have the shapes previously described. In some of the copulatory setae of segment viii, towards the base what I previously described as a lateral flange cut up into teeth appears rather as a series of distinct spines curved like petals or scales, applied to the surface of the seta (fig. 27).

Octochaetus castellanus, sp. nov.

(Pl. xvii, fig. 22 ; pl. xviii, figs. 23, 24).

W. 134/1. Castle Rock, N. Kanara Dist., Bombay Pres. October 1916. S. W. Kemp. A single specimen, in poor condition.

External characters.—Length 48 mm. ; maximum diameter 2 mm. Colour ? Segments roughly 125 ; in some regions the separate segments are not distinguishable.

Prostomium ?

Dorsal pores perhaps from furrow 5/6.

The setae are widely paired , $aa = 1\frac{2}{3}\ ab = bc = 1\frac{1}{2}cd$; $dd =$ approximately half the circumference.

The prostatic pores, on segments xvii and xix, are small pits situated, in each segment, on a common elevation with a rounded margin; the pores themselves are medial from the line of setae *a*. The seminal grooves are bowed outwards, and run on rather broad curved ridges, so that there is a circular depression in the middle of the male area.

The female aperture is single and midventral, on segment xiv.

The spermathecal apertures are perhaps indicated at the site of setae *a* on segments viii and ix.

Internal anatomy.—Septa 9/10 and 10/11 are slightly thickened ; all are present after the first few.

There is a long, soft, and bulged portion of the oesophagus in front of the gizzard ; the gizzard is conspicuous, relatively large, barrel-shaped, situated in segment vii. There is one pair of calcareous glands in xiv, of moderate size and symmetrical.

The nephridia cannot be identified on the body-wall ; there are large tufts at the side of the oesophagus, in front of the gizzard and spermathecae.

The testes were not identified ; funnels were present, free, in segments x and xi, the largest seeming to be that in the hinder segment on the left side, but I would not lay any stress on this slight difference. Seminal vesicles are present in segment xii ; they are deeply lobed, and rather small.

The prostates are in segments xvii and xix ; they are relatively small, and thrown into several loops ; the duct, thin, semi-transparent, and apparently not muscular, is half as wide as the opaque glandular part, and runs straight inwards.

The spermathecae (fig. 22) are two pairs of rather small organs situated near the middle line. The ampulla is spherical, and the duct, with a rather curved course, is about as long as the

ampulla and one-third as thick; the diverticulum is single, club-shaped, and attached near the ental end of the duct on its inner side; the spermatic chamber is single. The length of the diverticulum is less than that of the ampulla. So far as can be made out internally, the external openings of the spermathecae would be between the setal line and the anterior border of segments viii and ix respectively.

The length of the penial setae (fig. 23, *a* and *b*) varies, ·87—1 mm.; the thickness at the middle is 14μ; they are thus of very considerable length relatively to their thickness. The main part of the shaft has only a slight curve; but the curve of the distal end varies somewhat, so that two types can be distinguished. In the first, the curve of the distal end merely continues the curve of the shaft, and the tip is tapering and bluntly pointed; a few teeth, of moderate size and fairly closely applied to the shaft, are present some little distance above the tip. In the second, the distal end is considerably bent, it may be to nearly a right angle; the tip is thinned and rather expanded, and in a few almost spatula-like, the end being also less clearly defined and slightly bifid; the teeth are more numerous. The shorter length given above represents the first type, the longer the second.

The copulatory setae (fig. 24) belonging to segments viii and ix are ·61 mm. long and 20μ in thickness at the middle of the shaft. The shaft is bowed, at the ends more so than in the middle. The distal portion of the shaft,—almost half,—is cut up along both its convex and concave borders into a series of rough notches, seven or eight on each side, and a thin web appears to span each notch. The tip is rather claw-shaped, and bluntly pointed.

Genus **Eutyphoeus**.

Eutyphoeus incommodus (Bedd.).

Rurki, United Provinces. August (about), 1916. Ibrahim. Not quite mature, hence identification not absolutely certain.
Agra, United Provinces. September, 1916. L. Haru Ram.

Eutyphoeus waltoni, Mchlsn.

Hoshiarpur, Punjab. 14-vii-1916. Ibrahim.
Lucknow, United Provinces. August (about), 1916. Ibrahim.
Agra, United Provinces. September, 1916. L. Haru Ram.

Eutyphoeus gigas, sp. nov.

(Pl. xviii, figs. 28-30).

W. 73/1. Rangamati, Chittagong Hill Tracts, Bengal. 11-vii-1915. R. Hodgart. A single specimen.

External characters.—Length 250 mm.; thickness behind clitellum 9 mm. Colour purplish-brown dorsally with darker median stripe; pale ventrally. Segments 212; segment iv is biannulate, v triannulate, vi also triannulate but the posterior

annulus is beginning to be divided; vii is quadriannulate, and viii has five annuli through the division of the anterior annulus; the same annulation is continued back to the clitellum, except that some segments may have even more numerous secondary annuli.

The prostomium is minute, prolobous, withdrawn under cover of segment i.

Dorsal pores are present from furrow 11/12.

The setae are paired; in front of the clitellum $ab = \frac{1}{3}$ to $\frac{2}{5}$ aa, $= \frac{2}{3} cd$; $aa = bc$, and dd is two-thirds of the circumference. Behind the clitellum $ab = \frac{1}{3} aa$ (rather less immediately behind the clitellum), $= \frac{2}{3}$ or $\frac{3}{4} cd$, while aa is greater than bc, about $1\frac{1}{4}$ or $1\frac{1}{3}$ bc; dd is three-fifths of the circumference. Behind the middle of the body $ab = \frac{2}{5} aa$, $= \frac{3}{4} cd$; $aa = 1\frac{1}{3} bc$; and dd is little more than half the circumference.

The clitellum begins just behind the setae of xiii; it includes the whole of xvii. It is smooth, and there are no dorsal pores, but setae are present, or the indications of them.

The male apertures (fig. 28) are situated in pits on segment xvii; these pits are large and circular, with their centres in line with seta *b*, and their inner borders internal to the line of *a*. The apertures are transverse slits which are borne on papillae at the bottom of the pits. The papilla being in the outer part of the pit, the centre of the aperture is slightly outside the line of seta *b*.

The female aperture was seen on the left side only, on segment xiv, as a transverse slit corresponding in extent to the interval *ab*, in front of which setae it is situated.

The spermathecal apertures are comparatively small, slit-like, the lips not swollen, in furrow 7/8 just outside the line of seta *b*.

In furrow 15/16 are a pair of transverse depressions, elongated and rather irregular in shape, pointed at their inner and outer ends and broadest in the middle of their extent; these extend inwards to near the middle line and almost meet each other there; and as their middle point is external to seta *b* they are fairly extensive. On the hinder part of segment xvi, behind the setae *ab* and extending equally for a short distance to the inner side of the line of *a* and to the outer side of the line of *b*, are a pair of small oval areas, surrounded by a narrow groove and somewhat depressed in the middle.

Internal anatomy.—Septum 4/5 is strong, 5/6 very strong; 6/7 and 7/8 are absent; 8/9 and 9/10 are somewhat thickened, 10/11 slightly thickened; the last three are very close together, so that segments ix and x are very short segments internally. Segment xi is absent as a separate cavity; septum 11/12 is a membrane-like sheet of tissue which binds the heart of segment xi to the alimentary canal, and also attaches the vesiculae seminales to the wall of the gut (see the description of the septa in *E. waltoni*, by Stephenson (18), with which the present species agrees). Septum 12/13 is thin, and bulged backwards by the seminal vesicle so as to lie against 13/14.

The gizzard is large, firm, and subspherical, in the posterior part of the very considerable free space between septa 5/6 and 8/9. Calcareous glands are present in segment xii; they are only visible on opening the gut, when the condition is seen to be that which I have described for *E. bishambari* (18); externally they are indicated only by the oesophagus being swollen, and rather dark in colour and hard. The intestine begins in segment xv; in xxviii are a pair of caeca, of an elongated conical form resembling those of *Pheretima*; they lie wholly in xxviii, that of the right side being directed transversely towards the middle line above the intestine, that of the left being doubled underneath the intestine.

The last heart is in segment xiii. The dorsal vessel ends anteriorly in front of septum 8/9, at the hinder end of the large free space, by giving origin to two transverse commissures on each side; these lie close together behind the gizzard; and since they belong to segments viii and vii the gizzard is morphologically in segment vii.

The micronephridia are arranged behind the clitellum in perfectly regular transverse rows, one row in each segment, and about a dozen nephridia on each side; they are irregular in the clitellar region and for some distance in front of it, absent in the "free space" between septa 5/6 and 8/9, and irregular again in front; there are the usual tufts on each side of the pharynx, and thick clusters round the base of the spermathecae.

Testis-sacs are present in segment xi, opaque white in colour, and communicating with the seminal vesicles in xii; the heart of segment xi, covered by a connective tissue membrane representing septum 11/12, passes down internal to the sac. As the specimen was single I did not carry out the dissection which would have been necessary to ascertain whether the sacs communicate with each other beneath the alimentary tube. The seminal vesicles, one pair, extend forwards as far as septum 10/11, and push septum 12/13 back to the level of 13/14; they are large and appear wrapped round the alimentary tube; their margins are somewhat lobate.

The prostates extend through segments xvii to xx, and consist of a number of closely applied coils; each narrows at its anterior end to form a firm, shining and muscular duct, one-third of the diameter of the glandular portion; maintaining the same thickness it takes an inward direction, with many coils and loops, to its ending.

Ovaries and funnels not identified.

There is one pair of spermathecae (fig. 29); each consists of an antero-posteriorly elongated sac, irregular in shape, attached to the parietes by a broad base, from which the sac projects both forwards and especially backwards; the region on its under surface where the sac is attached to the body-wall is the only thing that can be described as a duct. There are two diverticula, one on each side, opening at the base of the ampulla; each consists of a sac and duct, the sac compound, showing a dozen to twenty chambers

which cause a lobulation of the surface, and the duct stout, slightly curved, and about as long as the terminal sac.

The penial setae (fig. 30) are in length 5·3 mm., and in thickness near the base 50 μ ; near the tip the thickness is still 44 μ. The shaft is almost straight, slightly bowed towards the tip, where it tapers rather rapidly to a fine point The distal portion of the shaft, about ·85 mm., is ornamented (except the extreme tip) with very numerous and densely crowded transverse markings, each consisting of a few points set side by side.

Remarks.—Several species of *Eutyphoeus* run to a large size; thus *E. paivai* may be 195 mm. in length, and *E. waltoni* 230 mm., while *E. chittagongianus* is the same length as the present specimen.

A rather curious feature of the present species is the presence of intestinal caeca resembling those of *Pheretima.*

Subfam. *TRIGASTRINAE.*

Gen. **Eudichogaster.**

Eudichogaster chittagongensis, sp. nov.

(Pl. xviii, figs. 31-33).

W. 71/1. Rangamati, Chittagong Hill Tracts, Bengal. 11-vii-1915. R. Hodgart. Two specimens.

External characters.—Length 30 mm.; diameter 1·5 mm., the swollen preclitellar portion 2 mm., the constricted clitellar region just under 1 mm.; a curious appearance is given by the bulbous anterior end followed by the constricted clitellum. Colour an indefinite grey. Segments approximately 121.

Prostomium epilobous $\frac{1}{2}$ or a little more; it is triangular, the blunt apex being directed posteriorly; the apex may be continued backwards as a shallow groove as far as the furrow between the first and second segments.

The dorsal pores begin immediately behind the clitellum.

The setae are paired. Behind the clitellum $ab = \frac{1}{3}aa = \frac{2}{5}bc = \frac{2}{3}cd$, and d is below the lateral line of the body; towards the hinder end of the body the setae are less closely paired, and $ab = \frac{1}{2}aa$, $= \frac{2}{3}bc = \frac{2}{3}cd$, bc and cd being equal or very nearly so, while d is about the lateral line of the body.

The clitellum is smooth and constricted, and extends over segments $\frac{1}{2}$xiii-$\frac{1}{2}$xvii (over the whole of xiii on the ventral surface).

There is a depression behind the slightly excavated posterior border of the clitellum; this depression, elongated in the transverse direction, thus takes up the hinder part of segment xvii, but does not extend beyond it. On its sloping sides are the male apertures, short obliquely placed slits, their anterior ends nearer the middle line than the posterior; they are situated between the lines of setae a and b, which are absent from segment xvii (fig. 31).

The female apertures, on segment xiv, appear as transverse cracks one on each side just in front of seta a.

The spermathecal apertures are possibly represented by whitish patches on segment viii in the site of the ventral pair of setae (*ab*); a single seta, apparently *b*, is present in each patch.

There are no other genital markings.

Internal anatomy.—Septa 4/5 to 7/8 are thin; the rest of those in the anterior part of the body,—8/9 to 12/13,—are slightly strengthened.

The gizzards are large, in segments v and vi. Calcareous glands are present as small white swellings in segments x, xi, and xii. The typhlosole is a simple vertical lamina.

The last heart is in segment xii.

The excretory system is micronephridial; the arrangement varies a little in various parts of the body. Behind the prostatic region the nephridia are in three or four rows, of which the dorsal row consists of more elongated loops than the rest; the organs are not of the flat circular type met with in some species, but are thin tubes in the form of loops; if there are four rows, the two ventralmost are close together. Behind the middle of the body there are three rows, of the same relative size as further forwards. Near the hinder end the lowermost of the three nephridia increases relatively and absolutely in size, and is the most conspicuous of the three,—a twisted tube which has its inner end in the line of setae *a* and its outer end external to *b*; of the other two, one lies between *c* and *d*, and the other dorsal to *d*; these two are less easily seen.

In segment x are a pair of large opaque white shining masses with deeply lobulated margins; these are the most prominent things in the dissection; they are attached to septum 10/11, meet each other in the middorsal line above the other structures of the segment, and extend deeply down in the segment but without being attached to the ventral body-wall. These represent testis-sacs and seminal vesicles conjoined; on opening one, a funnel was found deeply placed, but the testis was not identified. There are no other anterior male organs.

The prostates, one on each side, are very small; they are situated in segment xvii, and are placed in a direction transverse to the long axis of the body. The duct is much narrower than the gland, of the same diameter throughout, and rather bent; if straightened out it would be almost as long as the glandular portion; the general direction of the duct is transversely inwards.

The ovaries are situated in segment xiii. There are a pair of well-marked and relatively large ovisacs in segment xiv.

The spermathecae lie in segment viii; each is a twisted tube, without distinction of ampulla and duct. On one side (fig. 32, *a*) the tube appeared of equal diameter throughout, except for a slight dilatation at its ental extremity; on the other side it was more irregular (fig. 32, *b*, which represents it under the low power of the microscope). The external opening is near the middle line and behind the anterior limit of the segment in which they lie,—possibly, as surmised from the external characters, in the situation of setae

a; but the worm is extremely small for dissection. The simple form of the spermathecae does not appear to be due to immaturity; the clitellum is remarkably well defined and thick, and all the other organs are present.

The penial setae (fig. 33) are 58 mm. in length, and approximately 3·5μ in thickness; they are rather whip-like,—slender, tapering gently, with pointed tip and rather wavy course; they are without ornamentation

Remarks.—The present form shows resemblances to *E. parva* (Fedarb), but differs in the absence of seminal vesicles in segment xi, in possessing penial setae, and in the shape of the prostates and narrowness of the prostatic ducts.

Gen. **Dichogaster.**

Dichogaster bolaui (Mchlsn.).

W. 84/1. Rangamati, Chittagong Hill Tracts, Bengal. 15-vii-1915 R. Hodgart. Three specimens, in a bad state of preservation.

Dichogaster affinis (Mchlsn.).

W. 137/1. Tale Sap, Siam. 20-i-1916. N. Annandale. A single specimen.

The identification is not absolutely certain, as the specimen was not fully mature.

Subfam. *OCNERODRILINAE.*

Gen. **Ocnerodrilus.**

Ocnerodrilus (Ocnerodrilus) occidentalis, Eisen.

W. 90/1. Botanic Gardens, Singapore; among dead leaves in tank, 24-xii-1915. N Annandale. About a dozen specimens, in poor condition, some fragmentary.

Fam. GEOSCOLECIDAE.

In addition to the following species, the collection contained a quite immature specimen of this family, obtained from a small isolated almost dry pool in sand, at Balighai (Chilka Survey, 8-iv-1915).

Gen. **Pontoscolex.**

Pontoscolex corethrurus (Fr. Mull.).

W. 91/1. Penang Hill, at edge of a small stream, alt. 1200 ft. 10-ii-1916. N. Annandale.

Fam. LUMBRICIDAE.

Gen. **Helodrilus.**

Helodrilus (Allolobophora) caliginosus (Sav.) subsp **trapezoides** (Ant. Dug.)

Simla, 7000 ft., W. Himalayas. Oct. 1916. S. L. Ghose. Several specimens.

Helodrilus (Bimastus) parvus (Eisen).

Kasauli, 6000 ft., W. Himalayas. 31-viii-1916. Baini Prashad. Several specimens.

Helodrilus (Eisenia) foetidus (Sav.).

W. 86/1. Sevok, Darjiling Dist., E. Himalayas. 10-v-1915. J. N. Masson. A single specimen.

Helodrilus (Helodrilus) mariensis, sp. nov.

Murree, W. Himalayas (N. Punjab); alt. 7000 ft. 15-iv-1916. Gobind Singh. Several specimens.

External characters.—Length about 100 mm. (the specimens were much curled up); maximum thickness 6 mm. Colour greenish grey, equable throughout, except that the clitellum has a buff tinge. Segments 151. The anterior end tapers rapidly; the posterior is cut off straight, so that the anus is situated in the middle of a flat posterior surface; four segments are to be seen on this flat face. The anterior end is round in transverse section, but the clitellar and post-clitellar regions are flattened ventrally; at the middle of the body the dorsal surface becomes flattened also,—indeed concave,—and a section would appear four-sided, the dorsal side being the longest; towards the hinder end all four surfaces are concave, and the ventral setal bundles are placed at the ventro-lateral angles, the dorsal bundles being however below the dorso-lateral angles (text-fig. 6).

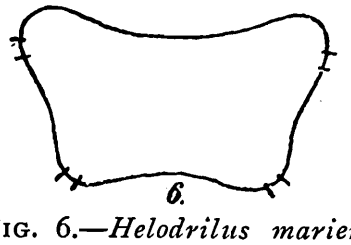


FIG. 6.—*Helodrilus mariensis*, transverse section behind middle, to show shape, and position of setae.

Prostomium epilobous $\frac{1}{3}$.

Dorsal pores from furrow 4/5.

The setae are closely paired throughout; $aa = 1\frac{1}{2}bc$, except towards the posterior end, where it is $1\frac{1}{3}bc$. In front of the clitellum the dorsal bundle is situated below the lateral line of the body; in the middle of the body they are about in the lateral line; while towards the hinder end they are above the lateral line, and, as said, below the dorso-lateral angle of a section of the body.

The clitellum extends over segments xxvii-xxxiv = 8. In fully mature specimens there are tubercles at the site of the ventral setae of all of these segments except the last, which almost form a "wall" on each side; the tubercles seem to be best marked on segments xxix or xxx to xxxiii. The ventral setal bundles of segments x and xi, or ix, x and xi, are also situated on glandular cushions or tubercles.

The male pores are situated on segment xv, on large round papillae which take up the whole of segment xv and parts of xiv and xvi. The apertures themselves are outside the line of setae *b*; the porophores about touch this line by their inner borders.

The female and spermathecal apertures were not visible.

Internal anatomy.—The first septum distinguishable by dissection is 5/6, which is somewhat thickened ; 6/7 is considerably thickened, 7/8, 8/9, and 9/10 are all very strong, 10/11 is about equal to 6/7, and 11/12 to 5/6. The next two septa, 12/13 and 13/14, are also slightly thickened.

The gizzard occupies segments xvii, xviii and a small part of xix; it is firm and cylindrical. The typhlosole is simple and rounded.

The oesophagus in segment x is swollen ; and, besides the general swelling of the tube, there are a pair of small yellowish projections on each side of the dorsal vessel and in front of the hearts; in segment xiii the tube is also distinctly bulged, in an evenly rounded manner, and is vascular ; in xiv it is quite narrow. On opening up the oesophagus, the inner surface of the wall is seen to be strongly ridged from its beginning in segment vi ; the small projections in segment x are distinct crypts, also ridged, and in open communication with the general lumen ; in xii the ridging is longitudinal, and more regular than in front ; in xiii the wall is very vascular, but the ridging has ceased.

The last heart is in segment xii.

The excretory system is meganephric.

Testes and funnels are free in segments x and xi. Vesiculae seminales, of moderate size, are present in segments xi and xii, attached to the anterior septum of the segment.

Ovaries, funnels, and ovisacs are present in the usual segments.

The spermathecae are two pairs, small, ovoid, sessile, and situated in segments x and xi at the anterior border of each ; they seem to open in grooves 9/10 and 10/11, in line with the dorsal setal bundles.

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EXPLANATION OF PLATE XVI.

FIG. 1.—*Drawida japonica*; genital region, showing copulatory organs. ♂, male papilla.

" 2.—*Drawida hodgarti*; prostate with the vas deferens entering; the spirally curved portion is the ectal end of the prostate.

" 3.—*Drawida rangamatiana*; appendage of spermathecal atrium, as seen by transparency under the low power.

" 4.—*Drawida nepalensis*; appendage of spermathecal atrium.

" 5.—*Perionyx pallidus*; spermatheca as seen under the low power by transparency. *a*, bulging perhaps representing an incipient seminal chamber.

" 6.—The same; penial seta, × 235.

" 7.—*Perionyx gravelyi*; region of male apertures.

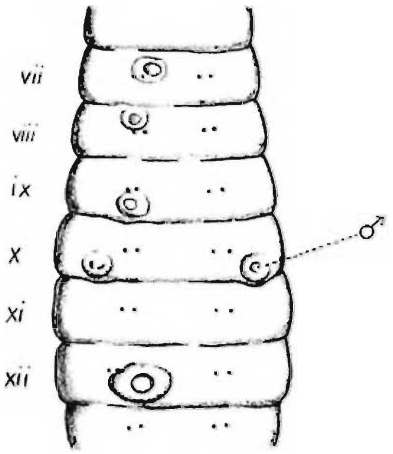
" 8.—The same; penial seta, × 150.

" 9.—*Perionyx aborensis* var. *heterochaetus*: spermatheca.

" 10.—*Perionyx nanus*; region of male apertures.

" 11.—*Pheretima annandalei*; spermatheca.

" 12.—*Hoplochaetella suctoria*; region of male apertures. *x*, sucker-like depression; *pr.*, prostatic apertures.



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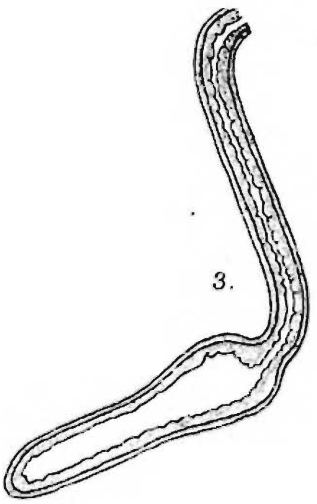

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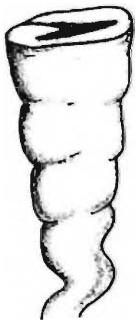

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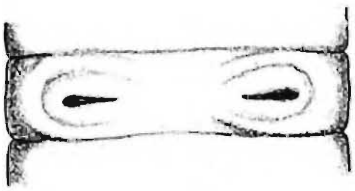

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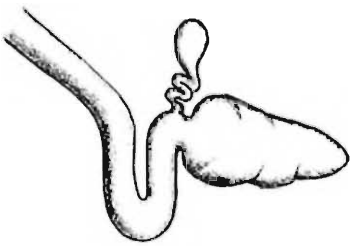

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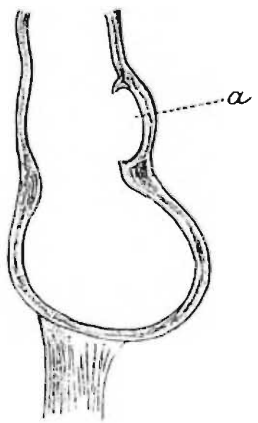

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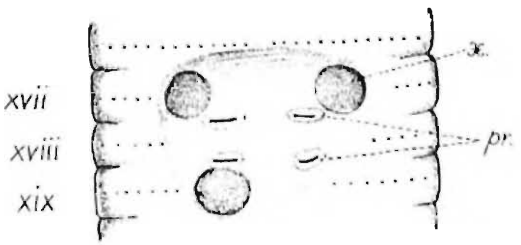


12.

J. Stephenson, del. A. Chowdhury, lith.

INDIAN OLIGOCHAETA.

EXPLANATION OF PLATE XVII.

FIG. 13.—*Hoplochaetella suctoria*; region of spermathecal apertures. *x*, group of displaced setae; *sp.*, spermathecal apertures.

,, 14.—The same; spermatheca.

,, 15.—*Hoplochaetella kempi*; region of male apertures. *x*, papilla surrounded by groove; *pr.*, prostatic apertures.

,, 16.—The same; spermatheca, represented with an accessory gland alongside.

,, 17.—*Hoplochaetella inornata*; spermatheca.

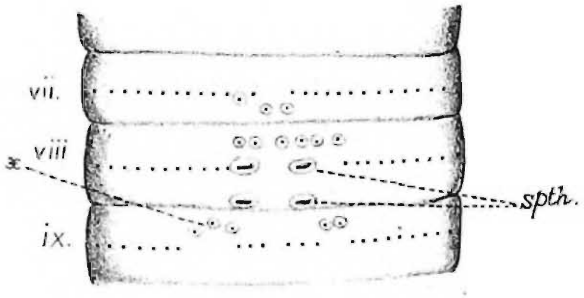
,, 18.—*Hoplochaetella bifoveata*; region of male apertures. *x*, depression; *pr.*, prostatic apertures.

,, 19.—*Hoplochaetella affinis*; region of male apertures. *pr.*, prostatic apertures.

,, 20.— The same; spermatheca.

,, 21.—*Erythraeodrilus kinneari*; spermatheca.

,, 22.—*Octochaetus castellanus*; spermatheca.



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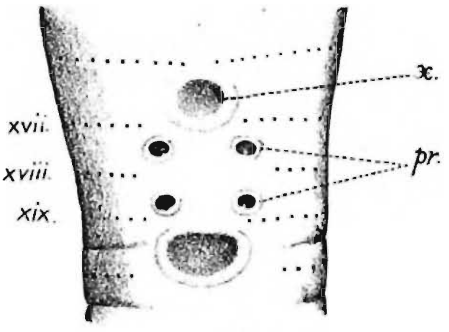

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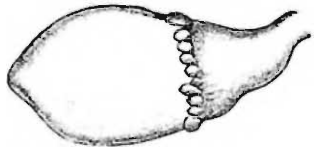

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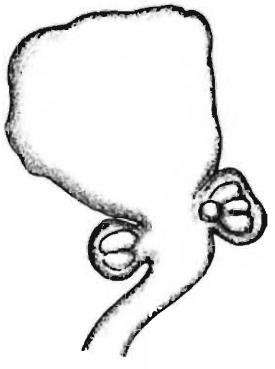

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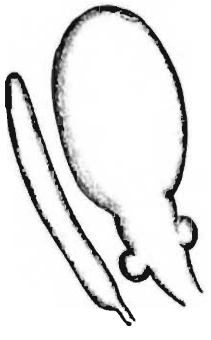

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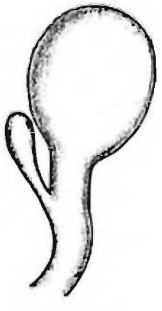

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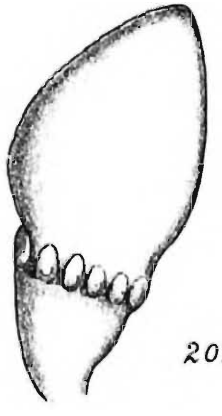

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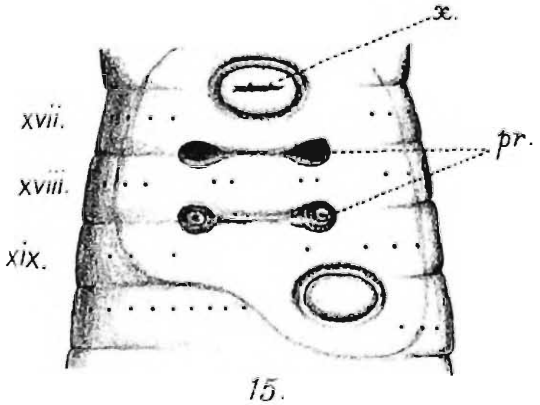

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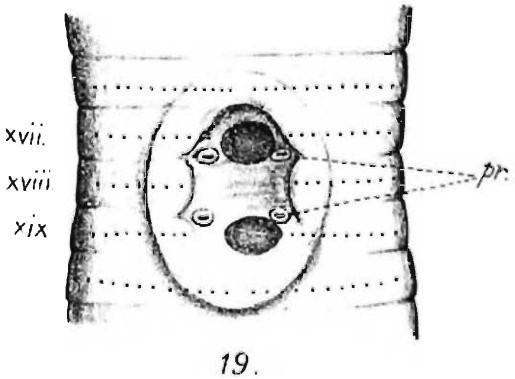


19.

J. Stephenson, del. A. Chowdhary, lith.

INDIAN OLIGOCHAETA.

EXPLANATION OF PLATE XVIII.

FIG. 23.—*Octochaetus castellanus*; penial setae, of two types, a and *b*; × about 360.

,, 24.—The same; copulatory setae of segment viii, × about 300.

,, 25.—*Octochaetus barkudensis*; male genital region of a specimen showing well-marked copulatory papillae.

,, 26.—The same; two spermathecae, *a* and *b*, showing variations in form.

,, 27.—The same; portion of shaft of copulatory seta of segment viii.

,, 28.—*Eutyphoeus gigas*; region of male apertures.

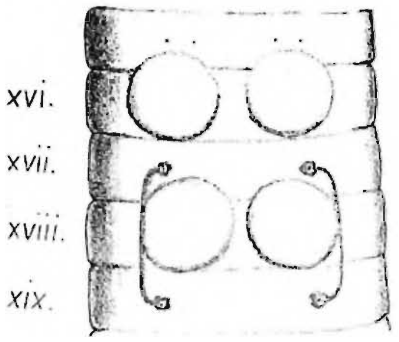
,, 29.—The same; spermatheca; the dotted lines indicate the portion of the under surface which is attached to the body-wall.

,, 30.—The same; penial seta, the distal end; × 160.

,, 31.—*Eudichogaster chittagongensis*; genital region.

,, 32.—The same; two spermathecae; *a*, as seen in the dissected specimen; *b*, a second, seen by transparency under the low power.

,, 33.—The same; outline of penial setae.



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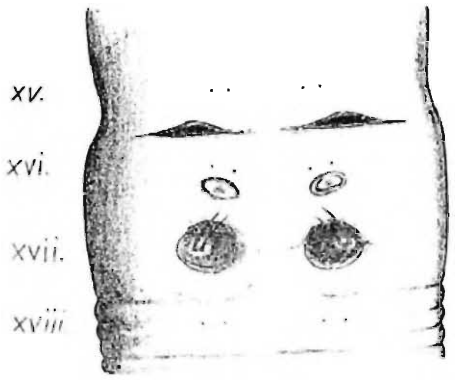

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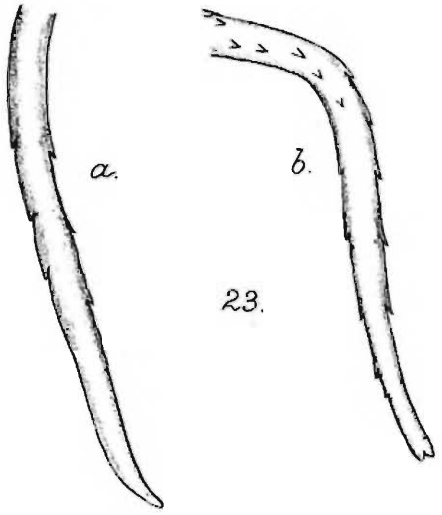

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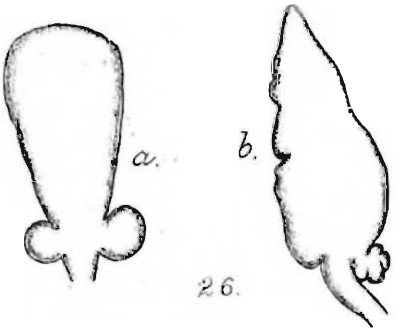

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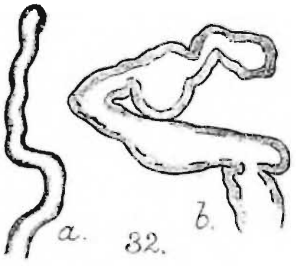

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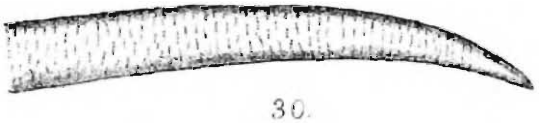

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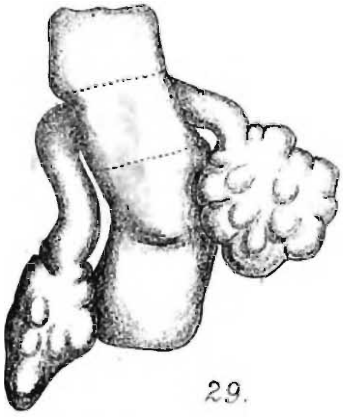

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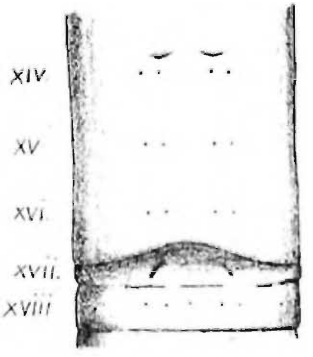


31.

J. Stephenson, del. A. Chowdhary, lith.

INDIAN OLIGOCHAETA.

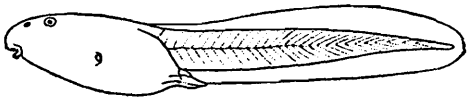
MISCELLANEA.

BATRACHIA.

The occurrence of *Rana pleskii*, Günther, in Kashmir.

The frog *Rana pleskii* is known from the Chinese Province of Sze-chuen, from North-eastern Tibet and from the Provinces of Tsang and U in the south of the latter country. It is common in these provinces at altitudes of from 13,000 to 15,000 feet and breeds in small streams and pools.

I have described the tadpole in *Rec. Ind. Mus.* II, p. 345. To my description I need only add that the mouth-disk is cup-like,



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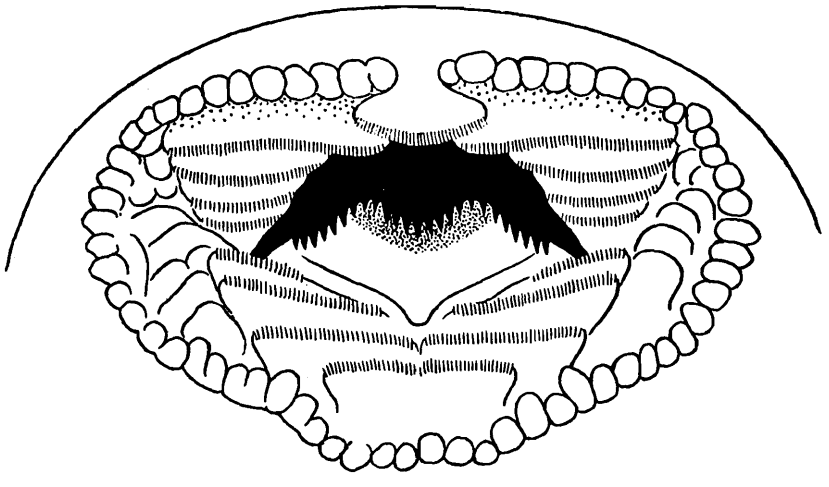

2

FIG. 1.—Tadpole of *Rana pleskii* from Lake Kreshen, Kashmir, nat. size.
,, 2.—Mouth-disk × 18.

and that the rows of horny teeth, which vary from four to five on each lip, are supported on thick fleshy ridges, which are sometimes sub-divided by longitudinal grooves. The upper beak is apt to be worn on the edge and may thus assume somewhat different shapes. The structure and appearance of the tadpole are very characteristic, and I do not think that there can be any doubt as to its identity. In the last few years I have received specimens

that agree exactly with those collected by Capt. Stewart in Tibet, from four different localities in Kashmir, at altitudes between 9,000 and 12,000 feet. These specimens were sent by the late Mr. H. C. Bion of the Geological Survey of India; by Col. F. Smith, R.A.M.C.; and by Mr. F. J. Mitchell, Honorary Director, Trout Culture, Srinagar, Kashmir.

The following are the Kashmir localities:—

Outlet of Gangabal Lake, *ca.* 11,700 ft.; Nagabera, 10,000-10,500 ft.; Lidarwart, *ca.* 9,000 ft.; Lake Kreshen, 12063 ft.

N. ANNANDALE.

BIRDS.

Myiophoneus temmincki.

Amongst a dozen specimens of the Himalayan Whistling-Thrush recently lent me by the Indian Museum were half-a-dozen from Gilgit, Kashmir, which ranged so much larger than the others —wings and tail of the largest male (No. 15546) 188 and 152 mm. respectively—that it seemed probable they might represent a distinct race. Still later, however, I received the rest of the Indian Museum series which comprises about forty specimens obtained from localities between Afghanistan and the Shan States, Gilgit and "south of Irawadi"; and though none are so large as the larger Gilgit examples, yet several approach those in length of wing and tail:—Kulu, ♂, 182 and 137; Simla, 177 and 140; South of Irawadi, 179 and 132. Such individuals bridge the difference between birds from Gilgit and other localities so that it seems that a distinction cannot be maintained, but it is perhaps desirable to draw attention to the point that it may receive further consideration.

Amongst the collection is a Whistling-Thrush from Komseng obtained by Mr. S. W. Kemp during the course of the Abor Expedition and referred to by Stuart Baker (*Rec. Ind. Mus.* VIII, 1913, p. 278) as a typical *temmincki*. This, however, hardly seems to be the case as all the other specimens of *temmincki* in the Museum have the feathers of the nape and inter-scapulary region pointed, with pointed terminal shining patches, while in the Komseng bird, which is not in worn plumage, the same feathers have rounded ends and broad rounded patches. Though apparently adult, the specimen is rather small (wing 160, tail 116 mm.) and one would like to see more skins from the region in which it was taken. It is quite distinct from *eugenii*.

C. BODEN KLOSS.

Miscellaneous Zoological Publications

	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
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
Account of the Triaxon (Hexactinellid) sponges collected by the R.I.M.S. "Investigator." By F. E. Schulze, Ph.D., M.D.	16	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
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
Aids to the identification of Rats connected with Plague in India. By W. C. Hossack, M.D.	0	8
Annotated List of the Asiatic Beetles in the Indian Museum. Part I. Family Carabidæ, Subfamily Cicindelinæ. By N. Annandale, D.Sc., and W. Horn ..	1	0
Catalogue of the Indian Decapod Crustacea. Part I.—Brachyura. Fasciculus I.—Introduction and Brachyura Primigenia. By A. Alcock, M.B., LL.D., F.R.S.	7	0
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
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Catalogue of the Indian Decapod Crustacea. Part I.—Brachyura. Fasciculus II.—Indian Freshwater Crabs—Potamonidæ. By A. Alcock, C.I.E., M.B., LL.D., F.R.S.	14	0
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
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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
Echinoderma of the Indian Museum: Account of the Deep-sea Holothurioidea collected by the R.I.M.S. "Investigator." By R. Koehler and C. Vaney	16	0
Echinoderma of the Indian Museum: Littoral Holothurioidea collected by the R.I.M.S. "Investigator." By R. Koehler and C. Vaney	2	0
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Guide to the Zoological Collections exhibited in the Invertebrate Gallery of the Indian Museum. By A. Alcock, M.B., C.M.Z.S. (*Out of print.*)		
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List of Snakes in the Indian Museum. By W. L. Sclater, M.A., F.Z.S. ..	1	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. (*Out of print.*)	3	0
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 Director of the Zoological Survey of India, Indian Museum, Calcutta.