

XV A FURTHER REPORT ON MOLLUSCA
FROM LAKE CHILKA ON THE
EAST COAST OF INDIA.

By H. B. PRESTON, F.Z.S.

At the request of Dr. Annandale of the Indian Museum the author has examined a second collection of Mollusca from Lake Chilka, a report on which is given below. The first collection was made by Dr. Annandale and Mr. Kemp in 1913 and included thirty-four species of which twenty-one were described as new,¹ though two of these (*Velorita satparaënsis* and *Tornatina soror*) have from the examination of considerable further material proved to be unworthy of retention, as will be seen later. The present collection was made by the same collectors during September and December of 1913 and January, February, March, July and September of 1914, and contains sixty-seven species of which twenty-five appear to have hitherto escaped notice and are described and figured in the present report, the type specimens in all cases being returned to the Indian Museum. This large number of new forms in both collections may be accounted for by the fact that practically no systematic collecting has ever been previously done in the lake.

As was to be expected a large proportion of the species originally recorded are again included in this second collection, some however very sparingly while others are conspicuous by their total absence. This is largely because examples of some easily recognized species were not sent.

In conclusion the author would take this opportunity to express his thanks to Mr. E. A. Smith, I.S.O., for much help ungrudgingly given in the generic determination of the smaller Pelecypods of which both collections contain a large number.

Class **GASTROPODA.**

Order *PROSOBRANCHIA.*

Family **TEREBRIDAE.**

***Terebra rambhaënsis*, Preston.**

Rec. Ind. Mus., X, p. 297.

Nalbano and channel S.E. of Nalbano, 4-8 ft.

¹ *Rec. Ind. Mus.*, X, pp. 297-310 (1914).

Family NASSIDAE.

Nassa sistroidea, G. and H. Nevill.

J As. Soc. Bengal, XLIII, pt. 2, pl. i, fig. 6.

Serua Nadi, 5-9 ft. (two immature examples).

Nassa marratii, Smith.

J Linn. Soc., XII, p. 543; *Proc. Zool. Soc. London*, 1878, p. 809.

Channel off Satpara Point, 8-12 ft.

Nassa orissaënsis, Preston.

Rec. Ind. Mus., X, p. 299.

Channel off Barhampur Id., 6-9 ft.; 1 mile N.E. by E. of Chiriya Id., $5\frac{1}{2}$ - $6\frac{3}{4}$ ft.; opposite Barkul bungalow; 2-8 miles N.E. $\frac{1}{2}$ E. of Kalidai, 5-6 ft.; S.E. of Barkuda and Samal Id., $\frac{1}{4}$ mile off shore, 6 ft.; 2-3 miles S.E. by E. $\frac{1}{2}$ E. of Patsahani-pur, $4\frac{3}{4}$ - $5\frac{1}{2}$ ft.; Serua Nadi, 5-9 ft.; channel between Barnikuda and Satpara, $6\frac{1}{2}$ ft.; about 4 miles E.N.E. of Kalupara Ghat; 1-1 $\frac{1}{2}$ miles off Kalupara Ghat. channel from Satpara towards Barnikuda, 9-12 ft.

Nassa denegabilis, Preston.

T c., pp. 297-299.

Channel between Satpara and Barhampur, 8-20 ft.; Nalbano and channel S.E. of Nalbano, 4-8 ft.; Sand-dunes opposite Manikpatna; Serua Nadi, 5-9 ft.

Bullia vittata, Linn.

Syst. Nat., Edit. 12, p. 1206.

Outer bar close to mouth (a single young and dead specimen).

Family STROMBIDAE.

Strombus isabella, Lk.

Anim. s. vert., IX, p. 700.

Chilka Lake (a very young specimen).

Family CERITHIIDAE.

Potamides (Tympantonos) fluviatilis, Pot. and Mich.

Cat. Moll. de Douai, p. 363.

Channel between Satpara and Barhampur, 8-20 ft.; channel from Satpara towards Barnikuda, 9-12 ft.; off Barnikuda, 5-12 ft.

Potamides (Telescopium) fuscum, Schumacher.*Essai Nouv. Syst.*, p. 233.

Outer bar opposite Manikpatna temple.

Family FOSSARIDAE.

Chilkaia, gen. n.

Shell minute, ovate, rimate, with large body whorl and aperture, spirally lirate and transversely plicate; operculum?

Hab.—Lake Chilka, E. coast of India.

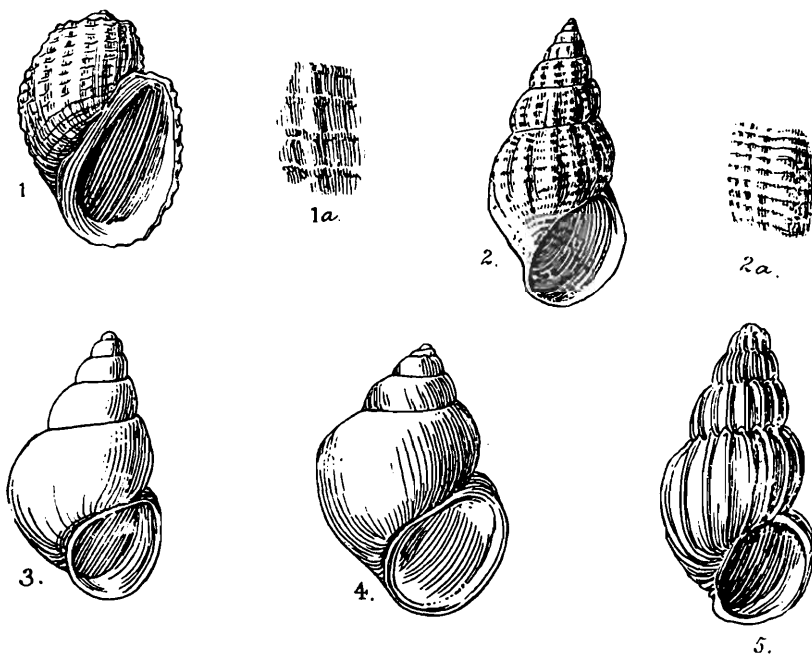


FIG. 1.—*Chilkaia imitatrix*, sp. n. $\times 10$.
 „ 1a.— „ „ (sculpture) $\times 30$.
 „ 2.—*Litiopa (Alaba) copiosa*, sp. n. $\times 8$.
 „ 2a.— „ „ (sculpture) $\times 12$.
 „ 3.—*Stenothyra trigona*, sp. n. $\times 14$.
 „ 4.—*Stenothyra obesula*, sp. n. $\times 8$.
 „ 5.—*Epitonium hamatulae*, sp. n. $\times 4$.

Chilkaia imitatrix, sp. n.

(Figs. 1, 1a.)

Shell small, oblong ovate, covered with a light reddish periostracum; whorls 3, finely and wavily spirally lirate and slightly distantly obliquely transversely plicate, the last whorl shouldered in the infra-sutural region; suture impressed; perforation very narrow; columella whitish, descending in a curve, extending above into a thick, white, restricted, parietal callus which unites it with the labrum above; labrum acute, a very little dilated below; aperture oblique and rather elongately ovate.

Alt. 2.5, diam. maj. 1.75 mm.

Aperture: alt. 1.25, diam. .75 mm.

Hab.—Mahosa, southwards towards sandhills, 4-8 ft. (*Type*); Serua Nadi, 5-9 ft.

Bearing, in miniature, an extraordinary resemblance to the more ovate forms of *Paramelania* from Lake Tanganyika.

Family LITIOPIDAE.

Litiopa (Alaba) *kempi*, Preston.

Rec. Ind. Mus., X, p. 300.

8 miles W. by S. of Breakfast Id., 5-5 $\frac{3}{4}$ ft.; E. side of Rambha Bay, 1-4 $\frac{3}{4}$ ft.; 1 mile N.E. by E. of Chiriya Id., 5 $\frac{1}{2}$ -6 $\frac{3}{4}$ ft.; Breakfast Id., midway between Ganta Sila and Chiriya Id. South Pt., 5-6 ft.; Nalbano and channel N.E. of Nalbano, 4-8 ft.; southwards from Mahosa, 5-9 ft.; Mahosa, Barhampur Id.; off Sankuda Id., Ganjam District, Madras; Rambha Bay; among grass-like weeds on sandy bottom in 3-3 $\frac{1}{2}$ ft. of water close to shore of Barkuda Id.

Litiopa (Alaba) *copiosa*, sp. n.

(Figs. 2, 2a, p. 291.)

Shell small, fusiformly turrit, whitish, showing traces of having been covered with a thin greenish periostracum, the last whorl narrowly transversely banded with reddish brown; whorls 6, the last two moderately convex, the upper whorls flattish, sculptured with fine, closely-set, spiral lirae and slightly oblique, rounded, rather distant, transverse costulae; suture impressed, crenellated by the terminations of the transverse costulae; columella obliquely descending, scarcely reflexed, diffused above into a restricted, well defined, parietal callus which reaches to the upper margin of the labrum; labrum simple; aperture oblique, ovate.

Alt. 3.75, diam. maj. 1.75 mm.

Hab.—Serua Nadi, 5-9 ft. (*Type*); channel between Barnikuda and Satpara, 6 $\frac{1}{2}$ ft.; Mahosa, southwards towards sandhills, 4-8 ft.; channel from Satpara towards Barnikuda, 9-12 ft.; Nalbano and channel S.E. of Nalbano, 4-8 ft.

Family HYDROBIIDAE.

Stenothyra minima, Sow.

Ann. Mag. Nat. Hist. London (Charlesworth's series), I, 1837, p. 217 (as *Nematura*).

Opposite Barkul bungalow; 1-5 miles N. by E. of Kalidai, 7-7 $\frac{1}{2}$ ft.; 1 mile N.E. by E. of Chiriya Id., 5 $\frac{1}{2}$ -6 $\frac{3}{4}$ ft.; southernmost island of Manikpatna series; 1 mile S. of Kalidai, 4-8 ft.; Serua Nadi, 5-9 ft.; between Barkuda and mainland, 6-8 ft.

Stenothyra chilkaënsis*, Preston.Rec. Ind. Mus.*, X, p. 300.

Serua Nadi, 5-9 ft.; 4-9 miles E., $\frac{1}{2}$ S. of Barkul bungalow, $5\frac{1}{4}$ - $5\frac{3}{4}$ ft.; channel off Barhampur Id., 6-9 ft.; 1 mile N.E. by E. of Chiriya Id., $5\frac{1}{2}$ - $6\frac{3}{4}$ ft.; channel between Barnikuda and Satpara, $6\frac{1}{2}$ ft.; off Barnikuda, inside lake, 6 ft.; 2-8 miles N.E. $\frac{1}{2}$ E. of Kalidai, 5-6 ft.; 1 mile S. of Kalidai, 4-8 ft.; between Barkuda and mainland, 6-8 ft.; Nalbano and channel S.E. of Nalbano, 4-8 ft.; southwards from Mahosa, 5-9 ft.; S.E. of Barkuda and Samel Id., $\frac{1}{4}$ mile off shore, 6 ft.; channel from Satpara towards Barnikuda, 9-12 ft.

Stenothyra orissaënsis*, Preston.T.c.*, pp. 300-301.

Serua Nadi, 5-9 ft.; Rambha Bay, about 6 ft. of water, among weeds; about 4 miles E.N.E. of Kalupara Ghat, 6-7 ft.; 1 mile N.E. by E. of Chiriya Id., $5\frac{1}{2}$ - $6\frac{3}{4}$ ft.; Nalbano and channel S.E. of Nalbano, 4-8 ft.; 2 miles N.E. by N. $\frac{1}{2}$ N. of Kalidai, 7 ft.

***Stenothyra trigona*, sp. n.**

(Fig. 3, p. 192.)

Shell rimate, thin, turrite, semitransparent, greyish white; whorls 5, smooth, rather rapidly increasing, the last inflated, ascending a little in front; suture impressed, margined below; perforation appearing as a narrow and not very deep chink; columellar lip descending in a curve; labrum continuous; aperture oblique, ovate.

Alt. 2.5 (nearly), diam. maj. 1.5, diam. min. 1 mm.

Hab.—Lake Chilka, opposite Barkul bungalow (*Type*); Rambha Bay, among weeds; Serua Nadi, 5-9 ft.; 1 mile N.E. by E. of Chiriya Id., $5\frac{1}{2}$ - $6\frac{3}{4}$ ft.; Nalbano and channel S.E. of Nalbano, 4-8 ft.

***Stenothyra obesula*, sp. n.**

(Fig. 4, p. 291.)

Shell rimate, ovately fusiform, of an olive colour; whorls 4, smooth, the first three small and regularly increasing, the last large, inflated, descending in front; suture impressed, very narrowly margined below; perforation reduced to a mere chink; labrum continuous, the margin dark brown; aperture slightly oblique, ovate; operculum normal.

Alt. 3.25, diam. maj. 2.25 mm.

Hab.—Southernmost island of Manikpatna series.

This species stands out, owing to the obese form of the last whorl, from any other yet described from the Indian region.

Family NATICIDAE.

***Natica marochiensis*, Gmel.**

Syst. Nat., p. 3673, No. 15.

Satpara, Chilka Lake.

Dead shells inhabited by *Coenobita*.

***Natica maculosa*, Lamarck.**

Anim. s. vert. (Desh. ed.), VIII, p. 641.

Satpara, Chilka Lake.

Dead shells inhabited by *Diogenes*.

Family SCALARIIDAE.

***Epitonium hamatulae*, sp. n.**

(Fig. 5, p. 291.)

Shell imperforate, turritely fusiform, whitish flesh colour; remaining whorls 5, sculptured with rather fine, erect and closely-set, transverse costulae, the terminations of which are bent forward in a hook-like manner in the immediate super-sutural region and of which there are seventeen on the last whorl, the interstices being quite smooth; suture impressed, crenellated by the hook-like terminations of the transverse costulae; columella descending in a slightly angular curve; aperture oblique, oval.

Alt. 7.75, diam. maj. 4.5 mm.

Aperture: alt. 3, diam. 2 mm.

Hab.—Channel off Barhampur Id., 6-9 ft.

Family PYRAMIDELLIDAE.

***Chrysallida (Mormula) humilis*, Preston.**

Journal of Malacology, XII, 1905, p. 6 [as *Pyramidella (Mormula)*].

Channel off Barhampur Id., 6-9 ft.; Nalbano and channel S.E. of Nalbano, 4-8 ft. (a single deformed specimen); E. side of Rambha Bay, 1 4 $\frac{3}{4}$ ft.; southwards from Mahosa, 5-9 ft.; main channel W. of Satpara Id., 3-8 ft.; Serua Nadi, 5-9 ft.; Mahosa, southwards towards sandhills, 4-8 ft.

This appears to be a very variable species in sculpture, convexity of the whorls and size. Specimens differing in all these characters merge into one another but perhaps a single tapering specimen, which the author was at first inclined to regard as distinct, from "Breakfast Island midway between Ganta Sila and Chiriya Island South Point (5-6 ft.)", may be especially mentioned, the dimensions of this individual being:

Alt. 8.75, diam. maj. 2.75, diam. min. 2.5 mm.

Aperture: alt. 2, diam. 1 mm.

While those of the type specimen from Ceylon with which a number of Lake Chilka examples fairly agree are—

Alt. 4.75, diam. maj. 1.5 mm.

Aperture: alt. 5 mm.

Nevertheless one race would seem to stand out from all others and to be worthy of subspecific rank, while two other forms are so distinct as to warrant the accordance of full specific status.

***Chrysallida (Mormula) humilis chilkaënsis*, subsp. n.**

(Figs. 6, 6a.)

Shell differing from the typical *P. (M.) humilis*, Preston, in its less tapering, shorter and proportionately broader form, finer transverse costulae, coarser spiral striae and more oblique aperture.

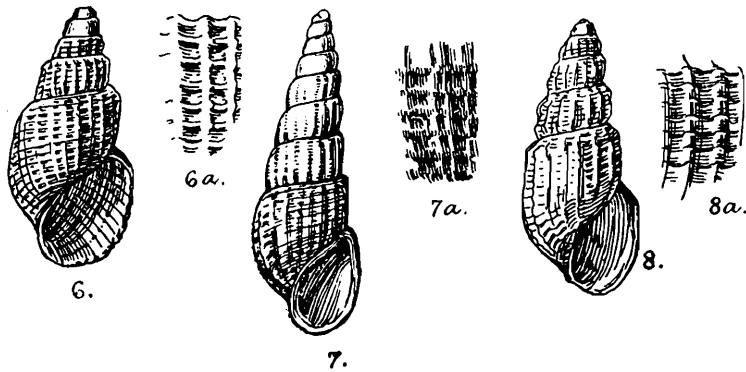


FIG. 6.—*Chrysallida (Mormula) humilis chilkaënsis*, subsp. n. $\times 8$.
 „ 6a.—„ „ „ „ (sculpture) $\times 12$.
 „ 7.—*Chrysallida (Mormula) ecclesia*, sp. n. $\times 4$.
 „ 7a.—„ „ „ „ (sculpture) $\times 8$.
 „ 8.—*Chrysallida (Mormula) nadiensis*, sp. n. $\times 8$.
 „ 8a.—„ „ „ „ (sculpture) $\times 12$.

Alt. 3.25, diam. maj. 1.75 mm.

Hab.—Serua Nadi, 5-9 ft. (*Type*); main channel W of Satpara Id., 3-8 ft.; southwards from Mahosa, 5-9 ft.; channel between Barnikuda and Satpara, 6½ ft.; Nalbano and channel S.E. of Nalbano, 4-8 ft.; Mahosa, southwards towards sandhills, 4-8 ft.; channel from Satpara towards Barnikuda, 9-12 ft.; off Barnikuda, inside lake, 6 ft.

***Chrysallida (Mormula) ecclesia*, sp. n.**

(Figs. 7, 7a.)

Shell subulately fusiform, tapering, reddish brown; whorls 8½, regularly increasing, not very convex, sculptured with rather closely-set, perpendicular, transverse plicae, crossed by fine, spiral lirae; suture impressed; columella descending in a curve, porcel-

lenous, slightly reflexed, extending above into a thin, well defined, restricted, parietal callus which reaches to the upper margin of the labrum; labrum acute, a little dilated at the base; aperture ovate, very slightly oblique.

Alt. 8.75, diam. maj. 2.75, diam. min. 2.25 mm.

Aperture: alt. 2, diam. 1 mm.

Hab.—Breakfast Id., midway between Ganta Sila and Chirya Id S. Point, 5-6 ft.

***Chrysallida (Mormula) nadiensis*, sp. n.**

(Figs. 8, 8a, p. 295.)

Shell fusiform, white; whorls 6, regularly but rather rapidly increasing, shouldered above and below, transversely costulate and finely spirally striate, the costulae becoming obsolete and the striae coarser on the base of the shell; suture well impressed; columellar margin somewhat obliquely descending and a little inwardly bulging above, curved below, extending above into a thickish, well-defined, parietal callus which unites it with the upper margin of the labrum; labrum acute, rather dilated at the base; aperture slightly oblique, ovate.

Alt. 3.25, diam. maj. 1.25 mm.

Hab.—Serua Nadi, 5-9 ft. (*Type*); Mahosa, southwards towards sandhills, 4-8 ft.; Nalbano and channel S.E. of Nalbano, 4-8 ft.; 1 mile S. of Kalidai; 4-8 ft.

***Odostomia chilkaënsis*, Preston.**

Rec. Ind. Mus., X, pp. 301-302.

Mahosa, southwards towards sandhills, 4-8 ft.

Family NERITIDAE.

***Neritina souverbiana*, Montrouzier.**

J. Conchyliol., Paris, XI, 1863, pp. 75, 175, pl. v, fig. 5.

Mahosa, Barhampur Id.; Serua Nadi, 5-9 ft.; 1 mile E. by N. of Patsahanipur, 4½ ft. (dead shells only).

Family CYCLOSTREMATIDAE

***Cyclostrema (Tubiola) innocens*, sp. n.**

(Figs. 9, 9a-b, p. 299.)

Shell small, discoidal, almost planulate, milk white, smooth throughout; whorls 3, rather rapidly increasing, the last convex, marked only with growth striae; suture well impressed; umbilicus moderately wide; labrum continuous, simple; aperture rather large for the size of the shell, subcircular.

Alt. .5, diam. maj. 2, diam. min. 1.75 mm.

Hab.—Serua Nadi, 5-9 ft.

Family TROCHIDAE.

Umbonium vestiarum, Lin.*Syst. Nat.*, X, p. 758.

Outer bar close to mouth; outer bar opposite Manikpatna temple.

Solariella satparaënsis, Preston.*Rec. Ind. Mus.*, X, pp. 302-303.

Mahosa, southwards towards sandhills, 4-8 ft. (a single dead specimen).

Order OPISTHOBRANCHIA.

Family BULLIDAE.

Bulla (Haminea) crocata, Pease.*Proc. Zool. Soc. London*, 1860, p. 19.

Serua Nadi, 5-9 ft. (a single small, though apparently, fully grown specimen).

Family TORNATINIDAE.

Tornatina estriata, Preston.*Rec. Ind. Mus.*, X, p. 303

Channel from Satpara towards Barnikuda, 9-12 ft.; one mile N.E. by E. of Chiriya Id., $5\frac{1}{2}$ - $6\frac{3}{4}$ ft.; Serua Nadi, 5-9 ft.; off Barnikuda, inside lake, 6 ft.; channel off Barhampur Id., 6-9 ft.; main channel W. of Satpara Id., 3-8 ft.; Nalbano and channel S.E. of Nalbano, 4-8 ft.; southwards from Mahosa, 5-9 ft.; 2 miles N.E. by N., $\frac{1}{2}$ N. of Kalidai, 7 ft.

In view of the plasticity of the members of this genus, the author considers it necessary to unite *T. soror*¹ with the present species, this conclusion having been come to as a consequence of the examination of a very large further series of examples from the lake in which more or less connecting links between the two originally described forms occur.

Class PELECYPODA.

Order TETRABRANCHIA.

Sub-order MYTILACEA.

Family MYTILIDAE.

Mytilus smaragdinus, Chemnitz.*Conch. Cab.*, VIII, pl. lxxxiii, fig. 745.

Manikpatna, oyster-beds (a single, very immature specimen).

¹ *Rec. Ind. Mus.*, X, p. 303.

Modiola undulata, (Dkr.).*Proc. Zool. Soc. London*, 1856, p. 363.

Channel off Barhampur Id., 10-20 ft.; channel between Satpara and Barhampur, 8-20 ft.; Nalbano and channel S.E. of Nalbano, 4-8 ft. (young examples only); 1 mile N.E. by E. of Chiriya Id., $5\frac{1}{2}$ -6 $\frac{3}{4}$ ft. (young only).

Var. **crassicostata**. Preston.

Rec. Ind. Mus., X, p. 304.

Serua Nadi, 5-9 ft. (young specimens only); main channel W. of Satpara Id., 3-8 ft. (a young specimen).

Sub-order *ARCACEA*.

Family *ARCIDAE*.

Arca (Fossularca) lactea, Lin.*Syst. Nat.* p. 1141.

Channel between Satpara and Barhampur Id., 6-8 ft., and 8-20 ft.; main channel W. of Satpara Id., 3-8 ft.; Satpara.

After very careful comparison the author is unable to separate the present shells from the common European form, which has already been recorded from Bombay and Mergui as well as from S. Africa, the Red Sea, Aden, Ascension Id. and (somewhat doubtfully) from the Philippines.

Sub-order *ERYCINACEA*.

Family *ERYCINIDAE*.

Kellya chilkaënsis, sp. n.

(Figs. 10, 10a, p. 299.)

Shell very thin, flattened, oblong-ovate, transparent, pale brownish, except towards the margins where it is covered with a thin membranaceous reddish brown periostracum, concentrically striate; umbones very small; dorsal margin arched; ventral margin gently rounded; anterior side obtusely rounded; posterior side very slightly produced, rounded; hinge-teeth normal.

Long. 4.25, lat. 5.75 mm.

Hab.—Channel between Satpara and Barhampur Id., 6-8 ft. (*Type*); Mahosa, southwards towards sandhills, 4-8 ft.; 1 mile S. of Kalidai, 4-8 ft.; channel off Barhampur Id., 6-9 ft.; 4-7 miles E. $\frac{1}{2}$ S. of Patsahanipur, 4-4 $\frac{1}{4}$ ft.

Kellya mahosaënsis, sp. n.

(Fig. 11, p. 299.)

Shell minute, inequilateral, oblong-ovate, transparent, pale yellowish horn colour, reddish at the margins, concentrically

striate; umbones comparatively large and rather prominent; dorsal margin strongly arched; ventral margin contracted in the median part; anterior side very obtusely rounded; posterior side rounded; hinge-teeth normal.

Long. 1.5, lat. 1.25 mm.

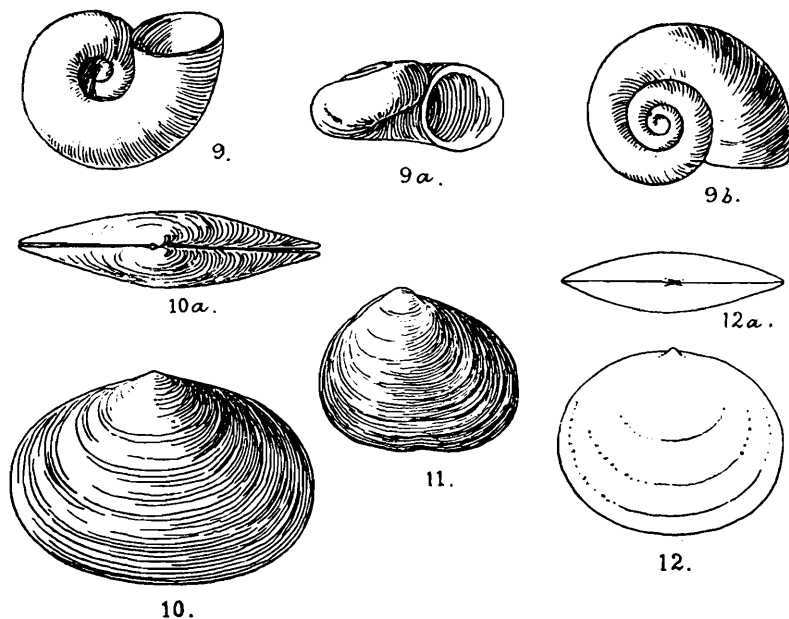
Hab.—Mahosa, southwards towards sandhills, 4-8 ft.

Family GALEOMMIDAE.

Scintilla chilkaënsis, sp. n.

(Figs. 12, 12a.)

Shell oblong ovate, considerably flattened, very thin, transparent, pale yellowish, polished, shining, irregularly concentrically striate; umbones very small; dorsal margin arched at either side, slightly sloping in the umbonal region; ventral margin



FIGS. 9, 9a, 9b.—*Cyclostrema (Tubiola) innocens*, sp. n. $\times 10$.

„ 10, 10a.—*Kellya chilkaënsis*, sp. n. $\times 6$.

„ 11.—*Kellya mahosaënsis*, sp. n. $\times 14$.

„ 12, 12a.—*Scintilla chilkaënsis*, sp. n. $\times 4$.

gently rounded; anterior side bluntly rounded; posterior side sloping above, rounded below; hinge-teeth normal.

Long. 4.5, lat. 5.75 mm.

Hab.—Mahosa, southwards towards sandhills, 2-8 ft. (*Type*); channel south of Satpara Point, 8-12 ft.; channel between Satpara and Barhampur, 8-20 ft.

Sub-order CARDIACEA.

Family CARDIIDAE.

Cardium (Fulvia) rugatum, Gronov.

Gronovius, *Zoophylaceum*, pl. xviii, fig. 5.

Outer bar close to mouth (juvenile examples only).

Sub-order *CONCHACEA*.

Family *VENERIDAE*.

***Meretrix casta*, Chem.**

Anim. s. vert., VI, p. 299.

Satpara Bay; Mahosa, Barhampur Id.; outer bar, opposite Manikpatna temple (young only); swamp inside bar, N. of Barhampur Id.; Manikpatna Id.

A very large example was secured, but has reached the writer with no other locality attached than "Chilka Survey"; the dimensions of this specimen are as below.

Long. 67, lat. 73 mm.

Having now had the opportunity to examine fresh specimens of this species from the outer channels of the lake, the author is of opinion that the shell recently described by him as *Corbicula (Velorita) satparaënsis*¹ cannot stand, the worn subfossil remains upon which the species was based clearly proving it to be identical with individuals of *M. casta* now to hand; this conclusion is borne out by Blanford's record of the occurrence of *M. casta* in the Rambha Island Beds.²

***Meretrix ovum*, Hanley.**

Proc. Zool. Soc. London, 1846, p. 21.

Satpara Bay; Mahosa, Barhampur Id.

***Meretrix morphina*, Lk.**

Anim. s. vert., VI, p. 300.

Channel off Barhampur Id., 10-20 ft. (a single valve).

***Tivela dillwyni* (Deshayes).**

Cat. Brit. Mus., Conchif., 1853, p. 49; *Cytherea mactroides*, Sowerby, *Thes. Conch.*, II, p. 615, pl. 128, fig. 56, *non* Born, *nec* Chemnitz, *nec* Lamarck.

Serua Nadi, 5-9 feet (young specimens only).

***Meroë scripta*, Gray.**

Rumphius, *Mus. Amb.*, pl. xliii, figs. L, M.

Outer channel, Lake Chilka (a single much worn valve).

***Tapes pinguis*, Chem.**

Conch. Cab., VI, p. 355, pl. xxxiv, figs. 355-357 (as *Venus*).

Manikpatna Id. (a somewhat inflated and rounded variety); Manikpatna Id. (a normal specimen); swamp inside bar N. of Barhampur Id.; S. side of Satpara Id., opposite bungalow.

¹ *Rec. Ind. Mus.*, X, p. 306.

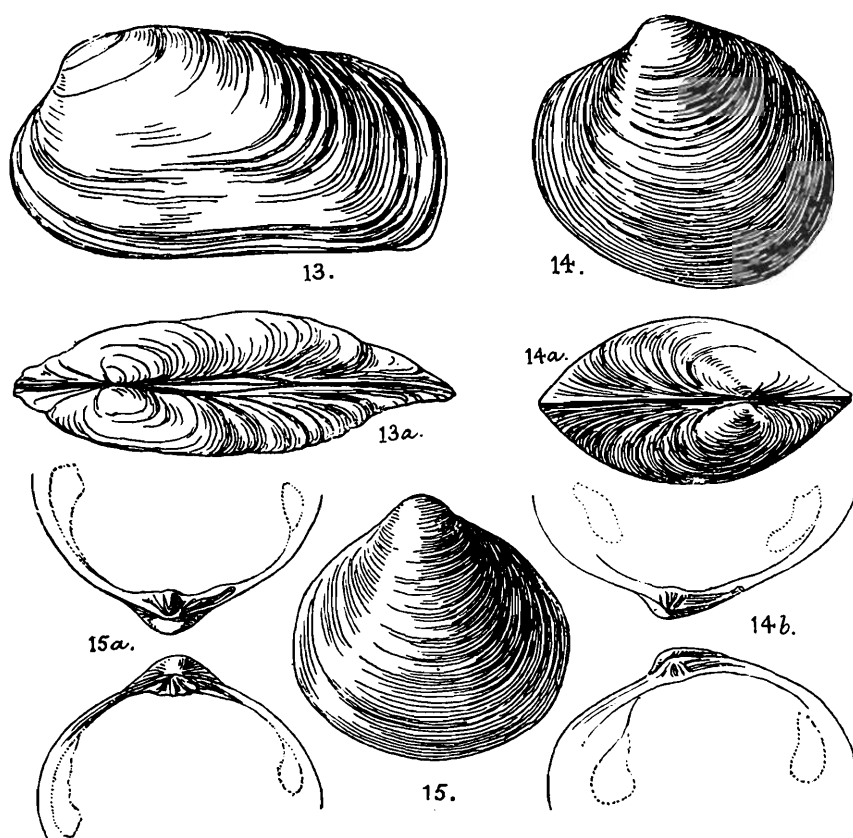
² *Rec. Geol. Surv. India*, V, p. 61.

Tapes ceylonensis*, SowThes. Conch.*, I, p. 683, pl. cxlvi, figs. 24-25.

Sand-dunes opposite Manikpatna (juvenile examples); channel near Mirzapur, 8-12 ft.; Mahosa, Barhampur Id; Serua Nadi, 5-9 ft. (young specimens only).

Clementia annandalei*, Preston.Rec. Ind. Mus.*, X, p. 306.

Serua Nadi, 5-9 ft. (young examples); Nalbano and channel S.E. of Nalbano, 4-8 ft (also young).



FIGS. 13, 13a.—*Petricola esculpturata*, sp. n. $\times 3$.
 „ 14, 14a.—*Diplodonta satparaensis*, sp. n. $\times 1\frac{1}{2}$.
 „ 14b.— „ „ (hinge) $\times 1\frac{1}{2}$.
 „ 15.—*Diplodonta barhampurensis*, sp. n. $\times 3$.
 „ 15a.— „ „ (hinge) $\times 3$.

Family PETRICOLIDAE.***Petricola esculpturata*, sp. n.**

(Figs. 13, 13a.)

Shell oblong, rather solid, white, showing traces of having been covered with a thin pale greenish brown periostracum, concentrically striate with lines of growth, but without other sculpture; umbones small, not very prominent, very anteriorly situa-

ted; dorsal margin sloping towards the posterior side; ventral margin nearly straight; anterior side obliquely and rapidly sloping above, somewhat rounded below; posterior side produced, very obtusely rounded, angled below; hinge normal.

The dimensions of the type specimen are as follows:—

Long. 13.25, lat. 23, diam. 75 mm.

Those of a larger, though imperfect individual are—

Long. 17, lat. 31.5, diam. 11.5 mm.

Hab.—Manikpatna, oyster-beds.

Since the above was written the author has seen more specimens of this species from the Chilka Lake, the largest of which yields the following measurements:—

Long. 27.5, lat. 47, diam. 17.25 mm.

Family UNGULINIDAE.

Diplodonta satparaënsis, sp. n.

(Figs. 14, 14a-b, p. 301.)

Shell ovately rhomboidal, fragile, slightly glossy, whitish, covered with a very thin, pale greenish yellow periostracum, irregularly finely and closely concentrically striate; umbones small, but slightly prominent; dorsal margin arched; ventral margin anteriorly sloping, posteriorly rounded; anterior side angled above, then descending in a rather oblique curve; posterior side sloping, rather abruptly rounded; right valve bearing two small cardinal teeth, of which the anterior is short and sloping and the posterior narrowly bifid above, broadly so below; left valve also bearing two cardinals of which the anterior is rather narrowly bifid and the posterior very fine and oblique.

Long. 19, lat. 20.5 mm.

Hab.—Channel between Satpara and Barhampur, 8-20 ft. (*Type*); swamp inside bar N. of Barhampur Id.; channel off Satpara, 16-20 ft.; Kalidai Id.; between Mahosa and Satpara, 6 ft.; Satpara Bay; channel off Barhampur Id., 10-20 ft.; channel off Barhampur Id., 6-9 ft.; channel between Barnikuda and Satpara, 6½ ft.; southwards from Mahosa, 5-9 ft.; Mahosa, Barhampur Id.

Diplodonta barhampurensis, sp. n.

(Figs. 15, 15a, p. 301.)

Shell inflated, subequilateral, roundly trigonal, covered with a dark brown periostracum, finely concentrically striate; umbones rather large, prominent; dorsal margin somewhat angularly arched; ventral margin rounded; anterior side rounded; posterior side obtusely rounded; hinge normal.

Long. 13.75, lat. 14.75, diam. 10 mm.

Hab.—Channel off Barhampur Id., 10-20 ft.

Diplodonta (Felania) annandalei, Preston.

Rec. Ind. Mus., X, p. 307.

Channel between Satpara and Barhampur Id., 6-8 ft.; outer bar close to mouth; main channel W. of Satpara Id., 3-8 ft.; channel off Barhampur Id., 6-9 ft.; 3-4 miles E. by S. $\frac{1}{2}$ S. of Patsahanipur, 5-5 $\frac{1}{4}$ ft.; 4-9 miles E. by S. $\frac{1}{2}$ S. of Patsahanipur, 4-5 ft.; near Barnikuda, inside lake, 5 $\frac{1}{2}$ ft.; Satpara Bay; outer bar opposite Manikpatna temple; Maludaikuda Id.; 2-8 miles N.E. $\frac{1}{2}$ E. of Kalidai, 5-6 ft.

Diplodonta (Felania) chilkaënsis, Preston.

T.c., p. 307.

Manikpatna Id., sand-dunes opposite Manikpatna; outer bar 1 mile S.W. of mouth, 6 ft.; swamp inside bar N. of Barhampur Id.; outer bar opposite Manikpatna temple; S. side of Satpara Id., opposite bungalow.

Diplodonta (Felania) ovalis, Preston.

T.c., pp. 308-309.

Outer bar, 1 mile S.W. of mouth, 6 ft.; channel between Satpara and Barhampur Id., 6-8 ft.

Family DONACIDAE.

Donax pulchella Hanley.

Proc. Zool. Soc. London, 1843, p. 6.

Outer bar close to mouth (a single valve).

Family PSAMMOBIIDAE.

Psammobia mahosaënsis, sp. n.

(Figs. 16, 16a-b, p. 304.)

Shell small, very inequilateral, ovately cuneiform, concentrically striate, whitish, covered with a thin brown periostracum which is chiefly noticeable round the margins, both valves angled posteriorly; umbones small; dorsal margin angularly arched; ventral margin gently rounded; anterior side rounded; posterior side rather abruptly descending; right valve furnished with two minute cardinal teeth, the anterior being placed at a very obtuse angle to the posterior; the left valve also bearing two minute cardinals of which the anterior fits between those of the right valve.

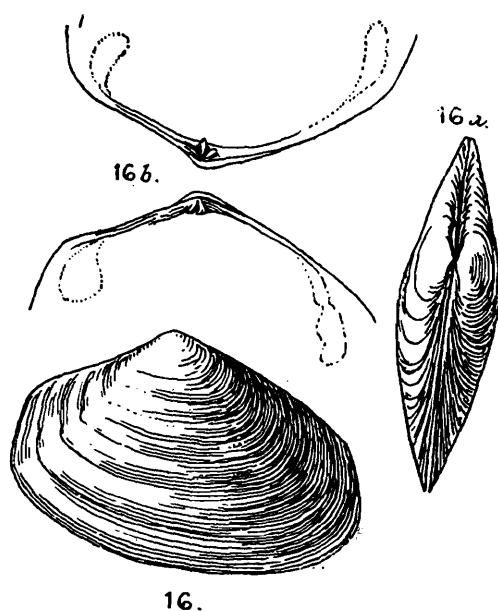
Long. 6.25, lat. 9.25 mm.

Hab.—Southwards from Mahosa, 5-9 ft. (*Type*); channel between Satpara and Barhampur, 8-20 ft.; channel between Barnikuda and Satpara, 6 $\frac{1}{2}$ ft.; on swamp inside bar N. of Barhampur Id.; Mahosa, southwards towards sandhills, 4-8 ft.

Family SOLENIDAE.

In the writer's former paper, on the Mollusca of the Chilka Lake, he recorded what he supposed to be juvenile examples of *S. truncatus*, Wood,¹ this determination however cannot stand; Dr. Annandale has since gone thoroughly into the matter and reports that there are, in his opinion, no less than three forms in the lake, one, a form only found on a bottom of fine mud inside the lake, a second, which only differs in its larger size and thicker shell and which according to Dr. Annandale is found "at sandy localities in the outer parts of the lake", and a third, which is found with the second, but has a much narrower shell.

The first (*i.e.* the smallest) of the three forms would appear,



FIGS. 16, 16a.—*Psammobia mahosaensis*, sp. n. $\times 4$.
 „ 16b.— „ „ „ (hinge) $\times 4$.

from Dr. Annandale's investigations, to be sexually adult and, as no such small forms are known from the Indian region, the shells of the last two are described in the present paper, no material being at the time of writing on hand from which to draw up a diagnosis of the first, the specimens having been returned to the Indian Museum with the author's previous report.

***Solen annandalei*, sp. n.**

(Figs. 17, 17a, p. 305.)

Shell small, covered with a yellowish brown, glossy, shining, polished periostracum, and plainly marked with concentric growth lines; dorsal and ventral margins quite straight; anterior side obliquely sloping in an anterior direction; posterior side obtuse,

Sowerby, *Genera of Shells*; Reeve, *Con. Icon.*, *Solen*, XIX, 1874, pl. i, fig. 1.

slopingly rounded at the ventral corner and sharply so at the dorsal corner; right valve bearing a single cardinal tooth which is grooved below and posteriorly erect above; left valve furnished with a very anteriorly erect, somewhat claviform, cardinal tooth.

Long. 49.25, lat. 9.5 mm.

Hab.—Satpara Bay.

***Solen kempī*, sp. n**

(Figs. 18, 18a.)

Shell differing from *S. annandalei*, in its smaller and proportionately much narrower form, it is of a thinner texture and the concentric growth lines are not so clearly marked, the anterior side is more obliquely truncate, the cardinal tooth in the right

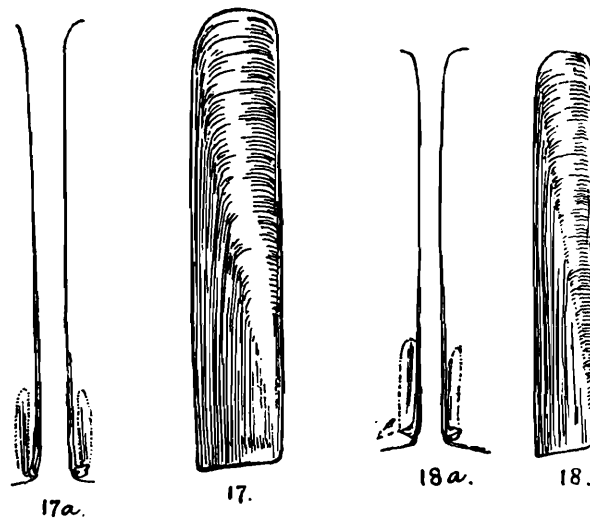


FIG. 17.—*Solen annandalei*, sp. n. $\times 1\frac{1}{2}$.
 " 17a.—" " (hinge) $\times 1\frac{1}{2}$.
 " 18.—*Solen kempī*, sp. n. $\times 1\frac{1}{2}$.
 " 18a.—" " (hinge) $\times 1\frac{1}{2}$.

valve is grooved, though only shallowly, throughout its whole breadth, while that in the left valve is more rigidly erect, even than is the case in *S. annandalei*.

Long. 43, lat. 6.5 mm

Hab.—20 miles S.E. by S. of Patsahanipur, $5\frac{1}{2}$ feet.

Sub-order *MYACEA*.

Family *MACTRIDAE*.

***Standella annandalei*, sp. n.**

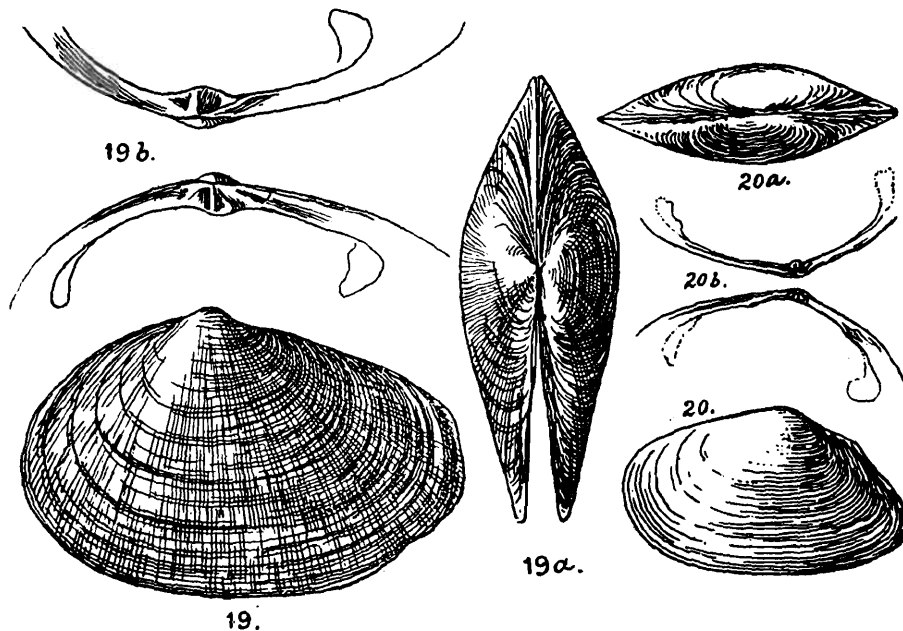
(Figs. 19, 19a-b, p. 306.)

Shell thin, fragile, gaping posteriorly, broadly cuneiform, whitish, covered with a thin brownish yellow periostracum, concentrically striate; umbones small; dorsal margin arched ante-

riorly, sloping posteriorly; ventral margin very gently rounded; anterior side rounded; posterior side produced, rather sharply rounded; right valve furnished with a V-shaped, somewhat anteriorly erect and jagged cardinal; left valve bearing an even more erect, but not jagged, cardinal tooth; lateral teeth in both valves short and sloping.

Long. 15.5, lat. 23.5 mm.

Hab.—N.E. side of Nalbano (*Type*); Satpara Bay.



FIGS. 19, 19a.—*Standella annandalei*, sp. n. $\times 2$.
 „ 19b.— „ „ (hinge) $\times 3$.
 „ 20, 20a.—*Tellina chilkaensis*, sp. n. $\times 3$.
 „ 20b.— „ „ (hinge) $\times 3$.

Sub-order *ADESMACEA*.

Family *TEREDINIDAE*.

Xylotrya stutchburyi, Sow.

Con. Icon., XX, pl. ii, fig. 5, *a*, *b*, *c*.

Post in channel off Satpara Point, 3-8 ft.

Order *DIBRANCHIA*.

Sub-order *TELLINACEA*.

Family *TELLINIDAE*.

Tellina chilkaensis, sp. n.

(Figs. 20, 20a-b.)

Shell small, elongately ovate, yellowish flesh coloured, polished, shining, somewhat iridescent, concentrically striate, um-

bones small, rather flattened; dorsal margin anteriorly sloping and slightly arched, posteriorly shortly excavated; ventral margin very gently rounded; anterior side sharply rounded above, slopingly so below; posterior side bluntly rostrate; right valve bearing two divergent, short, grooved, cardinal teeth, a strong, anteriorly overhanging, anterior lateral and a very weak posterior lateral; left valve bearing a rather strong bifid anterior and a very weak posterior cardinal only.

Long. 6.25, lat. 9.75, diam. 3.25 mm.

Hab.—Channel off Barhampur Id., 6-9 ft.

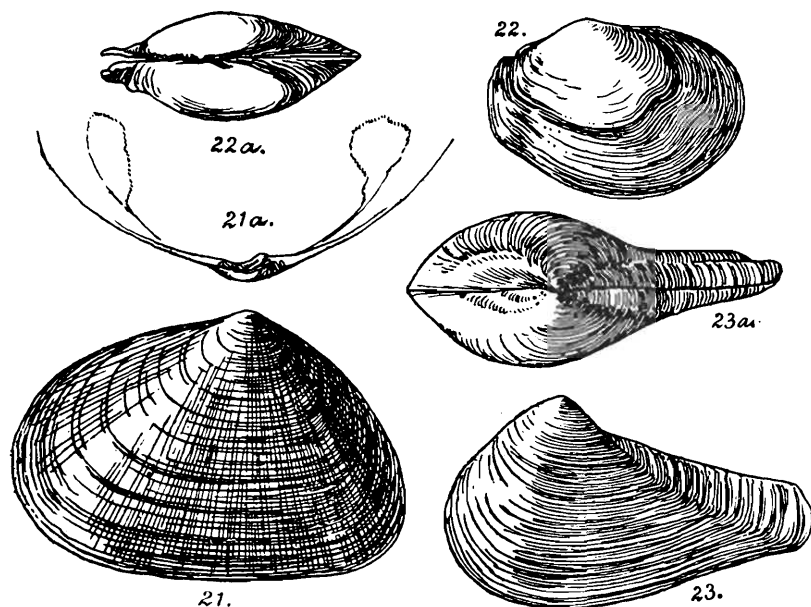


FIG. 21.—*Tellina barhampurensis*, sp. n. $\times 3$.
 " 21a.— " " (hinge) $\times 3$.
 " 22, 22a.—*Cumingia hinduorum*, sp. n. $\times 4\frac{1}{2}$.
 " 23, 23a.—*Cuspidaria annandalei*, sp. n. $\times 6$.

Tellina barhampurensis, sp. n.

(Figs. 21, 21a.)

Shell oblong-trigonal, whitish, concentrically and faintly radiately striate; umbone small; dorsal margin strongly arched; ventral margin almost straight; anterior side obtusely rounded; posterior side broad, rounded; anterior cardinal tooth very oblique, rather broadly bifid; posterior cardinal tooth angularly bent in a posterior direction; anterior lateral tooth very weak; posterior lateral short, erect.

Long. 14.5, lat. 20.5 mm.

Hab.—Channel between Satpara and Barhampur, 8-20 ft.

Unfortunately only a single valve (the right) has been available for description; but this is so characteristic that the author considers that no further apology is necessary for the founding of a species upon such scanty material.

Family SCROBICULARIIDAE.

Theora opalina, Hinds.

Proc. Zool. Soc. London, 1843, p. 78 (as *Neaera*).

Main channel W. of Satpara Id., 3-8 ft.; main channel between Satpara and Barnikuda, 6 ft.; 2-8 miles N.E. $\frac{1}{2}$ E. of Kalidai, 5-6 ft.; 1 mile N.E. by E. of Chiriya Id., $5\frac{1}{2}$ - $6\frac{3}{4}$ ft.; Serua Nadi, 5-9 ft.; 1-1 $\frac{1}{2}$ miles off Kalupara Ghat, 6-7 ft.; channel between Satpara and Barhampur Id., 6-8 ft.

Cumingia hinduorum, sp. n.

(Figs. 22, 22a, p. 307.)

Shell ovately rhomboidal, very thin, greyish, concentrically striate with growth lines only; umbones small; not very prominent; dorsal margin arched; ventral margin anteriorly rounded; posteriorly sloping; anterior side produced, rather sharply rounded; posterior side very obtusely rostrate; hinge normal.

Long. 6.5, lat. 9 mm.

Hab.—Main channel W. of Satpara Id., 3-8 ft. (*Type*); channel off Barhampur Id., 6-9 ft.; Mahosa, southwards towards sandhills, 4-8 ft.; 3-4 miles E. by S. $\frac{1}{2}$ S. of Patsahanipur, 5-5 $\frac{1}{4}$ ft.; channel between Satpara and Barnikuda, 6-10 ft.; southwards from Mahosa, 5-9 ft.; Mahosa, Barhampur Id.

Sub-order ANATINACEA.

Family CUSPIDARIIDAE.

Cuspidaria annandalei, sp. n.

(Figs. 23, 23a, p. 307.)

Shell small, irregularly triangulate, thin, yellowish white, except for the posterior prolongation and ventral margin which are covered with a light brown, membranaceous periostracum, concentrically striate, both valves being obliquely angled from the umbones downward, the angle being more accentuated in the right valve and extending to the ventral margin on the posterior side; umbones small, somewhat prominent; dorsal margin anteriorly arched, posteriorly gently sloping; ventral margin gently rounded especially anteriorly; anterior side rounded; posterior side rostrately produced, obliquely truncate, bearing a depression in both valves for about three-fourths of its length.

Long. 4, lat. 6.5 mm.

Hab.—4-9 miles E. by S. $\frac{1}{2}$ S. of Patsahanipur, 4-5 ft. (*Type*); Serua Nadi, 5-9 ft.; 4-7 miles E. $\frac{1}{2}$ S. of Patsahanipur, 4-4 $\frac{1}{2}$ ft.; about 4 miles E.N.E. of Kalupara Ghat, 6-7 ft.; 4-9 miles E. $\frac{1}{2}$ S. of Barkul bungalow, $5\frac{1}{4}$ - $5\frac{3}{4}$ ft.; 1-1 $\frac{1}{2}$ miles off Kalupara Ghat, 6-7 ft.; 1 mile S. of Kalidai, 4-8 ft.; Nalbano and channel S.E. of Nalbano, 4-8 ft.; main channel W. of Satpara Id., 3-8 ft.; main channel between Satpara and Barnikuda, 6 ft.; Mahosa, Barhampur Id.

Family LYONSIIDAE.

Lyonsia samalinsulae, Preston.*Rec. Ind. Mus.*, X, p. 310.

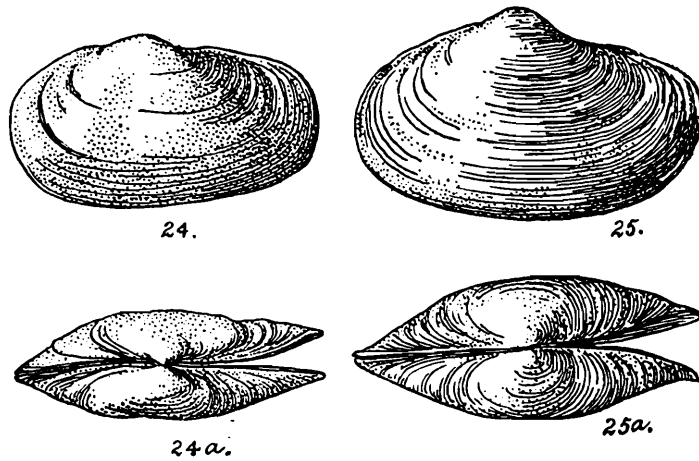
Main channel W of Satpara Id., 3-8 ft.; Serua Nadi, 5-9 ft.; Mahosa, southwards towards sandhills, 4-8 ft.

Family ANATINIDAE.

Anatina barkudaënsis, sp. n.

(Figs. 25, 25a.)

Shell rather small, oblong, gaping at both ends, but especially posteriorly, concentrically striate and minutely pustulate except at the posterior side, where the pustules cease abruptly and the shell is only very coarsely and irregularly concentrically striate;



FIGS. 24, 24a.—*Anatina barkulensis*, sp. n. $\times 3$.
 „ 25, 25a.—*Anatina barkudaensis*, sp. n. $\times 3$.

umbones of moderate size, slightly prominent; dorsal and ventral margins nearly straight; anterior side rounded; posterior side very abruptly rounded; hinge quite normal.

Long. 9.25, lat. 17 mm.

Hab.—Barkuda Id. (*Type*); Chiriya Id.; Manikpatna Id.; in mud at edge of Lake Rambha, Ganjam District, Madras; swamp inside bar, N. of Barhampur Id.; Satpara Bay; channel between Satpara and Barnikuda, 6-10 ft.; E. side of Rambha Bay, 1-4 $\frac{3}{4}$ ft.

Anatina barkulensis, sp. n.

(Figs. 24, 24a.)

Shell oblong ovate, thin, gaping at both sides, white, minutely pustulous, the margins showing traces of a reddish laminiferous periostracum, concentrically striate; umbones rather large, moderately prominent; anterior margin somewhat straight;

ventral margin gently rounded; anterior side rounded above, receding below; posterior side rounded; hinge normal.

Long. 11.25, lat. 20 mm.

Hab.—Barkul Point (*Type*); Mahosa, southwards towards sandhills, 4-8 ft.

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# XVI NOTES FROM THE BENGAL FISH ERIES LABORATORY, INDIAN MUSEUM

## NO. 2. ON SOME INDIAN PARASITES OF FISH, WITH A NOTE ON CARCINOMA IN TROUT.

By T. SOUTHWELL, A.R.C.S., F.L.S., F.Z.S., Dy. Director of  
Fisheries, Bengal, Bihar and Orissa, Honorary Assistant,  
Indian Museum.

(Plates xxvi-xxviii).

| CONTENTS.                                                                                                                                | Page |
|------------------------------------------------------------------------------------------------------------------------------------------|------|
| (1) A skin disease found on <i>Rasbora daniconius</i>                                                                                    | 312  |
| (2) A parasite encysted in the skin of <i>Cirrhina latia</i> .                                                                           | 313  |
| (3) <i>Cercaria</i> in skin of <i>Nuria danrica</i> .                                                                                    | 315  |
| (4) Cysts from the skin of <i>Nuria danrica</i> var. <i>grahami</i>                                                                      | 315  |
| (5) Encysted <i>Cercaria</i> in the superficial muscles of <i>Labeo rohita</i> and <i>Catla buehanani</i>                                | 316  |
| (6) Carcinoma of the thyroid in Rainbow trout ( <i>Salmo irideus</i> ) from Naini Tal                                                    | 317  |
| (7) Description of a new species of Isopod Crustacean parasitic on the Bhekṭi ( <i>Lates calcarifer</i> )                                | 321  |
| (8) <i>Argulus foliaceus</i> , Linn., from the skin of <i>Labeo rohita</i>                                                               | 323  |
| (9) <i>Amphilina magna</i> , n. sp., from the coelom of <i>Digramma crassispinum</i>                                                     | 326  |
| (10) <i>Syndesmobothrium filicollē</i> , Linton, parasitic in the flesh of <i>Harpodon nehereus</i> ("Bombay duck") from Diamond Harbour | 329  |
| (11) Disease in the eye of <i>Holocentrum rubrum</i>                                                                                     | 330  |

The following paper deals with a variety of fish diseases, all of which are—with two exceptions—caused by parasites.

The "lice" which live on the skin of Bhekṭi are not more harmful than other lice which live on other animals. The "lice" which are described from Rohu are, however, much more dangerous than those found on Bhekṭi. In tanks and confined water-areas these parasites may cause great mortality amongst Rohu, and every fish in the tank may die.

The larval Trematodes which live in the skin and flesh of a number of fish are of some importance. Heavy infection most probably interferes somewhat with normal growth, and it is not

impossible that certain of these parasites may mature in the human intestine.

The "pox" recorded from *Rasbora daniconius* (Bengali "dankona") may become a very fatal disease when occurring in limited water-areas such as tanks.

The parasite from the abdomen of *Diagramma crassispinum* (a fish somewhat like the one known in Bengal as Khora Bhekti) is not of any commercial importance.

An epidemic of goitre amongst the trout at Naini Tal is of a serious nature, and if not kept in check will interfere greatly with the successful cultivation of this species.

A case of Glaucoma of the eye in a marine fish recorded in this paper is of pathological interest only.

### (1) A skin disease found on *Rasbora daniconius*.

(Plate xxvi, fig. 3).

Four specimens were collected by Capt. R. B. Seymour Sewell, B.A., I.M.S., from a stream near Katiwan, Mirzapore (U. P.), India.

In all, six cysts were found on the four fish in question. They were situated immediately below the scales, in the epidermis, and were milky-white, soft, flattened, and roughly oval in shape. The largest measured 1.1 mm. No pigment was present.

Preparations of the contents of these cysts showed that they contained Myxosporidia, or parasitic protozoa. The order Myxosporidia, Butschli, contains a series of parasites which occur in both fresh water and marine fish. They are usually found beneath the skin, as small wart-like nodules near the fins and on the gills. The parasite causing the well-known silkworm disease (*Glugea bombycis*) is closely related to the parasite recorded in the present paper. Representatives of the Myxosporidia have also been found in the urinary bladder and gall bladder of fishes, and they are also recorded as occurring in Crustacea, frogs, and crocodiles. At the present time over 60 species of fish are known to harbour parasites included in the order Myxosporidia and about 50 distinct species of parasites are recognized. In Europe epidemics amongst fish have frequently been traced to the presence of such parasites, although it appears that the mortality is not directly due to their presence, but to the presence of bacilli which develop within the cysts and give rise to ulcerations, which, discharging, not only kill the fish, but spread the disease.

Our parasites belong to the family Myxobolidae, Thelohan. The characters of this family are as follows:—

Spores with one or two polar capsules and with a peculiar iodophilous vacuole in the sporoplasm (Minchin).

The genus *Myxobolus*, Butschli, 1882, to which our specimens belong, are characterized by the presence of one or two polar capsules and by the absence from the spore-membrane of a tail-like process. Minchin (Lankester's Zoology, Part I, London 1903,

p. 296) states that the genus is divisible into three sections. One section possess pear-shaped spores each with a single polar capsule. In the second section the two polar capsules are of unequal size. In the third section are numerous forms characterized by two polar capsules of equal size. *M. pfeifferi*, Thel., gives rise in Europe to the deadly "barbel disease." *M. cyprini*, Dofl. has been recorded from carp. As far as I have been able to ascertain, the only papers available in Calcutta which deal with the genus *Myxobolus* are the following :—

(1) Minchin, *vide ante*.

(2) Gurley. On the classification of the Myxoporida, a group of Protozoan parasites infesting fishes. *Bulletin United States Fish Commission*, vol. XI for 1891, Washington, 1893, pp. 407-420.

(3) Ludwig Cohn. Über die Myxosporidien von *Esox lucius* und *Perca fluviatilis*. *Zool. Jahrb., Anal. Abth.*, vol. IX, text and plates, Jena, 1896, pp. 228-272.

(4) (a) Linton. On certain wart-like excrescences occurring on the short Minnow, *Cyprinodon variegatus*, due to Psorosperms.

(b) Notice of the occurrence of Protozoan parasites (Psorosperms) on Cyprinoid fishes in Ohio. *Bulletin United States Fish Commission*, vol. IX for 1889, Washington, 1891, pp. 99-102 and 359-361.

Our specimens apparently do not belong to any of the species described in the above papers, but they are very closely related to the Psorosperms obtained by Linton from *Cyprinodon variegatus*. Owing to lack of literature I have been unable to determine whether our parasites represent a new species or not. Further, as our material was scanty, I have not been able to work out all the details regarding the shape of the spores. I have therefore deemed it advisable to leave our specimens unnamed, at least for the present. *Myxobolus cyprini* has been recorded from *Cyprinus carpio*, and it is quite possible that our parasites may belong to *M. cyprini*. The following details were ascertained.

*Cyst.*—Lenticular. Greatest length 1.1 mm.

*Spore.*—Length  $13\mu$ ; breadth  $13\mu$ .

Capsules; 2, equal,  $4\mu$  in length,  $4\mu$  in breadth, with a very short anterior tail-like process.

Vacuole present.

As all my specimens were at once stained and mounted in balsam, I was unable to conduct re-actions with iodine, and sulphuric acid.

*Habitat.*—Sub-cutaneous intermuscular tissue of *Rasbora daniconius*, Day (= *Cyprinus daniconius*, Ham. Buch.).

## (2) A parasite encysted in the skin of *Cirrhina latia*.

(Plate xxvii, fig. 10).

Three specimens from Mr. Mitchell, Srinagar, Kashmir, September, 1914. Mr. Mitchell stated that such diseased fish were fairly plentiful. Other genera or species affected were not defined.

One fish measured 77 mm. long and 28 mm. broad.

The size of the largest cyst found on this fish was 4 mm.  $\times$  2.5 mm., and that of the smallest was 1.25 mm.  $\times$  1 mm. There were 7 cysts on one specimen distributed as follows:—

- A. (1) Behind junction of upper and lower left lips.  
(2) One mm. behind left eye.  
(3) Ten mm. behind base of left pectoral fin.  
(4) Three mm. behind base of right pectoral fin.  
(5) Near posterior extremity of right pectoral fin.  
(6) Anterior and a little to left of anus.  
(7) Four mm. in front of anus.

B. This fish measured 89 mm. long and 18 mm. broad. The positions of the cysts were as follows:—

- (1) Under left eye.  
(2) Above right eye.  
(3) Between the branchial apertures.  
(4) Near posterior extremity of left pectoral fin.  
(5) One and a half mm. posterior to base of left pectoral fin.  
(6) Two mm. behind left eye, near middle line.  
(7) On the right side of the dorsal fin.  
(8) At the base of the caudal fin on the right side.  
(9) On anal fin.  
(10) Anterior to anus.  
(11) Near middle of right side of body-wall.  
(12) Eighteen mm. anterior to base of caudal fin, on the left side.  
(13) Twenty-nine mm. anterior to base of caudal fin, on the left side.  
(14) Ten and a half mm. posterior to right eye.  
(15) Mid-ventral line, between mouth and anus.

In every case the cysts were situated in the epidermis and were covered by scales. No cysts were found in the muscles. The wall of one cyst was 1.1 mm. thick and was densely pigmented with black. To the naked eye the cysts appeared of a dark steel-grey colour, due to the unpigmented covering of scales and epidermis. The wall of the cyst was tough and fibrous, and, as we have already noted, densely black.

The cysts contained *Cercaria* of a milky-white colour. They measured 7 mm. long and were bent upon themselves. The fish were not well preserved and the *Cercaria* were of a pasty consistency which did not allow of a careful examination of their anatomy. One sucker, however, appeared quite distinct. It is, of course, impossible to state the probable identity of the adult species represented by these immature forms. Similar cysts and parasites have been recorded by Linton from a "cunner", *Tautoglabrus adspersus* (Bull. U.S. Fish Comm., Washington

1889, page 296, pt. 40, figs. 76-81), and by Ryder (*Bull. U.S. Fish Comm.*, 1884, pages 37-42).

The 'cunner' however is a marine fish of the Wrasse family, and it is unlikely that our parasites are identical either with those obtained by Linton or Ryder.

Hofer (*Handbuch der Fischkrankheiten*, München, 1904) describes a number of similar cysts from European fresh-water fishes and classifies them as *Holostomum cuticula*. It is quite possible that our larvae belong to the same species.

If these encysted immature forms of Trematodes are actually the young of *Holostomum cuticula*, it is almost certain that the adult forms will eventually be found in the intestine of fish-eating birds. The two species of fish infected are both very small and would be easily available and readily eaten by such birds.

### (3) *Cercaria* in skin of *Nuria danrica*.

(Plate xxvii, fig. 9).

Eight specimens presented by Mr. J Taylor, Angul, Orissa, 4-v-14. All these fish (which are known in Bengal as "danrika") were very heavily infected. In the largest fish, which measured 36 mm. in length, 27 cysts were counted scattered all over the body. The smallest fish measured 21 mm. and 18 cysts were counted on this specimen. The older cysts were black pigmented, but the pigmentation was not nearly so dense as in the preceding form. The capsule was very delicate and easily ruptured. The amount of black pigment that was present varied, but was never very great. In two very young larval forms, which were removed from the gills, no pigment was present. In slightly older stages only a little pigment was observed, whilst in the largest and oldest forms obtained the pigment was never sufficiently abundant to obscure the larval cyst.

The largest cyst observed was oval and measured 1.1 mm. by .9 mm. The larva only occupied about one-half the interior space of the capsule. It measured .4 mm. and was folded upon itself. What appeared to be a sucker was discernible in the older forms.

It will be obvious that these larval forms differ from those obtained from *Cirrhina latia* in being younger and much smaller. Whether or not they are identical with those found on that species remains to be determined.

### (4) Cysts from the skin of *Nuria danrica* var. *grahami*.

(Plate xxvi, figs. 5, 5a, 5b and 5c).

Champadanga, R. Damodar near Calcutta, July, 1913.

This fish, which only measured 17 mm. long, was caught along with the young of a number of carp, *Ambassis* spp., and *Barbus* spp.

Three specimens were obtained having black cysts in the skin. In one specimen there were 7 cysts, in another 13 or 14, and in

the third there were over 20. The cysts were distributed generally over the body and were situated in the epidermis. They were surrounded with dense black pigment. On opening the cyst a milky-white larva was obtained which measured .7 mm. long and .5 mm. broad. This larva was enclosed in a thin, but pigmented sac, which was unattached and easily removed. Figures of the parasite are given on plate xxvi, figs. 5a, b and c. There was an outer, somewhat egg-shaped membrane, which was tough and transparent. The contents of this membrane were disposed towards one pole. A few cells in an active state of division were observed, towards the pole. The larva is evidently too young to admit of certain identification.

It is probable that the adult of this parasite will be found in fish-eating birds as its host is commonly eaten by them.

(5) Encysted *Cercaria* in the superficial muscles of *Labeo rohita* and *Catla buehanani*.

(Plate xxvi, fig. 4).

Locality.—(I) *Labeo rohita* and *Catla buehanani* from Rajmehar, Bihar, India, October, 1913.

(II) *Labeo rohita* (other specimens). No history.

The cysts were smaller but similar in outward appearance to those found in *Cirrhina latia*. They were, however, situated in the superficial muscular layer. The two suckers were prominent. At present, the identification of these larval forms is impossible.

Their occurrence in the muscular tissue of these fish is a fact of considerable importance. These two species of carp are the two most important food-fishes in Bengal and they frequently attain a weight of over 25 lbs. The fact that the larvae occur in the muscular tissue and not in the skin, means that they are not removed during the ordinary process of cleaning, prior to the fish being placed on the table. It is true that if well cooked, the larvae are destroyed. Even if not destroyed by cooking we have no information at present as to whether these larval forms mature in the human intestine, or not.

In a previous paper (*Rec. Ind. Mus.* vol. IX, part II, June, 1913) I called attention to the fact that the rare Trematode, *Gasterodiscus hominis*, Lewis and McConnel, has been recorded twice from man in Calcutta. It is quite possible that the larval form of this Trematode may occur in the skin of fish. In this connection it is to be remembered that fish is one of the staple articles of food in Bengal.

Although I have examined several thousands of marine fish during an experience of roughly six years on the Ceylon Pearl Banks, I have never found either Trematodes or Sporozoa in the skin.

(6) **Carcinoma of the Thyroid in rainbow trout (*Salmo irideus*) from Naini Tal.**

(Plate xxvi, figs. 1 and 2).

During the early part of 1914, the Dy. Conservator of Forests, Naini Tal, United Provinces, India, in a letter to me, stated that numbers of rainbow trout (*Salmo irideus*) were dying in the hill-waters in the vicinity of Naini Tal. I requested him to forward to me specimens of the dead fish, preserved in spirit. In all, I received 13 specimens. The largest measured  $15\frac{1}{2}$  inches and the smallest 10 inches. There were 4 or 5 females with ripe eggs. No external or internal parasites were discovered. Three of the fish had a small abrasion on the body. These wounds, however, were occasioned during packing and transit, and were in no way connected with the death of the fish. Out of the 13 fish sent, tumours were found on the gills of three. Excepting the tumours just mentioned, the fish appeared normal and well fed. The location of the tumours was as follows :—

(1) *A small trout 10 inches long.*—The tumour was situated in the gills, on the convex (postero-ventral) edge of the gill-arches on the right side. Only one tumour was present (plate xxvi, fig. 2). It measured 17 mm. long, 9 mm. high and 4 mm. thick. The outer surface of the gills in the vicinity of the tumour was slightly pigmented with black. The tumour did not involve the bony branchial arches, but only the gill-filaments in the vicinity, *i.e.* the tumour replaced the gill-filaments. The gill on the last branchial arch was the only one not involved.

(2) *A large trout  $15\frac{1}{2}$  inches.*—Two tumours, one in each branchial cavity, visible ventrally as coarsely nodulated or lobated masses in the anterior extremity of each branchial chamber. The one on the right side was larger than that on the left. The measurements were as follows :—

Large tumour—long 20 mm., high 13 mm., thick 11 mm.

Small tumour—,, 14 ,, ,, 7 ,, ,, 5 ,,

The external gill-filaments on the right side were only slightly affected. The corresponding gill-filament on the left side was not involved.

(3) *A medium-sized fish.*—Two tumours situated as in (2), both of the same size and measuring 20 mm. long, 14 mm. high and 15 mm. thick.

The latter tumours were situated at the anterior extremity of the branchial chamber just below the eye, and were sufficiently bulky to project into the buccal cavity. The tumours consisted for the most part of a yellow-white cheesy substance enclosed in a thin, but slightly tough, fibrous capsule. The tumours were not pedunculated, but were supported by the capsule, which was attached at various places to the anterior wall of the branchial chamber. Posteriorly the cyst was free. Anteriorly the two tumours were in contact in the centre line. The tumours consisted entirely of the caseous substance referred to above.

Unfortunately only spirit specimens were available and hence I have been unable to make observations on fresh material. Sections were made from one of the larger tumours. These tumours are undoubtedly due to a disease of the thyroid variously known as gill-disease, thyroid tumour, endemic goitre and carcinoma of the thyroid. The disease was first noted in 1883 by R. Bonnet (1)<sup>1</sup>—in *Trutta lacustris* obtained from a hatchery in Torbole on the Gardasee. The disease accounted for the death of 3000 fish.

The first investigator to define the tumour as Carcinoma was Scott (9) who found it in *Salmo frontinalis* from ponds at Opoho belonging to the Dunedin Acclimatisation Society, New Zealand.

In 1902, Marianne Plehn (8) recognized that the tumours were due to a disease of the thyroid gland. In 1903, L. Pick (7b) described the disease fully. Gilruth (3) in the reports of the New Zealand Department of Agriculture (Veterinary Division, 1901 and 1902) described a similar disease in *Salmo salar* as "Epithelioma affecting the branchial arches of Salmon and Trout." Later, this author recorded the disease from *Salmo irideus*.

L. F. Ayson, Chief Inspector of Fisheries, New Zealand, stated in a letter to Gilruth that he had noticed the disease in *Salvelinus frontinalis* in 1890. In 1908, Jaboulay (5) reported the disease in six trout from Thonon. Up to the present, five species of fish from Europe and 21 species from America have been recorded suffering from the disease. In America the disease appears to have been known for a long time although not described until 1909, when Dr. Gaylord read a paper on "an epidemic of cancer of the thyroid in brook trout" before the American Association for Cancer Research. The initial investigations into diseased thyroids in the Salmonidae by the American Association for Cancer Research were due to the papers on the subject which had previously appeared by Plehn and Pick.

The Association continued to make extensive observations on the disease, and an excellent and exhaustive report on the subject was published in the Bulletin of the Bureau of Fisheries vol. XXXII, 1912 ("Carcinoma of the Thyroid in the Salmonoid fishes," by Harvey R. Gaylord, etc., Doc. No. 790. Issued April 22, 1914). To these authors I am indebted for most of the details set forth in the present paper. In Salmonoid fishes the thyroid is a more or less diffuse, unencapsuled organ, distributed along the course of the ventral aorta. The gland, however, appears to be much more diffuse in domesticated trout than in wild trout. Gudernatch states that in wild species the gland may extend into the gill-arches and even into the muscle bundles of the isthmus. This circumstance serves to explain the fact that tumours may be found in places as far removed as the jugular pit and the rectum. The disease is universal where trout are artificially cultivated, and in certain hatcheries it may become endemic. Artificial cultivation is obviously a predisposing factor since the disease is rare in nature.

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<sup>1</sup> These numbers refer to the literature cited on p. 320.

Healthy wild fish placed in hatcheries where the disease is endemic soon become affected. The first symptoms of disease of the thyroid is simple hyperplasia usually marked in living specimens by a redness of the throat ("red floor") near the second gill arches, and caused by an increase in the blood supply to the thyroid, and to hyperaemia of the adjacent tissues. This condition of simple hyperplasia passes gradually into the stage of visible tumour. Various structural types of infiltrating tumour are known amongst Salmonoid fishes, including the alveolar, solid, tubular, papillar and mixed, and the investigations of workers in America show that the tumour is of a true malignant nature.

The cause of the disease has not been definitely determined, but it is known that trout fed on animal proteid food, in an *uncooked* condition, are more heavily infected than those fed on *cooked* animal proteid food. The crowding together of fish in confined spaces, and other generally unsatisfactory hygienic conditions also favours the spread of the disease.

General insanitary conditions alone are, however, insufficient to account for the phenomenon. A specific living organism is suspected, although no such organism has been isolated up to the present. In America it was found that scrapings from the inner surface of the wooden tanks in which diseased fish were kept, if suspended in water and administered to certain mammals, produced in such animals a definite condition of goitre, and it was accordingly believed that this agent was the cause of the disease amongst the fish in the tank.

It was further shown that by boiling the water the effective agent was destroyed. The disease does not appear to be directly transmissible from one individual to another.

Some species of the Salmonidae are practically immune from the disease, and in other species spontaneous recovery frequently occurs. Especially is this the case if the diseased fish are removed to natural conditions and allowed to feed on natural food. Moreover the disease is directly susceptible to treatment. At all times the normal thyroid contains traces of iodine. During hyperplasia the proportion of iodine appears to be reduced. Occasionally human goitre reacts favourably to treatment with iodine. In all stages of its growth the tumour in fish is favourably affected by solutions of iodine as well as by those of mercury and arsenic. It is thus possible, in a limited way, to treat these diseases in hatcheries and in limited water-areas. At the same time it will be obvious that the object of fish culturalists should be to prevent the disease rather than to effect its cure.

A tumour, apparently of a similar nature, is recorded by Williamson (Fisheries Scotland, Scientific Investigations for 1911, Glasgow, 1913, page 23) in the following words.

*"Tumour in the pharynx of a Salmon caught in the sea."*

"It was found loose in the gill cavity after the fish had been killed by a blow on the head. Two of the gills were found to be

damaged. There was a sinus in the free edge of the gill. It is not clear how the tumour was attached, but the connection was apparently a slender one. The tumour is lobulated, fibrous in structure, without any distinct lamina."

Simple hyperplasia of the thyroid has also been recorded in pike, bass, and occasionally in herring, by Marine and Lenhart.

During an experience of about five years on the Ceylon Pearl Banks, although I had occasion to examine very many thousands of fish, in no instance did I see a case of visible tumour in any examined.

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(7) Description of a new species of Isopod Crustacean  
parasitic on the Bhekṭi (*Lates calcarifer*).

*Rocinella latis*, n. sp.

(Plate xxviii, figs. 12-15).

|                       |                                |                     |               |
|-----------------------|--------------------------------|---------------------|---------------|
| No. $\frac{2056}{10}$ | From skin of <i>Lates cal-</i> | Diamond Harbour (R. | T. Southwell. |
|                       | <i>carifer</i> , 15-ii-1915.   | Hughli), near Cal-  |               |
|                       |                                | cutta.              |               |

All the specimens caught were males. The head projects well beyond the basal joints of the first and second antennae as a broadly rounded plate, convex from above. The first peraeon segment is longer than the rest. The first five segments of the pleon are a little narrower than those of the peraeon. The telson is slightly narrower than the preceding segments of the pleon.

The eyes are large, well separated, and situated laterally. They extend on to the ventral surface.

The bases of the first and second antennae are hidden in dorsal view by the frontal lamina which extends well beyond them. The first antennae are much stouter and much shorter than the second antennae. The flagellum is 8-jointed and terminates abruptly. The last joint extends to the middle of the first peraeon segment. The second antennae are, as noted, slender.

The flagellum consists of 10 (possibly 11) joints and it extends to the posterior extremity of the first peraeon segment. In length it exceeds that of the first antennae by its terminal 3 joints. The basal joints of the antennae are not distended.

The upper lip is crescentic, thin and membranous.

The mandibles have the palp somewhat elongated.

The first three pairs of legs are prehensile and have long and evenly curved dactyli, the extremities of which are of a dark brown colour in most specimens. The propodus is broad and crested and is armed with about 8 long, pointed, comb-like spines. There is a single elongated spine at the distal and exterior angle of the merus. The spines on the propodus of the first pair of legs are not quite as well defined as those of the second and third pairs.

The four gressorial legs are very similar to the first three pairs of legs, but a little more slender. The dactylus bears two spines near its base. The propodus bears 8 spines, but the spines are not borne on a crest, *i.e.* the propodus is not nearly so broad as is the case in the first three pairs of legs. The carpus bears four spines and the merus two. All these spines are situated on the internal surface. The last pair of legs is slightly smaller than the rest.

The largest specimen measured 1.4 mm. long and the greatest breadth was 4.5 mm.

In young specimens the whole surface is marked with minute pigment spots, hardly visible to the naked eye. In adults, however, the pigment consists of three very narrow longitudinal bands, one on each side and one running along the centre of the carapace.

This latter band spreads out between the eyes. Each band of colour consists of very numerous pigment spots.

The Bhekṭi on which these parasites occurred was caught in the vicinity of Diamond Harbour in the Hughli river near Calcutta on February 15, 1915. When placed on deck alive, some three dozen parasites were found to be moving over the skin of the fish. A few left the host and were picked up from the deck of the ship. I have never seen these parasites on any Bhekṭi in the markets and I believe that after the fish are removed from water the parasites quickly drop off.

The parasites are Isopods of the tribe Flabellifera. They are included in the family Aegidae and fall in the genus *Rocinella*, Leach, 1818. The characters of this genus are as follows :—

“Form of body resembling that of *Aega*, though being somewhat less compact and more depressed. Metasome generally less broad, with the terminal segment rounded off at the end and finely ciliated. Eyes well developed with very large and conspicuous cornea. Antennae slender, the superior ones much shorter than the inferior, and with the basal joints not expanded. Epistomal plate very small and narrow. Mandibles considerably produced, with the cutting edge expanded inside to a linguiform lamella (molar expansion); palp well developed with the basal joints much elongated. Maxillae nearly as in *Aega*. Maxillipeds with the palp composed of only two joints, the terminal one armed with strong recurved teeth. The three anterior pairs of legs having the propodus more or less expanded and armed inside with strong spines, dactylus forming a very large and evenly curved hook. The four posterior pairs slender, resembling in structure those in *Aega*. Pleopoda and uropoda normal” (Sars).

The conspicuous cornea, the non-expanded base of the antennae, the nature of the propodus in the three anterior pairs of legs, the evenly armed dactylus on the three anterior pairs of legs, and the four-jointed maxillipeds, distinguish the parasite as belonging to the genus *Rocinella*. An outstanding feature of the species is the broad elongated head-shield which extends well beyond the bases of the two pairs of antennae.

The specimens have been deposited in the Indian Museum.

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(8) *Argulus foliaceus*, Linnaeus, from the skin of *Labeo rohita* (Rohu).

(Plate xxviii, figs. 16-18).

Agricultural Farm tank, Siripur, Bihar, India. August 20, 1913.

During the year 1913 I was engaged making observations with reference to the breeding habits of Indian Carp. For this purpose three tanks were dug in the Agricultural Farm at Siripur. The measurements of the three tanks were the same, namely, 50 ft. in length, 37 ft. in breadth and 7 ft. in depth.

These tanks were situated in a line at right-angles with, and very close to, a neighbouring stream, from which they received water.

In addition, it was found that a small spring of water existed in the middle tank. The tanks were only separated from each other by a narrow bund and they were in connection with each other by means of a pipe running through each bund near the surface. The tank which we will consider as No. 1 was situated nearest to the stream, from which it was distant only about three or four yards.

About eighteen mature specimens of *Labeo rohita*, both males and females, were placed in these three tanks during the latter part of July. It was found that large numbers of frogs entered the tank nearest to the river. In order to exclude frogs from this tank a matted fence was erected all round it. About the middle of August, Mr. Mackenzie, the Superintendent of the Agricultural Farm, noticed that the fish became sluggish and floated on the top of the water. On examining one or two it was found that they were covered with external parasites. These were preserved in spirit and forwarded to me. The steps taken by the Farm Superintendent to remedy the disease were as follows:—First, all the fish were captured and scraped as clean as possible. The fence matting was then removed giving free access to frogs, etc. Lastly, an upright bamboo was erected in the centre of the pond. The Farm Superintendent, whose observations and statements are thoroughly reliable, states that the fish proceeded forthwith to rub themselves against this bamboo. There were no deaths.

About the end of September all the fish were captured and killed and were then found to be perfectly clean; not a single parasite was found. The fish present in the second and third tank were not affected. I have since ascertained that extensive deaths amongst carp in tanks due to "external parasites" have occurred, within the last four years, in the districts of Mymensingh and Murshidabad, and I have no doubt that the parasite causing these diseases was identical with the one obtained from Siripur. The forms examined by me are undoubtedly *Argulus foliaceus*, Linn., and have been recorded as external skin and gill parasites

from a large number of European freshwater fishes, such as *Tinca vulgaris*, *Gasterosteus* spp., *Cyprinus carpio*, *Esox lucius*, *Perca fluviatilis*, *Salmo trutta*, etc., and even from the tadpoles of frogs.

The parasites attach themselves to their host by means of two strong suckers which are the modified anterior maxillipeds. Like other parasitic Copepoda they suck the blood of their host. This is effected by means of a proboscis or dart which is evertable, and which is formed by a modification of certain of the mouth parts. The posterior maxillipeds are also modified for the purpose of clasping, and thus enable the parasite to cling to its host. In addition, the basal joints of the anterior antennae are modified for a similar purpose. The parasites lie inserted between the scales of the fish, with their long axis parallel to that of the host. They are, however, by no means stationary and fixed, but may be seen to skip about over the fish's body as if in search of a better position. During the breeding season they voluntarily leave the body of the fish and swim about actively in the water by means of four pairs of swimming legs. Unlike other Copepoda, the eggs, which are laid in gelatinous strings of two rows, are usually shed into the water and not carried about by the female. On being shed, the gelatinous covering hardens and thereby firmly attaches the eggs to the object on which they were deposited. Observations made in Europe show that the parasite breeds three times a year. Under these circumstances it is clear that there are three occasions each year when infected fish may free themselves from their parasites. The development of the egg occupies about a month.

Wilson states that the newly-hatched larvae have the general characters of the adults and on hatching begin to swim at once. The nauplius, metanauplius and early cyclops stages are passed inside the egg. After a few moults they become adult. Certain species of *Argulus* appear to be capable of living on both fresh and salt water fishes. This circumstance, together with the fact that the parasites can swim freely and frequently leave their host, accounts for the fact that the same species of parasite is often found on different species of fish.

As far as I am aware this is the first definite record of this parasite in India. In April, 1910 Mr. S. W. Kemp, Senior Assistant Superintendent, Indian Museum, inspected a tank near the palace of the Maharaja of Cossim Bazar in which diseased fish (*Rohu*, *Labeo rohita*) were living. He found that the disease was associated with scanty food, and the presence of large numbers of leeches and parasitic Copepoda, the latter belonging to the genus *Argulus*.

On April 17th, 1911, Dr. Annandale obtained a free-living *Argulus* from the Atrai river, near Siliguri, at the base of the Himalayas (Jalpaiguri District, Bengal). I have examined the latter specimen and found it to be a very small male *Argulus foliaceus*, Linn. Unfortunately I have been unable to obtain the specimens collected by Mr. Kemp, but it is very probable that they also belong to this species.

It is significant that the parasites, both at Cossim Bazar and Siripur, only attacked *Labeo rohita*, although other species of fish, such as *Catla buechanani* and *Cirrhina mirgala*, were living in the same tank at Cossim Bazar, and in the next tanks at Siripur. The mortality amongst tank fish in particular, due to the presence of this parasite, is, in all probability, fairly extensive in Bengal. In nature, however, the parasites are rarely dangerous. The practice of stocking tanks with fish—so prevalent in Bengal—undoubtedly favours conditions under which the parasite thrives. It is known that in Europe the parasites themselves are eagerly devoured by roach, dace and bream. The presence of such fish therefore tends to check the distribution of the parasite and thus to protect other fish from their attacks. It seems possible that in our tanks at Siripur, the frogs, when allowed to enter, also devoured the parasites, but no direct observations were made in this connection, and hence we have no certainty that such was really the case.

The family Argulidae, Muller, belongs to the sub-order Branchiura, Thorell, and to the order Copepoda, Muller. It contains three genera viz. *Argulus*, *Chonopeltis* and *Dolops*. In the former two genera the first maxillipeds are modified into sucking discs and in the latter genus sucking discs are absent. The genus *Argulus* contains about thirty-two species of which only three are European, the rest being found in American waters. The majority of the forms are marine. The various species exhibit but little trace of degeneration, a circumstance one would expect considering the alternation which exists between temporary parasitism and a free life. The males differ but slightly from the females but are considerably smaller.

Our specimens, of which we have over 200, are small, the extreme length of the largest female was 3.2 mm. and the greatest breadth was 2.2 mm. The carapace is elliptical. The posterior sinus extends nearly half-way up the length of the carapace. The abdomen is almost square and about  $\frac{1}{4}$  the length of the body. The suckers are small, placed quite anteriorly and well separated from each other. Their diameter is almost .4 mm. The basal plate of the posterior maxillipeds is triangular in shape with three well defined, sharp, rectangular teeth. All the swimming legs extend well beyond the edge of the carapace. In the male the abdomen is much longer and narrower than in the female, and the sinus is narrow, sharply cut, and deep.

The specimens have been deposited in the Indian Museum and are numbered  $\frac{9054}{10}$ .

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(9) *Amphilina magna*, n. sp. from the coelom of  
*Diagramma crassispinum*.

Group CESTODARIA, Mont., 1892.

= *Cestoidea monozoa*, Lang.

= *Cestodes monogeneses*, V. Ben.

= *Atomiosoma*, Monticelli, 1892?

Cestodes in which the animal consists of a single segment, containing a single set of reproductive organs. In addition to the male pore and female (vaginal) pore, there is a third aperture, that of the uterus (birth-pore). The apparatus by which fixation is effected, consists usually of a single sucker, but presents considerable variation in form, as well as in disposition, with regard to the genital pores.

Family AMPHILINIDAE, Braun, 1883.

Oval or leaf-shaped, without a distinct "head", but with a single small acetabulate sucker at one end.

Genus *Amphilina*, Wagener, 1858.

"Body flat. Long egg-shape to leaf-like. Anterior and posterior ends pointed. Dorsal surface more arched than ventral surface. Skin with a net pattern caused by regular pit-like depressions. Anterior extremity usually with a pit, deep, or otherwise, according to the degree of contraction. This extremity may also present the appearance of a papilla or glandiform snout. On this papilla numerous one-celled glands occur, with long excretory ducts. The excretory system consists of anastomosing vessels with pore posterior. Testes numerous. Cirrus-sac absent. Ovary and reproductive aperture posterior. Opening of vagina a little way from posterior extremity, marginal or on surface. Uterus a long N-shaped canal, first running forward, then turning round and running posteriorly, then again curving round and running forward" (Wagener).

*Apmhilina magna*, n. sp.

(Plate xxvii, figs. 6-7).

Z.E.V. <sup>6046</sup>/<sub>7</sub> Coelom of *Diagramma*] Pearl Banks, Ceylon. T. Southwell.  
*crassispinum*.

Three specimens. Two damaged, one perfect.

A description of the superficial characters of this worm was given by me in the Ceylon Marine Biological Reports, Vol. VI, Jan. 1912, page 273, and this I reproduce here.

"During the examination of a number of specimens of *Diagramma crassispinum*, three specimens were found to (each) contain a most remarkable free living parasite in the coelom. Un-

fortunately I have not had time to make a careful examination of this parasite, and I am at present uncertain of its strict zoological position. . . In the living condition it measured 15 inches long and  $1\frac{1}{8}$  inches broad. It was quite flat, and had a thickness of  $\frac{1}{16}$ th inch. The preserved specimens, of which I have 3, measure  $9\frac{1}{2}$  inches long,  $\frac{3}{4}$  inch broad, and are about  $\frac{1}{8}$  inch thick. The extremities are rounded and terminate in a minute, acute point. At one extremity there is a minute sucker-like aperture situated centrally, whilst at the other extremity there is a similar but slightly larger aperture situated laterally. This latter aperture appears to open to the interior of the worm. The edges of the worm are straight and parallel. A pair of narrow blackish tubes run along the lateral margins, one on each side. Down the centre of the worm, and stretching from one extremity of the worm to the other, is an opaque milky-white mass  $\frac{1}{4}$  inch broad. On each side of this mass there are a series of black coiled tubes,  $\frac{1}{16}$ th inch in diameter disposed in bunches, also running the entire length of the worm, but situated for the most part on one side. No other apertures could be detected. In consistency the worm is that of a stiff (milky-white) jelly, (in formalin)."

For assistance in working out the anatomical details of this worm I am indebted to Dr. Ekendranath Ghosh, L.M.S., M.Sc., Assistant Professor of Zoology in the Medical College, Calcutta.

The following measurements of the specimens (preserved in formalin) have been taken recently :—

|            | Length. | Breadth. |
|------------|---------|----------|
| Specimen I | 250 mm. | 20 mm.   |
| „ II       | . 180 „ | 14 „     |
| „ III      | . 160 „ | . 15 „   |

The testes lie scattered about through the parenchyma. At a point about 15 mm. from the posterior extremity, the paired vas deferens unite in the middle line, and open by a minute pore 1 mm. from the posterior extremity.

The germarium is situated in the middle line 15 mm. from the posterior extremity. It is 7 mm. long and 3.5 mm. broad. Immediately posterior to it are the paired follicular shell-glands. These are each 3 mm. long and together are 3 mm. broad. The vaginal pore is 2 mm. from the posterior extremity. The vitelline glands are paired, linear, and cylindrical, one on each side, near the lateral margins. They extend the whole length of the worm. At 4 mm. from the posterior extremity of the worm their ducts curve towards the vagina and open close to the shell-gland. The uterus is a long convoluted tube having exactly the same form as that figured for *A. foliacea*. It opens by a minute pore, which is situated at the base of the small anterior end of the worm. In this respect it agrees with *A. liguloidea*, Diesing, and differs from *A. foliacea* (Rud., 1819). It differs, however, from *A. liguloidea* in the absence of a vagina, anterior to the germarium. The situation

of the male and the vaginal pores also resemble that of *A. liguloidea*, and differs from that of *A. foliacea*.

No hooklets were observed on the penis of our specimens. The eggs are large, measuring almost 1 mm. In shape they resemble half a sphere, the flat surface of which has become concave. No filament was observed. Compared with other known species of *Amphilina*, our specimens are enormous, as will be seen from the following table:—

|                      | Length. | Host.                                     |
|----------------------|---------|-------------------------------------------|
| <i>A. foliacea</i>   | 60 mm   | <i>Acipenser</i> sp.                      |
| <i>A. liguloidea</i> | 80 mm.  | ?                                         |
| <i>A. neritina</i>   | 18 mm.  | <i>Acipenser</i> sp.                      |
| <i>A. magna</i>      | 250 mm. | <i>Diagramma</i><br><i>crassispinum</i> . |

The nearly related genus *Wageneria* contains the following species:—

- W. proglottis* (Wag., 1854), Mont., 1892.
- W. aculeata*, Cohn, 1902.
- W. porrecta* (Lühe), Cohn, 1902.
- W. impudens* (Crep., 1846), Cohn, 1902.
- W. sp.* Lühe, 1902.
- W. sp.* (Mont.)?

Unfortunately I have been unable to compare my types with descriptions of any of the above species of *Wageneria*, as literature was not available in India. The type of *Amphilina magna*, n. sp. is deposited in the Indian Museum.

#### LITERATURE.

1. Wagener, G.—Enthelminthica No. V Ueber *Amphilina foliacea* mihi (*Monostomum foliaceum* Rud.), *Gyrocotyle* Diesing und *Amphiptyches* Gr. W (*Arch. f. Naturges.* 24 Jahrg. I Bd., pp. 244-249, Taf. viii, Berlin, 1858).
2. Salensky, W.—Ueber den Bau und die Entwicklungsgeschichte der *Amphilina*. (*Zeits. f. wiss. Zool.* Bd. XXIV, pp. 291-342, Taf. xxviii-xxxii, Leipzig, 1874).
3. Monticelli, F. S.—Appunti sui Cestodaria. (*Atti Accad. Napoli.* Ser. 2, Vol. V, No. 6, pp. 67-78, 4 figs., 1892).
4. Braun, M.—Vermes in Braun's Thierreichs, Bd. IV, Abt. Ia, 1893.
5. Cohn, L.—Zur Kenntniss des genus *Wageneria*, Monticelli, und anderer Cestoden. (*Centrbl. Bakter.*, Bd. XXXIII, pp. 53-60, 7 figs., Jena, 1902).
6. Pintner, Th.—Ueber *Amphilina*. (*Verhandl. Ges. deuts. Natf. und Aerzte.* 1905.)
7. Janicki, C. V.—Über den Bau von *Amphilina liguloidea*, Diesing. (*Zeits. f. wiss. Zool.* Bd. LXXXIX, pp. 568-599, Taf. xxxiv-xxxv, Leipzig, 1908.)
8. Southwell, T.—Ceylon Marine Biological Reports. Pt. VI, Jany. 1912, Colombo.

(10) *Syndesmobothrium filicollis*, Linton, parasitic in the  
flesh of *Harpodon nehereus* ("Bombay duck")  
from Diamond Harbour.

(Plate xxvii, fig. 8).

Z.E.V. 6869<sub>7</sub>      Flesh of *Harpodon*      Diamond Harbour,      T. Southwell.  
                                         *nehereus*.                              17-ii-1915.

The original description of this parasite was given by Linton in the Report of the Commissioner of Fish and Fisheries for 1887 (published 1891, Washington), page 861, plate xv, figs. 2 and 4. The description was from a single specimen and the details given are so meagre that the identification of the parasite is attended with a little uncertainty. The adult form was obtained by Linton from the spiral valve of *Trygon centrura* at Woods Hole, Mass. Encysted forms were also obtained by Linton from various species of Teleosts such as *Pomatomus saltatrix*, *Cybbium regale*, etc.

The present writer also obtained the same parasite on the Ceylon Pearl Banks from the intestines of *Cybius guttatum* (Seer fish) and *Chorinemus lysan* (Southwell, Ceylon Marine Biological Reports, Part VI, page 269, plate ii, figs. 16 and 17. Colombo, 1912).

The flesh of *Harpodon nehereus* (when alive) is transparent, resembling that of a jelly-fish. The cysts being milky-white were easily discernible with the naked eye. Many cysts were 16 mm. long and the smallest obtained was 4 mm. They were all roughly tadpole-shaped, but the "tail" portion varied greatly in length and thickness. When removed, the cyst moved about actively. The parasite itself could be seen under a low power as a more densely milk-white spot in the head of the cyst. Over 80 cysts were taken from the flesh of a single fish which measured  $3\frac{1}{2}$  inches long.

*Harpodon nehereus* was very plentiful in the river between the sea and Diamond Harbour; in the vicinity of the latter place it was scarce and ten miles further north entirely absent. Every fish caught was infected. As far as I am aware, this is the first record of a cestode parasite occurring in the flesh of any fish, east of Suez. The parasite becomes adult in the larger species of *Trygon* and *Hypolophus*. In other words when rays and skates eat the infected Bombay duck, the larval parasites in the latter become adult tapeworms in the intestines of the rays. The parasites do not inhabit the human intestine and hence there is not the slightest danger of human beings becoming infected by eating the infected fish.

Diamond Harbour is on the river Hughli and is situated about 40 miles from the sea.

## LITERATURE.

Linton.—Notes on entozoa of Marine fishes. *Report U.S. Fish Comm.* for 1887, pp. 862-866, plate xv, figs. 5-9. Washington, 1891.

Southwell.—Ceylon Marine Biological Reports, Part VI, page 273, plate iii, fig. 40. Colombo, 1912.

**(11) Disease in the eye of *Holocentrum rubrum*.**

(Plate xxviii, fig. 11).

The opportunity is taken of recording in this paper the occurrence of a disease of the eye in *Holocentrum rubrum*. This fish is a marine species.

I noticed the disease in question in January, 1915 during a visit to the Marine Aquarium, Madras, where the fish was then living in one of the tanks.

I am indebted to Dr. J. R. Henderson, Superintendent of the Madras Museum, for kindly presenting the specimen. Dr. Henderson suggested that the disease was a glaucoma, probably caused by an accident whilst the fish was being captured at sea or during its transference to the aquarium.

Since the above paper was written I have obtained very large cysts containing young Trematodes from the flesh of *Ophiocephalus striatus*, *Ophiocephalus marulius* and *Ophiocephalus gachua*. Smaller cysts, apparently containing Cercaria, have also been obtained from the flesh of *Saccobranhus fossilus* and *Trichogaster fasciatus*. In *Saccobranhus fossilus* over 140 cysts were counted in the flesh of a small specimen.

The infected fish were obtained from *beels* in the Khulna district. I hope to describe the parasites in a future paper.

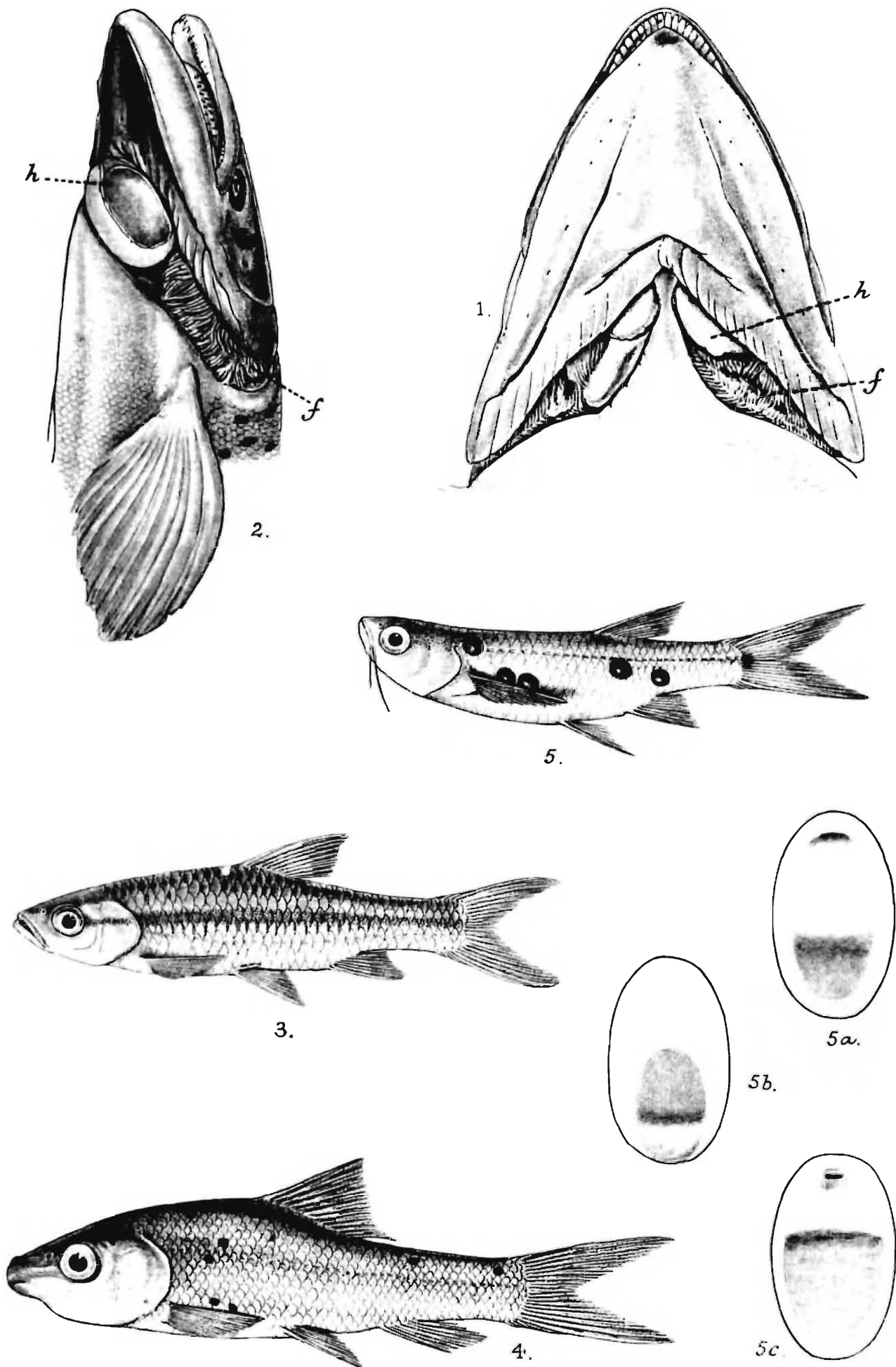
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### EXPLANATION OF PLATE XXVI.

- FIG. 1. Carcinoma in *Salmo irideus*. Ventral view,  $\times \frac{2}{3}$ .  
,, 2. ,, ,, ,, Latero-ventral view,  $\times \frac{2}{3}$ .  
,, 3. *Rasbora daniconius*, showing white spot near dorsal fin  
containing *Myxobolus* sp.,  $\times 1\frac{1}{2}$ .  
,, 4. *Labeo rohita*, showing encysted *Cercaria*,  $\times 1\frac{1}{2}$ .  
,, 5, 5a, 5b, 5c. *Nuria danrica* var. *grahami*, showing cysts re-  
moved.

#### *Explanation of Lettering.*

(a) anterior ; (b) vas deferens ; (c) germarium ; (d) shell glands ; (e) vaginal pore ; (f) gills ; (g) vitteline glands ; (h) carcinoma ; (p) posterior ; (t) testis ; (u) uterus.



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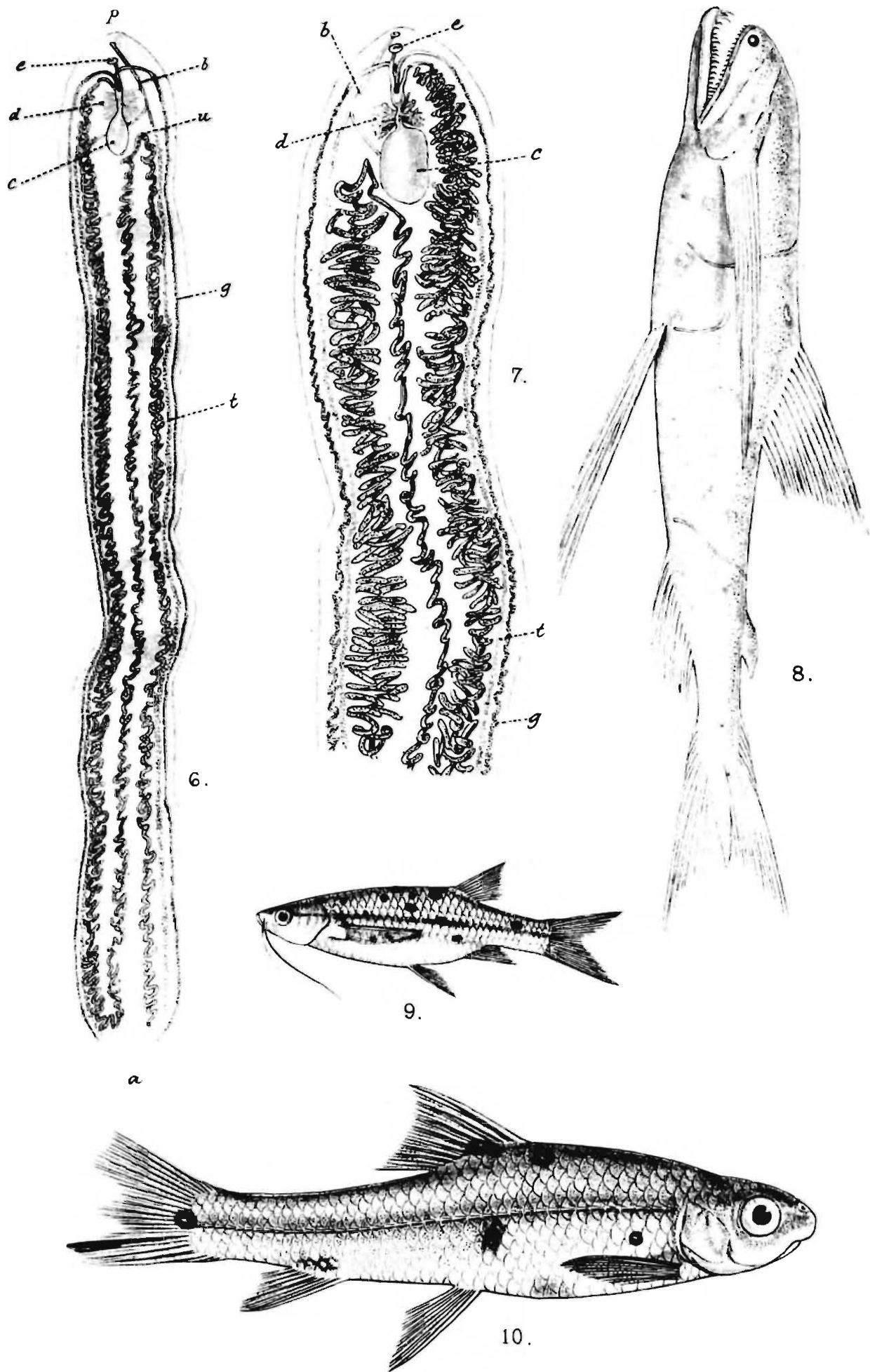
Bennett, Collie, Derby

### EXPLANATION OF PLATE XXVII.

- FIG. 6. *Amphilina magna*, n. sp.,  $\times \frac{1}{3}$ .  
,, 7. ,, ,, posterior extremity,  $\times 2$ .  
,, 8. *Harpodon nehereus*, showing encysted larvae of *Syndes-  
mobothrium filicolle*, Linton,  $\times 1\frac{1}{2}$ .  
,, 9. *Nuria danrica*, showing Cercaria in skin,  $\times 1\frac{1}{2}$ .  
,, 10. *Cirrhina latia*, showing parasites encysted in skin,  $\times 1\frac{1}{2}$ .

#### *Explanation of Lettering.*

(a) anterior ; (b) vas deferens ; (c) germarium ; (d) shell glands ; (e) vaginal pore ; (f) gills ; (g) vitteline glands ; (h) carcinoma ; (p) posterior ; (t) testis ; (u) uterus.

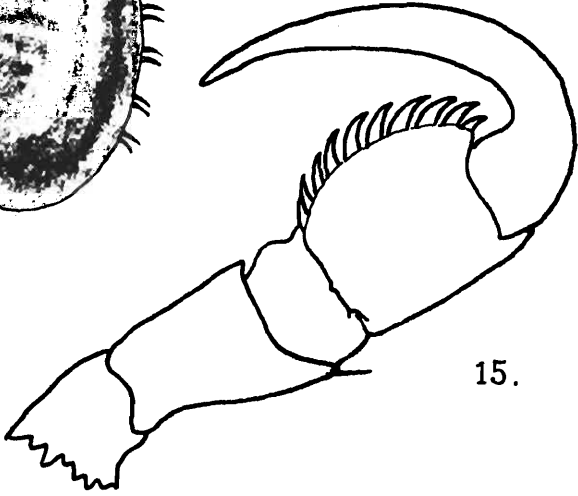
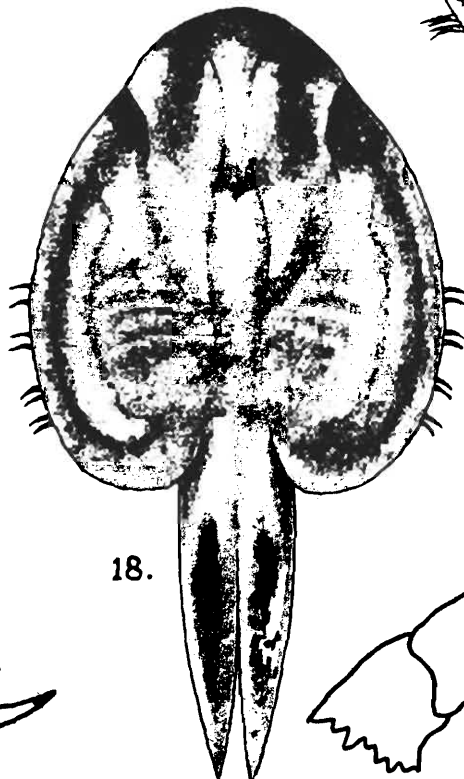
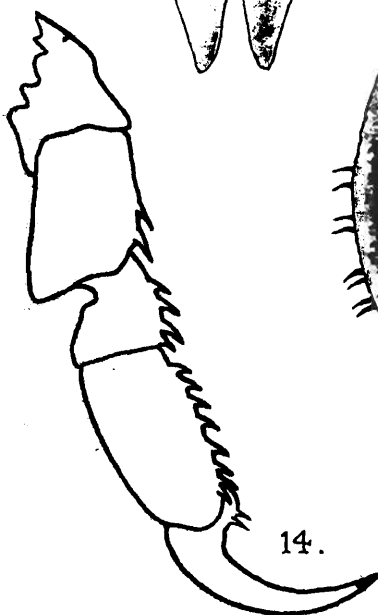
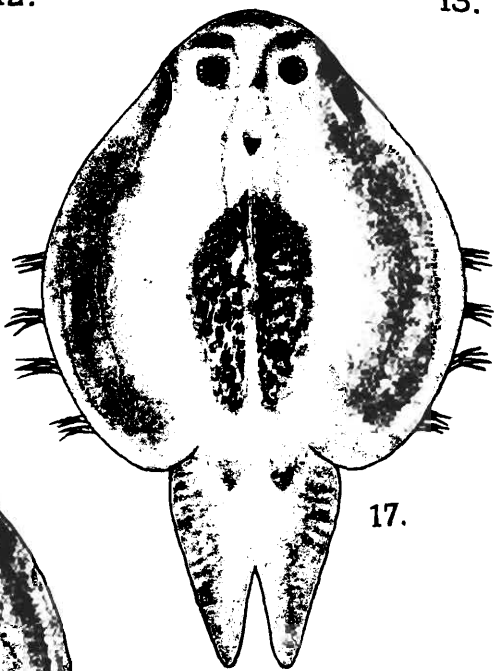
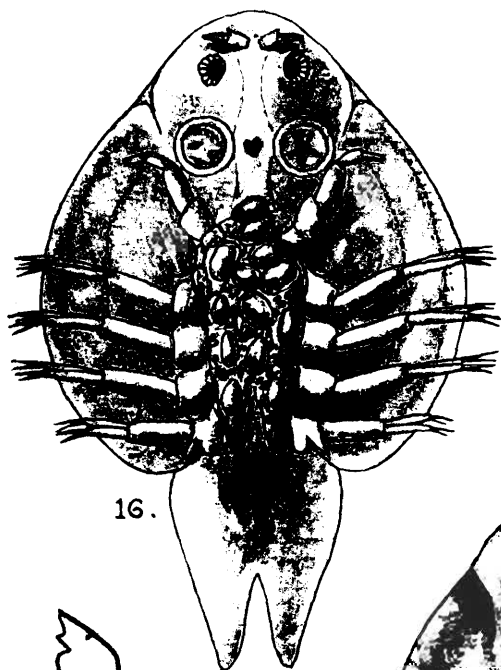
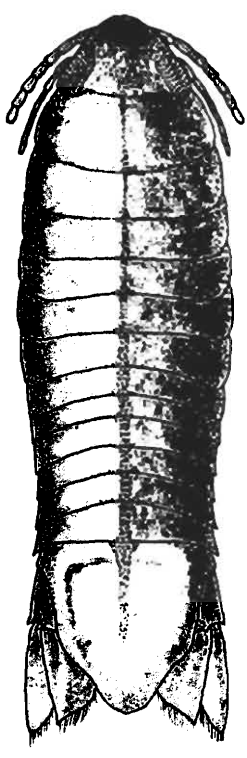
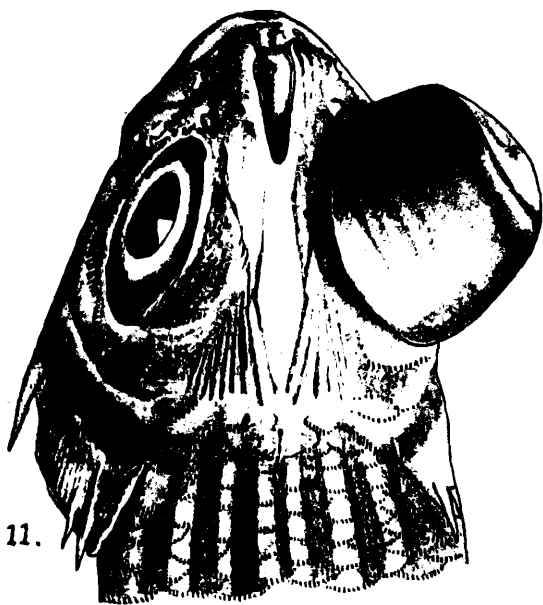


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Bemrose, Colln, Derby

# EXPLANATION OF PLATE XXVIII.

- FIG. 11. Glaucoma in eye of *Holocentrum rubrum*, natural size.  
 „ 12. *Rocinella latis*, n. sp., male, ventral view,  $\times 6\frac{1}{4}$ .  
 „ 13. „ „ dorsal view,  $\times 6\frac{1}{4}$ .  
 „ 14. „ „ first gnathopod,  $\times 30$ .  
 „ 15. „ „ second peraeopod,  $\times 30$ .  
 „ 16. *Argulus foliaceus*, Linn., female, ventral view,  $\times 30$ .  
 „ 17. „ „ dorsal view,  $\times 30$ .  
 „ 18. „ „ male, dorsal view,  $\times 30$ .



XVII NOTES FROM THE BENGAL  
FISHERIES LABORATORY,  
INDIAN MUSEUM.

No. 3.—ON HELMINTHS FROM FISH AND AQUATIC BIRDS IN  
THE CHILKA LAKE.

By T. SOUTHWELL, A.R.C.S., Lond., F.L.S., F.Z.S.,  
Dy. Director of Fisheries, Bengal, Bihar and Orissa,  
Honorary Assistant, Indian Museum.

Dr. Annandale visited the Chilka Lake during the last two weeks of November 1914, in order to continue his enquires into the fauna of this area. I had the pleasure of accompanying him, and the parasites described in the following paper were collected during the investigations.

The fish from which the parasites were taken were caught in an otter-trawl about two miles east of Rambha. They appear to feed principally on prawns and crabs.

A number of small rays (*Trygon imbricata*) were also caught and examined, but no parasites were found. This species appears to feed on small crustaceans and on thin-shelled molluscs.

The little cormorant was shot on the shore of the lake near Rambha, and the pochard (*Nyroca ferina*) was shot in a swamp near Nalbano Island.

Other birds and fish were examined but no parasites were found.

The collection is an interesting one, but possesses no outstanding or distinctive features.

Family TETRABOTHRIDAE, Linton, 1891.

Tribe TETRABOTHRINI, Perrier, 1897.

Genus I. *Phyllobothrium*, Van Beneden, 1849.

Body articulate, taeniaeform; head separated from the body by a neck, with four opposite sessile bothria, each bothrium lacinio-cristate on the margin and provided with a single ampulla-like supplementary disc. Genital apertures marginal.

***Phyllobothrium pammicrum***, Shipley and Hornell.

|                         |                           |              |               |
|-------------------------|---------------------------|--------------|---------------|
| Z.E.V. $\frac{6870}{7}$ | <i>Hypolophus sephen.</i> | Main area    | T. Southwell. |
|                         |                           | Chilka Lake, |               |
| Thirteen specimens.     |                           | Dec. 1914.   |               |

Extreme length, 4.2 mm. to 5.5 mm.

Breadth of head, .4 mm.

Breadth of last segment, .25 mm.

Length of last segment, 1 mm.

Length of neck, .25 mm.

The head consists of four sessile, crimped bothridia, which have their edges slightly thickened. There is no myzorhynchus, and accessory suckers are absent.

There is a short neck. The worms consist of 5, or at most 6 segments. In many, what appeared to be the terminal vesicle was still intact. As in Shipley's specimens (*Ceylon Pearl Oyster Reports*, V, London, 1906, p. 53) the genital organs were developed in the very first segment, and no short, shallow, young proglottides were observed in any of our specimens. The genital aperture was only obvious in the last segment. This segment had the sides slightly curved, and the greatest breadth was across the middle, through the genital aperture.

The testes are very numerous and large, and were disposed on each side of the longitudinal axis of the proglottid. The cirrus pouch is not conspicuous. No spines were observed on the penis. The deferent canal runs transversely to the genital pore. The vitteline glands were disposed parallel, and external to the testes. The ovary and shell gland were situated posteriorly. The ducts from the vitteline glands also unite in the centre line posteriorly. The oviduct occupies a central position and runs anteriorly in a loosely coiled manner.

The genus *Phyllobothrium*, Van Beneden, is closely related to the genus *Crossobothrium*, Linton. The latter differs from the former only in having the bothria pedicelled and in possessing no neck. It will be noted that our specimens do not possess accessory suckers. No mention is made of accessory suckers in *Phyllobothrium blakei*, Shipley and Hornell (*Ceylon Pearl Oyster Reports*, V, London, 1906, p. 70, figs. 72 and 73), although suckers are shown in *P. pammicrum*, Shipley and Hornell. Johnstone was unable to find accessory suckers in specimens of *P. lactuca*, Van Beneden (*Trans Biol. Soc. Liverpool*, XX, 1906, pp. 159-160), and he refers to the absence of a myzorhynchus in both *P. lactuca*, Van Beneden, and *P. thridax*, Van Beneden.

No myzorhynchus was observed in our specimens and no myzorhynchus is described or figured for the following species:—

- P. minutum*, Shipley and Hornell,
- P. pammicrum*, Shipley and Hornell,
- P. blakei*, Shipley and Hornell,
- P. lactuca*, Van Beneden,
- P. thysanocephalum*, Linton.

A neck is absent in *P. blakei*, Shipley and Hornell, long in *P. lactuca*, Van Beneden, *P. minutum*, Shipley and Hornell, and *P. thysanocephalum*, Linton.

The characters of the genus *Spongiobothrium*, Linton, are as follows:—

Body articulate, taeniaeform. Head separated from the body by a neck. Bothria 4, opposite, pedicelled, broken up into lacinio-cristate folds which are transversely costate. Unarmed. Auxiliary acetabulum none, terminal papilla none. Genital apertures marginal.

The genus *Phyllobothrium* would thus also appear to be closely related to the genus *Spongiobothrium*, from which it differs only in the absence of the cristate folds on the rostellum. It will be observed that the characters of the genera *Crossobothrium* and *Spongiobothrium* relate almost entirely to external features, and the anatomical details are few and unsatisfactory. It is highly desirable that such details should be worked out so that the true relationships of the genera could be determined. It is not impossible that subsequent research may suggest the desirability of regarding external features such as the presence or absence of a neck, or supplementary suckers, or of a myzorhynchus, as specific, rather than generic, characters.

#### LITERATURE.

Shipley and Hornell, *Ceylon Pearl Oyster Reports*, Part V, London, 1906.

#### Genus II. *Parataenia*, Linton, 1889.

##### *Parataenia medusia*, Linton, 1889.

|                         |                                                      |                                              |               |
|-------------------------|------------------------------------------------------|----------------------------------------------|---------------|
| Z.E.V. $\frac{6871}{7}$ | Intestine of<br><i>Hypolophus</i><br><i>sephen</i> . | Main area,<br>Chilka Lake,<br>Nov. 29, 1914. | T. Southwell. |
|-------------------------|------------------------------------------------------|----------------------------------------------|---------------|

Only two species of *Parataenia* are known, viz. *P. medusia*, Linton, and *P. elongatus*, Southwell. The latter differs from the former in being ten times longer, in possessing a neck, and in the ripe segments being broader than long.

Linton's specimens of *P. medusia* measured 6 mm. long, but he observed that "they must grow somewhat longer than this." Our specimen (we obtained only one) measured 15 mm. In other respects it agreed with Linton's description.

#### LITERATURE.

Linton, Notes on Entozoa of Marine Fishes. *U.S. Fish Comm. Report for 1887*, pp. 862-866, plate xv, figs. 5-9 (Washington, 1891).

Southwell, *Ceylon Marine Biological Reports*, Part VI, p. 273, pl. iii, fig. 40 (Colombo, 1912).

#### Tribe *CALLIOBOTHRIINAE*, Perrier, 1897.

##### Genus *Calliobothrium*, Van Beneden, 1850.

##### *Calliobothrium eschrichtii*, Van Ben.

|                         |                                                         |                                          |               |
|-------------------------|---------------------------------------------------------|------------------------------------------|---------------|
| Z.E.V. $\frac{6872}{7}$ | Spiral valve of<br><i>Hypolophus</i><br><i>sephen</i> . | Main area,<br>Chilka Lake,<br>Dec. 1914. | T. Southwell. |
|-------------------------|---------------------------------------------------------|------------------------------------------|---------------|

A single specimen is referred here with some hesitation. A definite identification was impossible because the spines were somewhat damaged. In other details it agreed with Van Beneden's species *eschrichtii*. The length of the worm is 9 mm. There were only about 13 segments the last of which measured 1 mm. long.

#### LITERATURE.

Linton, *U.S. Fish Comm. Report for 1887*, pp. 812-1816, figs. 5-12 (Washington, 1891).

Van Beneden, *Acanthobothrium eschrichtii*. *Bull. Acad. Belg.*, Ser. 2, Vol. XVI, p. 280.

Van Beneden, *Calliobothrium eschrichtii*. *Mem. Acad. Belg.*, Vol. XXV, 1850, pp. 145 and 195.

Family HYMENOLEPIDIDAE, Railliet and Henry, 1909.

Genus *Hymenolepis*, Weinland, 1858.

*Hymenolepis breviannulata*, Führmann, 1906.

|                         |                                                                          |                            |               |
|-------------------------|--------------------------------------------------------------------------|----------------------------|---------------|
| Z.E.V. $\frac{6875}{7}$ | <i>Phalacrocorax</i><br><i>javanicus</i><br>(the little Cor-<br>morant). | Chilka Lake,<br>Dec. 1914. | T. Southwell. |
|-------------------------|--------------------------------------------------------------------------|----------------------------|---------------|

Two specimens, 57 mm. long and 5 mm. broad. Rostellum with 20 hooks.

Führmann in his original description states "leider fehlt der scolex."

The genital openings are unilateral and are situated near the anterior extremity of the proglottid.

#### LITERATURE.

Führmann, *Centrbl. Bakter.*, I. Abt. Bd. XLI, Heft 4, pp. 445-446, fig 25, 1906.

Family TAENIIDAE, Ludwig, 1886.

Genus *Diploposthe* Jacobi, 1896.

*Diploposthe laevis*, Jacobi, 1896.

|                         |                                          |                            |               |
|-------------------------|------------------------------------------|----------------------------|---------------|
| Z.E.V. $\frac{6874}{7}$ | <i>Nyroca ferina</i> ,<br>(the Pochard). | Chilka Lake,<br>Nov. 1914. | T. Southwell. |
|-------------------------|------------------------------------------|----------------------------|---------------|

A single specimen is referred here with some hesitation. No spines could be detected on the rostellum when the head was cleared in clove oil. Three testes were observed near the posterior border of the proglottides. The vesiculae seminalis is large. The cirrus is large, tubular, and armed with strong spines.

The female genital organs lie in the centre of the proglottid. No other details could be observed save that masses of eggs lay in

what appeared to be a lateral extension of the uterus, close to the cirrus sac, and of about the same size as the latter.

The synonymy of this species is extensive. For a full account the reader is referred to Johnstone (i).

#### LITERATURE.

- (1) Johnstone, T. H. H., On a re-examination of the types of Krefft's species of Cestoda in the Australian Museum, Sydney, Part I.
- (2) Führmann, *Centrbl. Bakter.*, Vol. XL, 1906.
- (3) Führmann, *Zool. Jahrb.*, Suppl. Bd. X, Heft I, 1908.

#### *Anaporrhutum largum*, Lühe.

Z.E.V. <sup>6782</sup><sub>7</sub>      *Hypolophus sephen.*      Chilka Lake,      T. Southwell.  
Stations  
140-141,  
Nov. 1915.

This Trematode was found on the liver and in the coelom of the above ray. It is a transparent leaf-like form, and occasionally occurs in such numbers as to completely cover the outer surface of the liver. The fish was caught in the main area of the lake.

#### LITERATURE.

- Lühe, in Herdman's *Ceylon Pearl Oyster Reports*, Pt. V, London, 1906.  
Southwell, *Rec. Ind. Mus.*, Vol. IX, Pt. II, Calcutta, June, 1913.



XVIII NOTES ON ORIENTAL DRAGON-  
FLIES IN THE INDIAN  
MUSEUM, No. 2.

By F. F. LAIDLAW.

LIBELLULINAE.

Genus **Amphithemis**.

See Ris, *Monogr. Libell.*, pp. 88-91 in *Coll. Zoolog. Selys*, Fasc. IX, 1909.

Anal loop feebly developed, containing few cells. Arculus lying between the second and third antenodal nerve. Costal side of discoidal triangle of fore-wing relatively long, broken. Radial supplementary sector moderately developed, median supplement not at all. Proximal side of discoidal triangle of hind-wing a little distal to the arculus. Three or four median nerves on the hindwing. Discoidal triangle *followed by one or two rows of cells*, increasing.

Colouration black with yellow or brick-red markings; (adult male of *A. vacillans*, Selys, with pruinescence on basal segments of abdomen). Abdomen rather long, slender and cylindrical; segment 8 of female without dilatation. Legs long, the hairs on femora rudimentary.

The discovery of *A. mariae* necessitates a slight modification in the definition of the genus shown in the character italicized.

This interesting genus is confined to S. India and to the Indo-Chinese Peninsula so far as is at present known; the S. Indian species *A. mariae*, here described as new, being very distinct from its congeners. This distribution of a genus is somewhat unusual. Its nearest ally is *Pornothemis* from Sumatra and Borneo.

*A. mariae* is readily distinguished from the two remaining species by wing characters, the discoidal triangle in each wing being followed by a single row of cells, in *A. vacillans* and *A. curvistyla* by two rows. The Deccan species is moreover more brilliantly coloured, with bright yellow bands on the dorsum of the thorax.

The Burmese species are not so readily distinguished from one another. *A. curvistyla* is distinctly the smaller (hind-wing 18.22 mm. as opposed to 21.24 mm. in *A. vacillans*).

It has also much red on the abdomen, whilst *A. vacillans* has yellowish markings in the young male and female, its adult males having the body entirely black.

Males of these two species are well characterized by the anal appendages. In *A. vacillans* the upper pair are twice as long as the

lower appendage and end in a fine upturned point, in *A. curvistyla* the upper pair are about equal to the lower appendage, rather stout, curved downwards and divaricate from one another.

### ***Amphithemis vacillans*, Selys.**

2 ♂ ♂ 1 ♀  $\frac{4851}{20}$   $\frac{4852}{20}$   $\frac{4853}{20}$  Sibsagar, Assam.

These specimens were named by de Selys in whose handwriting are the labels. They are unfortunately in poor preservation, the best preserved specimen, an adult male, has the body entirely black. A male from the Abor Expedition collection, still more adult, has the second and third segments of the abdomen covered with bluish-white bloom.

*Distribution*: Burma, Assam.

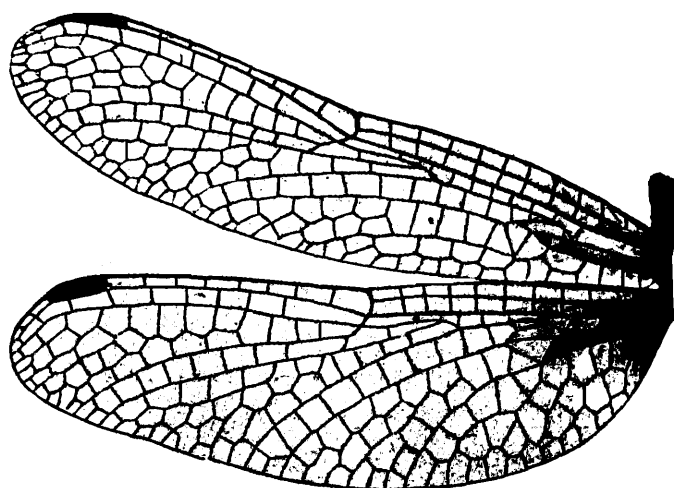


FIG. 1.—Wings of *Amphithemis mariae*, sp. n.

### ***Amphithemis curvistyla*, Selys.**

1 ♂ 1 ♀  $\frac{4854}{20}$   $\frac{246}{6}$  Sibsagar, Assam.<sup>1</sup>

As with the last species the specimens were named by de Selys. Their condition is too bad to admit of a satisfactory examination.

*Distribution*: Burma, Tonkin, Assam.

### ***Amphithemis mariae*, sp. n.**

4 ♂ 4 ♀ (in spirit.)  $\frac{8260}{20}$   $\frac{8259}{20}$   $\frac{8280}{20}$   $\frac{8279}{20}$   $\frac{8281}{20}$  Forest tramway, mile 29-30, 1600 ft.; Parambikulam, 1790-3200 ft., Cochin State, 16-24-ix-14 (*F. H. Gravely*).

(For the photograph reproduced in text-figure 1, I am much indebted to Messrs. H. and F. E. Campion).

*Types* ♂ ♀ in the Indian Museum.

<sup>1</sup> On several labels of specimens from this locality de Selys wrote "Palone." It is not clear what he means.

Abdomen ♂ 19 mm., ♀ 19 mm. Hind-wing ♂ 20 mm., ♀ 21 mm.

*Venation* characters (see text-fig.).

Wings relatively shorter and broader than in the other species of the genus. Triangles and supratrangles normally uncrossed. Cubito-anal (median) space of hind-wing with three cross-nerves. Discoidal triangles in both wings followed by a single row of cells; supplementary radial sector feebly developed. Base of wings tinged with yellow to level of discoidal triangles.

♂ Lower lip cream-colour edged with black. Upper lip, post- and anteclypeus and vertical part of frons also creamy-yellow; upper surface of frons, vertex, and occiput metallic green.

Prothorax black.

Thorax dorsal surface black with a broad greenish yellow humeral stripe on either side; inter-alar space brick-red. Lateral surface brownish yellow with two well-defined dark bands on either side, ventral surface yellow.

Abdomen. Segments 1, 2, 3 brick-red, the last with a narrow black terminal ring. The remaining segments black, 4-7 with a basal yellow ring, most marked laterally, and progressively smaller from before backward.

Legs black, first pair of femora with a yellow line on their posterior side.

Anal appendages black, rather short, upper pair regularly curved downwards, moderately stout. Lower appendage a little shorter than the upper pair. Resemble in general the appendages of *A. curvistyla*, Selys.

Genital structures on segment 2. Anterior lobe very small, hamulus on either side with a fine backwardly directed spur. Lobe of segment 2 small, triangular, curved a little forward.

♀ Head coloured as in the male.

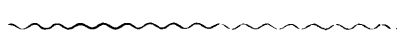
Prothorax pale yellow.

Thorax brownish black anteriorly, with a pair of very wide pale yellow ante-humeral bands, much larger than those of the male and united above at the base of the wings. The rest of the thorax is pale yellow in colour.

Abdomen. Segments 1, 2, 3 pale yellow, 3 with a fine black terminal ring, 4-8 yellow at the base, the apical half of the segment (two-thirds in 8) black; the yellow ring divided dorsally by a fine black line along the mid-dorsal carina. Segments 9, 10 entirely black.

Legs as in the male, anal appendages black. Lateral margins of segment 8 not widened. Valvulae vulvae very small.

*Distribution* : Southern Peninsular India.





## XIX HERPETOLOGICAL NOTES AND DESCRIPTIONS

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

(Plate xxxiii.)

### **Trionyx sulcifrons**, sp. nov.

(Plate xxxiii, figs. 1, 1a, 2.)

The head is relatively small, triangular in shape and somewhat flattened; the tubular nostrils are relatively long and have a well-developed median longitudinal groove on the dorsal surface; the interorbital space is narrow and in fresh specimens the superciliary regions are raised.

*A number of small longitudinal grooves originate between the eyes and, proceeding forwards, diverge on the forehead.* These give an excuse for the specific name.

The disk is sub-circular, coarsely tuberculate in front of and behind the bony carapace; there is no dorsal ridge or groove, but a large prominence occurs on the bony carapace in front.

In the young (pl. xxxiii, fig. 2) the head is olivaceous, with a smallish yellow spot beneath each eye, and another rather larger one at the junction of the jaws; the following black linear marks occur on the dorsal surface—a sinuous line originating behind the lower part of each eye, proceeding upwards and then bending downwards and running along each side of the head to disappear on the nape, and a large Y-shaped mark situated in the middle of the dorsal surface some distance behind the eyes and connected somewhat indefinitely with diverging lines on the nape. In the adult these dark marks break up as shown in fig. 1 (p. 342) and perhaps disappear finally. The yellow spot at the junction of the jaws persists but its limits become somewhat indefinite. In the adult living animal the eyelids are reddish-brown and such dark marks as persist are bordered with a brighter shade of the same colour. The disk of the young bears (? 4 or) 5 relatively small ocelli, the ground-colour being dark olivaceous obscurely reticulated; there is a narrow yellow margin. In the adult the ocelli disappear and the whole disk becomes dark olivaceous green obscurely marbled with a paler shade.

The pupil of the eye (in the only living individual, an adult female, examined) was black and the iris dark olivaceous with a yellow ring internally.

The skull (pl. xxxiii, figs. 1, 1a) resembles that of *T gangeticus* in general appearance, but is considerably smaller and narrower. The interorbital space is slightly concave and considerably narrower than either the nasal cavity or the orbit; the post-orbital arch is rather more than half as broad as the orbit and the post-orbital foramen remarkably small. The snout is longer than the orbit and distinctly declivous; it is more pointed than in *T gangeticus*, but less so than in *T hurum* and *T leithii*. The symphysis of the lower jaw is long, equalling the orbit in length; the jaw itself is bluntly pointed; there are no ridges either longitudinal or transverse in this region; the two rami are more convergent than in *T gangeticus*.

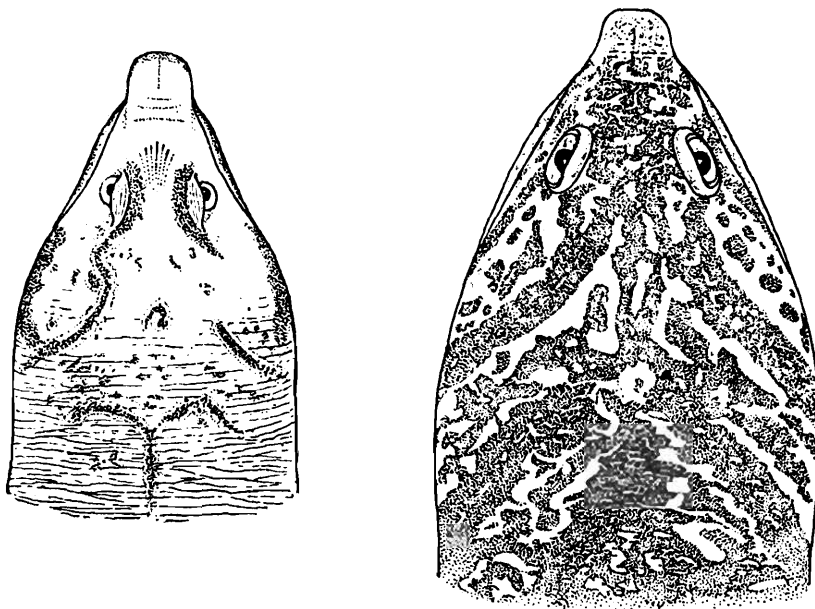


FIG. 1.—Head of *Trionyx sulcifrons* (from life),  $\frac{1}{3}$  nat. size.  
 „ 2.—Head of *Trionyx gangeticus mahanaddicus* (from type specimen),  
 $\frac{1}{2}$  nat. size.

The branchial skeleton resembles that of *T gangeticus*,<sup>1</sup> but the greater cornua are more slender and the ceratobranchials stouter and shorter; the hypobranchials are distinct and show traces of segmentation into 2 or 3 pieces; this is, however, less marked than in *T. gangeticus*.

The margin of the bony carapace is concave in front and almost straight behind; the sculpturing of the posterior region is coarser than that of the anterior and near the posterior border there are small scattered bony tubercles. There are two or three neural plates between the first pair of costals. The plastron closely resembles that of *T gangeticus*, but the hypoplastra and hyoplastra of the two sides apparently remain widely separated in the adult and all the bones are smaller.

<sup>1</sup> Annandale, *Rec. Ind. Mus.* VII, p. 159, fig. 1 (1912).

*Type*.—An adult female, which was examined alive and is now preserved as a skeleton in the Indian Museum (No. 17973: *Rept. Ind. Mus.*). The skin of the head is preserved in spirit.

I have also examined a slightly larger female (stuffed) and a young individual (in spirit) (pl. xxxiii, fig. 2), both the property of the Nagpur Museum.

The following are the measurements of the type :—

| Disk.                  |     |         | Skull.                 |     |        |
|------------------------|-----|---------|------------------------|-----|--------|
| Total length           | ... | 497 mm. | Length                 | ... | 84 mm. |
| " breadth              | ... | 427 "   | Breadth                | ... | 54 "   |
| Bony carapace (length) | ... | 335 "   | Orbit                  | ... | 15 "   |
| " " (breadth)          | ... | 331 "   | Snout                  | ... | 24 "   |
|                        |     |         | Interorbital width     | ... | 11 "   |
|                        |     |         | Nasal aperture (width) | ... | 13 "   |
|                        |     |         | Postorbital arch...    | ... | 8 "    |
|                        |     |         | Mandibular symphysis   | ... | 15 "   |

*Distribution*.—The type is from a tank in the town of Nagpur, the capital of the Central Provinces of India, as is also the adult specimen in the Nagpur Museum; while the young example in that museum is from a canal or stream at the same place.

This species is related to *T gangeticus*, Cuv., the chief differences being (1) the presence of ocelli on the disk of the young and the absence of forwardly directed V-shaped markings on the head, (2) the more pointed snout, (3) the smaller postorbital foramen, (4) the longer symphysis of the lower jaw and the absence of a transverse ridge on its inner margin.

The eggs are small, the diameter being only 31 mm. in examples found ready for deposition in the type-specimen, which was killed in June. Another female killed at Nagpur was found to contain fully formed eggs in January.

I have to thank Mr. E. A. D'Abreu for the opportunity of making this very noteworthy addition to the herpetological fauna of India. He has also sent me for examination two specimens of the form I recently described as *T gangeticus* subsp. *mahanaddicus*.<sup>1</sup> One is a skeleton of an adult slightly larger than the type (fig. 2, p. 342), while the other is a much smaller stuffed example. The localities are (?) Jubbulpore and Seonath R., Bilaspur district; both places being in the Central Provinces.

### ***Trionyx leithii*, Gray.**

1915. Annandale, *Rec. Ind. Mus.* XI, p. 189, fig. 1.

In a recent paper I cast doubt on the occurrence of *T leithii* in the Gangetic river-system, but I now take the earliest opportu-

<sup>1</sup> *Rec. Ind. Mus.* VII, p. 262 (1912).

nity to note that I have found in the old collection of the Indian Museum a number of young specimens from Allahabad and the River Hughli. There is no specimen of this species in the Nagpur Museum, though it occurs in the Central Provinces

***Gonatodes bireticulatus*, sp. nov.**

(Plate xxxiii, figs. 3, 3a.)

*Head small*, ovate, moderately convex above; snout obtusely pointed, declivous, a little longer than the distance between the eye and ear-opening and more than twice as long as the eye; forehead grooved; ear-opening moderate, oval; 7 upper and 8 lower labials.

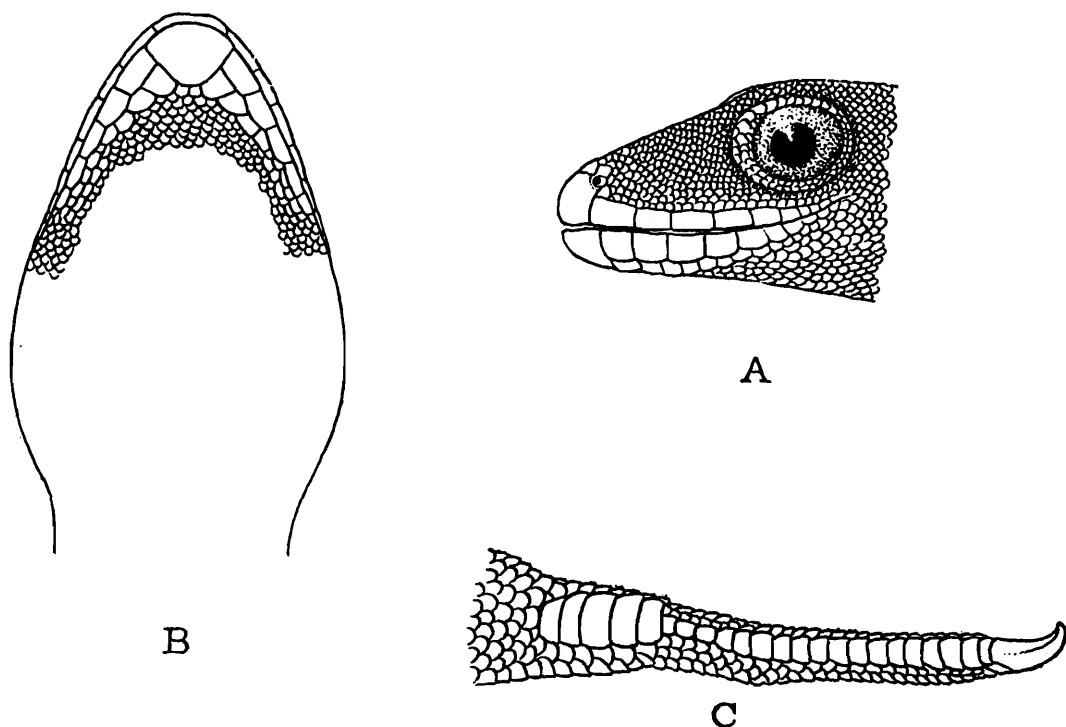


FIG. 3.—*Gonatodes bireticulatus*, sp. nov.

A. Snout in lateral view,  $\times 3$ . B. Lower surface of head,  $\times 3$ .

C. Lower surface of fifth toe,  $\times 8$ .

*Body and limbs* moderate, the hind limb reaching the axilla; digits slender, basal joints not dilated and without transverse plates; five relatively large plates below the first articulation. Dorsal surface covered with conical keeled tubercles, which vary considerably in size, and are much smaller on the head than on the body; throat covered with similar tubercles; mental moderate in size, subtruncate posteriorly and followed by two small flattened scales placed transversely; several enlarged scales, which decrease in size from before backwards, on either side below the labials. Ventral scales small, leaf-shaped imbricate. Male with 7 femoral pores on each side. *Tail* cylindrical, tapering, covered above with small, oval, sub-imbricate, almost smooth scales, and below

with flattened scales, the central row of which is distinctly enlarged.

*Colouration.*—Brown above, with a coarse black reticulation and, superimposed upon it, a much finer one of dotted white lines; two parallel white lines running backwards from the eye to above the ear; throat brownish, with a coarse, irregular white reticulation and with a white line running along each side; chest and abdomen brownish grey speckled with white. Ventral surface of tail greyish brown speckled with white; about 12 pale transverse bars on the dorsal surface. Fingers and toes with alternate brown and white bands.

#### *Measurements.*

|                 |        |
|-----------------|--------|
| Total length    | 95 mm. |
| Length of tail  | 50 „   |
| Length of head  | 15 „   |
| Breadth of head | 9 „    |

*Type.*—No. 17970: *Rept. Ind. Mus.*

*Locality.*—In jungle at Kavalai, 1300-3000 feet, Cochin State (F. H. Gravely).

Numerous specimens of *G. wynadensis* (Beddome) and a few of *G. gracilis* (Beddome) were taken with the type, which is an unique specimen.

The species is closely related to *G. wynadensis*, but is distinguished from it (among other characters) by its colouration, by the larger number of femoral pores and by differences in the scaling of the feet.

#### ***Tropidonotus sancti-johannis*, Boulenger.**

1893. Boulenger, *Cat. Brit. Mus.* 1, p. 230, pl. xv, fig. 1.

This snake, which seems to me to be a distinct species, has been recorded from several widely separated localities in Kashmir, the Himalayas and central India. I am not aware, however, that it has been found hitherto in the Malabar Zone. A typical specimen was obtained by Mr. F. H. Gravely at Chalakudi in the State of Cochin in September last.

#### ***Chirixalus simus*, sp. nov.**

*Head* large, broader than long; snout truncated, considerably shorter than the diameter of the orbit; canthus rostralis barely distinguishable; loreal region vertical, slightly concave; nostrils much nearer tip of snout than eye; interorbital region broader than upper eyelid, flat; tympanum about one-third the diameter of the eye.

*Limbs.*—Inner fingers with a very slight rudiment of a web; toes about two-thirds webbed; disks of fingers smaller than tympanum, slightly larger than those of toes; subarticular tubercles

well-developed; a small and rather indistinct inner metatarsal tubercle. The tibio-tarsal articulation reaches the tip of the snout.

*Skin*.—Skin of head with small round scattered warts, of back nearly smooth; sides and throat with similar warts, abdomen and inner surface of thighs coarsely granular; a glandular fold extending from the supercilliary region to above the shoulder, and another, somewhat interrupted, from the gape to the same point.

*Colouration*.—Dorsal surface pale buff with several indistinct longitudinal dark lines and numerous scattered black specks. Ventral surface yellowish; throat and chest with minute black and white specks. Limbs without definite markings, inner surface of thighs reddish.

*Measurements.*

|                               |        |
|-------------------------------|--------|
| Total length of head and body | 22 mm. |
| Length of head                | 8 „    |
| Breadth of head               | 9 „    |
| Length of hind limb           | 32 „   |



FIG. 4.—Head of *Chirixalus simus*, sp. nov.,  $\times 3$ .

*Type*.—No. 17971: *Rept. Ind. Mus.*: an unique specimen.

*Locality*.—Mangaldai, Assam north of the Brahmaputra (S. W. Kemp, 6-i-11).

This species differs from *C. doriae*,<sup>1</sup> the only other as yet known, in its larger head, truncated snout, smaller tympanum and rather longer hind legs, and in possessing a glandular fold between the eye and the shoulder.

*C. doriae*, which was described from Upper Burma, has recently been recorded from the Himalayan foot-hills<sup>2</sup> immediately to the north of Assam. The discovery of a second species near the base of the same hills is therefore interesting.

***Ichthyophis glutinosus* var. *tricolor*, Annandale.**

1909. Annandale, *Rec. Ind. Mus.* III, p. 186.

Two specimens of this variety or local race were found by Mr. F. H. Gravely on the eastern slopes of the Western Ghats in Cochin in September last, the exact locality being Parambikulam

<sup>1</sup> Boulenger, *Ann. Mus. Genova* (2) XIII, p. 341, pl. x, figs. 5, 5a (1893).

<sup>2</sup> Annandale, *Rec. Ind. Mus.* VIII, p. 18 (1912).

(alt. 1700-3200 ft.). The specimens are considerably larger than the type, one of them being 280 mm. long. The yellow lateral band on each side is separated from the white median ventral band by a dark one, which is greyish in spirit. This dark band varies considerably in breadth.

### ***Ichthyophis monochrous* (Bleeker).**

1912. Boulenger, *Faun. Malay Penin., Rept.*, p. 286.

Boulenger notes (*op. cit.*) that this species has not been recorded from Ceylon, but there are two specimens from that island in the collection of the Indian Museum. They were taken some years ago at Pattipola in the hills of the Central Province (alt. ca. 6000 feet) by Mr. F. H. Gravely.

### ADDENDA.

Since these notes went to the press I have received specimens of three species of *Chelonia* from Mr. W. Lancelot Travers, who obtained them near Baradighi in the Jalpaiguri district of Bengal. The same gentleman had already sent me examples of two others from the same locality. As our knowledge of the *Chelonia* of northern Bengal is still far from complete, this little collection is of considerable importance. It includes the following species:—*Chitra indica* (several young specimens), *Emyda granosa* (a half-grown specimen of the typical form), *Testudo elongata* (one young specimen), *Geoemyda tricarinata* (one adult), *Geoemyda indopeninsularis* (a large male).

It is of particular interest to find that the range of *T. elongata* actually extends, as Anderson thought probable, along the sub-Himalayan tract to the west of Assam, and that *G. indopeninsularis* occurs north of the Ganges.

The specimen of the latter species agrees well with the male type.<sup>1</sup> The shell is actually deeper as a whole than in *G. trijuga* var. *edeniana*, but the bridge has relatively a much smaller vertical depth. The specimen from Assam referred doubtfully to *edeniana* (*op. cit.*, pp. 69, 70) should probably be assigned to *G. indopeninsularis*, in spite of its broad second vertebral shield; it is much smaller than the other three in the collection.

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<sup>1</sup> *Rec. Ind. Mus.* IX, p. 71, pl. v, fig. 2.

### EXPLANATION OF PLATE XXXIII.

All the figures on this plate are from untouched photographs of natural size.

FIGS. 1, 1*a*, 2.—*Trionyx sulcifrons*, sp. nov.

1.—Skull of type-specimen as seen from above : 1*a*.—Lower jaw of the same specimen.

2.—Young specimen preserved in spirit.

FIGS. 3, 3*a*.—*Gonatodes bireticulatus*, sp. nov.

3.—Type specimen from above : 3*a*.—Same specimen from below.

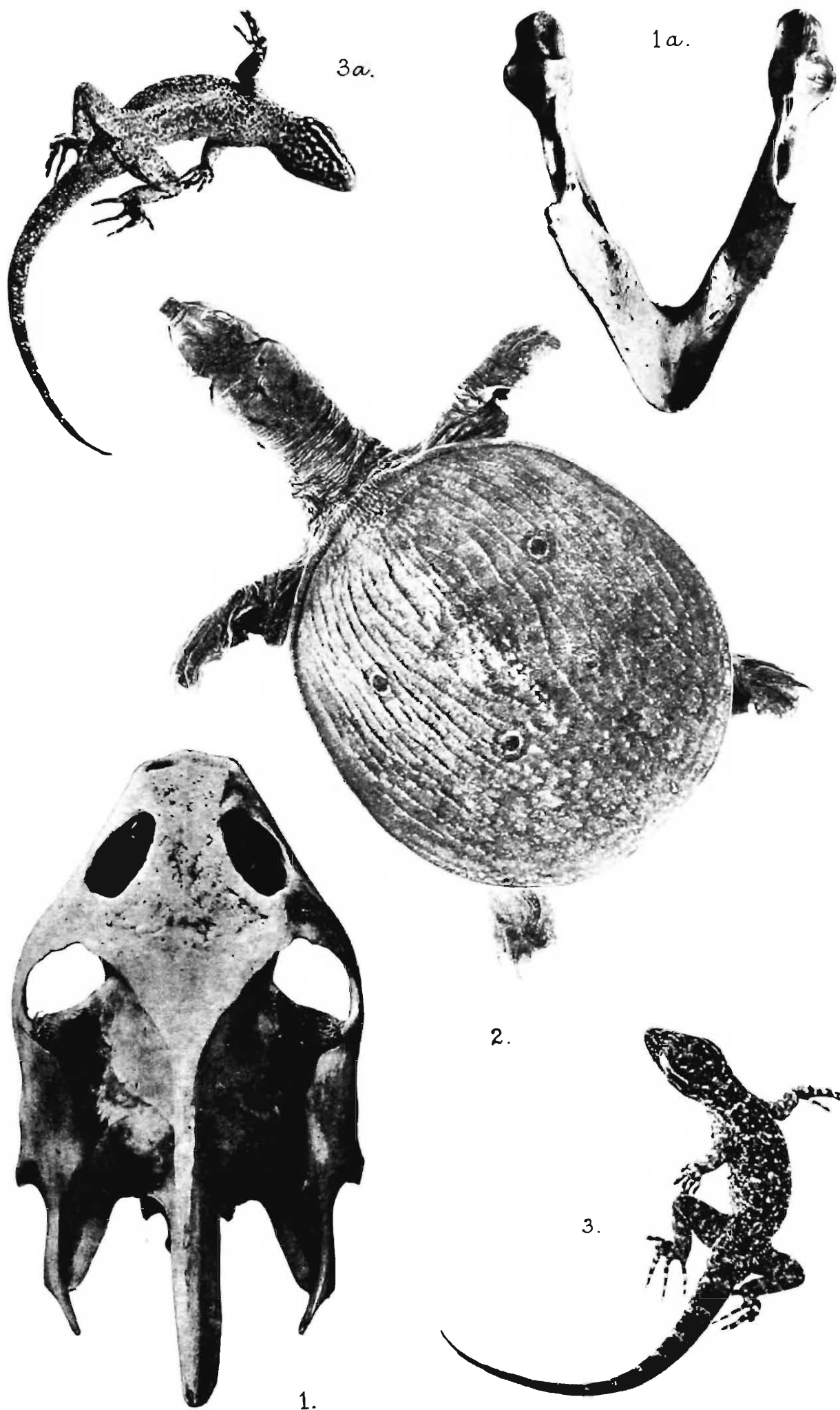


Photo by S.C.Mondul.

1,1a. 2 TRIONYX SULCIFRONS.

3,3a. GONATODES BIRETICULATUS.

## MISCELLANEA

### HYDROZOA.

#### A Short Note on *Hydra oligactis*, Pallas.

On the occasion of a recent visit to Ludhiana (Punjab) I found a few specimens of *Hydra oligactis*, Pallas, in a small pond full of the pond-weed *Potamogeton pectinatus*, Linn. One of these specimens of *Hydra* was rather peculiar in having seven tentacles. Dr. Annandale in his account (*Fauna of British India, Freshwater Sponges, Hydroids and Polyzoa*, p. 159) says that he has not seen any Indian specimen with more than six tentacles, while quite a large number of specimens that I have examined from Lahore and Ferozapore had usually four, and in exceptional cases five tentacles. The manner of capturing food was also observed, it exactly corresponds to Dr. Annandale's account (*Fauna*, p. 152) of *Hydra vulgaris* phase *orientalis*, Annandale. The food consisted of very young individuals of the Aphis *Siphocoryne nymphae* which was infesting the plant in large numbers.

|                       |                                  |
|-----------------------|----------------------------------|
|                       | BAINI PARSHAD, B.Sc.,            |
| Government College, } | Alfred Patiala Research Student, |
| Lahore. }             | Zoological Laboratory.           |

### BATRACHIA.

#### The larva of *Rhacophorus pleurostictus*, Boul. (*Fauna*, p. 479.)

The tadpoles, which were collected in Coorg, presented some difficulty in the matter of identification. This was due to the absence of any four-legged forms in the collection; but Dr. N. Annandale, who had received a fine collection of tadpoles from Cochin, has by a process of exclusion identified them as the larvae of *Rhacophorus pleurostictus*; as he has pointed out, the character of the feet at once excludes these larvae from the genus *Rana*.

*The head and body* are moderately flattened above and broadly oval, ventrally convex. The snout is rounded. The length of the body is to the breadth as 7 : 5. The body is finely pitted above, perfectly smooth below; but in specimens in which the hind limbs have not sprouted it is smooth above as well as below. Two conspicuous oval parotoids are present.

*The eye and nostril* are both small, dorsally placed, by no means prominent. The nostril is very small, directed almost anteriorly, equidistant between the eyes and the tip of the snout. The internasal space is twice the interorbital.

*The mouth* is subterminal, small. Its greatest width is only slightly greater than the interorbital space (as 7 : 5). The lower

lip is strongly developed, directed backwards; the upper is not prominent. The distribution of tubercles varies; they are generally absent or only sparsely present on the upper lip, while stronger ones fringe the corners and the lower lip. The dental formula is liable to vary. It may probably be expressed thus:—

$$2-3:5-7+5-7 \mid 5-7+5-7:4-6.$$

The uninterrupted tooth rows on both the lips are longest.<sup>1</sup> The lower jaw is V-shaped with granulate or dentate edge. The upper beak is broadly crescentic. Almost every specimen in the

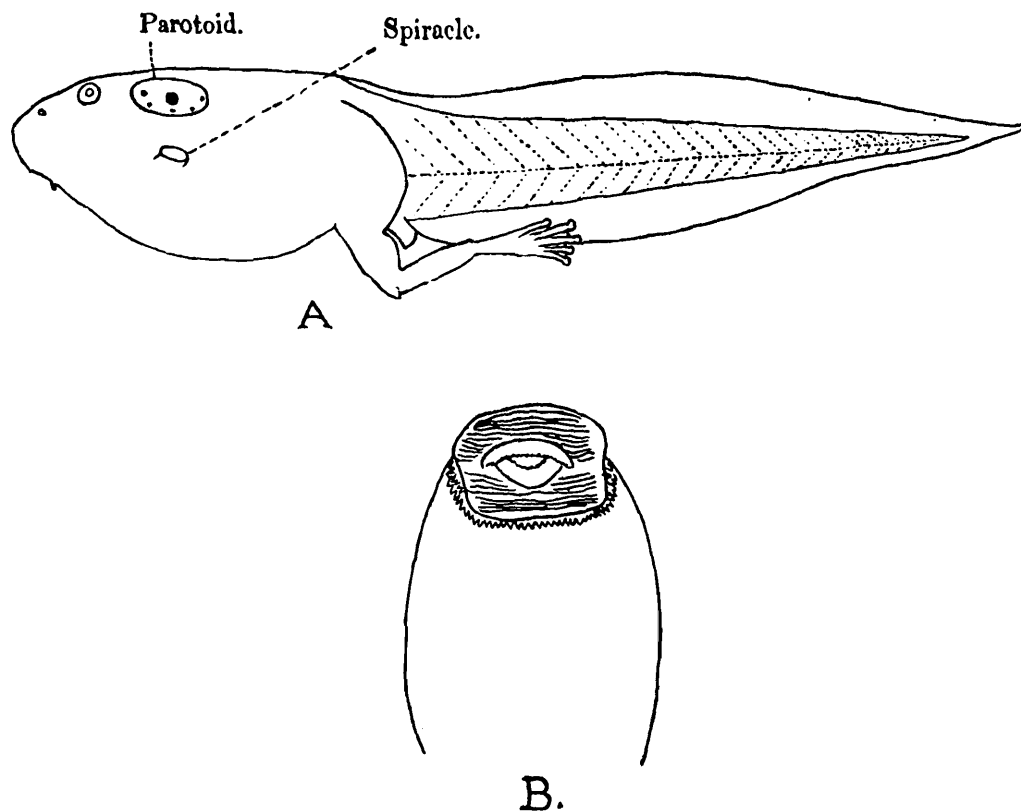


FIG. 1.—Tadpoles of *Rhacophorus pleurostictus*.

A. Lateral view. B. Mouth, showing the beak, tooth-rows and tubercles.

collection shows the lower jaw to be cornified, but the upper beak is very fully developed. No glandular swellings are present at the corners of the mouth.

*Skin and glands.*—In specimens in which the hind limbs have not developed, the skin is smooth and no whitish glandular pits occur. When the hind limbs have grown, the dorsal surface is beset with numerous cutaneous glands, which are distributed over the head as well. Two most conspicuous large oval parotoids, twice the diameter of the eye, are present; they may be

<sup>1</sup> In the specimens in my collection I could discover no horny teeth, only bare ridges; but Dr. Annandale, to whom examples have been sent, states that he has found patches of small teeth in a few.

yellow or darker in colour. One or two irregular rows of white round glandular swellings exist on both the caudal crests.

*Spiracle*.—Sinistral, large, very slightly tubular; opens just below the parotoid; nearer to it than to the eye. The opening is directed slightly upwards, not visible from above or below, quite as large as the eye.

*Vent*.—Tubular, median or slightly dextral, quite as large as the spiracular opening.

*Tail*.—Gradually pointed or only slightly rounded at the tip. The muscular portion is very strongly developed, the membranous crests are thin and transparent. The total length of the tail is nearly  $1\frac{1}{2}$  times the length of the body and head, and the muscular part is only  $\frac{1}{2}$  the total width. Both crests are strongly convex and of equal depth.

*Colouration*.—The young tadpoles are nearly transparent and the parotoids are bright yellow with a dark central spot. A few dots occur on the tail. In older specimens, the body is dull grey (slightly bluish in spirit specimens) with more numerous blotches on the back and the muscular part of the tail. Generally there is a ring of small dots with a bigger one in the centre on the parotoids. The central surface is dirty white, in most specimens immaculate.

*Dimensions*.—The measurements of (A) an individual in which the hind limbs have not sprouted, and of (B) an individual in which they have fully grown are as follows:—

|                         | A.     | B.     |
|-------------------------|--------|--------|
| Total length            | 52 mm. | 92 mm. |
| Length of head and body | 24 mm. | 36 mm. |
| Length of tail          | 28 mm. | 56 mm. |
| Maximum breadth of body | 13 mm. | 25 mm. |
| Maximum depth of body   | 11 mm. | 20 mm. |
| Maximum depth of tail   | 10 mm. | 16 mm. |

*Biological*.—These tadpoles occur in abundance in tanks in the vicinity of houses where fish are reared. The bottom of the tanks being more or less clayey, the tadpoles can hardly be made out in the water. Water snakes destroy them in large numbers.

C. R. NARAYAN RAO.

## BIRDS.

### An Albino Bulbul.

A very fine specimen of an Albino Bulbul, *Molpastes burmanicus*, has recently been sent to the Museum from Mr. A. H. Ricketts.

The bird was captured when only just commencing to learn to fly, and was at that time wholly white, with the typical white bill, feet and claws and bright red eyes of a true albino.

After being about six months in captivity this bird acquired the normal brilliant crimson colouring on the under tail coverts and (in the skin) a faint shade of reddish or buffy brown may be noticed both on the head and the rectrices. At the same time the bill and claws are still entirely colourless showing that, as a whole, there was no probability of increase in the pigmentation. Mr. Ricketts records that when about a year old the bird developed epileptic fits and died.

This specimen is very interesting not only in that it possesses one patch of most brilliant normal colouration in spite of the rest of the plumage remaining that of a true albino, but also in the fact that the faint tinge of colouration elsewhere discernible is buff or reddish.

Reds and yellows are the most volatile of all colours and in skins of birds exposed to sun and weather the first colours to evaporate are the yellows and then the reds, yet we find in this bulbul, as in many albino snipes, etc., the buff persisting to some extent to the exclusion of the far more permanent browns whilst the one vivid colour retained is crimson.

The conjunction of epileptic characteristics with albinism is also worthy of note as the same is known to obtain in human beings and other animals.

E. C. STUART BAKER.

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