

III. A NEW VARIETY OF FRESHWATER CRAB FROM TRAVANCORE.

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In a small collection of crabs sent for identification by the Director of the Trivandrum Museum were two specimens on which the following remarks are based. They appear to constitute a new variety of the species from a stream in the Cochin State Forests, described as *Paratelphusa malabarica* in the Records of the Indian Museum, vol. vii, part ii, May 1912.

***Paratelphusa (Liotelphusa) malabarica*, Henderson,
var. *travancorica*, nov.**

Habitat.—Ponmudi, Travancore, 2500 ft., 30-xii-11. Two specimens (♂ and ♀) and a third in a bad state of preservation.

These specimens agree with *P. malabarica* in general appearance and size, but differ in the following respects. The epigastric and postorbital crests of the carapace are more prominent and form a continuous line in the new variety. The epigastric crests are represented, as in *P. malabarica*, by patches on either side of the somewhat deep mesogastric furrow, but in the variety *travancorica* they are distinctly elevated, and bounded posteriorly by a line representing the crest proper, which is higher than the surface in front of it. This surface shows some minute almost linear elevations. The frontal surface is more convex than in *P. malabarica*, and its anterior margin is no longer straight, but slightly bilobed. A broad shallow excavation, not seen in *P. malabarica*, occurs on either side of the carapace, leading up towards the lateral epibranchial tooth, but it is not continuous with the crescentic cervical groove. This excavation no doubt represents a forward extension of the cervical groove, and it at any rate occurs in the position which the latter would have occupied had it been definitely present. The sixth segment of the male abdomen has the proximal end distinctly wider than the distal, and the length of the segment is only slightly greater than its width; in *P. malabarica* the two ends are of subequal width. The ischium of the external maxillipedes has a distinct, though not sharply cut longitudinal line on the outer surface. In this last character the new variety resembles *P. austrina*, Alcock, but the latter species has the cervical groove hardly visible, the mesogastric furrow is indistinct, the epigastric and postorbital crests are only just

distinguishable, and the edge of the front is distinct from the edge of the antennular fossæ.

With more material it may hereafter be shown that the present form is entitled to specific rank, but for the present I prefer to regard it as a variety of *P. malabarica*. This determination is equivalent to the admission that certain characters, which have been regarded as of value in separating the so-called species of freshwater crabs, are liable to considerable variation in closely related individuals. It would no doubt be possible, in some cases, to discover slight differences which are more or less constant, among

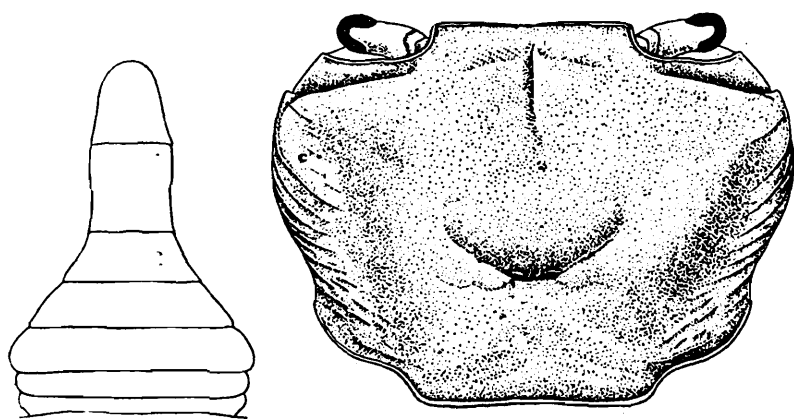


Fig. 1.—*Paratelphusa malabarica*, Henderson, ♂ type, × 3.

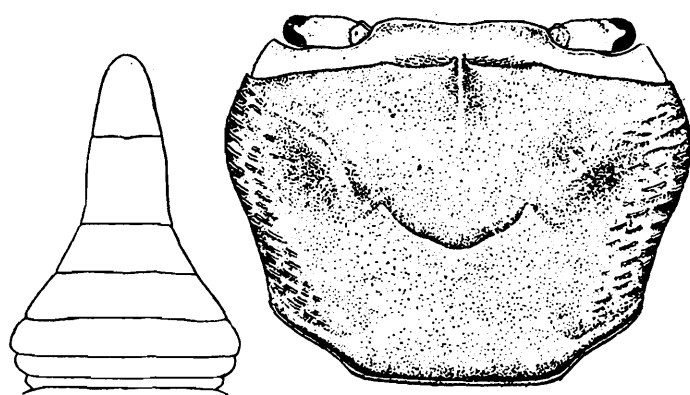


Fig. 2.—*Paratelphusa malabarica* var. *travancorica*, nov., ♂ type, × 3.

individuals belonging to one of the recognized 'species,' if collected from different streams and particularly from those on different hill ranges, but it may be doubted if any benefit would result from the attempt to name such slightly marked varieties. In the new variety just described, the characters on which it is based cannot, however, be described as slight.

This Travancore crab also illustrates the difficulty which sometimes arises in connection with the assignment of a species to one or other of the so-called subgenera. It cannot be said to show obscure epigastric and postorbital crests, which is one of the out-

standing features of the subgenus *Liotelphusa*; indeed in this respect it agrees better with *Barytelphusa*, in which the crests are well defined. It, however, differs from most species of the latter subgenus in the small size of the individuals and the incompleteness of the cervical groove, hence it may be placed in *Liotelphusa*. In any case its affinities with *P. malabarica* are unmistakable, and the latter is clearly a *Liotelphusa*.

The opportunity is taken of figuring the type-specimen of *P. malabarica*, preserved in the Indian Museum, as well as the type of the new variety.

The type of the variety described above (Crustacea Reg. No. $\frac{7936}{10}$) is preserved in the Indian Museum.



IV ON SOME THYSANURA IN THE INDIAN MUSEUM.

By F. SILVESTRI.

I have received a small, but a very important collection of Indian Thysanura from Dr. N. Annandale, Superintendent of the Indian Museum, and in two other papers¹ I have described the Machilidae: 3 new genera (*Allopsontus*, *Megalopsobius*, *Machilontus*) and 4 new species. I describe or record here the species of Campodeidae, Japygidae and Lepismidae. These families are

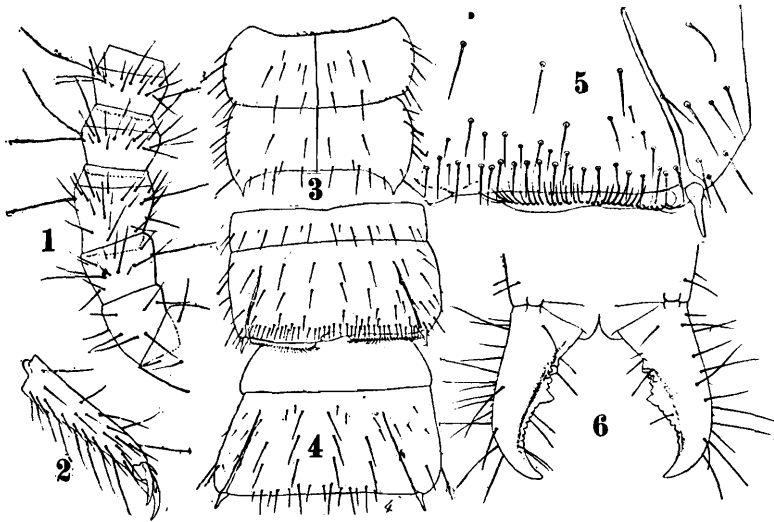


FIG. 1.—*Japyx indicus*: 1. antennae pars proximalis ab articuli primi apex; 2. pedis paris tertii tarsus et praetarsus; 3. abdominis tergita 6^{um} et 7^{um}; 4. abdominis urosterna 1^{um} et 2^{um}; 5. urosterni primi dimidia pars postica; 6. abdominis pars postrema cum cerco.

represented in the Indian Museum by 14 species, of which 5 species and 1 variety are new to science.

Fam. CAMPODEIDAE.

Lepidocampa weberi, Oudm.

Three specimens from Kobo, N.E. frontier of B. India. This species has a very wide distribution in the tropics (Asia and America).

¹ Materiali per lo studio dei Tisanuri, xli-xv. *Boll. Lab. Zool.*, v, 1910 (*Allopsontus annandalei*, pp. 89-90).

Machilidarum (*Thysanura*) species nonnullae novae ex regione indo-malayana. *Zool. Anz.*, xl, 1912 (*Machilis gravis*, p. 1; *Megalopsobius convergens*, p. 4; *Machilontus gravelyi*, p. 6).

Campodea, sp.

I have seen some specimens of this genus collected at Paltipola, Ceylon, but in a condition that it was impossible to identify or describe them.

Fam. JAPYGIDAE.**Japyx indicus, Oudm.**

Specimens collected at Peradeniya (Ceylon). The figures of the more important parts of the body are represented in fig. i.

Parajapyx grassianus var. indica, nov.

Stramineus, abdominis segmento decimo cum forcipe ferrugineo. Corpus setis brevibus simplicibus instructum. Antennae

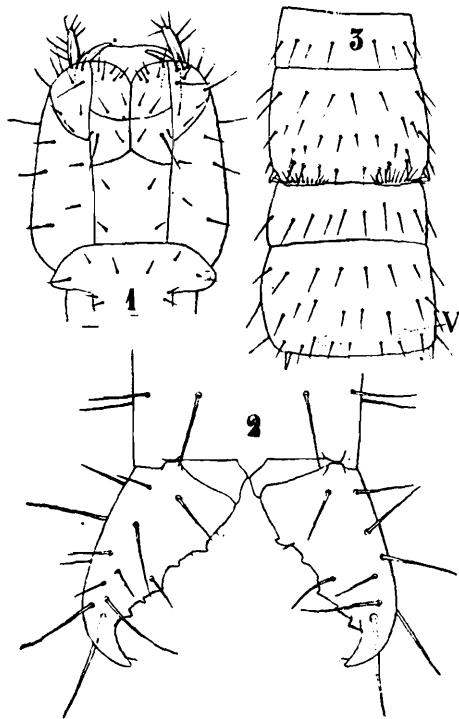


FIG. ii.—*Parajapyx grassianus* var. *indica*: 1. caput supinum; 2. abdominis pars postrema cum forcipe; 3. abdominis sterna 1^{um} et 2^{um}; V. vesicula.

18-articulatae, setis brevioribus instructae, sensillis unisetis nullis. Labium (fig. ii, 1) palpo nullo, propalpo seta longa instructum. Pedes breves, parce setosi, praetarsi unguibus parum inaequalibus, simplicibus, unguicola mediana brevissima.

Abdomen tergito septimo angulo postico obtuso, segmento octavo quam septimum c. $\frac{1}{3}$ angustiore, segmento decimo subtus menso c. $\frac{3}{7}$ longiore quam latiore. Urosternum primum (fig. ii, 3) setis nonnullis brevibus ut urosterna cetera instructum, nec non in margine postico utrimque organo parum lato, setis brevibus uniseriatis aucto. Stili breves, conici. Urosterna 2-3 utrimque vesicula sphaerica sub margine postico oblecta instructa.

Forceps (fig. ii, 2) quam segmentum decimum subtus mensum c. dimidio brevior, brachiis subaequalibus dentibus 5 acutis, inter sese aliquantum remotis armatis, apice sat attenuato et sat recurvo.

Long. corp. mm. 2.35; lat. abdominis segmenti septimi 0.195; long. forcipis 0.135.

Habitat.—Exemplum ad Ghumti ("Darjiling dist., E. Himalayas"), F. Gravely legit.

Observatio.—Varietas haec forcipis dentibus minoribus et segmento decimo parum longiore a specie typica vix distinguenda.

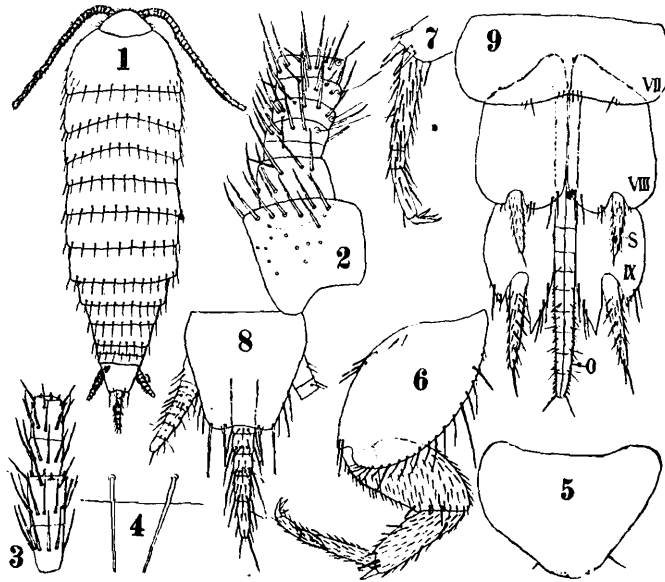


FIG. iii.—*Lepisma gravelyi*: 1. corpus pronum; 2. antennae pars proximalis; 3. ejusdem pars terminalis; 4. abdominis tergiti quinti particula postica; 5. metasternum tertium; 6. pedis paris tertii; 7. ejusdem tibiae apex, tarsus et praetarsus; 8. corporis pars postica; 9. abdominis sterna 7^{um} ad 9^{um}: O. ovipositor, S. stili.

Lepisma gravelyi, sp. nov.

♀ Nigra; corporis squamae crebre pluriradiatae majores μ 94×64. Caput supra bene squamosum, antice et lateraliter setis brevibus et setis sat longis, robustis, in apice incisus instructum. Oculi parvi. Antennae in exemplo typico forsán integrae quam thorax parum longiores, 26-articulatae; articulis ab articulo octavo in articulinis duobus paullum distinctis divisis, setis et sensillis *cfr.* fig. iii, 2-3. Palpi maxillares breviores setosi; palpi labiales articulo ultimo subovali. Thorax (fig. iii, 1) quam abdominis par antica vix latior, scuto dorsuali singulo serve postica setarum robustarum et setis brevibus marginalibus lateralibus instructo. Metasterni lamina mediana (fig. iii, 5) ad basim latior quam longior, postice angustata, rotundata, setis nonnullis instructa. Pedes *cfr.* fig. iii, 6-7.

Abdomen partem posticam versus gradatim angustatum, tergitis 1-8 serie setarum (fig. iii, 1) posticarum longarum robustarum instructis. Urotergitum decimum (fig. iii, 8) subaeque longum atque ad basim latum, partem posticam versus gradatim paullum angustatum, margine postico paullulum sinuato, seta sublaterali et seta laterali posticis, longis, robustis, nec non setis nonnullis lateralibus instructum. Urosterna 1-2 setarum pectine mediano, urosterna 3-7 (fig. iii, 9) setarum pectine mediano et pectine parvo laterali instructa. Urosterni octavi subcoxae ad latus internum stilorum setis duabus longis et duabus ad marginem internum instructae; urosterni noni subcoxae angulo interno longo, dimidium stilum superante. Stili in segmenti 8-9 sat longi, seta apicali robustiore.

Ovipositor (fig. iii, 9) tenuis, longus, stilorum segmenti noni apicem parum superans, anulatus, setis paucis instructus. Cerci laterales (fig. iii, 9) 5-6-articulati marginem posticum urotergiti decimi parum superantes, setis externis brevibus robustis et sensillis praesertim internis instructi; cercus medianus quam laterales aloquantum longior, 6-7-articulatus.

Long. corp. mm. 3.5; lat. thoracis 1.2; long. antennarum 1.35; palpi maxillaris 0.32; pedum paris tertii 1.69; cerci mediani 0.50; cercorum lateralium 0.32.

Habitat.—Exemplum typicum ad Calcutta ("maidan") inter folias super humum legit F. H. Gravely, cui speciem dico.

Observatio.—Species haec ad *Lepisma gyriniformis*, Luc., proxima est, sed colore nigro, tergitorum setis seriei posticae aliquantum brevioribus et robustioribus, urotergito decimo partem posticam versus minus angustato, distinctissima est.

***Lepisma nigrina*, sp. nov.**

♀ Corpus dorso nigro, ventre subterreo, squamis crebre pluri-radiatis majoribus μ 177×70. Caput supra bene squamosum antice et lateraliter setis sat longis robustis, in apice incisus instructum. Oculi parvi. Antennae in exemplis typicis haud integrae, partis basalis et partis distalis setis et sensillis *cfr.* fig. iv, 2-3. Palpi maxillares et palpi labiales *cfr.* fig. iv, 4-5. Thorax (fig. iv, 1) quam abdomen aliquantum latior, scutorum dorsualium margine postico setis nullis, margine laterali setis pluribus brevibus et setis 5-6 sat longis, robustis, in apice incisus aucto. Pedes *cfr.* fig. iv, 7-8.

Abdomen partem posticam versus gradatim aliquantum attenuatum. Urotergita 1-3 setis lateralibus inferis et seta laterali supra, urotergitum 4^{um} etiam seta sublaterali, urotergita 5-8 (fig. iv, 9) setis tribus lateralibus inferis, seta supera laterali, seta sublaterali et seta submediana et urotergitum nonum setis lateralibus inferis aucta. Urotergitum decimum (fig. iv, 10) longum, fere $\frac{1}{3}$ longius quam ad basim latius, partem posticam versus gradatim paullum angustius, margine postico parum sinuato, angulis posticis seta sat longa, robusta, auctis. Urosterna

1-2 setarum pectine mediano et urosterna 3-7 setarum pectine laterali etiam instructa. Urosterni 8i subcoxae (fig. iv, 11) stilorum sinu profundo, angulo externo quam internus parum magis producto, angulo interno setis duabus longis robustis, praeter setas breves, aucto. Urosterni 9i subcoxae angulis posticis longis, acutis, angulo interno quam externus c. $\frac{2}{3}$ longiore.

Stili in segmentis 8° et 9°, noni quam subcoaxarum angulus internus c. duplo longiores, breviter setosi et apice setis duabus apicalibus sat longis robustis instructo.

Ovipositor (fig. iv, 11) sat tenuis, longus, quam stili noni paullum brevior, anulatus, breviter setosus.

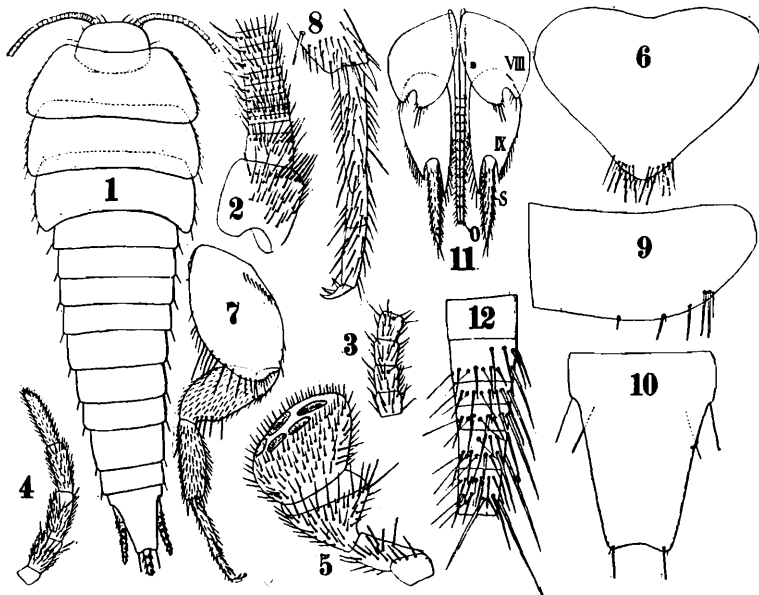


FIG. iv.—*Lepisma nigrina*: 1. corpus pronum; 2. antennae pars proximalis; 3. antennae articuli duo partis distalis; 4. palpus maxillaris; 5. palpus labialis; 6. metasterni pars mediana; 7. pes paris tertii; 8. ejusdem tibiae apex, tarsus et praetarsus; 9. abdominis tergiti sexti dimidia pars; 10. urotergitum decimum; 11. abdominis sterna viii-ix: O. ovipositor, S. stilus; 12. cercus lateralis (haud integer).

Cerci in exemplis typicis haud integri partis basalis setis et sensillis *cfr.* fig. iv, 12.

♂ Penis brevissimus: paramera quam angulus internus subcoaxarum segmenti noni paullum breviora, breviter setosa.

Long. corp. mm. 7; lat. thoracis 2.2; long. antennarum ?; palpi maxillaris 1.17; pedum paris tertii 3.38; cercorum ?.

Habitat.—Exempla nonnulla vidi ad Puri, Orissa coast, S. W. Kemp collecta.

Observatio.—Species haec ad *Lepisma indica*, Esch., proxima est, sed thorace aliquantum latiore et tergiti decimi margine postico parum sinuato distincta videtur.

Ctenolepisma nigra (Oudm.).

Syn. *Lepisma nigra*, Oudm.

Color (in alcool): dorso squamis vestito subcastaneo antennis, cercis, ventre pedibusque stramineis. Corporis squamae magnae, majores μ 180×148 , dense pluriradiatae.

Caput in frontis parte submediana antica et lateraliter setis nonnullis simplicibus et setis nonnullis ciliatis instructum, clypeo utrinque setis pluribus coaservatis, mandibularum facie externa setis pluribus aucta. Antennae in exemplis observatis haud integris quam corpus parum breviores attenuatae. Palpi maxillares (fig. vi, 1) 5-articulati, tenues. Palpi labiales (fig. vi, 2) articulo ultimo crasso, subaeque longo atque lato. Thorax (fig. v) quam abdomen haud latior, lateribus subparallelis, scutorum dorsalium

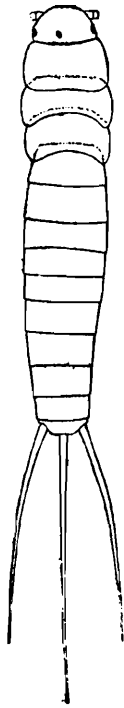


FIG. v.—*Ctenolepisma nigra* : animalculi circumlitio.

marginale laterali setis paucis subtilibus brevibus et seta longa subtili, margine postico seta robusta et setis brevibus subtilibus 2-3 sublateraliter instructo. Metasterni pars mediana (fig. vi, 3) aliquantum ad basim latior quam longior margine postico rotundato.

Pedes *cfr.* fig. vi, 3.

Abdomen partem posticam versus parum angustatum. Tergitum primum setis duabus sublateralibus, tergita 2-5 (fig. vi, 4) utrimque setarum pectinibus tribus (pectine laterali) incluso, pectine interno tantum setis duabus constituto, supero laterali setis tribus et infero laterali setis quatuor praeter setas breviores subtiliores. Tergita vi-viii pectine supero sublaterali et pectine laterali externo tantum instructa. Sternita 3-8 pectine setarum

2-3 sublaterali instructa. Subcoxae ix parte interna sat longa triangulari, angustata, acuta. Cerci in segmentis 8-9 sistentes, longi setosi, segmenti noni apicem subcoxarum c. dimidia longitudine superantes.

Ovipositor tenuis, longus, apicem stilorum ix multo superans.

Tergitum decimum (fig. vi, 5) breve, subtrapezoideum, angulis aliquantum rotundatis, postice subrecte truncatum vel vix sinuatum.

Cerci longi, tenues et attenuati, setosi et sensillis unisetis pluribus longis, subtilissimis aucti; in exemplis observatis haud integris, quam corpus parum breviores.

♂ Penis (fig. vi, 6) brevissimus.

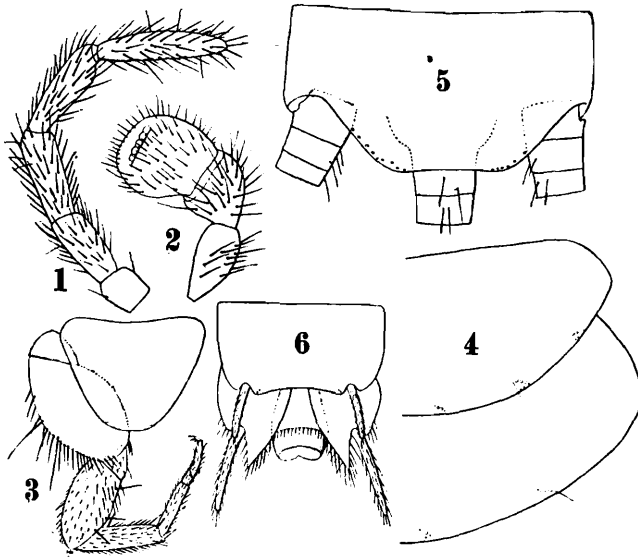


FIG. vi.—*Ctenolepisma nigra*: 1. palpus maxillaris; 2. palpus labialis; 3. pes paris tertii cum metasterni pars mediana; 4. abdominis tergitorum 5ⁱ et 6 dimidia pars; 5. abdominis pars postica cum cercorum basi; 6. maris abdominis sterna 8^{um} et 9^{um}.

Long. corp. mm. 6; lat. thoracis 1.45; long. antennarum 5; palpi maxillaris 0.95; pedum paris tertio 2.52; cercorum 5.

Habitat.—Ceylon (Peradenya), in domis; Calcutta.

Ctenolepisma longicauda, Esch.

There are specimens in the collection from Calcutta, Peradenya, Siliguri, Darjiling. The species is also known from South Africa.

Thermobia domestica, Pack.

This cosmopolitan species was found common in houses at Lahore in the Punjab by Dr. Annandale.

Acrotelsa collaris (F.).

Calcutta. This is also common in the tropics.

Atelura typhloponis, sp. nov.

♀ Corpus creineum, squamis consuetis, pluriradiatis, radiis postice vix liberis.

Caput supra squamosum antice et lateraliter setis nonnullis brevibus, quarum nonnullae majores ad apicem breviter bifurcatae sunt. Antennae quam thorax breviores, 13-articulatae, articulis a septimo tenuissime in articulinis duobus divisis, setis et sensillis *cfr.* fig. vii, 2-4. Palpi maxillares et labiales *cfr.* fig. vii, 5-6. Thorax (fig. vii, 1) quam abdominis pars antica parum

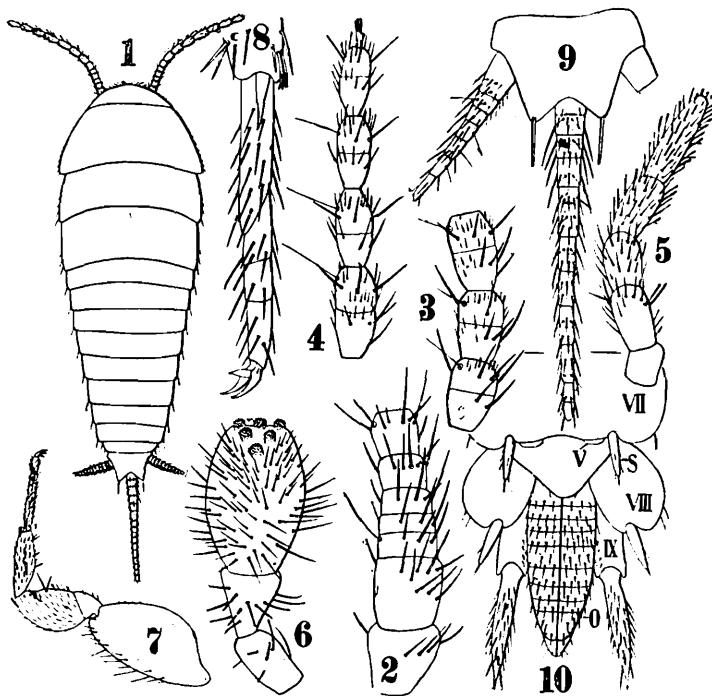


FIG. vii.—*Atelura typhloponis*: 1. corpus pronum; 2. antennae pars proximalis; 3. antennae articulis tres dimidiae partis; 4. ejusdem pars apicalis; 5. palpus maxillaris; 6. palpus labialis; 7. pes parvis tertii; 8. ejusdem tibiae apex, tarsus et praetarsus; 9. corporis pars postrema a segmento decimo; 10. abdominis sterna viii-ix: V. vesicula, S. stili, O. ovipositor.

latior et c. $\frac{1}{3}$ brevior, tergitorum margine postico setis nullis, margine laterali setis brevioribus et seta brevi robusta subpostica instructo.

Pedes *cfr.* fig. vii, 7-8.

Abdomen partem posticam versus gradatim parum angustius, tergitorum margine postico tantum seta laterali robusta apice bifurcata et seta breviori subtili instructo. Urotergiteum decimum (fig. vii, 9) fere $\frac{1}{3}$ ad basim latius quam longius, partem posticam versus gradatim aliquantum angustatum, margine postico sat profunde sinuato, angulis posticis acutis, seta apicali longa robusta instructis. Urosternum secundum vesiculis duabus medi-

anis parvis instructum, urosterna 3-7 setis duabus submedianis, urosterna 5-9 etiam stilis et urosternum septimum pseudovesicula instructa. Stili sat longi, segmenti noni quam octavi magis quam duplo langiores et aliquantum crassiores. Urosterni octavi pars mediana, sat magna subcordiformis.

Ovipositor (fig. vii, 10) crassiusculus, stilorum ix dimidiam longitudinem attingeus, tenuissime anulatus, breviter setosus.

Cercus medianus quam laterales c. duplo longior, setis et sensillis *cfr.* fig. vii, 1.

Long. corp. mm. 3; lat. thoracis 1.10; long. antennarum 0.98; pedum paris tertii 1.65; cerci mediani 0.85; cercorum lateralium 0.48.

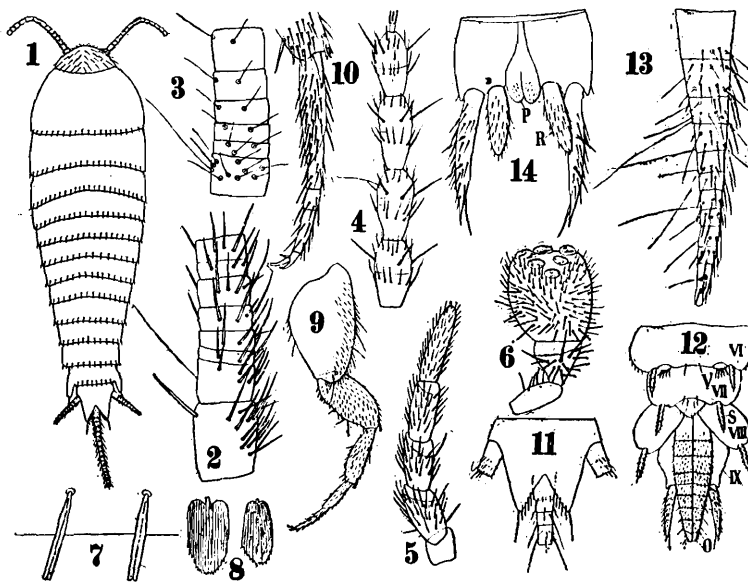


FIG. viii.—*Gastrotheus indicus*: 1. corpus pronum; 2. antennae pars proximalis supra inspecta; 3. ejusdem pars proximalis ab articulo tertio subtus inspecta; 4. ejusdem pars apicalis; 5. palpus maxillaris; 6. palpus labialis; 7. urotergiti quinti particula postica; 8. squamae dorsuales; 9. pes paris tertii; 10. ejusdem tibiae apex, tarsus et praetarsus; 11. abdominis pars postica cum cercorum parte proximali; 12. abdominis sterna vi-ix: V. vesicula, S. stili, O. ovipositor; 13. cercus dexter; 14. maris urosternum nonum cum pene P, R. paramera.

Mas ignotus.

Habitat.—In nidis *Dorylus* (*Typhlopone*) *labiatus*, Shuck, d. N. Annandale et S. Kemp ad Siliguri ("base of E. Himalayas") exempla nonnulla legit.

Observatio.—Species haec ad *Atelura jacobsoni*, Silv., perproxima est, sed stilorum numero (in *A. jacobsoni* paribus tribus) bene distincta est.

Gastrotheus indicus, sp. nov.

♀ Corpus ochroleucum, squamis (fig. viii, 8) pluriradiatis, radiis postice spatio brevissimo liberis.

Caput setis brevibus, robustis, attenuatis, integris nec non setis brevioribus instructum. Antennae 14-15 articulatae, articulis ab octavo in articulinis gradatim magis sejunctis divisis, partis basalis et apicalis setis et sensillis *cfr.* fig. viii, 2-4. Palpi maxillares et labiales *cfr.* fig. viii, 5-6. Thorax (fig. viii, 1) quam abdominis pars antica vix latior, scutis dorsalibus serie setarum posticarum et setis brevibus lateralibus instructis. Setae serili posticae, ut caedem abdominis (fig. viii, 7) breves, latiusculae, apice inciso. Pedes femoris apice supra spina breve bifurcata, tibiae apice supra spinis brevibus tribus bifurcatis armata, cetero *cfr.* fig. viii, 9-10.

Abdomen partem posticam versus gradatim aliquantum angustatum, tergitis 1-9 serie postica setarum brevium, robustarum, ut eadem thoracis, instructis nec non seta robustiore parum

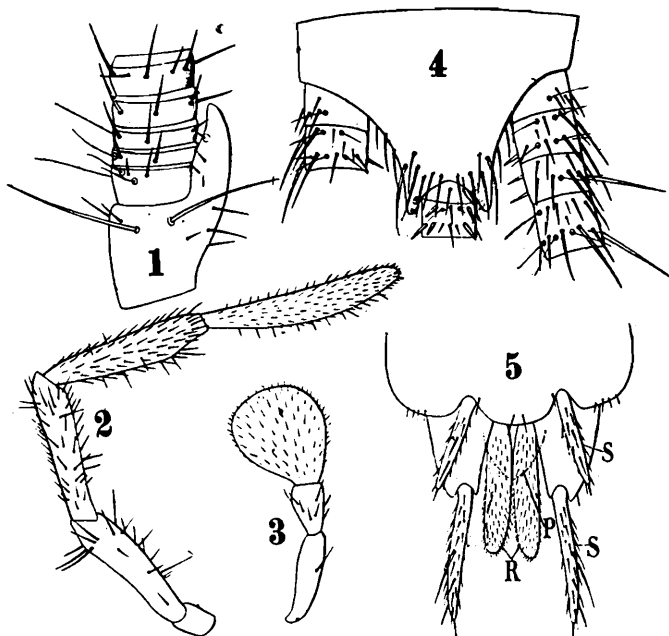


FIG. ix.—*Lepidospora ceylonica*: 1. antennae pars proximalis ab articulo secundo; 2. palpus maxillaris; 3. palpus labialis; 4. abdominis pars postica cum cercorum basi; 5. abdominis sterna 8um et 9um: P. penis, R. paramera, S. stili.

longiore laterali. Urotergitum decimum (fig. viii, 11) parum ad basim latius quam longius, partem posticam versus gradatim parum angustatum, postice angulatim profunde incisum, seta apicali longa robusta et setis nonnullis per marginem internum incisurae instructum. Urosterna 2-5 setis duabus submedianis et setis nonnullis lateralibus, urosternum sextum (fig. viii, 12) setis duabus submedianis, pseudovesicula magna, seta 5 robustas gerente, et stilibus sat longis, urosternum septimum vesiculis obsoletis, stilibus et setis duabus submedianis instructa; urosternum octavum parte mediana triangulari. Stili noni quam octavi aliquantum longiores.

Ovipositor (fig. viii, 12) crassus, partem posticam versus attenuatus, apicem stilorum ix vix superans, tenuissime anulatus setis brevibus pluribus instructus.

Cerci laterales (fig. viii, 13) quam urotergitum decimum parum longiores, setis nonnullis externis brevibus robustis, sensillis superis ad basim et internis, nec non setis nonnullis brevibus instructi; cercus medianus quam laterales longior.

Long. corp. mm. 4.2; lat. thoracis 1.8; long. antennarum 1.30; palpi maxillaris 0.78; pedum paris tertii 2.73; cercorum lateralium 0.65; cerci mediani 1.45.

♂ Antennarum articulus secundus simplex; penis brevissimus, paramera (fig. viii, 14) longa, c. dimidium stilum attingentia.

Habitat—Exemplum ♀ ad Puri, Orissa coast, S.^oW Kemp et exemplum ♂ ad Bangalore ("S. India, ca. 3000 feet") N. Annandale legit.

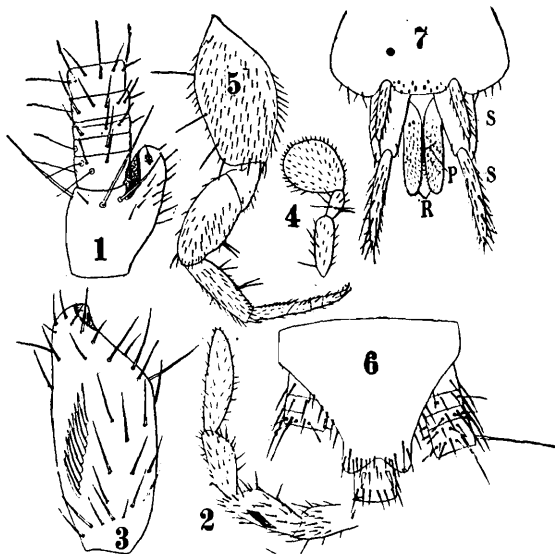


FIG. 10.—*Lepidospora notabilis*: 1. antennae pars proximalis ab articulo secundo; 2. palpus maxillaris interne inspectus ab articulo secundo; 3. palpi maxillaris articulus tertius interne inspectus; 4. palpus labialis, 5. pes paris tertii; 6. abdominis pars postica cum cercorum basi; 7. abdominis sternum 8^{um} et 9^{um}: P. penis, R. paramera, S. stili.

Lepidospora ceylonica, Silv.

I refer to this species a male collected at Rotuna under stones. As I described only the female from Ceylon, I give here the figures (ix, 1-5) of the more characteristic parts of the male.

I have also seen specimens of this species collected by Dr. Imms in Kumaon.

Lepidospora notabilis, sp. nov.

♂ Corpus ochroleucum lateribus subparallelis, postice tantum aliquantum angustatum, squamis et setis instructum. Squamae sat crebre pluriradiatae, majores μ 117 × 52.

♂ Caput supra setis sat numerosis brevibus et nonnullis sat longis instructum. Antennae in exemplo typico haud integrae, abdominis segmentum sextum attingentes, articulo primo parum longiore quam latiore, articuli secundi parte apicali supera interna, (fig. x, 1) in processum latiusculum obtuse-rotundatum protracta, articulis ceteris setis et sensillis *cfr.* fig. x, 1. Palpi maxillares (fig. x, 2) sat longi, articuli tertii facie interna pectine longitudinali setarum (fig. x, 3) aucta; palpi labiales (fig. x, 4) articulo ultimo parum longiore quam latiore, apice late rotundato. Thorax abdominis latitudini subaequalis, lateribus parallelis, tergitis setis sat numerosis brevibus, nonnullis lateralibus et posticis longis et squamis instructis. Pedes setis *cfr.* fig. x, 7.

Abdomen tergitis setis brevibus a primo gradatim minus numerosis et squamis magis numerosis instructis et setis nonnullis posticis longis; tergito decimo (fig. x, 6) parum ad basim latiore quam longiore, angustato, margine postico sat profunde inciso, angulis posticis crassis, rotundatis et subtus ad apicem tuberculis spiniformibus tribus auctis; urosternis squamosis setis duabus submedianis et nonnullis posticis instructis. Stili et vesiculae bene evoluta.

Penis (fig. x, 7) brevis paramera subcylindracea quam stili segmenti noni aliquantum breviora.

Cerci in exemplo typico haud bene integri sed quam abdomen breviores et attenuati.

Long. corp. mm. 6; lat. thoracis 1.10; long. antennarum?; palporum maxillarium 1.43; pedum paris tertii 2.50; cercorum?.

Habitat.—Exemplum typicum ad Sukli ("E. side of Dawna Hills, L. Burma, ca. 2100 ft.") F. H. Gravely legit.

Observatio.—Species haec a praecedenti praesertim palpi maxillaris articulo tertio setarum pectine instructo et tergiti decimi abdominali forma bene distincta est.



V. THE TORTOISES OF CHOTA NAGPUR.

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

(Plates v-vi).

The Chelonia, and more particularly the terrestrial tortoises of Chota Nagpur, the territory that lies between the Ganges and Orissa in the interior of the north-eastern part of the Indian Peninsula, have considerable interest of a geographical kind, for they appear to differ from those of the Ganges valley and to resemble those of northern Assam. In other words, this valley now separates the terrestrial Chelonian fauna of North-Eastern India into two distinct and widely parted sections, one inhabiting the wooded hills of the interior of the northern Peninsular area, the other found in northern Assam, where the jungle is even denser and has more of an "equatorial" character. No terrestrial tortoise of any species has hitherto been found either in the lower part of the Gangetic valley nor, so far as is precisely known,¹ in the country between it and the Himalayas. More detailed information, however, is badly needed as to the westward range in Assam and possibly northern Bengal of those tortoises that inhabit the foothills north of the Brahmaputra on the one hand, and the hills of Central India (to use the term in a geographical rather than a political sense) on the other.

As I believe that the collection of Indian Chelonia now in the Indian Museum, brought together largely by the exertions of Blyth, Theobald and John Anderson, is very much more nearly complete than any collection elsewhere, I have based the following notes upon it. They are confessedly of a tentative nature and are published largely in the hope of attracting attention to our ignorance and thereby appealing to naturalists throughout India to assist, by contributing specimens and information, in the preparation of a full revision of the Indian Chelonia. This work I have had in hand for nearly eight years; not only have constant interruptions occurred, but I have found it extraordinarily difficult to obtain specimens of many of the species. Large series of all but a few very common forms are still necessary, and the fact that our collection is so large makes it the more imperative to render it still more complete.

¹ Anderson was informed by Major Kinloch that the latter had found a living tortoise in the Jalpaiguri district that agreed with a figure of *Testudo elongata* (Anat. Zool. Res. Yunnan, p. 712, 1879). (See also foot-note on p. 74.)

I have to thank Dr. J. R. Henderson of the Madras Museum, Mr. N. B. Kinnear of the Bombay Natural History Society and Mr. B. L. Chaudhuri of the Indian Museum for assistance in preparing this paper.

Family TESTUDINIDAE.

Genus *Geoemyda*, Gray.

- Geoemyda*, Gray, *Proc. Zool. Soc.*, 1834, p. 100; Boulenger, *Cat. Chel.*, p. 135 (1889), *Fauna Ind.*, p. 23 (1890) and *Fauna Mal. Pen.*, p. 16 (1912); Stejneger, *Proc. Biol. Soc. Washington*, XV, p. 257 (1902) and *U.S. Nat. Mus. Bull.*, 58, p. 500 (1907); Siebenrock, "Synopsis der rezenten Schildkroten," *Zool. Jahrb. Suppl.* 10, Heft 3, p. 495 (1909); Henderson, *Rec. Ind. Mus.*, VII, p. 217 (1912).
- Nicoria*, Gray, *Cat. Sh. Rept.*, I, p. 17 (1855); Boulenger, *Cat. Chel.*, p. 129 and *Fauna Ind.*, p. 26; Annandale, *Journ. As. Soc. Bengal*, 1906, p. 205.
- Chaibassia*, Theobald, *Cat. Rept. Ind.*, p. 6 (1876); Anderson, *Anat. Zool. Res. Yunnan*, p. 718 (1879).
- Heosemys*, Stejneger, *Proc. Biol. Soc. Washington*, XV, p. 258; Siebenrock, *Zool. Jahrb. Suppl.* 10, Heft 3, p. 506.

The genus *Geoemyda* was originally described in 1834 by Gray, who designated as its type-species Gmelin's *Testudo spengleri*. Ten years later the same author described another new (or supposed new) genus, for which he coined the name *Nicoria*, again with *T. spengleri* as type-species. Mr. Boulenger in all his more important works has used the generic name *Geoemyda* for the little group of species that includes Gray's *Emys spinosa*, and has accepted the later name *Nicoria* for the group typified by *T. spengleri*; but Dr. Stejneger has pointed out, as is doubtless true in the strict letter of the law of priority, that this course is inadmissible and has relegated to *Geoemyda*, *T. spengleri* and its allies, inventing a new generic name (*Heosemys*) for the *Emys spinosa* group. This change has been accepted by Dr. Siebenrock in his valuable "Synopsis der rezenten Schildkroten" and also by Dr. J. R. Henderson in his description of a new Indian species recently published in these "Records." Mr. Boulenger's books are of such fundamental importance to all students of herpetology that I had proposed to follow his lead. The discovery, however, of a new species exactly intermediate between the two so-called genera and of certain anatomical facts in connection with described forms, renders it unnecessary to adopt either course, and I am forced to combine the two groups under the generic term *Geoemyda*, which is undoubtedly the older of the two names.

Between the groups *Nicoria* and *Geoemyda*, to use the terms in the sense adopted in the "Fauna," there was, at the time that work was written, every reason to believe, as indeed there still is

so far as published statements go, that a valid difference existed in the skull, *viz.* the presence or absence of a temporal arch. Two factors are concerned in the formation of this arch, the ossification of the quadrato-jugal and the production of a backwardly-directed (postorbital) process of the orbital ring in the formation of which both the postfrontal and the jugal bones take a part. If the arch is complete it is formed by a dovetailing of the forward process of the quadrato-jugal and the backward process of these two bones.

In the three species of *Geoemyda* (s.s.) (*i.e.* of *Heosemys*, Stejneger) it is probable that the temporal arch is always absent, the quadrato-jugal being absent or vestigial and the postorbital process of the postfrontal and jugal short and blunt. In one skull of Blyth's *Geoemyda tricarinata* (pl. vi, fig. 6b) from Assam the same condition occurs. This skull was removed from the head of a specimen preserved in spirit and only a very thin, almost membranous cartilage was found in the place of the quadrato-jugal. In two other skulls of the same species, including that of the type from Chota Nagpur (pl. vi, fig. 6a), there is a short postorbital process and the quadrato-jugal, although distinctly ossified, is very delicate and slender and barely meets it. In many skulls of the typical form and of both the races *thermalis* and *edeniana* of "*Nicoria*" *trijuga* the arch, although quite complete, is extremely delicate, being at any rate no thicker than the lower posterior part of the orbital ring. But in some skulls of these races the arch is as stout as any part of that ring: apparently it is always complete. It is also complete in the type-skull of *N. trijuga coronata*, but its condition much more closely resembles that found in the two skulls of *G. tricarinata* in which it is ossified. In the two skulls of the new species *Geoemyda indopeninsularis* as yet examined the postorbital process is well developed; but there is no quadrato-jugal. There is thus a distinct arch, but it is incomplete.

These facts leave, in my opinion, no course but to amalgamate the genera *Nicoria* and *Geoemyda* under the latter name; for I can find no real generic difference between the shells of species assigned to one group or the other.

A more difficult question is, Should Blyth's genus *Chaibassia* be recognized as distinct? The single species included in this genus exhibits considerable variation in skull-characters, but differs from all other Oriental species that can be assigned to *Geoemyda* (except the recently described *G. sylvatica*) in the vestigial nature of the digital webs and in the approximation of the hind feet to the type characteristic of the genus *Testudo* and its allies: it and *G. sylvatica* are true land-tortoises, whereas the other Asiatic species are amphibious. The American forms, however, most closely related to the Oriental "*Nicoriae*" show great specific variation in respect to the webbing of the fingers and toes. Until it has been possible to compare large series of specimens from the two continents, I think, therefore, that it is as well not to revive *Chaibassia* as a distinct genus.

The following key should make it possible to distinguish the Indian and Burmese species of the genus formed by joining together *Gcoemyda* (s.s.), *Nicoria* and *Chaibassia*.

- I. Species with flattened feet and distinctly webbed fingers and toes.
 1. Carapace tricarinate.¹ Posterior orbital process elongate and slender. (Anterior margin of shell smooth).
 - A. Second vertebral shield considerably more than half as wide as first costal shield; quadrato-jugal ossified *G. trijuga.*
 - B. Second vertebral shield a little more than half as wide as first costal shield; quadrato-jugal absent *G. indopeninsularis.*
 2. Carapace with a single median carina. No temporal arch.
 - A. Anterior margin of shell serrated; second vertebral shield much broader than long, at least as broad as second costal shield *G. spinosa.*
 - B. Anterior margin of shell smooth; second vertebral shield not much broader than long, not as broad as second costal.
 - a. Vertebral region arched or tectiform in cross-section in the adult; the whole carapace flattened in the young *G. grandis.*
 - b. Vertebral region flattened *G. depressa.*
- II. Digital webs vestigial, hind feet more or less club-shaped. (Carapace tricarinate).
 1. Upper jaw distinctly hooked; carapace flattened as a whole *G. sylvatica.*
 2. Upper jaw distinctly notched; carapace domed *G. tricarinata.*

As can be seen from the key, the Indian and Burmese species fall readily into three groups, which perhaps may be ultimately recognized as subgenera.

- I. Amphibious species with a tricarinate carapace, fully webbed digits and a temporal arch, which, however, may be incomplete, = *Nicoria*, Gray.

¹ In the carapace of aged specimens the three keels may be almost completely obliterated.

2. Amphibious species with a unicarinate carapace, with webbed digits but without a temporal arch, = *Geoemyda*, Boulenger (Gray), = *Heosemys*, Stejneger.
3. Terrestrial species with a tricarinate carapace, with the digits hardly webbed and the hind feet club-shaped; the temporal arch present or absent, = *Chaibassia*, Theobald.

The only other Oriental species [*G. spengleri* (Gmelin)] belongs to the first of these groups. There is some doubt as to the limits of its range, but it is supposed to be distributed over an area extending from Sumatra to Japan. The Indian species of this group have their head-quarters in India south of the Indo-Gangetic plain, but a race of one of them is found in Burma. Those of the second group are Burmese and in two out of three instances also occur in the Malay Peninsula. One of these two species is also found in Siam and Indo-China, the other in Sumatra and Borneo. The species of the third group are found in the Indian Peninsula and in Assam. A fossil form allied to them but perhaps specifically distinct is described by Lydekker from the Pliocene of the Siwalik Hills under the name *Nicoria tricarinata* var. *sivalensis* (*Journ. As. Soc. Bengal*, 1889, p. 333, fig. 2).

The American species assigned to *Nicoria* by Mr. Boulenger, and to *Geoemyda* (s.s.) by some recent writers, differ from the Oriental ones in having only a single keel on the carapace and at the same time possessing a complete bony temporal arch.

Geoemyda trijuga (Schweigg.).

1. *Forma typica.*

Testudo trijuga, Schweigg., *Prodromus*, p. 41 (1814); Boulenger (*Nicoria*), *Cat. Chel. Brit. Mus.*, p. 121 and *Fauna Brit. Ind. Rept.*, p. 27; Siebenrock (*Geoemyda*), *Synops. Schildkroten*, p. 495.

Emys trijuga var. *madraspatana*, Anderson, *Anat. Zool. Res. Yunnan*, p. 729.

The descriptions given by Boulenger and by Siebenrock serve for the ready recognition of the species. I propose merely to lay stress on sub-specific characters, on which the large series of specimens at my disposal makes it possible to cast further light.

Shell.—Carapace broadly oval, usually of a warm brown colour, but sometimes nearly black, not more than about 22 cm. long in a straight line, moderately depressed, distinctly flattened on the dorsal surface in adults (as well as young) of both sexes; keels sometimes yellowish. Plastron moderately concave in the adult male, brown or blackish, sometimes with a yellowish longitudinal streak on each side.

Head of young dull olivaceous with yellowish and greenish streaks and veins (never very conspicuous) on the dorsal and

lateral surfaces: of adult much duller with small yellowish spots on the posterior part. Iris white.

Geographical distribution.—Common in the east-central parts of the Madras Presidency and found at an altitude of at least 3000 ft. on the Mysore Plateau. Also recorded (? correctly) from Chota Nagpur, from Poona and from the Jhelum canal in the Punjab. The exact limits of the range are unknown. Recently introduced into Calcutta, but not indigenous to the Gangetic delta.

Habits.—The Madras Pond-tortoise is mainly aquatic and vegetarian in habits. Individuals released in a pond in Calcutta left the water at night and made their way upstairs in a house near the edge.

2. Race *thermalis* (Lesson).

Emys thermalis, Lesson, *Cent. Zool.*, p. 86, pl. xxix (1830); Boulenger (*Nicoria trijuga* var. *thermalis*), *Cat.*, p. 122 and *Fauna*, p. 27; Siebenrock (*Geoemyda trijuga thermalis*), *Synops.*, p. 496; Robinson (*Nicoria trijuga*), *Quart. Journ. Micro. Sci.*, LV, p. 742 (1910).

Shell a little broader and distinctly flatter, in old individuals of both sexes, than in the *forma typica*, also larger (up to 26 cm. long) and as a rule darker.

Head black with conspicuous orange or orange-red spots and streaks scattered assymmetrically on the dorsal, lateral and ventral surfaces: spots and streaks less conspicuous in the adult than in the young but never absent. Iris (? always) chocolate.

Geographical distribution.—Ceylon (plains and hill-country up to at least 1600 ft.) and the district of Ramnad on the Indian shore of the Gulf of Manaar; also (probably introduced) in the Maldives and the Chagos Archipelago.

Habits.—The tortoises of this race exhibit remarkable individual variation in habits. In Ceylon they are abundant in ponds, sunning themselves, sometimes two or three deep, on stones and logs that project from the surface of the water. If disturbed they dive immediately and swim along beneath the surface. At night they are frequently found in ditches and among wet grass. In the lake at Kandy they frequent the mouths of drains that open into the lake. But, as Miss Muriel Robertson has noted, some individuals are much more terrestrial in their habits than others. In Ramnad I found both young and half-grown tortoises in the shade of xerophytic plants growing in the sand a long way from water. Mr. T. Southwell tells me that he has dissected many specimens in Ceylon and has never found remains of any but vegetable food in their stomachs.

3. Race *coronata* (Anderson).

Emys trijuga var. *coronata*, Anderson, *Anat. Zool. Res. Yunnan*, p. 729; Siebenrock (*Geoemyda trijuga coronata*), *Synops.*, p. 496; Henderson (*Geoemyda trijuga* var. *coronata*), *Rec. Ind. Mus.* VII, p. 218 (1912).

Shell uniform black, otherwise probably as in the *forma typica*, but perhaps smaller.

Head black, a great part of the dorsal and lateral surfaces being occupied by a broad V-shaped pale yellow mark the point of which is directed backwards on the occiput; the tympanum and the surrounding skin black.

Geographical distribution.—Only known from the southern parts of the Malabar Zone (Travancore and Cochin) on the western side of the Western Ghats. Northern limits of range unknown.

Habits.—Henderson states that this race is aquatic in its habits.

Type (skeleton). Rept. Ind. Mus. No. 1012 (♀).

The type-specimen of this race is a skeleton, which could hardly be distinguished from one of the typical form. There is a large example in spirit in the British Museum, labelled *thermalis*. So far as colouration is concerned, this is perhaps the most easily recognized of the races of *N. trijuga*.

4. Race *edeniana* (Theobald).

Melanochelys edeniana, Theobald, *Cat. Rept. Brit. Mus.*, p. 12 (1876); Boulenger (*Nicoria trijuga* var. *edeniana*), *Cat. Chel. Brit. Mus.*, p. 123 and *Fauna*, p. 28; Siebenrock (*Geoemyda trijuga edeniana*), *Synops.*, p. 496.

Emys trijuga var. *burmana*, Anderson, *Anat. Zool. Res. Yunnan*, p. 723, pls. lvii and lviii.

Nicoria trijuga var. *edeniana*, Annandale (*partim*), *Journ. As. Soc. Bengal*, 1906, p. 205.

Shell black in the adult, with (except in very old individuals) conspicuous yellow keels on the carapace and lateral stripes on the plastron, in the young brown and less conspicuously marked. In very old shells in which the surface of the epidermal shields is worn, the colours are dull and inconspicuous. *The carapace is not known to exceed 29 cm. in length in a straight line.* It is not quite fully ossified when 19 cm. long. In the adult it is more strongly arched and deeper than in any of the races yet discussed and this is more conspicuously the case in the female than in the male, but the plastron of the male is only slightly concave.

Head.—The head of the male above is nearly uniform brown, darkest on the upper surface over the nose, and destitute of any markings. In some females, the upper surface of the head is reticulated with olive-brown and orange-yellow. An orange spot on the mandible below the angle of the mouth, leading interruptedly to the tympanum." (Anderson).

Geographical distribution.—Upper Burma, Arrakan (hills and coast), N. Tenasserim. There is a stuffed specimen in the Indian Museum labelled "Assam," but it is not quite typical, having the second vertebral shield much broader than usual: the skull is not present. Possibly it may represent a distinct race or species.

Habits.—Anderson states that this race feeds on water-plants, more particularly on *Vallisneria*.

Types (skeletons). Rept. Ind. Mus. Nos. 1369, 2589, 1010-11, 1097 and 830.

The same specimens form the types of Theobald's *Melanochelys edeniana* and of Anderson's *Emys trijuga* var. *burmana*. Apparently the latter name had priority in manuscript, and Anderson refused to resign it. Both in the British Museum "Catalogue" and in the "Fauna" there is an error as to the dimensions of this race. Mr. Boulenger informs me that the largest specimen in the British Museum has a carapace 29 cm. long by direct measurement. The largest carapace in our collection is 27.5 cm. long. It is that of an adult not yet aged, but two slightly smaller carapaces have the lines of growth on the epidermal scales completely obliterated and evidently belonged to very old tortoises. There is no specimen on record larger than the one in the British Museum. In a shell 19 cm. long the foramina between the costal and the marginal bones are not completely closed, as they are in one 19.7 cm. long. They have completely disappeared in much smaller shells of the other races.

In examining a large series of skulls of the different races of *G. trijuga* it does not seem possible to find any distinctive racial character, except that skulls of adult individuals of *edeniana* and *thermalis* are larger than those of the typical form, as might be expected from the greater size of the whole animal. The thickness of the bone that forms the temporal arch varies considerably; sometimes it is no thicker than that of the lower posterior part of the orbital framework, sometimes it is nearly twice as thick. In some of our older specimens of young skulls the arch appears to be incomplete, owing to the falling away of the quadrato-jugal, which is never firmly ankylosed to the tympanic frame except in old individuals. In such cases, however, it is always possible to detect on the outer margin of the framework a slight projection above the point which had originally corresponded with the antero-superior limit of the missing bone.

The geographical distribution of the species as a whole is a somewhat discontinuous one, extending all over Peninsular India south of the Indo-Gangetic plain and perhaps penetrating into that plain in the north-west, but not including the valley of the Ganges, although it does include the greater part of Burma. It is a little doubtful whether any race occurs in Chota Nagpur, in which *G. indopeninsularis* may replace *G. trijuga*, but Anderson states that the typical form occurs there.

Specimens in the Indian Museum.

I. GEOEMYDA TRIJUGA MADRASPATANA (ANDERSON) (=*forma typica*).

831 (15b. A.S.B.), ♀ Madras. Madras Museum.
(stuffed).

1008-9, ♀ ♀ (skeletons) „ „ „

40-1; 53, ♂ ♀ (spirit) Madras Madras Museum.
 16723, ♀ (spirit) Madras (town). Dr. J. R. Henderson.
 16722 ♂ (skeleton) „ „ „

Nos. 831, 1008-9, 40-1 and 53 are co-types of *Emys trijuga* var. *madraspatana*, Anderson.

2. GEOEMYDA TRIJUGA THERMALIS (Lesson).

1400-4; 1389-91; 1357-63, }
 1382; 1384-5; 1638; 2906; } ♂ ♂, ♀ ♀ (skeletons) } Dr. Kelaart;
 1348; 1399; 1395; 832; } Ceylon. } Dr. J. Ander-
 933; 1373-4. } son.
 18; 20-36; 54-69; 637. ♂ ♂, ♀ ♀, juv. (spirit) Dr. J. An-
 Ceylon. derson.
 16691, ♂ juv. (spirit). Anuradhapura, Ceylon. Dr. N. Annan-
 dale.
 16692, ♀ „ „ Kandy Lake, Ceylon; 1600 ft. „
 15435-8, ♂ ♀ juv. „ Mandapam, Ramnad, S.E. „
 India.

3. GEOEMYDA TRIJUGA CORONATA (Anderson).

15534, ♀ (skeleton) Travancore. First Prince of
 Travancore.
 17018, ♀ (spirit) Chalakudi, Cochin. Dr. J. R. Hen-
 derson.

No. 15534 is the type of *Emys trijuga* var. *coronata*, Anderson.

4. GEOEMYDA TRIJUGA EDENIANA (Theobald).

1369, 2589, 1010-11, ♂ ♂ ♀ ♀ (skeletons) Hon. A. Eden.
 1018. Burma.
 1097, (skull) „ „
 830 (15a. A.S.B.) ♀ Arrakan hills. Dr. W. T. Blan-
 (shell) ford.
 17112, ♂ (shell) No history.
 178, ♀ (stuffed) Assam. Major Sladen.

Nos. 1369, 2589, 1010-11, 1018, 1097 and 830 are apparently all co-types both of *Melanochelys edeniana*, Theobald and of *Emys trijuga* var. *burmana*, Anderson.

Geoemyda indopeninsularis, sp. nov.

Nicoria trijuga var. *edeniana*, Annandale (*partim*), *Journ. As. Soc. Bengal*, 1906, p. 205.

Carapace dark brown or blackish without markings except for some yellowish blotches at the axilla and groin, relatively deep, flattened on the vertical region in the male and in the young female, strongly arched in the aged female, with three longitudinal keels which (except the median keel in its posterior half) become obscure in adult tortoises. Nuchal small, much longer than broad; first

vertebral shield at least as long as broad, octagonal, with a distinct notch in its posterior margin (which is the shortest), about half as broad as the first costal; second vertebral shield similar in shape and proportions but sometimes shorter; third vertebral shorter than either of the first two; fourth and fifth broader than long; fifth as broad as fourth costal; two caudals, the notch between them obscurely indicated. Posterior margin of shell smooth, somewhat retroverted, especially in the female; anterior margin smooth, barely retroverted in either sex. Lower part of marginal shields on the bridge very deep and approaching the vertical.

Plastron brown with paler margins, deeply concave in the male; the anterior lobe considerably, the posterior lobe distinctly shorter than the bridge; posterior notch deeply angulate; anterior extremity truncate. Epidermal shields in the following order of length: humerals, pectorals, anals, abdominals, gulars. Plastron firmly united by bone to the carapace, with axillary and inguinal buttresses as in *G. trijuga*. Axillary and (sometimes) inguinal shields present.

Head longer than tail, dark olivaceous or brownish without definite markings in either sex, but with a somewhat obscure dark mid-dorsal line running backwards from the snout in the male and narrowing posteriorly; throat dirty white. Skull resembling that of *G. trijuga*, but with the temporal arch incomplete owing to the vestigial condition of the quadrato-jugal bone; dorsal surface flat and horizontal; dorsal profile of squamosal bone much more strongly concave than in *G. trijuga* and supra-occipital bone more strongly produced backwards; upper jaw deeply notched at apex; tooth at apex of lower jaw very prominent and distinct. In the hyoid skeleton the posterior cornua are much broader and the median cornua longer and stouter than in the allied species. The iris is chestnut-brown.

Limbs powerful, black above, greyish below; feet flattened, with well-developed webs; claws long and powerful (especially in the male), sharply pointed, more or less curved, blackish; horny shields large and strong on both limbs, arranged as in *G. trijuga*.

Types. Nos. 17098 (♂) and 17100 (♀) *Rept. Ind. Mus.*

Geographical distribution.—The specimens in the Indian Museum are from the Singhbhum district of Chota Nagpur and there is one in the vivarium of the Bombay Natural History Society from the Dharwar district in the interior of the southern part of the Bombay Presidency. It was taken at Devikop, 26 miles south of the town of Dharwar.

Measurements of specimens of Geoemyda indopeninsularis.

	Type ♂.	Type ♀	Bombay ♀
Length of carapace (straight)	336 mm.	342 mm.	284 mm.
Breadth of ,, (,,)	231 ,,	236 ,,	.
Height of ,, .	130 ,,	148 ,,	135 ,,
Length of ,, along curve	350 ,,	350 ,,	
,, plastron (notch to notch)	282 ,,	310 ,,	258 ,,

	Type ♂	Type ♀
Length of skull (to occipital condyle)	58 mm.	56 mm.
Zygomatic breadth of skull	38 „	38 „
Length of orbit	15 „	15 „
Height of nasal aperture (skull)	10 „	10 „
Breadth of nasal aperture („)	10 „	11 „
Interorbital breadth	14 „	14.5 „
Breadth of lower jaw (at symphysis)	4 „	4 „

In measuring the height of the male carapace I have not included the concavity of the plastron but have measured from the surface on which the shell rested to its highest point. The greatest depth of the concavity is about 20 mm.

This species is closely allied to *G. trijuga* and it is not improbable that confusion has occurred in the case of immature tortoises. Apart from the incompleteness of the temporal arch, there are apparently constant differences in the skull, and the shape of the carapace is different, although it is difficult to bring out this difference by means of measurements. One of our specimens was examined by the late Dr. J. Anderson, who apparently thought that there was some mistake about the label, but the capture of a second specimen from the same district makes this improbable, as there is no evidence against the authenticity of the recorded history except the fact that no other individual was known from that district. The first specimen was taken by the late Dr. V. Ball.

Very little is known of the habits of this species. Mr. Chaudhuri, who obtained the male specimen in our collection through Mr. B. C. Sen, I.C.S., from the Hos, an aboriginal tribe of Chota Nagpur, tells me that they regard it as a land tortoise. The female living in the rooms of the Bombay Natural History Society was, however, taken in a shallow tank, and I detected on its shell the remains of a colony of the polyzoon *Plumatella*, which cannot live long out of water. It is not improbable that tortoises of the species visit water in hot weather, but live habitually, without actually entering water, in damp places. The Bombay female laid several eggs in April and March and did not at that time of year show any inclination to enter water. The eggs were 148 mm. long by 30 mm. in transverse diameter.

Geoemyda tricarinata, Blyth.

Geoemyda tricarinata, Blyth, *Journ. As. Soc. Bengal*, 1856, p. 714; Theobald (*Chaibassia*), *Cat. Rept. Brit. Ind.*, p. 7 (1876); Anderson (*Chaibassia*), *Anat. Zool. Res. Yunnan*, p. 718 (1879); Boulenger (*Chaibassia*), *Cat. Chel.*, p. 139 (1889); Lydekker (*Nicoria*), *Journ. As. Soc. Bengal*, 1889, pp. 327, 330, fig. 1; Boulenger (*Nicoria*), *Fauna*, p. 28 (1890); Siebenrock (*Geoemyda*), *Zool. Jahrb. Suppl.*, x, Heft 3, p. 497 (1909). *Chaibassia theobaldii*, Anderson, *op. cit.*, p. 718; Boulenger, *Cat. Chel.*, p. 140.

I have no doubt that recent authors are right in regarding these two species of Anderson (*tricarinata* and *theobaldii*) as specifically identical. There is little if any constant difference between skulls from the two districts (Chaibassa and northern Assam) in which the two species were supposed to live, but the individual variation between two skulls from Assam is not only considerable but also of great importance in the taxonomy of the genus. I have already indicated its nature (p. 65), which is clearly shown in fig. 6, pl. vi. No information is available as to the soft parts of specimens from Chota Nagpur.

The following measurements include those of the type of *Geoemyda tricarinata*, Blyth, and of two co-types of *Chaibassia theobaldii*, Anderson:—

	No. 816. (♂)	No. 1017. (♀)	No. 188. (♀)	No. 189. (♂)
Length of carapace (straight)	136 mm.	163 mm.	163 mm.	130 mm.
Breadth of carapace (straight)	91 ,,	101 ,,	97 ,,	83 ,,
Length of carapace along curve	165 ,,	197 ,,	190 ,,	159 ,,
Breadth of carapace along curve	145 ,,	163 ,,	160 ,,	132 ,,
Height of carapace	52 ,,	70 ,,	75 ,,	56 ,,
Length of plastron (notch to notch)	104 ,,	132 ,,	135 ,,	106 ,,
Length of skull	23.5 ,,		23.5 ,,	
Breadth of skull	21 ,,		22 ,,	
Length of orbit	10 ,,		10 ,,	
Interorbital breadth	7 ,,		7 ,,	
Length of snout	5.5 ,,		7.5 ,,	
Height of nasal aperture	4 ,,		5 ,,	..
Width of nasal aperture	5 ,,		5 ,,	
Breadth of lower jaw and of symphysis	4.5 ,,		5 ,,	

The skull of No. 1017 was accidentally broken some years ago and that of No. 189 has not been removed from the specimen. Although exact measurements of the former cannot be given, sufficient of it remains to prove its close resemblance to that of No. 188.

*Geoemyda tricarinata*¹ has hitherto been found in the district of Singhbhum (Chaibassa) in the south of Chota Nagpur and at the base of the foot-hills north of the Brahmaputra. Anderson has shown that the locality "Naga Hills" was given in error. The species is apparently terrestrial in habits. Specimens are very difficult to obtain on account of the inaccessible districts in which it occurs.

¹ Since this paper went to the printer I have received a living specimen from Mr. Lancelot Travers, who obtained it in the neighbourhood of the Baradighi tea-estate in the Jalpaiguri district of northern Bengal.

Specimens in the Indian Museum.

816 (10a. A.S.B.), ♂ (shell and imperfect skeleton).	{ Chaibassa (Singh- bhām) district, Chota Nagpur. }	A.S.B. (Blyth).
189, ♂ (spirit).	Bisnath plain, N. Assam.	Capt. Godwin-Austen.
188, ♀ (spirit: skull separate).	Bisnath plain, N. Assam.	,,
1017, ♀ (skeleton).	Base of Daffa Hills, N. Assam.	,,

No. 816 is the type of *Geoemyda tricarinata*, Blyth, while Nos. 189 and 188 are co-types of *Chaibassia theobaldii*, Anderson.

Geoemyda sylvatica, Henderson, from Cochin is apparently related to this species, but only the external characters have as yet been described. Its depressed carapace, strongly hooked upper jaw, etc. separate it distinctly.

Genus **Testudo**, Linn.

Since Mr. Boulenger published his volume on the Reptiles and Batrachia in the *Fauna of British India* four species of this genus have been added to the Indian list. I have to add a fifth. The four additional species already known are:—

1. *Testudo latinuchalis*¹ (Vaillant) (Lower Burma and Malaya).
2. *Testudo travancorica*,² Boulenger (Western Ghats).
3. *Testudo horsfieldii*,³ Gray (Central Asia, Baluchistan).
4. *Testudo baluchiorum*,⁴ Annandale (Baluchistan).

The fifth species I propose to name *Testudo parallelus*. Its position among the Indian species will be shown by the following key:—

I. Species with five claws on the fore-feet.

1. Supracaudal shield single.

A. Forehead with large shields; carapace not marked with radiating pale lines; no spurs on hind thighs.

a. Nuchal shield (usually) present; gular suture no longer than pectoral suture, which is at least nearly as long as humeral suture

T. elongata.

¹ Boulenger, *Fauna of the Malay Peninsula*, vol. i, p. 15 (1912).

² *Id.*, *Journ. Bombay Nat. Hist. Soc.*, vol. xvii, p. 560, 2 pls.

³ *Id.*, *Cat. Chel.*, p. 178.

⁴ Annandale, *Journ. As. Soc. Bengal*, 1906, pp. 75 and 205, pl. 2, fig. 1.

- b. Nuchal shield present; gular suture as long as pectoral and humeral sutures together *T parallelus*.
 - c. Nuchal shield absent; gular suture no longer than pectoral suture, which is not more than half as long as humeral suture *T travancorica*.
 - B. Forehead with small, irregular shields; carapace with radiating yellow lines; spurs on hind thighs present or absent.
 - a. Spurs on hind thighs well developed; plastron with dark radiating lines well developed on shields *T elegans*.
 - b. Spurs on hind thighs feeble; dark radiating lines absent from or poorly developed on plastron *T platynota*.
 - 2. Supracaudal shields two.
 - A. Antero-lateral border of second and third vertebral shields not or but slightly shorter than postero-lateral *T emys*.
 - B. Antero-lateral borders of second and third vertebral shields much shorter than postero-lateral *T latinuchalis*.
- II. Species with four claws on the fore-feet.
 - 1. Carapace much depressed *T horsfieldii*.
 - 2. Carapace not depressed *T baluchiorum*.

***Testudo parallelus*, sp. nov.**

Testudo elongata, Anderson (*partim*), *Anat. Zool. Res. Yunnan*, p. 712 (1879).

The statement that *Testudo elongata* occurs in Peninsular India, which is repeated in several revisions of the Testudinidae, appears to rest on a passage in Anderson's account of that species cited above. He says that he obtained specimens from Chaibassa in Chota Nagpur from Colonel Dalton. None of these specimens can now be traced; another from the same district differs in so many characters from any individual in our long series of Burmese examples that it must be recognized as the type of a new but closely allied species, for which the name *Testudo parallelus* is proposed.

Carapace long and narrow, about $2\frac{1}{2}$ times as long as high and $1\frac{3}{5}$ times as long as broad; *sides parallel*; *costal region steep, not at all convex*; *vertebral region hardly flattened but by no means strongly arched longitudinally*; *posterior region convex backwards, descending abruptly*; anterior and posterior margins retroverted and somewhat feebly serrated. Nuchal narrow, with parallel sides, projecting strongly in front; vertebral shields as in *T elongata*; supracaudal

undivided, strongly arched and curved inwards below. Shields of a warm golden-brown colour, some of them bearing small eccentric black marks; axillary and inguinal shields well developed.

Plastron large, of the same colour as the carapace, with a few scattered black spots; bridge longer than either anterior or posterior lobe; the former truncate and slightly retroverted in front, the latter deeply notched behind. *Gulars* very large, the suture between them equal to the median humeral and pectoral sutures together or to the median femoral suture; suture between the pectorals a little longer than that between the humerals; that between the abdominals much the longest; anals forming a short suture.

Head pale yellow (in spirit), of moderate size; a pair of very large praefrontals covering the snout, followed behind by a much smaller frontal with a pair of shields considerably longer than itself disposed symmetrically one on either side of it; occipital region covered with small irregular shields. Jaws by no means strongly hooked or prominent; upper jaw feebly tricuspid.

Limbs not very powerful. Fore limbs with five claws, covered with well-developed scales; those on the dorsal surface irregular in size, with three very much larger than the others; outer edge of the limb with strongly projecting, imbricate, claw-like scales. Hind limb devoid of femoral spurs; some relatively small projecting tubercles on the heels.

Tail moderate, ending in a claw-like spur.

Skull closely resembling that of *T. elongata* but with the terminal tooth of both jaws shorter.

Type (♀). No. 11379. Rept. Ind. Mus.

Habitat.—Chaibassa (Singhbhum) district, Chota Nagpur.

Closely as this species is related to *T. elongata*, it can be recognized by the straight and parallel sides and abrupt posterior region of its shell, the plane (non-convex) costal region and the large gular shields. The cephalic shields and the scales on the dorsal surface of the fore-feet are also different. The same characters will separate it from *T. travancorica*. The type is an adolescent female in spirit from which I have had the skull removed. Its shell is 185 mm. long. It is unfortunate that only a single specimen is available. I have been attempting in vain for some years to obtain more material; but our series of *T. elongata* is a large one and no confusion with any other species is possible. In *T. travancorica* the gulars are shorter than in *T. elongata* and the frontal shield is even larger, unless, as is sometimes the case, it is broken up irregularly into several scales.

Family TRIONYCHIDAE.

Emyda granosa intermedia, Annandale.

Emyda granosa intermedia, Annandale, *Rec. Ind. Mus.*, VII, p. 171, pl. vi, fig. 3 and p. 264 (1912).

This race is apparently common all over Chota Nagpur, except probably in the hills. I have recently obtained specimens from

Angul in the interior of Orissa from Mr. J Taylor; other localities are given in the papers cited.

Although I can at present only put on record definitely five species of *Chelonia* as having been recorded from Chota Nagpur, viz. :—

- ? *Geoemyda trijuga* (amphibious),
Geoemyda indopeninsularis, nov. (amphibious),
Geoemyda tricarinata (terrestrial),
Testudo parallelus, nov. (terrestrial),
and *Emyda granosa intermedia* (aquatic),

it is probable that the following species, at any rate, also occur :—

Testudinidae	{	<i>Kachuga lineata</i>	}	Aquatic species.
		<i>Kachuga dhongoka</i>		
		<i>Kachuga tectum intermedia</i>		
		<i>Batagur baska</i>		
		<i>Testudo elegans</i>	}	Terrestrial species.
Trionychidae	{	<i>Trionyx leithii</i>		
		<i>Trionyx gangeticus mahanad-</i>	}	Aquatic species.
		<i>dicus</i>		

These seven forms have been found on both sides of Chota Nagpur, and no reason why they should not be found in that division of the Province of Bihar and Orissa can at present be brought forward.

It would be idle, until we know more of the tortoises of the division, to discuss in detail the geographical distribution of those that have actually been found. It is, however, noteworthy that of the four Testudinidae, two should belong to previously undescribed species; while two, or possibly three, are closely related to, when not identical with, forms otherwise known only from territory east of the Gangetic delta, and quite distinct from forms found in the valley of the Ganges. The three species are:—*Geoemyda tricarinata*, which is specifically identical with a form only known to occur in Assam north of the Brahmaputra, *Testudo parallelus* (very closely related to *T elongata*, found in Assam, Burma, Indo-China and the Malay Peninsula) and *Geoemyda indopeninsularis*, which is related to the Burmese (? and Assamese) race of *G. trijuga* and ranges westwards and southwards into the Bombay Presidency. *Testudo parallelus* is closely related not only to *T elongata* but also to *T travancorica*, which is only known from the Western Ghats,¹ and also to *T forsteni* from Celebes; the four species together forming a very compact and distinct section of the genus *Testudo*.

¹ Dr. J. R. Henderson has recently sent me a specimen from the western slopes of that range in Cochin and Mr. F. Hannington one from Coorg.

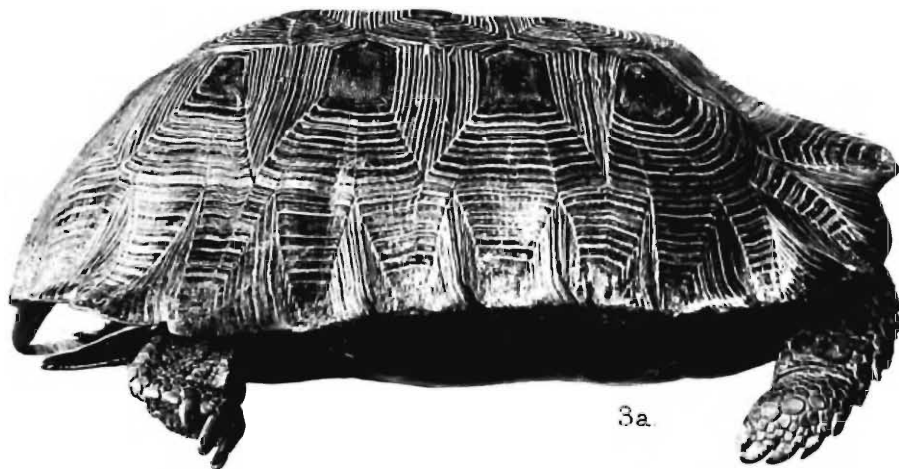
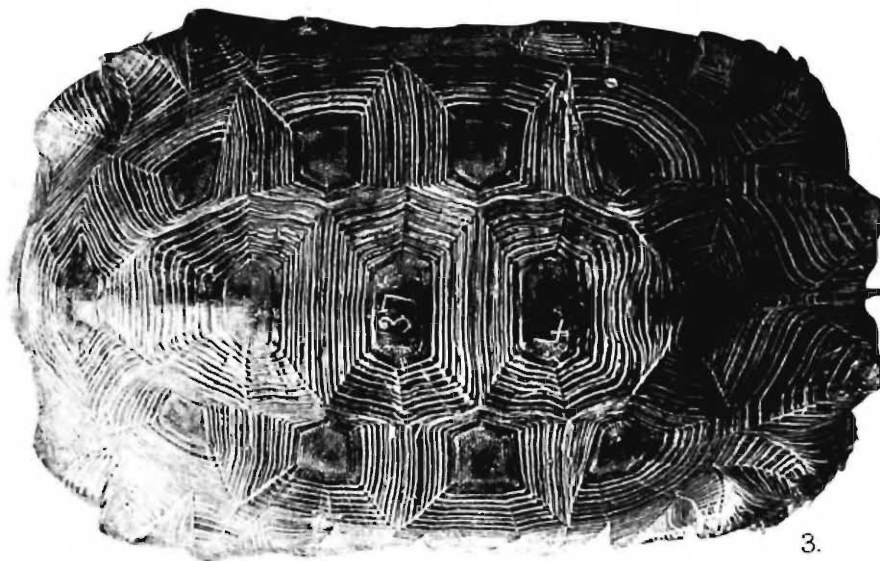
EXPLANATION OF PLATE V.

New Species of Tortoise from Chota Nagpur.

FIG. 1. Female type of *Geoemyda indopeninsularis* (reduced).

FIG. 2. Shell of male type of *Geoemyda indopeninsularis* (reduced).

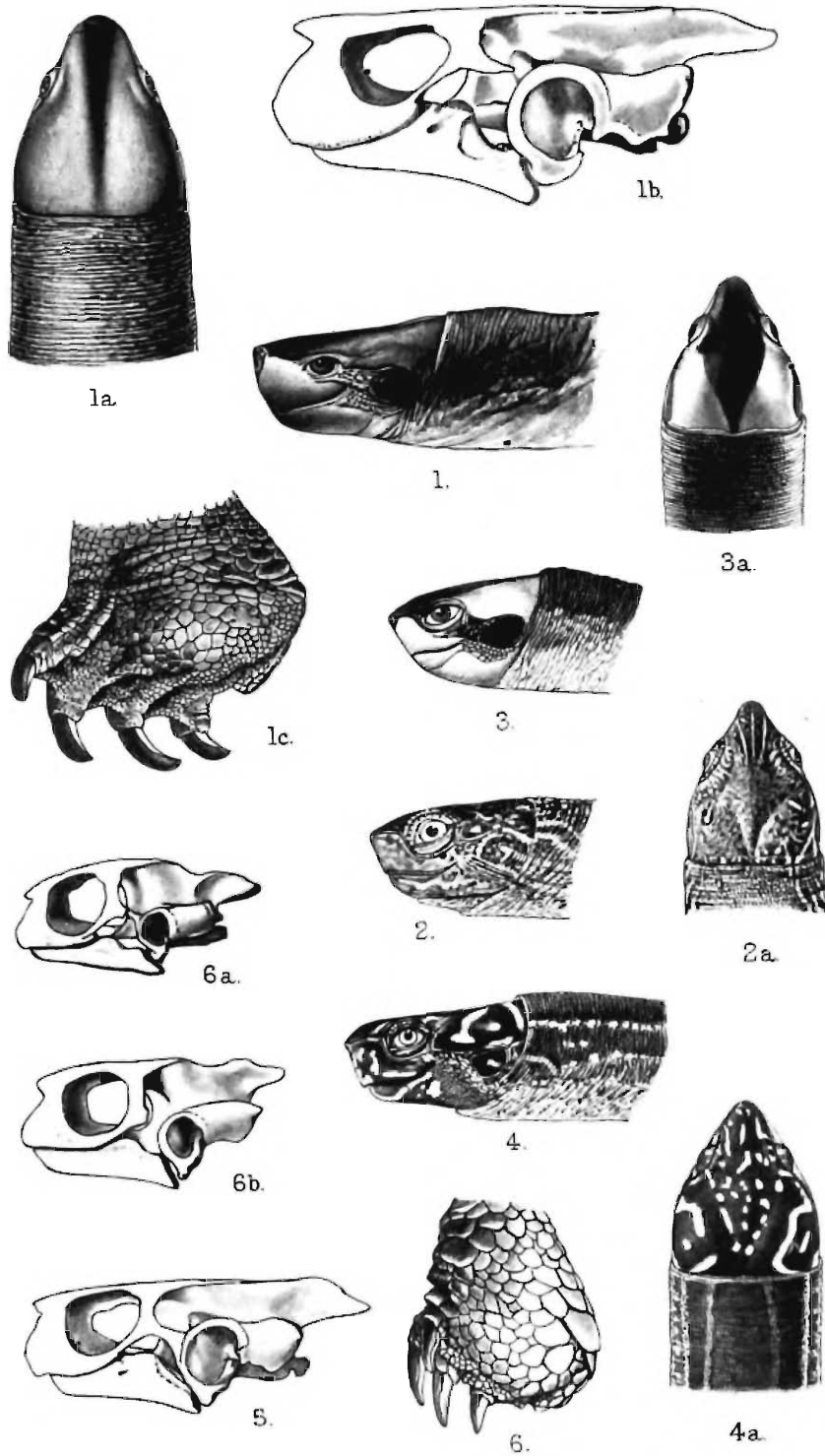
FIGS. 3, 3a. Type (female) of *Testudo parallelus* (reduced).



EXPLANATION OF PLATE VI.

- FIG. 1. *Geoemyda indopeninsularis*.
1, 1a.—Head of male type, $\times \frac{1}{2}$: 1b.—Skull of same specimen (nat. size): 1c.—Hind foot, $\times \frac{1}{2}$.
- FIG. 2. Head of typical form of *Geoemyda trijuga*: young female from Madras (nat. size).
- FIG. 3. Head of *Geoemyda trijuga coronata*: young female from Cochin (nat. size).
- FIG. 4. Head of *Geoemyda trijuga thermalis*: young female from Ramnad, S.E. Madras (nat. size).
- FIG. 5. Skull of *Geoemyda trijuga edeniana* from Burma (nat. size).
- FIG. 6. *Geoemyda tricarinata*.
6.—Hind foot of specimen from northern Assam (nat. size): 6a.—Skull of type of *G. tricarinata* from Chota Nagpur (nat. size): 6b.—Skull of one of the co-types of *Chaibassia theobaldii* from northern Assam.

NOTE.—The head of *G. trijuga thermalis* is figured entirely from a specimen in spirit. The spots and streaks are much darker in life and the iris is rarely, if ever, white.



VI. NOTES FROM THE BENGAL FISHERIES LABORATORY, INDIAN MUSEUM.

No. I.

By T. SOUTHWELL, A.R.C.S. (*Lond.*), F.L.S., F.Z.S.,
Deputy Director of Fisheries, Bengal.

(Plates vii—x.)

INTRODUCTION.

Dr. Linton in presenting his report on the Parasites of fishes of Beaufort, North Carolina, to the American Bureau of Fisheries (1)¹ made the following remarks :—

“ To the naturalist no defence need be made for the time and energy spent in the study of life in any of its phenomena. To those who are not naturalists, however, some justification is due. Particularly does this become proper when the general public, by means of such laboratories as those of the Bureau of Fisheries, furnishes facilities for scientific enquiry. One who has never undertaken to get knowledge at first-hand from nature is likely to have little conception of the vast amount of work which is oftentimes necessary for the establishment of a very simple proposition. Suppose, for example, exact and complete information is desired as to the food of the English sparrow. It should not require much reflection to convince anyone that before an adequate answer can be made to such an inquiry, trustworthy observations must be made, by competent investigators, on the feeding habits of this bird, both adult and young, in different localities throughout the year, and through a series of years. But the general public may wish to know, and in this case has a right to know, what advantage there is to it in such scientific inquiry as is implied by an investigation made on the food and the parasites of fishes.

“ It may, I think, be confessed that so far as may be seen while the investigations are in progress, much of the information which is collected will be of interest only to zoologists. In view, however, of the well-known fact that many diseased conditions, and even epidemics, result from the presence of parasites, and, further, that the parasites are as a rule introduced, either as eggs or larvæ, along with the food, it is not difficult to see that the more complete and systematic our knowledge becomes of the interrelations of the animals which harbour the parasite, interrelations which depend very intimately on the food habits of fishes, the more certain are we to be able to cope successfully with any disease which may arise. A case in point is furnished by one of the recent triumphs of medical knowledge. It is scarcely possible that the cause of malaria and of yellow fever could have been discovered if it had not been for the previous contributions to knowledge made by investigators in parasitism. The germ of malaria is a parasite whose round of life is passed in the blood-cells of man, and in certain organs of the mosquito. The germ of yellow fever seems to have a similar history. These interrelations between the mosquito and man were not even dreamed of a generation ago. The history of trichinosis is now so well known that a simple allusion to it in this connection is sufficient. Every well-informed

¹These numbers refer to the literature cited at the end.

person knows, or may easily know, how the disease is communicated and what part is played in the matter by the pig and by rats and mice.

"The immense value to humanity of such a discovery as the cause of malaria and of yellow fever is entirely beyond our powers to estimate; and yet, this value must not be credited to this one discovery alone, as if it were a thing apart. No less credit must be given to the long line of investigators whose persistent interrogations of nature have led up to this discovery, and will surely lead to others no less valuable."

Linton's remarks apply very aptly to the situation of affairs in India. As our knowledge of the parasites of freshwater fish in India is at present nil, it is impossible to say to what extent the inland fisheries in particular are affected through this cause. As far as we know, there are no fish parasites in India capable of infecting man. In Europe, the larva of *Bothriocephalus latus* (a worm inhabiting man and often measuring 20 to 30 ft. in length) occurs in the Pike and is transmitted from this host to man; but up to the present this worm has not been recorded from India. It is just possible that a certain rare Trematode (*Gasterodiscus hominis*, Lewis and McConnel) recorded twice from man in Calcutta, may have its earlier stages either in the flesh or on the skin of certain fish. As far as we know at present, the bad effects of parasitism amongst fish are confined, in Bengal, entirely to the fish themselves, and amongst those forms inhabiting freshwater tanks these effects tend to be cumulative. An illustration will emphasize my meaning.

In the following paper is recorded a large larval worm (*Ligula simplicissima*) from the coelom of *Labeo calbasu*. This worm has its adult stages in a certain bird. Such birds live in the vicinity of the tanks containing the fish on which they feed. When a bird becomes infected, the parasite matures in the bird's intestine and passes millions of eggs to the exterior with the bird's faeces. Such faeces are often dropped in a tank and provide an extensive source of infection to the fish in the tank. The cumulative infection of the fish is due solely to the fact that such tanks have no current of running water. To what extent such infection exists in Indian fish has still to be determined. Infected fish are almost always thin, emaciated, undersized and lacking in vitality.

Of the Cestode parasites, the majority occur in the gut or on the mesenteries, and are thus removed before the fish is eaten. Up to the present no Cestode parasite, or cyst, has been recorded from the flesh of any fish in India. The Trematode parasites may occur either on the skin or in the gut, or, as in the case of the Mahseer recorded in this paper, the parasite may infect the muscles.

Of other causes resulting in the disease of fishes, such as parasitic Crustacea, Acanthocephala, Nematodes, infectious parasitic fungi, infectious parasitic Protozoa (Myxosporidia) and bacteria, India provides a new field of work, and at present it is impossible to say to what extent the inland fisheries suffer through the effects of such parasites.

ON SOME TREMATODE AND CESTODE PARASITES
FROM FISH.

The only work done as yet on the parasites of Indian fish consist of the reports of :—

I. Shipley and Hornell who worked out the collection of Cestodes made by Prof. Herdman in Ceylon.

II. The present writer who continued and extended that work and described his own collections in the Ceylon Marine Biological Reports. (17).

III. Max Lühe who described the Trematodes collected by Prof. Herdman. (5).

These reports all deal with parasites from marine fish. The present paper is the first one dealing with parasites mostly from freshwater fish, either in India, Burma or Ceylon.

CESTODA.

The two species of Cestode parasites to be described, viz. *Ophryocotyle bengalensis*, n. sp., and *Bothriocephalus* (*Anchistrocephalus*) *polyptera* (Leyd) constitute the first record of any adult Cestode found in any Teleostean fish in Indian waters. Southwell in his examination of marine Teleosts in Ceylon over a period of five years never obtained a single adult Cestode parasite, although encysted larval forms were extremely common. The above two species were obtained from (a) *Ophiocephalus striatus* (Bengali, *Sol*) and (b) *Labeo rohita* (Bengali, *Rohu*). Both species of parasites occurred in each species of fish. Those from *Labeo rohita* were few in number. Those from *Ophiocephalus striatus* occurred in such large numbers, along with some undescribed Trematodes, that the lumen of the intestine of this fish in one particular case appeared entirely choked. Specimens of *Ophryocotyle bengalensis*, n. sp. were numerous. Only two specimens of *Bothriocephalus* (*Anchistrocephalus*) *polyptera* (Leyd.) were obtained. It has been noted that cystic forms of Cestoda in general are exceedingly common amongst marine Teleosts. On the other hand such cysts are quite rare in freshwater forms. Up to the present I have been unable to discover any except the larva of *Ligula simplicissima*, which will be referred to later, and this was not encysted, but free in the coelom. Contrary to what occurs in marine fish, adult Cestodes are fairly common in freshwater Teleosts in Bengal, and our examples were obtained from the first fish of the preceding species which we examined. This difference finds an explanation in the widely different conditions existing normally in the sea, and in fresh water. In the sea, adult Cestodes are always found in fish of the shark and ray tribe, which, on the whole, are not subject to the ravages of other predatory fish. In such an host the adult tapeworms find a safe and secure retreat, from which abode an unending stream of eggs are liberated.

The following list given by Linton will illustrate this fact:—

Cestode.	Usual or only known final host.	Intermediate hosts.
<i>Tetrarhynchus bisulcatus</i>	<i>Carcharhinus obscurus</i>	18 species of Woods Hole fishes. 22 species of Beaufort fishes. 2 species of Bermuda fishes.
<i>Rhynchobothrium bulbifer</i>	<i>Mustelus canis</i>	22 species of Woods Hole fishes.
<i>Rhynchobothrium speciosum</i>	<i>Carcharhinus obscurus</i>	12 species of Woods Hole fishes. 3 species of Beaufort fishes. 5 species of Bermuda fishes. 4 species of Tortugas fishes.
<i>Rhynchobothrium imparispine</i>	<i>Raia ocellata</i>	28 species of Woods Hole fishes.
<i>Otobothrium crenacolle</i>	<i>Sphyrna zygaena</i>	In a large number of Woods Hole and Beaufort fishes, and in 3 Bermuda fishes; especially abundant in flesh of butterfish.

In fresh water, similarly suitable conditions for the parasite are found in Teleosts, as the larger forms of this group like *Labeo rohita*, and the voracious *Ophiocephalus striatus* (which occasionally attains a length of 3 feet or more), are seldom, if ever, preyed upon. There are only two species of freshwater rays known in India, viz. *Hypolophus sephen* (Mull. and Hen.) and *Trygon fluviatilis* (H.B.), measuring $5\frac{1}{2} \times 3\frac{1}{2}$ and $4\frac{1}{2} \times 2\frac{1}{2}$ feet respectively. These are not voracious, and it is improbable that either of them devour large Teleosts.

In the sea, Teleosts are frequently eaten by sharks and rays, and hence we find that Teleosts under these conditions harbour cystic forms only, and that these are capable of maturing and becoming adult in the intestines of their larger and more powerful enemies. In this connection it has already been pointed out (Southwell, 17) that marine Teleosts are not usually intermediate, but collateral hosts to the parasite, and this statement receives strong support from the conditions found to exist in freshwater Teleosts. The larval forms of the parasites to be described have not up to the present been found. It seems probable that they will eventually be discovered encysted either in certain Copepoda on which *Labeo rohita* feeds, or on the mesenteries of smaller fish such as are devoured by *Ophiocephalus striatus*.

The following list comprises, as far as I have been able to ascertain, all species of Cestodes which have been recorded from Teleosts. It is compiled from the works of Rudolphi (16), Lönnberg

(13), Rüggenbach (15), Diesing (10), Lühe (14), Ward (18), Braun (9) and various papers by Linton. In some cases I have been unable to determine the authority for certain of the species of parasites named, and especially is this the case with those recorded by Diesing. The name placed in *square* brackets, after the specific name of the worm, indicates the source from which the record is derived. Those fish marked with an asterisk (*) are marine; those marked with a dagger (†) are freshwater forms, whilst those marked with a double dagger (‡) live partly in the sea, and partly in fresh water.

Parasite.		Host.
<i>Sanguinicolle armata</i> , Plehn.	[Lühe.]	† <i>Tinca tinca</i> .
„ <i>inermis</i> , Plehn.	„	† <i>Cyprinus carpio</i> .
(Parasitic in the blood.)		
<i>Caryophyllaeus mutabilis</i> ,	[Lühe.]	† Cyprinoids generally.
Rudolphi.		
<i>Cyathocephalus truncata</i>	„	† „ „
(Pall.)		
<i>Leuckartia</i> sp., Moniez.	[Ward.]	‡ Salmon.
<i>Bothriocephalus proboscideus</i> (Block.)	„	‡ „
„ <i>solidus</i> , Drummond.	„	‡ „
„ <i>succicus</i> , Lönn.	[Lönnberg.]	‡ <i>Salmo salar</i> .
„ <i>cordiceps</i> , Ledy.	[Ward.]	‡ Salmon.
„ <i>infundibuliformis</i> , Rudolphi.	„	‡ „
„ <i>claviceps</i> , Rudolphi.	[Lühe.]	‡ <i>Anguilla anguilla</i> .
„ <i>carpionis</i> .	[Diesing.]	‡ <i>Salmo carpio</i> .
„ <i>eriosis</i> .	„	* <i>Salmo eriox</i> .
„ <i>barbatulae</i> .	„	† <i>Cobitis barbatula</i> , Linnaeus.
„ <i>callariae</i> , Rudolphi.	„	* <i>Gadus callarias</i> , Linnaeus.
„ <i>gadi rediani</i> .	„	* <i>Gadus (Morrhua) minutus</i> , Cuvier.
„ <i>gadi morrhua</i> , Cuvier.	„	* <i>Gadus morrhua</i> .
„ <i>lophii</i> .	„	* <i>Lophius piscatorius</i> , Linnaeus.
„ <i>cepolae</i> .	„	* <i>Cepola rubescens</i> , Linnaeus.
„ <i>bicolor</i> , Nordm.	„	* <i>Pelamys sarda</i> , Cuvier.
„ <i>rectangulatum</i> , Rudolphi.	[Rudolphi.]	† <i>Cyprinus barbatus</i> .
„ <i>fragilis</i> , Rudolphi.		‡ <i>Clupea alosa</i> .

<i>Bothriocephalus punctatus</i> , Ru-	[Rudolphi.]	* <i>Cottus scorpio</i> .
dolphi.		
„ (<i>Anchistroce-</i>	[Southwell.]	† <i>Labeo rohita</i> and
<i>phalus</i>) <i>po-</i>		† <i>Ophiocephalus striatus</i> .
<i>lyptera</i> (Ley-		
den).		
<i>Dibothrium belones</i> , Rudol-	[Diesing.]	* <i>Belones acus</i> , Cuvier.
phi.		
„ <i>punctatum</i> , Risso.	„	* <i>Rhombus barbatus</i> .
„ <i>crassiceps</i> , Cu-	„	* <i>Merluccius vulgaris</i> .
vier		
„ <i>rugosum</i> , Ru-	„	* „ „
dolphi.		
„ <i>plicatum</i> , Ru-	„	* <i>Xiphias gladius</i> , Lin-
dolphi.		naeus.
„ <i>heteropleurum</i> ,	„	* <i>Centrolophus pompilus</i> ,
Diesing.		Lac.
„ <i>angustum</i> ,	„	* <i>Scorpaena scrofa</i> , Lin-
Rudolphi.		naeus.
„ <i>labracis</i> .	[Diesing.]	* <i>Labrax lupus</i> , Cuvier.
„ <i>manubriforme</i> ,	[Linton.]	* <i>Tetrapturus imperator</i> .
Linton.		
„ <i>hastatum</i> , Lin-	„	† <i>Polyodon spathula</i> .
ton.		
„ <i>laciniatum</i> , Lin-	„	* <i>Tarpon atlanticus</i> .
ton.		
„ <i>occidentale</i> , Lin-	„	* <i>Sebastodes</i> .
ton.		
„ <i>restiforme</i> , Lin-	„	* <i>Tylosurus caribaeus</i> .
ton.		
„ <i>punctatum</i> , Lin-	„	* <i>Platessa plana</i> .
ton.		
„ <i>microcephalum</i> ,	„	* <i>Mola rotunda</i> .
Linton.		
„ <i>plicatum</i> , Lin-	„	* <i>Xiphias gladius</i> .
ton.		
„ <i>rugosum</i> , Lin-	„	* <i>Gadus morrhua</i> .
ton.		
„ <i>aluterae</i> , Lin-	„	* <i>Alutera schoepfi</i> .
ton.		
<i>Taenia ocellata</i> , Rudolphi.	[Braun.]	††* <i>Salmo</i> , <i>Perca</i> , <i>Aceri-</i>
		<i>na</i> , <i>Esox</i> .
„ <i>osculata</i> , Goeze.	[Diesing.]	† <i>Silurus glanis</i> .
„ <i>pollochii</i> , Ratke.	„	* <i>Merlangus pollachius</i> .
„ <i>octolobata</i> .	[Rudolphi.]	* <i>Cottus norvegica</i> .
„ <i>filicollis</i> , Rudolphi.	„	* <i>Cottus cernua</i> .
„ <i>calycina</i> , „	„	† <i>Silurus glanis</i> .
„ <i>dilatata</i> , Linton.	[Linton.]	* <i>Anguilla chyrsope</i> .
<i>Ichthyotaenia diesingii</i> , Mon-	[Riggenbach]	† <i>Silurus dargado</i> .
ticelli.		

<i>Ichthyotaenia macrocotyle</i> , [Riggenbach]	† <i>Silurus megalcephalus</i> .
Monticelli.	
„ <i>coryphicephala</i> , „	† „ sp.
Monticelli.	
„ <i>abscisca</i> , Rig-	„ „ „
genbach.	
„ <i>fossata</i> , Rig-	† <i>Pimelodus pati</i> .
genbach.	
„ <i>malapteruri</i> , „	† <i>Malapterurus electricus</i> .
Fitsch.	
„ <i>hemisphaerica</i> , „	† <i>Anguilla vulgaris</i> .
Molin.	
„ <i>salmonis omul</i> , „	† <i>Salmo omul</i> .
Pallas.	
„ <i>eperlani</i> , Acha-	* <i>Osmerus eperlanus</i> .
rius.	
„ <i>idus</i> , Viborg.	† <i>Leuciscus idus</i> .
„ <i>macrophalla</i> , „	† <i>Cichla monoculus</i> .
Dies.	
„ <i>belones</i> , Müller.	* <i>Belone acus</i> .
„ <i>micropteri</i> , „	† <i>Micropterus nigricans</i> .
Liedy.	
„ <i>osculata</i> [Lühe.]	† <i>Silurus glanis</i> .
(Goeze).	
„ <i>longicollis</i> (Ru-	† Salmonidea.
dolphi).	
„ <i>torulosa</i> „	† Cyprinoids.
(Batsch).	
„ <i>percae</i> (Müll.) „	† <i>Perca</i> , etc.
„ <i>salmonis umb-</i> „	† <i>Salmo salvelinus</i> .
<i>lae</i> , Zschokke.	
„ <i>sagitta</i> , Grimm.	† <i>Nemachilus barbatula</i> .
„ <i>ambigua</i> (Duj-	† <i>Gasterosteus laevis</i> .
ardin).	
„ <i>cyclops</i> , Lin-	† <i>Coregonus maraena</i> .
stow.	
„ <i>macrocephala</i> , „	† <i>Anguilla anguilla</i> .
Creplin.	
<i>Bothriotaenia proboscidea</i> , [Ward.]	† Salmon.
Mühling.	
<i>Ophryocotyle bengalensis</i> , [Southwell.]	† <i>Labeo rohita</i> and
Southwell.	† <i>Ophiocephalus striatus</i> .
<i>Rhynchobothrium crassiceps</i> , [Diesing.]	* <i>Lophius piscatorius</i> ,
Diesing.	Linnaeus.
<i>Tetrarhynchus appendicula-</i> [Ward.]	† Salmon.
<i>tus</i> , Rudolphi.	
„ <i>macrobothrius</i> ,	
Von Siebold.	
<i>Stenobothrium appendicula-</i> [Ward.]	† „
<i>tum</i> , Diesing.	

<i>Tetrarhynchus grossus</i> , Rudolphi.	[Ward]	‡ Salmon.
„ <i>solidus</i> , Drummond.	„	‡ „
„ sp., McIntosh.	„	‡ „
„ sp., Creplin.	[Lühe.]	† <i>Silurus glanis</i> .
<i>Dibothriorhynchus gracilis</i> .	[Diesing.]	* <i>Ammodytes cicerelus</i> , Rafinesque.
<i>Tetrabothriorhynchus migratorius</i> , Diesing.	„	* <i>Belones acus</i> , Cuvier.
<i>Tetrabothrium minimum</i> , Linstow.	[Ward.]	‡ Salmon.
<i>Monobothrium hexacotyle</i> , Linton.	[Linton.]	† <i>Catostomus</i> sp.
<i>Ptychobothrium belones</i> , Mihi.	[Lönnerberg.]	* <i>Belone vulgaris</i> .
<i>Triaenophorus anguilla</i> , Lönner.	„	‡ <i>Anguilla</i> „

In addition to the preceding, the following parasites are probably adult in certain Teleosts, but I have been unable to verify this statement:—

<i>Alyselminthus gasterostei</i> , Zed.	<i>Taenia cyclops</i> , Linstow.
<i>Bothriocephalus gadi barbati</i> , Rudolphi.	„ <i>cyprini idi</i> , Rudolphi.
„ „ <i>merlucii</i> , Rudolphi.	„ <i>gasterostei</i> , Fabr.
„ <i>cyprini phoxini</i> , Leuckart.	„ <i>percae</i> , Müll.
„ <i>salmonis carpionis</i> , Rudolphi.	„ <i>salmonis</i> , Müll.
„ „ <i>umblae</i> , Koll.	„ „ <i>umblae</i> , Zschokke.
„ <i>salvelina</i> , Lönnerberg.	„ „ <i>wartmanni</i> , Fröl.
	„ <i>salvelina</i> , Schrk.
	<i>Tetrabothrium polypteri</i> , Leydig.
	<i>Tetrarhynchus morrhuae</i> , Rudolphi.

The preceding list represents, I think, in a general way, all the adult Cestodes recorded to date from Teleosts. As far as I have been able to ascertain, I have excluded larval and immature forms from the list. In this respect I am by no means sure that this list is free from error, or that it includes absolutely every adult form recorded.

In all about a hundred species are recorded. As the total number of Cestodes known is probably well over 2000 species, the percentage recorded from Teleosts amounts to less than 5 per cent. of known species. It will be noted that very many of the Teleosts named, from which adult Cestodes have been obtained, are either marine, or spend some part of their life out at sea. Thus, salmon are marine fish which normally migrate up the rivers to spawn. The eels, on the other hand, are freshwater forms which migrate to the sea to spawn. In both cases it seems highly probable that the initial infection is brought about out at sea. This is certainly the case with the salmon. Excluding the migratory and marine species from the list, the number of Cestodes recorded from fish

which are purely freshwater forms is not more than 30, or approximately 1·5 per cent.

Specimens of the parasites described in this paper have been deposited in the Indian Museum.

***Ophryocotyle bengalensis*, sp. nov.**

(Pl. vii, figs. 1—3.)

Over sixty specimens of this worm were obtained from the intestine of *Ophiocephalus striatus*, and a few were also obtained from the intestine of *Labeo rohita*. Both fish were caught at Berhampur Court, Bengal, in a freshwater tank. This genus of tapeworm usually occurs in birds, and considerable interest attaches to the presence of these adult forms in Teleosts. The average length of the worms was 7·5 mm. Greatest breadth (at posterior end) ·8 mm. These latter segments were from 4 to 5 times broader than long. The head consists of four cup-shaped suckers, directed slightly forward. Anteriorly the head terminates in an umbrella-shaped protrusible rostral disc whose circumference is armed with a large number of hooks arranged in two rows. The exact number could not be determined, as, in removing the parasites from the intestine of the fish, many of the hooks had been torn away. The exact number counted in three specimens is given in the following table;—

- (i). One row of twenty-five hooks
- (ii). Two rows with a total of fifty-three hooks.
- (iii). Two rows with a total of fifty-two hooks.

The hooks appear to be all similar. They have broad bases and are sharply recurved in profile. Viewed end on they appear elongated (plate vii, fig. 3).

The suckers are armed with exceedingly minute spines which appear to be limited to their anterior borders. The head measures about ·5 mm. broad. The neck is fairly long, measuring 2·7 mm. Dots of black pigment are scattered about over the whole worm. The first proglottides are exceedingly shallow, and *all* proglottides are broader than long. The lateral margins are wrinkled in such a way that in young specimens the true strobilization can only be determined under a lens. The genital apertures are lateral and are almost all on one side.

The uterus appears to be made up of a number of rounded egg capsules scattered about the proglottid.

Habitat.—The intestines of *Labeo rohita* and *Ophiocephalus striatus*. Berhampur Court, Bengal, June 1912. About sixty specimens.

Amongst the worms just described were two large specimens measuring 27 mm. and 22 mm. respectively. They differ from the smaller forms only in having the neck very much shorter and in being much larger. Two rows of about 50 hooks were counted round the circumference of the rostral disc.

Bothriocephalus (Anchistrocephalus) polyptera (Leyd.).

(Pl. vii, figs. 4—6.)

Two specimens of this tapeworm were obtained. One was from *Ophiocephalus striatus* (Bengali, *Sol*) and the other from *Labeo rohita* (Bengali, *Rohu*). As far as I am aware it has hitherto been recorded only from *Polypterus bichar*.

Our largest worm measured 17 mm. long and the greatest breadth was .8 mm. The head is rectangular in shape and consists of two fleshy bothridia united along their whole length, and deeply concave laterally, thus forming two sucker-like discs. The suckers vary slightly in size according to their degree of contraction. In the largest specimen the head measured 1 mm. long and .45 mm. broad. Anteriorly it terminates in an umbrella-shaped sucker-like rostral disc, armed with about fifty-six spines around its circumference. The spines are fairly large and spindle-shaped, and are limited to a single row round the circumference of the rostral disc. These are arranged as in fig. 6. There is no neck. The anterior segment is overhung by the posterior edges of the bothridia. The first proglottid is almost square; succeeding proglottides broaden and become slightly shorter, so that the last segment is about five times as broad as long. The edges are markedly salient. The genitalia and excretory systems were not made out. Under high magnification the body was seen to be slightly pigmented, the pigment being distributed in the form of minute globular dots. Our specimens differ from the figure given by Braun (9) of this species, in the following points:—

I.

Our specimens.

- (a) Fifty-four spines round terminal disc.
- (b) Spines spindle-shaped and straight.
- (c) Two spines, anterior and opposite to each lateral sucker.

II.

Braun's figure.

- (a) Only thirty-two spines shown.
- (b) Spines slightly sinuous.
- (c) Absent.

Only having two specimens, I have not thought it desirable to propose a new species on these minor differences. These variations may occur in this species. The occurrence of this worm in a Teleost is unique and has already been referred to.

Syndesmobothrium filicollis, Linton.

This parasite was obtained from a "Hilsa." As is well known, this fish (*Clupea ilisha*, Day) migrates from the sea up the principal rivers of Bengal in order to spawn. This takes place between August and October. One or more pterocercoid larvæ are frequently found on the mesenteries of each adult

fish. Such cysts have been obtained from Hilsa caught at Monghyr, Buxar, Calcutta and Diamond Harbour. The cysts are usually tadpole-shaped, but a few are strap-shaped. They vary extensively both in size and shape. The strap-shaped examples measured on an average 20 mm. long and 3 mm. broad. The tadpole-shaped cysts measured on an average 30 mm. long. The "head" of the cyst measured 3 mm. by 3 mm. and the rest of the cysts are 1.2 mm. broad. The larva itself is contained in the "head" of the cyst. This species appears to have a very wide distribution and was first described by Linton, who obtained it from a sting ray (*Trygon centrura*) in tropical America. The genus was founded by Diesing. Southwell also recorded it from Ceylon (17) as under:—

" I have no hesitation in referring to this species a number
 " of larval forms obtained from the intestines of *Cybium guttatum*
 " and *Chorenemus lysan*. The head of the larva is squarish in
 " front view, with a bothrium at each corner. The bothridia are
 " oval or cup-shaped. The larva agrees in every detail with
 " Linton's figure of this species, save that in our types the exit
 " of the proboscides were closed. The proboscis sacs were marked
 " with fine criss-cross lines only visible under a high power.

" *Habitat* I. The mesenteries of *Chorenemus lysan*.

" February 25th, 1911; 45 specimens.

" These larvæ were enclosed in tadpole-shaped cysts. The
 " cysts measuring on an average 25 mm. by 2.5 mm. The larva
 " was contained in the head part of the cyst which, in preserved
 " specimens, was of a yellow colour.

" The rest of the cyst was white, membranous and trans-
 " parent. The larvae measured 2 mm. by .5 mm.

" II. The mesenteries of *Cybium guttatum*.

" November 27th, 1910.

" Fifty-five specimens; the same as the preceding. I believe
 " these specimens to be the same as those described by Shipley
 " and Hornell from *Cybium guttatum* in Part V of the Ceylon
 " Pearl Oyster Reports, plate iii, fig. 43. It is interesting to
 " note that Linton states that he has met with encysted forms
 " similar to this (*Syndesmobothrium filicolle*) in various species of
 " Teleostei, such as *Pomatomus saltatrix*, *Cybium regale*, etc.
 " He described one from Spanish Mackerel (*Cybium regale*) in
 " the 'American Naturalist' for February 1887, under the name
 " of *Tetrarhynchobothrium*.

" The occurrence of this larva in these Teleosts raises the
 " question as to the position of this stage in the life-history of
 " the parasite. On the whole I feel confident, and I have every
 " reason to believe, that the larvæ normally inhabit the tissues
 " of either crabs or molluscs, and have their adult stage in some
 " Elasmobranch. The presence of the larvae in these Teleosts is
 " due to their feeding on crabs or molluscs, but the larva does

“ not develop any further in them than in crabs and molluscs.
 “ But if either the fish containing these cysts derived from crabs
 “ and molluscs, or the crabs and molluscs themselves, be eaten
 “ by an Elasmobranch, then, in every case, the larva would attain
 “ the adult form in the Elasmobranchs. The stage found in
 “ these fish is probably not intermediate, but casual and accidental.
 “ These fish are not to be regarded as intermediate but as
 “ accidental hosts.”

Rhynchobothrium sp. ?

A large number of club-shaped Cestode cysts were obtained from *Cybiium guttatum*, Day, caught at Puri in January 1912. They measured 11 mm. long by 3 mm. broad. The smallest measured 6 mm. by 2 mm. This is the same species as that obtained and figured by Southwell from Ceylon waters (17) and from the same species of fish. The larva was also obtained in Ceylon from *Chorenemus lysan*, and was referred to as *Rhynchobothrium*, species I. The bothridia are two in number and are concave. Each bothridium appears to be divided by a faint longitudinal septum into two halves. At the posterior end, each bothridium is indented. The proboscides are coiled. The hooks are all similar and are long and slender, and bent suddenly almost at right angles at their extremity. Ninety-five specimens were collected from Ceylon in February 1911, eighty-six being from *Chorenemus lysan* and nine from *Cybiium guttatum*.

Ligula simplicissima, Rudolphi.

(Pl. vii, figs. 7—8.)

Ligula simplicissima, Diesing.

„ *monogramma*, Creplin.

„ *digramma*, Creplin.

„ *catastoma*, Linton ?

„ *intestinalis*, Linnaeus.

Dibothrium ligula, Donnadieu.

Our examples were taken from the coelom of *Labeo calbasu* caught in a tank at Berhampur Court, Bengal, in September 1912. Five specimens were obtained having the following measurements :—

Specimen.	Length.	Breadth.
I.	22 mm.	8 mm.
II.	30 mm.	7 mm.
III.	43 mm.	10 mm.
IV	145 mm.	8 mm.

The largest specimen fragmented itself during preservation, but it measured over 320 mm. and its greatest breadth was 9.5 mm. These measurements refer to preserved specimens. The average

thickness was approximately 1 mm. This larva is very widely distributed in the coelom of fishes, particularly Cyprinoids. It becomes adult in from one to two days in the intestine of certain water birds, such as those of the genus *Sterna*, *Larus*, *Colymbus*, *Urinator*, etc., which normally devour infected fishes. The adult worm (*Ligula intestinalis*, Linnaeus) sometimes measures 1 metre long and from 5-15 mm. broad, and differs but little from the larval form.

In the Indian Museum there are the following specimens of this larva :—

I. One specimen from *Labeo rohita* (Bengali, *Rohu*), measuring 165 mm. long and 10 mm. broad.

II. One specimen from *Nemachilus rupicola* (Bengali, *Korika*), length 69 mm., breadth 5.5 mm., from a small mountain stream in the East Himalayas.

III. Three specimens with no history having the following measurements :—

(a) Length 147 mm. Breadth 9 mm.

(b) „ 165 mm. „ 10 mm.

(c) (Fragmented). Over 350 mm. long and 9 mm. broad.

The parasite is strap-shaped, and in our specimens the extremities vary considerably in appearance. In three specimens both the anterior and posterior extremities are deeply concave. In the remaining two, the posterior extremity tapers gradually to a rounded point, whilst the anterior extremity is broadly rounded with deep, acute, median indentation. The structure and anatomy of *Ligula catostoma* is described by Linton.

These larval Cestodes form articles of food in Italy where they are sold in the markets as “Maccaroni piatti,” and in southern France where they are sold in the markets as “Ver blanc” and eaten extensively.

TREMATODA.

Isoparorchis, gen. nov.

Leaf-like and translucent worms, longer than broad. Oral and ventral suckers present, the latter being near the anterior extremity. Genital aperture almost midway between the two suckers. Each intestinal ramus in the form of a continuous letter **S** extending to the posterior margin of the worm. Testes in front of germarium, paired and globular, anterior, one on each side and very slightly posterior to ventral sucker. Vitelline glands dendritic and posterior. Germarium single, tubular and posterior. Uterus single, very long, disposed along the laterally directed loops of each ramus of the intestines, passing from one loop on one side to a loop on the other side alternately, across the body of the worm, to a point near the ventral sucker. It then runs straight in the median line to the genital aperture. Shell gland minute, situated at the junction of the uterus with the duct of the vitelline glands. Excretory pore terminal, median and posterior. Vesicle of varying size.

Excretory vessel bifurcating into two lateral branches a little anterior to vesicle, each branch running approximately parallel to the intestinal ramus on its own side. Parasitic in fishes.

***Isoparorchis trisimilitubis*, sp. nov.**

(Pl. viii, figs. 9-11; and pl. ix, fig. 12.)

These Trematodes were first discovered infesting the air bladder of an adult specimen of the Silurid fish, *Wallago attu* (Bengali, *Boali*), caught in a freshwater tank at Bankipur, in March 1912. Since then, large numbers of specimens have been obtained, and every adult fish examined was found to be infected. Immature forms of this parasite have since been noted to occur in the flesh of the Mahseer (*Barbus tor*). Specimens of *Wallago attu* occur extensively in nearly all rivers of North and North-east India, and during the floods their larvae and fingerlings enter the tanks *viâ* the paddy fields. The fish is exceedingly voracious.

The following are the dimensions of a few of the parasites from *Wallago attu* :—

Specimen.		Length.		Breadth.
(a)	..	33 mm.	..	16 mm.
(b)	..	30 mm.	..	20 mm.
(c)	..	35 mm.	..	18 mm.
(d)	..	28 mm.	..	17 mm.
(e)	..	25 mm.	..	13 mm.
(f)	..	26 mm.	..	12 mm.
(g)	..	19 mm.	..	11 mm.
(h)	..	20 mm.	..	9 mm.
(i)	..	19 mm.	..	10 mm.
(j) ¹	..	10 mm.	..	4.5 mm.

The thickness of the largest worm was .9 mm., that of the smallest .2 mm. (approximately). The dimensions and thickness of the worms varied a little according to the degree of contraction.

The parasites were killed in an expanded condition by spreading two drops of spirit over the surface of the body. The worms in every case expanded. When fully expanded, they were plunged into 5 per cent formalin. For the determination of the anatomy, a few specimens were dehydrated, cleared in clove oil, and mounted whole. A few were stained with Delafields Haematoxylin, and others with Borax Carmine. I did not prepare sections, but made careful dissections of the genital organs.

External characters.—The parasites are leaf-like and of a deep flesh-colour, roughly oval in shape, the posterior margin

¹ The smallest specimen obtained.

being broadly rounded and the anterior extremity being produced into a rather long, thickened, acute projection with a rounded extremity. The thickening is apparently due to the presence of the cirrus sac. This projection shows a marked tendency to curve ventrally and assume a position at right angles to the body. The oral sucker is situated somewhat ventrally, at the extreme anterior. In the largest specimen (referred to as *c*) the diameter of the sucker was 7 mm. In the same specimen the ventral sucker was situated 7 mm. from the anterior extremity and had a diameter of 1 mm. with extremely thick muscular walls. The genital aperture is situated midway between the oral and the ventral suckers and had a diameter of .85 mm. The aperture of the excretory apparatus is situated posteriorly and is median. In mature specimens the testes can be seen as opaque milky-white globular bodies, 1 mm. in diameter, situated one on each side, and slightly posterior to the ventral sucker. The vitelline glands are conspicuous as darkish masses aggregated on the posterior dorsal surface and disposed principally round the posterior termination of the two rami of the gut. These two rami stand out prominently as a pair of black sinuous tubes having a diameter of 1 mm., and running from the anterior to the extreme posterior end of the worm, where they terminate blindly. They occupy a considerable part of the middle $\frac{2}{3}$ of the length and breadth of the worm. The uterus is just visible as a delicate sinuous tube starting from the posterior end, running along the posterior laterally-directed loop of one ramus of the intestine, across to the laterally directed loop of the other ramus of the intestine, etc., to the genital aperture. Under magnification the tissue of the parasite presents a granular appearance.

Digestive system.—The mouth is situated at the base of the oral sucker and leads directly into a stout muscular pharynx. The oesophagus is exceedingly short and divides immediately into the two rami forming the intestine. Each branch runs at first straight towards the lateral margin of the worm and, rounding the ventral sucker laterally, runs ventrally to the posterior end in the form of a continuous letter **S**. The two rami do not lie symmetrically. The centrally directed loop of one ramus is situated opposite the laterally directed loop of the other ramus. The disposition of the coils of the uterus round these loops will be noted later. The two rami of the intestine extend to the extreme posterior extremity, where they terminate blindly, close to each other. The wall of the intestine is pigmented with very dark brown, almost black, and is minutely, annularly rugose throughout its length.

Excretory system.—Unless sections are made the gross details of this system cannot be made out, except perhaps in the living worm, and not always then.

The excretory aperture is situated at the posterior margin of the worm and is median. This aperture leads into a more or less globular or cylindrical contractile vesicle. From this vesicle the excretory duct runs forward a little distance and then bifurcates.

The two branches follow the contour of the two rami of the intestine, one on each side, to a point near the ventral sucker, beyond which they could not be traced. The inwardly directed loops of the branches of the excretory duct, however, extend much nearer the median line than do the corresponding loops of the intestine.

Reproductive system: (A) *Male*.—The testes are a pair of opaque globular bodies 1 mm. in diameter, situated one on each side of, and very slightly behind, the ventral sucker, and one testis is slightly anterior to the other. The efferent canals run forward towards the median line of the body where they appear to meet just in front of the ventral sucker. The vas deferens is short. The vesicula seminalis was not clearly made out. As sections were not prepared it was impossible to make out further details.

(B) *Female*.—The germarium is single and is situated posteriorly, and just anterior to the last inwardly directed loop of the right ramus of the intestine, and about 5 mm. from the posterior margin of the worm. It lies transversely as a sinuous tube. The uterus is a very long sinuous tube which first runs along the penultimate laterally directed loop of the right ramus of the intestine. It then runs across the body of the worm and along the penultimate laterally directed loop of the left ramus of the intestine. Then across the body again to the antepenultimate laterally directed loop of the right ramus of the intestine, etc., to the anterior, where it passes dorsal to the ventral sucker, to the genital aperture. The vitelline glands lie on the posterior dorsal surface. They consist of a large number of grape-like follicles connected to a duct which opens to the germarium close to the junction of the germarium with the shell gland. The shell gland is situated close to the junction of the vitelline duct with the uterus.

The recent advances made in parasitic zoology have resulted in the old genus *Distomum* having been split up into over eighty new genera. As far as I have been able to ascertain our specimens are not closely related to any of these genera.

A few specimens of this parasite were found in the flesh of a Mahseer (*Barbus tor*) caught by Capt. Parker, R.A.M.C., Sanitary Officer, Poona (Bombay Presidency), in April 1910, and were sent by him to the Indian Museum. The specimens were afterwards sent to Dr. Lieper of the Tropical School of Medicine, London. A single mounted specimen was retained in the Indian Museum and this I have examined. It measured 8 mm. in length, and the greatest breadth was 4 mm. It was immature.

Capt. Parker states that the parasite in the flesh of the Mahseer was surrounded with black pigment, and that the pigmented area extended to the surface of the skin, thereby suggesting that the parasites had bored their way in. As, however, these worms have no armature, this seems unlikely. Mahseer occur generally throughout India, but are found in greatest abundance, and of largest size, in mountain streams, or in streams which are rocky.

Wallago attu occurs throughout India, Ceylon and Burma. If Mahseer is a normal host of this parasite, then two hosts are now known. The host, or hosts, in which the earlier larval stages, sporocyst, redia and cercaria, occur, have still to be discovered.

Wallago attu is an exceedingly voracious fish and doubtless feeds amongst other species on *Nandus marmoratus*. It is possible that the mature Distomid described from *Wallago attu* may be the adult of the young Distomid described in this paper from *Nandus marmoratus*. The principal and only obvious differences lie in the fact that in the young form of this worm the gut is not sinuous, but this may become so when the parasite becomes adult. In that case the Mahseer (*Barbus tor*) becomes a collateral host only.

An immature Trematode from the ovaries of *Nandus marmoratus*, Ham. Buch.

“*Distomum*” sp.

(Pl. ix, figs. 13—14.)

During the examination of a number of specimens of *Nandus marmoratus*, Ham. Buch., a freshwater fish seldom exceeding 7 inches in length, from the Bhagirathi river at Berhampur Court, Bengal, India, on June 30th, 1912, large numbers of immature Trematodes were discovered parasitic in the ovaries.

No examples were found in the male fish examined, the parasites being limited entirely to the females. This fish spawns in the various rivers beyond tide-marks, between the middle of June and the middle of August. The diameter of the eggs is approximately 5 mm. The parasites were found adherent by their ventral sucker to the eggs of the fish. Not more than one parasite was found attached to each egg, and roughly, not more than 10 per cent of the eggs were affected. The parasites were not easy to detect, being of exactly the same colour as the eggs of the fish, viz. yellowish brown. Other specimens of the parasite were found attached to the mesentery and to the stroma framework of the ovary. There can be no doubt but that such eggs as are attacked by this parasite are eventually destroyed, and it appears probable that the output of eggs is thus decreased by approximately 10 per cent. Infection appears to be highest when the eggs of the fish are almost ripe, and this serves the double purpose of providing a maximum of food for the parasite, as well as ensuring its protrusion and liberation with the ripe eggs. Opportunity is thus afforded the parasite of finding its final host and maturing therein.

Description of the parasite.

Length of the longest specimen	..	4 mm.
Length of the smallest specimen	..	2·8 mm.
Breadth of the longest specimen	..	1·3 mm.
Breadth of the smallest specimen	..	1 mm.

The body is superficially divided into two parts. The anterior $\frac{1}{3}$ th is subglobular and the posterior $\frac{2}{3}$ ths is flat and leaf-like. They

vary slightly accordingly to the degree of contraction during preservation. The ventral surface is slightly concave and the dorsal surface convex. The curvature is usually greatest towards the anterior extremity. At this extremity there is placed terminally, a slightly muscular sucker, .4 mm. in diameter, at the base of which the mouth is situated. Owing to the curvature of the animal this sucker appears subventral rather than terminal. On the ventral surface, anteriorly, there is a second larger and more muscular sucker, having a diameter of .6 to .7 mm. and situated so that the centre of the sucker lies midway between the two superficial divisions of the body. Granular depositions occur in the skin. Anteriorly these are arranged in discontinuous concentric bands, whilst more posteriorly they become irregular, and are often concentrated at the lateral margins. The digestive apparatus represents all that is developed of the internal anatomy. As we have seen, the mouth is situated at the base of the anterior sucker. It leads into an extremely short oesophagus, and this divides immediately into the gut, which consists of two simple undivided branches running along the sides of the animal to the extreme posterior end. No pharynx was present. The two lateral branches, or rami, of the intestine are discernible to the naked eye, as broad thickened patches of a yellow colour, forming nearly the entire body of the animal. Under magnification, the walls of the intestine are seen to be puckered. Posteriorly, the two branches terminate blindly. No trace of either the reproductive or excretory system was discernible even under high magnification.

This species, which being immature, cannot at present be determined, bears a general resemblance to an immature *Distomum* obtained and figured by Linton (1) from two species of Dolphin, viz. *Coryphaena hippurus* and *Coryphaena equisetis*, common in American waters. He refers to this parasite (without naming it) as under:—

“Dimensions in millimeters, slightly compressed. Length 3.35. Diameter anterior 0.11, at ventral sucker 0.33, nearly uniform to posterior end. Oral sucker 0.10, breadth 0.08, ventral sucker circular 0.24 in diameter. These specimens are immature. There is no pharynx. The oesophagus is slender. The intestinal rami begin in a convoluted mass slightly in front of ventral sucker, and continue to the posterior end, being voluminous and apparently irregularly constricted, so as to present the appearance of a series of translucent bodies filling the post-acetabular region of the body. The intestines are filled with structureless seemingly colloid material. No trace of genitalia could be made out in any of these distomes. While they are immature there should be no difficulty experienced in recognizing these peculiar forms.”

Our species thus differs from Linton's in being much broader and in having larger suckers. His were marine, ours are freshwater. Young forms of different species are, in all probability, very similar. It seems likely that in spite of the general resemblance of Linton's species to ours, they are different. The occurrence of

his specimens, however, in a Dolphin, which had fish in its stomach, seems to indicate that his form had been derived from fish, and that the worm had either not had time to develop in the Dolphin, or that it did not do so in that host. The condition described by Linton would find a parallel here in the stomach of any predaceous animal (such as *Wallago attu*) which might eat the eggs, or the mature female of *Nandus marmoratus*. The only other form, which, as far as I have been able to ascertain, resembles our species is a larva of *D. variegatum* figured by Dr. A. Looss (2). The differences between the two are that our specimens are twice as large, and that the ventral sucker is more anterior in ours than in that figured by Looss. Looss's examples were from the lung of a frog. The life-history of the worms constituting the genus to which our young specimens belong is extraordinarily complicated. Two examples briefly outlined will serve to indicate this fact and will also illustrate how difficult it is to determine young forms.

I. There occurs in Europe a Trematode belonging to the genus *Gasterostomum*. The eggs liberated from this worm have their first larval stages in certain mussels (*Anodonta*). In this host the larvae develop into sporocysts, and redia, and cercaria are eventually formed. If infected mussels are eaten by *Belone vulgaris* (a Gar fish) the cercaria develop into young Trematodes. *Belone vulgaris* has finally to be devoured by a Dogfish or Ray before the young worms become adult.

II. Again the disease known in Europe as liver-rot in sheep is caused by a worm (*Distomum hepaticum*) of the same genus as the larvae described from *Nandus marmoratus*. The eggs from the worm causing liver-rot are liberated with the faeces of the sheep, and these attack a small snail (*Limnea truncatula*). The earlier larval, sporocyst and redia stages are passed in the tissues of the snail. The resulting cercaria leave the snail and encyst on the grass. In this condition they are again eaten by sheep and the life cycle recommences. In the case of *Distomum hepaticum* the earlier larval, sporocyst, redia, and cercaria stages all develop in one host, whilst in the case of the *Gasterostomum* already cited, the preceding stages are distributed between two hosts, namely mussels and the Gar fish.

In the case of the young worms under consideration, the earlier larval, sporocyst, redia and cercaria stages have already been passed through. These stages, or part of them, are possibly passed in the snail *Vivipara bengalensis* which occurs abundantly along the banks of most rivers in Northern India. These must needs be eaten by the fish *Nandus marmoratus* before the young forms develop. The young worms are apparently liberated with the ripe eggs of the fish. These eggs are extensively devoured by frogs and voracious fish, and it seems likely that the adult worm occurs in such an host. A limited investigation of about 60 frogs found on the banks of the Bhagirathi yielded no result, and up to the present, other probable hosts have not been examined. Linton's young *Distomum*, referred to above, was apparently from

the stomach of the Dolphin, and the Dolphin had been feeding on fish as was shown by the stomach contents. The young form might not develop into an adult in the Dolphin, as nearly every parasite has its particular host.

***Allocreadium annandalei*, sp. nov.**

(Pl. ix, figs. 15—16.)

A large number of specimens of this Trematode were obtained from the stomach of a specimen of *Rhynchobatis djeddensis* measuring 5 feet, caught in Portugal Bay, Ceylon, on February 2nd, 1911. The parasites were cylindrical in shape, slightly flattened dorso-ventrally and measured on an average 13 mm. in length (alcoholic specimens) and 3 mm. in breadth. The oral sucker is situated .5 mm. from the anterior end and is subventral. The ventral sucker is situated 5.5 mm. from the anterior extremity and is raised above the general surface of the worm. The diameter of both suckers is 1.1 mm. and each sucker is very strongly developed. The genital aperture is situated nearer the oral than the ventral sucker, and is so minute that it cannot be seen except in sections. The excretory aperture is situated at the posterior extremity, which is pointed. The portion of the worm anterior to the oral sucker is flattened dorso-ventrally, and is also pointed. The external surface of the worm is marked by a series of both annular and discontinuous concentric rings.

Viewed *in toto*, cleared in clove oil, the edges of the worm appear serrated. No spines, however, are present, the spinose appearance being due entirely to the wrinkled cuticle. The muscular system is strongly developed, the thickness of the muscular wall of the body being .3 mm. in spirit specimens.

Digestive system.—The mouth is situated at the base of the oral sucker, and leads directly into a strong muscular pharynx. The two rami of the intestine immediately succeed the pharynx and run laterally close up to the body-wall, to the extreme posterior end.

Reproductive system.—There are a pair of large testes, situated one in front of the other, at the extreme posterior end. They each measure roughly 1.4 mm. long and are squarish or oblong in shape and flattened dorso-ventrally. The vas deferens consists of a pair of extremely delicate tubes running laterally (one on each side) to a point just dorsal to the anterior rim of the ventral sucker, where they unite and open into the cirrus sac. This is large, muscular and conspicuous.

The cirrus is an irregularly coiled organ lying midway between the cirrus sac and the large seminal vesicle. The seminal vesicle abuts on the pharynx.

The ovary is single and is situated just in front of the testes in the middle line, 4.5 mm. from the posterior end. Between the ovary and the testes is the shell gland. The uterus is a coiled tube lying

between the ovary and the ventral sucker. Portions of the uterus extend forward on each side of, and dorsal to, the ventral sucker, and it eventually opens at the genital pore. The vitteline glands consist of a series of grape-like follicles, situated laterally between the ventral sucker and the extreme posterior end. The ducts connecting the follicles are clearly visible. In cross sections, the vitteline glands seem to be sunk in the muscular body-wall, and when this wall is removed the vitteline glands come away with it. The main ducts of the vitteline glands run transversely, one on each side, and, uniting in the middle line, open at the junction of the shell gland and the germarium, 4.4 mm. from the posterior extremity of the worm.

Excretory system.—As sections were not made, no details of this system could be made out.

Habitat.—The stomach of *Rhynchobatis djeddensis*. Sixty-seven specimens. Pearl Banks, Ceylon. February 2nd, 1911.

This species appears to fall naturally into the genus *Allocreadium*, Looss, of which the type species is *Distomum isoporum*, Looss. I have pleasure in naming my specimens in honour of Dr. Annandale, Superintendent of the Indian Museum.

PROVISIONAL DESCRIPTION OF A NEW GENUS AND SPECIES OF
TREMATODE.

Cylindrorchis, gen. nov.

Body cylindrical. Oral and ventral suckers present, the latter being situated near the anterior extremity. Genital pore minute and situated immediately posterior to oral sucker. Intestinal rami in form of a continuous letter **S** and extending to the posterior end. Testes in front of germarium. The former are paired, cylindrical, thick, conspicuous, bent in the form of the letter **S**. They extend, one on each side, from the anterior margin of the ventral sucker to a point one-third the length of the worm from the posterior end. Germarium and shell gland single, median, and situated immediately behind posterior limit of testes. Uterus coiled and lying for the most part behind the germarium. Vitteline glands aggregated into two main masses, lateral to the germarium, and situated on the loop of the intestine, one mass on each side. Excretory pore median, terminal, posterior.

The character of the testes indicates that this genus has no close relationship with any other known genera.

Parasitic in fishes.

Cylindrorchis tenuicutis, sp. nov.

(Pl. x, figs. 17—18.)

During the examination of a number of specimens of *Tetrodon stellatus*, caught on the Ceylon Pearl Banks in 1911, a few Trematodes were found in the air-bladder. In every case where these Trematodes were obtained, the air-bladder was found to be full of a

black shihy substance having the consistency of wet clay. It is possible that this substance represents decomposed blood, the exudation of blood into the air-bladder being caused by the sucking action of the parasite. Unfortunately a sample was not kept for examination. The parasites lay embedded in this mass and measured 16 mm. long and 5.5 mm. broad. In shape they were cylindrical. The oral sucker is terminal and subventral. The ventral sucker is situated 3.5 mm. from the anterior extremity. Both suckers have a diameter of .8 mm., and are but feebly developed. The most remarkable feature of this parasite is the almost entire absence of muscles from the body-wall, the various organs being encased in an exceedingly thin diaphanous transparent cuticle. This circumstance is to be correlated with the habits of the parasite, living as it does in a medium where movement is well nigh impossible. The mouth is situated at the base of the oral sucker. This leads directly into a muscular pharynx. The oesophagus is very short. The two rami of the intestine are large sinuous tubes having a diameter of 1.1 mm. and being usually filled with a dark brown material apparently derived from the medium in which they live. Both rami of the intestine run to the extreme posterior end, where they terminate blindly.

As only a very few specimens of the parasite were obtained, it was found impossible to satisfactorily make out, with *certainly*, the precise details of the reproductive system. I am therefore not certain that the following description is absolutely correct in every detail.

The genital pore is minute and is situated ventrally, immediately posterior to the oral sucker.

The testes are a pair of very large, sinuous, cylindrical bodies situated one on each side, and extending to a point about 6 mm. from the posterior extremity. Anteriorly, each gives off a vas deferens, and these unite in the middle line. The cirrus is bent upon itself. The main mass of the vitteline glands is aggregated over a loop of the intestine, one mass on each side, immediately behind the termination of the testes. The main ducts run transversely, towards the median line, and open at the junction of the ovary and shell gland. These latter organs are situated close together, in the middle line, about 5 mm. from the posterior extremity, the shell gland being posterior to the ovary. The uterus is a coiled tube. For the first part of its length it lies posterior to the ovary, and then runs forward, sinuously, in the middle line (anterior to the ovary) to the genital pore.

The excretory pore is terminal, but no details of this system could be made out.

“ *Distomum* ” sp. ?

(Pl. x, fig. 19.)

Four specimens of an immature species of “ *Distomum* ” were obtained from the intestine of *Ophiocephalus striatus*, the same

specimen of fish in which were found specimens of *Ophryocotyle bengalensis*, n. sp. and *Bothriocephalus* (*Anchistrocephalus*) *polyptera* (Leyd.). They measured 9 mm. long and were club-shaped. The breadth at the posterior is 2.5 mm. and at the anterior extremity 1 mm. The oral sucker is .6 mm. in diameter. The ventral sucker is situated 4 mm. from the anterior extremity and has a diameter of .85 mm. The pharynx is small and no oesophagus is present. The two rami of the intestine are sinuous, terminating blindly at the posterior extremity. The inwardly directed loop of one ramus of the intestine is situated opposite to the laterally directed loop of the other ramus. Reproductive organs were not developed. It is impossible at present to identify this immature form, but it bears a strong resemblance to the immature form of *Isoparorchis trisimilitubis*, n. sp., obtained from the muscles of the Mahseer (*Barbus tor*) and already described.

Anaporrhutum largum, Lühe. (5)

This Trematode was first obtained by Prof. Herdman in Ceylon from the coelom of *Rhinoptera javanica*. He only obtained a single specimen. Large numbers of this species have since been obtained by Southwell in Ceylon, from the coelom of *Chiloscyllium indicum*, *Ginglymostoma concolor* and *Aetobatis narinari*.

A species of *Anaporrhutum* was also obtained by Dr. Jenkins from the coelom of *Stegostoma tigrina*, caught off the Orissa coast on December 15th, 1910.

It differed from the Ceylon specimens of this species in the following points :—

<i>Orissa specimens.</i>	<i>Ceylon specimens.</i>
(a) Leaf-like in outline.	(a) More circular in outline.
(b) Internal wall of the gut thrown into steep ridges.	(b) Ridges not well marked.

Besides the preceding points the testes and vitteline glands in the specimens collected by Dr. Jenkins were but feebly developed. At first, this seemed a striking difference, but I am inclined to think that the species are the same in spite of the differences named.

The three species of *Anaporrhutum*, viz. *A. largum*, *A. albidum* and *A. richiardi*, appear to be widely distributed amongst Elasmobranchs in Indian waters.

Anaporrhutum albidum, Ofenh.

Large numbers of this Trematode were obtained in 1911 from the surface of the liver of a *Chiloscyllium indicum*, caught on the Ceylon Pearl Banks. They differed from Ofenheim's description and figure (7) in (i) having the ventral sucker much larger than in Ofenheim's specimens and (ii) in having the testes less scattered. This latter fact may, however, be due to the testes not being

fully developed in our specimens. Ofenheim's specimens were from *Aetobatis narinari*.

Anaporrhutum richiardi, Lopez. (7).

About six specimens of this Trematode were obtained from the surface of the liver of *Aetobatis narinari*, caught on the Ceylon Pearl Banks in 1911.

Cricocephalus resectus, Looss. (3).

Three specimens of this Trematode were obtained from the intestine of the land tortoise, *Testudo elegans*, caught in Ceylon in 1911. Although this parasite was obtained from a tortoise, and not from a fish, the opportunity is here taken of recording it.

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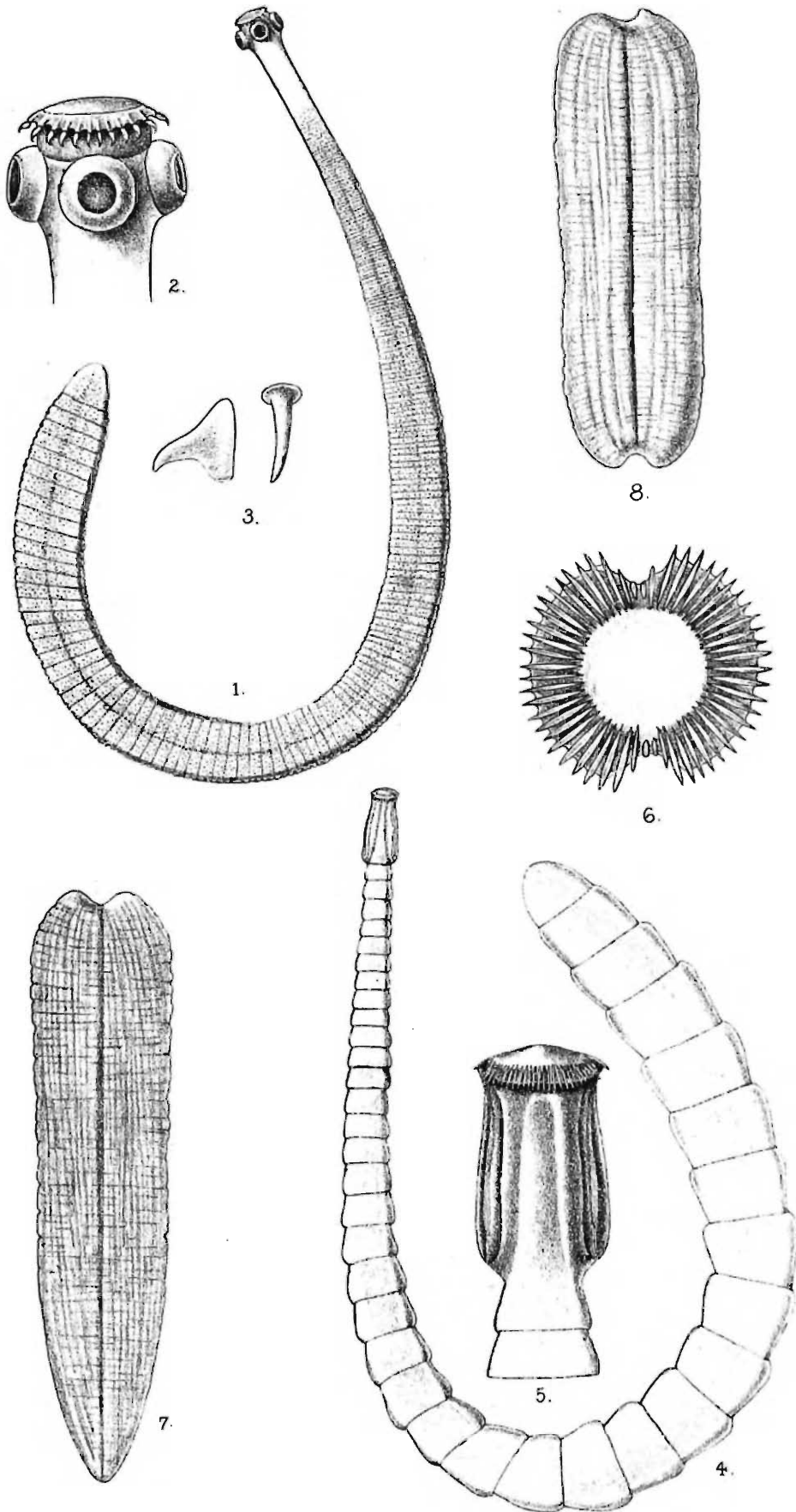
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EXPLANATION OF PLATE VII.

- FIG. 1. *Ophryocotyle bengalensis*, n. sp. Entire worm, $\times$ about 30.
- „ 2. Scolex of same. Magnified about 100.
- „ 3. Perirostral spines. Greatly enlarged.
- „ 4. *Bothriocephalus* (*Anchistrocephalus*) *polyptera* (Leyd.). Entire worm, $\times$ about 18.
- „ 5. Scolex of same, $\times$ 75.
- „ 6. View of anterior end of scolex, $\times$ about 140.
- „ 7. *Ligula simplicissima*, Rudolphi. Showing pointed posterior extremity, $\times 2\frac{1}{2}$.
- „ 8. Another specimen of same showing concave anterior and posterior extremities, $\times 2\frac{1}{2}$.



D. Bagchi, del.

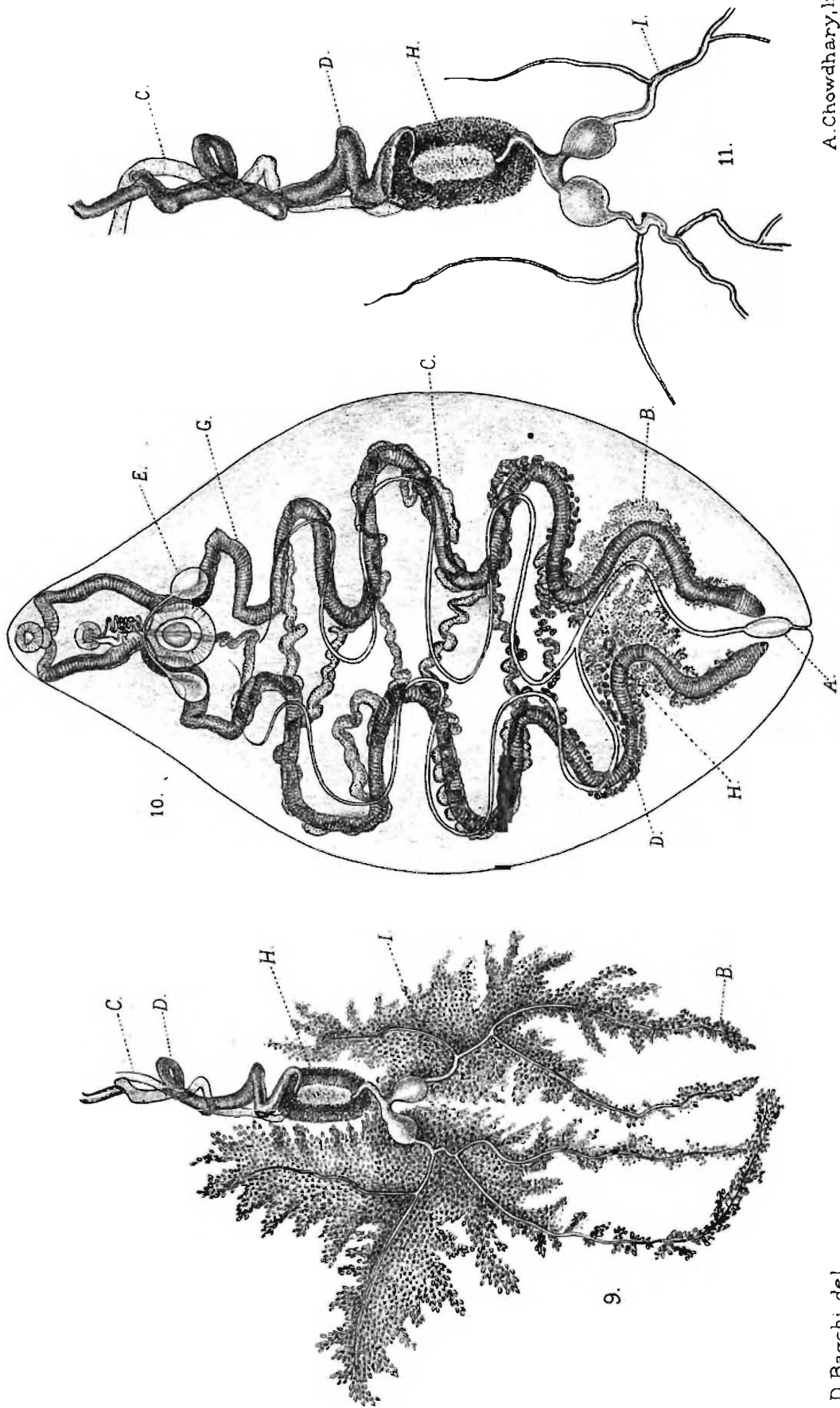
A. Chowdhary, lith.

EXPLANATION OF PLATE VIII.

- FIG. 9. *Isoparorchis trisimilitubis*. Genital organs, $\times$ about 100.
,, 10. Animal entire; from ventral surface, cleared in clove oil, $\times$ 4.
,, 11. Genital organs of same, $\times$ about 150.

EXPLANATION OF LETTERING.

A. Excretory vesicle.	E. Testes.
B. Vitteline glands.	G. Intestine.
C. Uterus.	H. Shell gland.
D. Germanium.	I. Ducts of vitteline glands.



A. Chowdhary, lith.

PARASITES OF INDIAN FISH

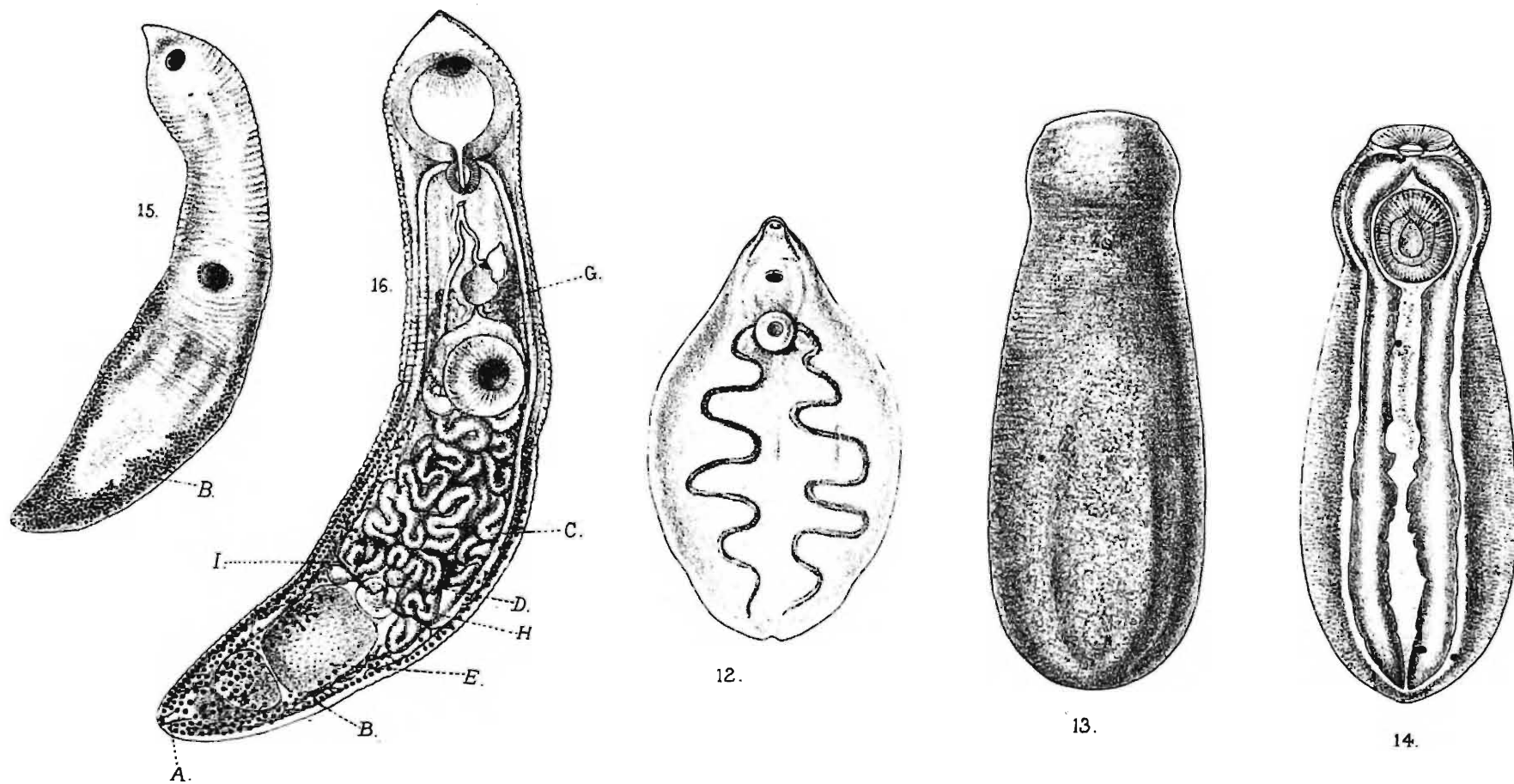
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EXPLANATION OF PLATE IX.

- FIG. 12. *Isoparorchis trisimilitubis*, n. sp. Animal entire, from ventral surface, $\times 2$.
,, 13. '*Distomum* sp.' Dorsal view, $\times 20$.
,, 14. Same, ventral view. Cleared in clove oil, $\times 20$.
,, 15. *Allocreadium annandalei*, n. sp. Entire worm, $\times 7$.
,, 16. Same. Compressed, and cleared in clove oil, $\times 10$.

EXPLANATION OF LETTERING.

- | | |
|-----------------------|-------------------------------|
| A. Excretory vesicle. | E. Testes. |
| B. Vitteline glands. | G. Intestine. |
| C. Uterus. | H. Shell gland. |
| D. Germarium. | I. Ducts of vitteline glands. |



D. Bagchi, del.

PARASITES OF INDIAN FISH.

A. Chowdhary, lith.

EXPLANATION OF PLATE X.

- FIG. 17. *Cylindrorchis tenuicutis*, n. sp. Entire worm, $\times 7$.
„ 18. Same. From a dissection, $\times 7$.
„ 19. '*Distomum* sp.' Entire worm, $\times 9\cdot5$.

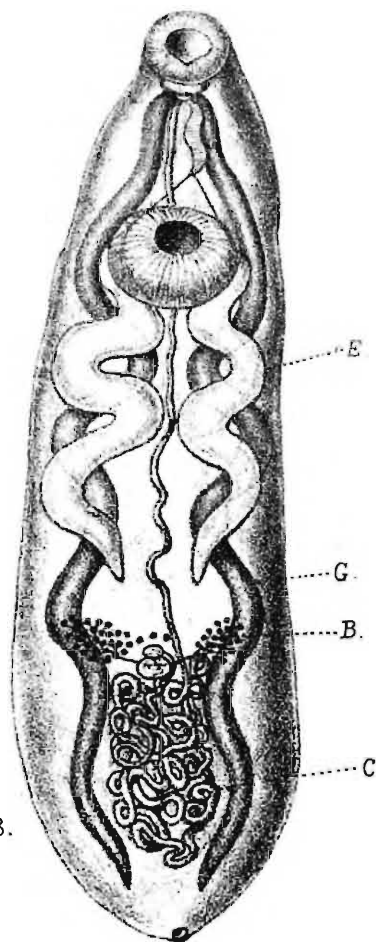
EXPLANATION OF LETTERING.

B. Vitelline glands.
C. Uterus.

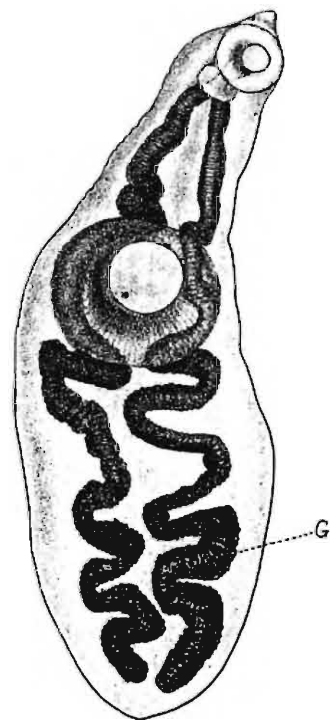
E. Testes.
G. Intestine.



17.



18.



19.

A. Chowdhary, del et lith.

PARASITES OF INDIAN FISH

VII. CRYPTOSTOMES FROM THE INDIAN MUSEUM

By S. MAULIK, F.E.S.

The present paper is based on a collection of Hispinae and Cassidinae belonging to the Indian Museum. The list contains 38 species of Cassidinae and nine of Hispinae. One new form and two new varieties of Cassidinae have been described. In many cases the generic position of previously described species has been changed. Full notes regarding variation and geographical distribution have been added.

The work has been done in the Zoological Laboratory of Cambridge University. To Professor Gardiner and Mr. Scott my thanks are due for encouragement and much assistance. I wish to express my obligations to the British Museum authorities for kindly allowing me access to the reserve collections. My acknowledgments are also due to the Indian Museum authorities for kindly sending this collection to me at Cambridge.

Fam. CHRYSOMELIDAE.

CASSIDINAE.

Genus *Calopepla*, Hope.

1. *Calopepla leayana*, Latr.

Boh., Mon. Cassid., 1850, vol. i, p. 9.

Fifty-four examples in the collection.

Localities.—Sikkim; Dam Dim; Assam; Naga Hills; N.E. Frontier; Pashok, 2800 ft., Sikkim, 13-ix-1909; Cheerapunji, Khasi Hills; Darjiling, 8000 ft., E. Himalayas; Sadon, Myitkyina district, U. Burma, 2500-3500 ft., May 1911 (*E. Colenso*); Calcutta, July; Tezpur, Assam.

There is one specimen from Poona with the following note: “(*F. Gleadow*) feeds on the leaves of shivan tree, *Gmelina arborea*, 26-ix-1893.”

From these localities it may be concluded that its range is more or less the Eastern Himalayan and sub-Himalayan region. Its occurrence in Poona is interesting.

This species varies a great deal in colour. The prothorax varies between light yellow and very dark brown. The elytra are greenish bronze with a bluish violet margin. This latter colour may spread over the whole elytra. The colour of the underside and legs, except the tarsi which are dark, is always that of the

prothorax. Another form of elytral colouring may be differentiated in which there is a predominance of the bronze over the green. It may be noted that the four specimens from Poona in the collection have this shade.

Genus *Epistictia*, Boh.

The genus *Epistictia* was erected by Boheman in 1850 for the reception of three species, viz., *selecta*, Boh., *viridimaculata*, Boh., and *matronula*, Boh. The first two were from Nepal and the third from Ceylon. In 1863 (Journ. of Ent., ii, pp. 7, 8) Baly described two species, viz., *perplexa*, Baly, and *parryi*, Baly, also from the Oriental region. These two, however, were sunk by Weise into varieties of *viridimaculata*, Boh. (Deutsch. Ent. Zeitschr., 1897, p. 99). T. Kirsch published a description of a new species closely allied to *viridimaculata*, Boh., which he named *marginata*, from Malacca (Mitt. Mus. Dresd., i, p. 56, 1875). Outside the Oriental region a species was discovered in East Africa which Linell named *quadripunctata* (Proc. U.S. Mus., xviii, p. 696, 1896). I have seen two specimens in the collection of the British Museum (Natural History) named *inornata* by Waterhouse collected from Lake Nyassa (Cist. Ent., ii, p. 229). Altogether, therefore, there are only six species belonging to this genus hitherto known excluding the two species described by Baly and subsequently sunk by Weise.

Antenna gradually thickens towards the apex, first joint longer than the second; the second joint rounded; last joint bluntly pointed.

Prothorax slightly narrower than elytra, widely emarginate at apex, lateral margins slightly reflexed, base bisinuate on both sides, posterior angles acute.

Scutellum shorter than its breadth, apex rounded.

Elytra punctate.

Underside.—First abdominal segment produced in the middle into a pointed process which meets the metasternum between the hind coxae. Prosternal process expanded apically with bluntly triangular apex.

The genus is a natural one. Insects of other genera cannot be placed in it by mistake. A Cassidid from the Oriental region, in which the head, viewed dorsally, is not completely concealed under the prothorax, might belong to any of the following four genera: *Calopepla*, *Epistictia*, *Hoplionota*, *Prioptera*.

A table will easily distinguish them thus:—

A. Body oblong or oblong-ovate.

a. Prothorax much narrower than elytra and with strongly reflexed margin

Calopepla.

a¹. Prothorax only slightly narrower than elytra and with slightly reflexed margin

Epistictia.

A¹. Body sub-quadrate or rotundate.

b. Antennae clubbed

Hoplionota.

b¹. Antennae subfiliform

Prioptera.

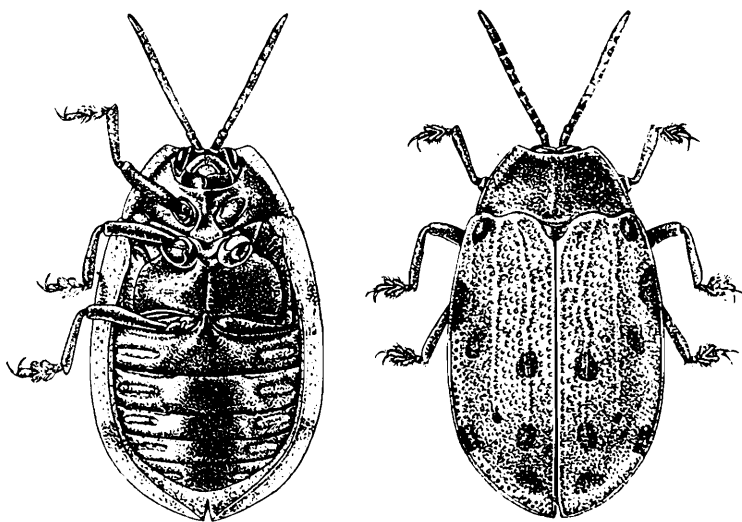
2. *Epistictia fulvonigra*, n. sp.

Oblong-ovate, slightly narrower in front; antennae black; prothorax coarsely punctate, black, the reflexed margin of prothorax fulvous; scutellum black shining, apex rounded; elytra dark orange-brown, sub-nitid, eight black spots on each elytron; underside and legs black and shining. Length 11 mm. (from head to apex of elytra); greatest breadth across abdomen 6.5 mm.

Locality.—Upper Shan Hills, Upper Burma (J. C. Brown).
Described from one example.

Type in Indian Museum, Calcutta.

Fuller description.—The colour and markings are completely different from all other species of the genus.



Epistictia fulvonigra, n. sp., $\times 4$.

Head not very much projecting; rugose, coarsely punctate, depressed between the bases of antennae; black, with a small rufescent area in the middle of the front, and rufescent colour extending outwards from below the base of each antenna; labrum rufescent, especially at the base; antennae black, four basal joints finely punctate, rest of the joints finely striated; eyes oblong, moderately convex.

Prothorax black, with the reflexed lateral margin fulvous and the anterior margin narrowly fulvous; widely emarginate at apex, considerably narrowed in front with sides very slightly curved, bisinuate on either side at base which is almost as broad as that of the elytra, anterior angles obtuse and posterior angles acute; base in front of the scutellum thickened, shining and impunctate; an impunctate, shining line runs down the middle of disc up to the apex; centre of disc more finely punctate, towards the sides punctures become coarser and run into each other, forming rather deep pits.

Scutellum shorter than breadth at base, sub-quadrate, almost straight at base, apex rounded, lateral margins very slightly reflexed towards base, basal angles very acute; impunctate, black, shining.

Elytra dark orange-brown, coarsely punctate, two shining ridges run down each elytron, that closer to the suture covers about two-thirds or a little more of the length of the elytron, and is longer than the second ridge which ends at the middle. Margins slightly explanate. There are eight black spots on each elytron disposed as follows:—one on the humeral callus which is prominent, shining and impunctate; on the line of the first elytral ridge (that nearer the suture) three spots, one just beyond the middle, the second at the point where the ridge ends, the third beyond this point on the sloping apical portion of the elytron; there is a very small and almost obsolete spot at the point where the second (outer) ridge ends, and a large spot at about the middle of the elytron just outside this ridge; finally there are two on the explanate margin, one behind the humerus, the other about one third the length of the margin from the apex at the point where the margin curves inwards to the apex.

Underside.—Black shining; apex of prosternal process, inner side of middle and hind coxae, apices of tibiae, lobes and claws of tarsi, diluter, more or less rufescent; underside of prothoracic and elytral margins reddish-brown, the elytral marginal black spots showing. First abdominal segment produced in the middle into a pointed process which meets the metasternum between the hind coxae. Prosternal process margined at the sides, expanded apically, with bluntly triangular apex.

On either side of each abdominal segment is a slightly raised transverse (1 mm.) ridge surrounded by a depression; these ridges are not black, but reddish in colour.

Tarsus covered with brownish pubescence on the underside.

3. *Epistictia viridimaculata*, Boh.

Boh., Mon. Cassid., 1850, vol. i, p. 15.

There are twenty examples in the collection, all of which except three are from Sikkim.

Localities.—Mungphu, Sikkim; Ukhrul, Manipur, 6400 ft., (*Rev. W. Pettigrew.*); Perak; Upper Tenasserim.

The colour varies from rufo-testacea to very dark red brown, almost obscuring the elytral spots.

Var. *trivandrumensis*, n. var.

One example from Trivandrum has the prothorax completely yellow without any trace of the bronze-greenish spots. All the specimens I have seen have at least a trace of them and the prothorax is never yellow. It is, therefore, a definite variety.

Genus **Prioptera**, Hope.4. **Prioptera westermanni**, Mannerh.

Boh., Mon. Cassid., 1850, vol. i, p. 45.

Six examples.

Localities.—Myawadi, Burmo-Siamese Frontier, Amherst district, 900 ft., 24—26-xi-1911 (*F. H. Gravely*); Shan Hills, Upper Burma (*J. C. Brown*); Assam.

5. **Prioptera impustulata** (Mannerh.).

Boh., Mon. Cassid., 1850, vol. i, p. 46.

Two examples.

Localities.—Calcutta, Nov. 18; Upper Tenasserim.

6. **Prioptera maculipennis**, Boh.

Boh., Mon. Cassid., 1850, vol. i, p. 50.

Five examples.

Localities.—Dekhut Bhuli, Nepal Terai, 30-iv-1907; Assam-Bhutan Frontier, Mangaldai district, N.E., 26-xii-1910 (*S. W. Kemp*).

7. **Prioptera io-pustulata**, Boh.

Boh., Mon. Cassid., 1850, vol. i, p. 55.

One example.

Locality.—Misty Hollow, Dawna Hills, 400-2400 ft., 22—30-xi-1911 (*F. H. Gravely*).

8. **Prioptera decimmaculata**, Boh.

Boh., Mon. Cassid., 1850, vol. i, p. 60.

Nineteen examples.

Localities.—Siliguri, base of E. Himalayas, 1-vii-1906; Sikkim, E. Himalayas; Dam Dim, base of E. Himalayas; Cachar; Shillong, Assam Hills, 5000 ft.; Naga Hills; Sibsagar, Assam.

There is a certain amount of variation in this species. It chiefly consists in the colour which varies between light yellow and dark brown. The ultimate joints of the antennae are not always black. The spots on the thorax and elytra are fairly constant in size.

P. pallidicornis, Boh. and *P. decemsignata*, Boh. are the same as this species.

9. **Prioptera multiplagiata**, Wagn.

Wagner, Mitt. Münch. Ent. Ver., v, p. 26.

There are seven examples, all from the Andaman Islands, including two specimens of one variety. In this variety one half of the elytra is covered with a black patch, which proceeds diagonally from the humerus up to the point where the explanate margin

begins to bend towards the apex of the elytra, and here it broadens and meets a similar patch on the other elytron, at the suture, and also covers laterally a little of the explanate margin.

10. *Prioptera nigricornis*, Baly.

Jour. of Ent., 1863, vol. ii, p. 9.

There is only one example of a variety of this species from Sadon, Myitkyina district, Upper Burma, 2500-3500 ft., May 1911 (*E. Colenso*).

Genus *Aspidomorpha*, Hope.

11. *Aspidomorpha miliaris* (Fab).

Boh., Mon. Cassid., 1854, vol. ii, p. 261.

Ninety-one examples.

Localities.—Calcutta; Malda, E. Bengal; Shillong; Mungphu, Sikkim; Darjiling; Ranchi (*Irvine*); Mysore, S. India; Bangalore (*Cameron*); Tenasserim, June, 1889; Sibsagar, Assam; Perak; Andaman Islands; Sadon, Myitkyina district, Upper Burma, 2500-3500 ft., April-May 1911 (*E. Colenso*); Nilgiri Hills; Pegu, Burma; Tavoy; Sibui, Sarawak, 2-vii-1910 (*Beebe*). It has also been recorded from Java.

Range.—From the above localities it appears that this insect has a wide distribution in the Oriental region. In India it extends from Darjiling to Mysore, South India. It ranges from Upper Burma to Borneo. It has also been taken in the Andaman Islands. It occurs at an altitude of 8000 ft. (Darjiling). In the plains also it thrives well as a great number of specimens has been collected from Calcutta and the Malda district.

Variation.—Variation in this species is mainly confined to the elytral spots and markings. Size and colour vary, but not to such an extent as do the markings. The variation of the latter is so gradual that it is difficult to describe any definite variety. From a specimen where the spots and markings are bold and prominent, they can be traced down to one on which they are almost obsolete. Five examples from Sadon, Upper Burma, exhibit this character, they are also very light in colour.

Notes.—In the Indian Museum it has been bred on *Convolvulus*, July 7th, 1886; on another specimen the following notes occur:—"Larvae received Dec. 1887; Pupae Jan. 13th, 1888; Imago Feb. 1888. E. C. C." The label of another specimen records the following note:—"Convolvulus pest. Eggs. 7-viii-86, emerged 29-vii-86 (*J. H. Jackson*)."

12. *Aspidomorpha fusconotata*, Boh.

Boh., Mon. Cassid., 1854, vol. ii, p. 279.

There is one example from the Philippine Islands. Boheman records it also from India Orientalis.

13. *Aspidomorpha St. crucis* (Fab.)

Boh., Mon. Cassid., 1854 vol. ii, p. 287.

One hundred and thirty-six examples.

Localities.—Calcutta; Sukna, E. Himalayas, 500 ft., 2-vii-1908 (*Annandale*); Kurseong, 5000 ft., E. Himalayas, 13—16-vii-1907; Sikkim; Dam Dim; Tindharia, E. Himalayas, 2822 ft.; Shillong, Assam Hills; Berhampur, Bengal; Siliguri, N. Bengal, 18—20-vii-1907; Birbhum, Bengal; Saraghat, N. Bengal; Darjiling, E. Himalayas, 8000 ft.; Cachar (*J. Wood-Mason*); Sibsagar, Assam; Dikrang Valley (*H. H. Godwin-Austen*); Buxa; Pegu, Upper Burma; Garo Hills, Assam; Tenasserim; Wynad, N. Malabar; Bangalore, S. India; Trivandrum, S. India; Shan Hills, Upper Burma (*J. C. Brown*); Is. Elephanta (?). Between Tengyueh and Tali-Fu, Yunnan, W. China, 1909-10 (*J. C. Brown*).

Range.—Bengal, Assam, Upper Burma and S. India. It occurs on the hills (8000 ft.) as well as in the plains.

14. *Aspidomorpha dorsata* (Fab.)

Boh., Mon. Cassid., 1854, vol. ii, p. 296.

Fourteen examples.

Localities.—Sibsagar, Assam; Dam Dim; Perak; Naga Hills (*Capt. Butler*); Sinkip Island; Sikkim; Khulna, E. Bengal, 9-viii-1907 (*J. Caunter*); Darjiling; Tavoy, Burma.

15. *Aspidomorpha inquinata*, Boh.

Boh., Mon. Cassid., 1854, vol. ii, p. 309.

One example from the Andamans. Boheman records it from Java.

16. *Aspidomorpha micans* (Fab.)

Boh., Mon. Cassid., 1854, vol. ii, p. 313.

Seven examples.

Localities.—Calcutta, Nov. 18; Gopkuda Island, Lake Chilka, Orissa, 7—15-viii-1907; Sadon, Myitkyina district, Upper Burma, 2500-3500 ft., May 1911 (*E. Colenso*); Bangalore (*Cameron*); Kandy, Ceylon, June 1910.

17. *Aspidomorpha amabilis* (Dej.)

Boh., Mon. Cassid., 1854, vol. ii, p. 315.

Eighteen examples.

Localities.—Calcutta, 13-vii-1895 (*W. R. Yates*); Mazbat, Mangaldai district, Assam, 11—15-x-1910 (*Kemp*); Gopkuda Island, Lake Chilka, Orissa, 7—15-viii-1907; Sukna, 500 ft., E. Himalayas, 2-vii-1908 (*Annandale*).

18. *Aspidomorpha mutilata*, Boh.

Boh., Mon. Cassid., 1854, vol. ii, p. 316.

Four examples.

Localities.—Calcutta; Gopkuda Islands, Lake Chilka, Orissa, 7—15-viii-1907; Bangalore (*Cameron*).

19. *Aspidomorpha orientalis*, Boh.

Boh., Mon. Cassid., 1862, vol. iv, p. 260.

Three examples.

Localities.—Assam; Bhim Tal, 4500 ft., Kumaon, W Himalayas, 22—27-ix-1906 (*Annandale*).

20. *Aspidomorpha difformis*, Boh.

Boh., Mon. Cassid., 1862, vol. iv, p. 277.

Two examples.

Locality.—Calcutta, taken in a house, 14-ix.

21. *Aspidomorpha dulcicula*, Boh.

Boh., Mon. Cassid., 1862, vol. iv, p. 278.

One example.

Locality.—Ten miles south of Kuching, Sarawak, 24-vi-1910. It has been reported only from Borneo.

Genus *Sindia*, Weise.22. *Sindia clathrata* (Fab.)

Boh., Mon. Cassid., 1854, vol. ii, p. 330.

Weise, Deutsche Ent. Zeitschr., 1897, p. 105.

Fifteen examples.

Localities.—Malda, Bengal (*W. H. Irvine*); Murshidabad, Bengal (*Atkinson*); Madupur, Bengal.

It also occurs in South India.

Genus *Cassida*, Linn.23. *Cassida obscura*, Fab.

Boh., Mon. Cassid., 1854, vol. ii, p. 415.

Ten examples.

Localities.—Murshidabad, Bengal; Calcutta; Bhogaon, Purneah district, N. Bengal, 21-xii-1909 (*C. Paiva*). Gangurpur Ptiya, Naini Tal district, U. Provinces, 12—13-iv-1907.

24. *Cassida syrtica*, Boh.

Boh., Mon. Cassid., 1862, vol. iv, p. 311.

Two examples.

Localities.—Kurseong, E. Himalayas, 4700–5000 ft., 21-vi-1910 (*Annandale*); Pareshnath, W. Bengal, 4000–4400 ft., 9-iv-1909 (*Annandale*).

25. *Cassida enervis*, Boh.

Boh., Mon. Cassid., 1862, vol. iv, p. 338.

One example from Rajmehal, Bengal, 5-vii-1909 (*Annandale*). It is reported also from Bombay.

26. *Cassida 16-maculata*, Boh.

Boh., Mon. Cassid., 1862, vol. iv, p. 290.

Four examples.

Localities.—Sikkim; Ghumti, Darjiling district, E. Himalayas, 4000 ft., vii-1911 (*F. H. Gravely*).

Genus *Lacoptera*, Boh.

27. *Lacoptera quatuordecimnotata*, Boh.

Boh., Mon. Cassid., 1855, vol. iii, p. 64.

Five examples.

Localities.—Wynad, Malabar; Nilgiri Hills; Peradeniya, Ceylon, 27-v-1910.

It is apparently confined to South India and Ceylon.

28. *Lacoptera vigintisexnotata*, Boh.

Boh., Mon. Cassid., 1855, vol. iii, p. 66.

Sixteen examples.

Localities.—Pegu, Burma; Upper Tenasserim; Shillong; Sib-sagar, N.E. Assam (*S. E. Peal*); Cachar.

Its range appears to be N.-E. India and Upper Burma.

29. *Lacoptera tredecimpunctata* (Fab.)

Boh., Mon. Cassid., 1855, vol. iii, p. 73.

Seventy-six examples.

Localities.—Calcutta; Murshidabad, Bengal (*Atkinson*); Kati-har, Purneah district, N. Bengal, 12-x-1907 (*C. A. Paiva*); Dam Dim, foot of E. Himalayas (*Patterson*); Siliguri, foot of E. Himalayas; Mungphu, Sikkim, E. Himalayas, below 5000 ft.; Pusum-bing, Darjeeling, 4700 ft., Oct.—Dec. 1906 (*H. H. Mann*); Naini Tal (28-ix-1907), W. Himalayas; Bhim Tal, Kumaon, 4500 ft., W. Himalayas, 22—27-ix-1906 (*Annandale*); Shillong, Assam Hills; Sibsagar, Assam; Tavoy, U. Burma; Maymyo, Upper Burma; Sadon, Myitkyina district, Upper Burma, 2500–3500 ft., May 1911 (*E. Colenso*); Andaman Islands.

30. *Lacoptera philippinensis*, Reiche.

Voy. Pole. Sud., iv, p. 321, t. 18, f. 14.

Boh., Mon. Cassid., vol. iii, p. 79.

Two examples.

Localities.—Mulang, Sarawak, 12-vii-1910 (*Beebe*); Kapte, Sarawak, 9-vii-1910 (*Beebe*).

Genus *Metriona*, Wiese.

Insects with the following characters are placed in the genus *Metriona* and are separated from *Coptocyclus*.

Claws with a tooth-like appendage at base, antennae *not* in grooves round the eyes, the ridge on the anterior edge of prosteronum not interrupted, 3rd joint of antenna longer than 2nd.

In *Coptocyclus* the claws are simple (Weise, Deutsche Ent. Zeitschr., 1896, p. 13).

31. *Metriona circumdata* (Herbst.)

Boh., Mon. Cassid., 1855, vol. iii, p. 279.

Weise, Deutsche Ent. Zeitschr., 1905, p. 125.

Eighty-five examples.

Localities.—Calcutta; Balighai, near Puri, Orissa, 16-20-viii-1911 (*Annandale* and *Gravelly*); Vaikam, Travancore, costal region, 5-xi-1908 (*Annandale*); Coromandel, S. India, 2500 ft., 23-x-1910; Nilgiri Hills; Dehra Dun, foot of W Himalayas.

The varieties may be divided as follows:—

Prothorax maculate	{	colour dilute green	var. <i>d</i> .
		colour brown	var. <i>a</i> .
Prothorax immaculate	{	colour dilute green	var. <i>c</i> .
		colour brown {	var. <i>b</i> .
		elytral vittae	
		dilute sanguinis	
		elytral vittae black	var. <i>e</i> .

Vars. *a*, *b*, *c*, were proposed by Boheman. The large number of examples before me warrants the division of this species into five colour varieties. I, therefore, propose var. *d* and *e* as is shown in the table

In var. *a* the black mark in front of the scutellum varies in shape and size. Generally it is a line scarcely reaching up to the middle of the prothorax. The apex of this line, in some cases, thickens and is produced into two horizontal lines curving inwards. In others the black line is attenuated anteriorly, very short, and bifurcating.

Var. *dentatus*, n. var.

One example taken at Dehra Dun differs from all others in having the elytral punctures deeper. Other characters being the

same and in absence of more specimens I do not separate it, but I consider this as a definite variety having more importance than mere colour varieties.

It is brown, prothorax maculate, apical joints of antennae not black or dark.

32. ***Metriona cataneta*** (Dej.)=(*physodis*, Boh.)

Boh., Mon. Cassid., 1855, vol. iii, p. 262.

Speath., Verh. Ges. Wien, 1898, p. 280.

Weise, Deutsche Ent. Zeitschr., 1892, p. 352.

Thirteen examples.

Localities.—Mungphu, Darjeeling distr., E. Himalayas, below 5000 ft.; Pegu, U. Burma; Tenasserim; Dam Dim, Jalpaiguri distr., Bengal (G. S. Patterson); Kanaul, 18-x-1907; Bhim Tal, 4500 ft., Kumaon, 19—22-x-1906 (Annandale); Sibul, Sarawak, 2-vii-1910 (Beebe).

Genus ***Chirida***, Chap.

Insects with the following characters are differentiated from *Coptocyclus* and are classed in *Chirida*.

Claws with a tooth-like appendage at the base, antennae placed in grooves round the eyes, the ridge on the anterior edge of the prosternum is interrupted. In *Coptocyclus* the claws are simple (Weise, Deutsche Ent. Zeitschr., 1896, p. 13).

33. ***Chirida ornata*** (Fab.)

Boh., Mon. Cassid., 1855, vol. iii, p. 134.

One example.

Locality.—Kandy, Ceylon, June 1910.

34. ***Chirida promiscua*** (Boh.)

Boh., Mon. Cassid., 1855, vol. iii, p. 130.

One example.

Locality.—Bangalore (Cameron).

35. ***Chirida sexmaculata*** (Dej.)

Boh., Mon. Cassid., 1855, vol. iii, p. 114.

Wiese, Deutsche Ent. Zeitschr., 1896, p. 14.

Fifty-four examples.

Localities.—Bangalore, S. India (Cameron); Calcutta; Chattraput, Ganjam distr., N.-E. Madras (C. Fischer).

36. ***Chirida septemnotata*** (Boh.)

Boh., Mon. Cassid., 1855, vol. iii, p. 133.

Thirteen examples.

Localities.—Sibsagar Assam (*S. E. Peal*); Mungphu, Darjiling distr., E. Himalayas, below 5000 ft.; Tindharia, Darjiling distr., E. Himalayas, 2822 ft.; Calcutta, i-vii-1907.

The variation in this species is confined to the prothoracic macula. Usually it is in the form of two vertical parallel black lines in the middle of the prothorax in front of the scutellum. This may be completely absent or may be the continuation of the sutural red line going beyond the middle of the prothorax.

37. *Chirida bowringii* (Boh.)

Boh., Mon. Cassid., 1855, vol. iii, p. 123.

One example.

Locality.—Dawna Hills, 2000-3000 ft., Lower Burma, 2-3-iii-1908 (*Annandale*).

38. *Chirida andamanica* (Dohrn).

Dohrn, Stettiner Ent. Zeitung, xli, p. 370.

Three examples from the Andaman Islands.

HISPINAE.

Genus *Botryonopa*, Blanch.

1 *Botryonopa sheppardi*, Baly.

Baly, Cat. Hisp., 1858, p. 92, t. 7, f. 4.

Weise, Stett. Ent. Zeit., 1908, lxix, p. 214.

Six examples.

Localities.—Sikkim, E. Himalayas; Sylhet; Sibsagar, N.-E. Assam (*S. E. Peal*).

Genus *Estigmana*, Hope.

2. *Estigmana chinensis*, Hope.

Hope, Coleopt. Man., 1840, iii, p. 175, t. 2, f. 1.

Baly, Cat. Hisp., 1858, p. 100, t. 7, f. 7.

Gest., Ann. Mus. Civ. Gen., 1897, p. 49.

Six examples.

Localities.—Calcutta, June; Cachar (*J. Wood-Mason*).

It is a widely distributed species having been reported from China, India, Sumatra, Java.

Genus *Anisodera*, Baly.

3. *Anisodera cylindrica*, Hope.

Zool. Misc., 1831, p. 27 (*Trogosita*).

Baly, Cat. Hisp., 1858, p. 106.

Gest., Ann. Mus. Civ. Gen., 1890, p. 236.

Twenty examples.

Localities.—Sikkim; Assam-Bhutan Frontier, Mangaldai distr. N.E., 31-xii-1910 (S. W. Kemp); Sibsagar, N.E. Assam. It has also been reported from Burma and Nepal.

4. *Anisodera excavata*, Baly.

Baly, Cat. Hisp., 1858, p. 105, t. 8, f. 1.

Thirty-four examples.

Localities.—Sikkim; Darjiling, E. Himalayas; Cachar, Assam (J. Wood-Mason); Sadon, Myitkyina distr., U. Burma; 2500-3500 ft., May 1911 (E. Colenso).

5. *Anisodera (Lissochila) bowringi*, Baly.

Baly, Cat. Hisp., 1858, p. 102.

One example.

Locality.—Dikrang valley, Nanang's (Godwin-Austen).

6. *Anisodera (Lissochila) guerinii*, Baly.

Baly, Cat. Hisp., 1858, p. 168, t. 7, f. 8.

Gest., Ann. Mus. Civ. Gen., 1885, p. 163; *l.c.*, 1890, p. 233 and 1897, p. 50.

ferruginea, Guér., Rev. Zool., 1840, p. 333; Baly, Cat. Hisp., p. 101.

Four examples.

Localities.—Sikkim; Shillong; Sibsagar, Assam; Purneah distr., N. Bengal (C. Paiva).

It has also been reported from West India, Sumatra and Java.

Genus *Lepthispa*, Baly.

7. *Lepthispa pygmaea*, Baly.

Baly, Cat. Hisp., 1858, p. 2.

Lewis, Ent. Month. Mag., 1888, p. 94.

Gest., Bull. Soc. Ent. Ital., 1902, p. 51.

Eight examples.

Localities.—Malhawanaad, Malabar distr., S. India; Poona, 4-xii-1893.

It has also been reported from Ceylon. Apparently it is confined to S. India. It is of economic importance inasmuch as it is reported to be destructive to sugar-cane, while in Malabar it is said to attack paddy stalks.

Genus *Oncocephala*, Chevr.

8. *Oncocephala quadrilobata*, Guér.

Guér., Icon. Règne Anim. Ins., 1844, p. 261.

Weise, Deut. Ent. Zeit., 1897, p. 121; 1905, p. 117.

Gest., Ann. Mus. Civ. Gen., 1899, p. 314, f. 1.

Eight examples.

Locality.—Andaman Islands. It was not recorded from these islands before.

Genus **Gonophora**, Baly.

9. **Gonophora masoni**, Baly.

Ent. Month. Mag., 1888, p. 85.

Four examples.

Locality.—Andaman Islands. It has been reported only from the Andamans.
