XV SOME GASTROPOD MOLLUSCS FROM THE GANGETIC DELTA

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(With Plate XX).

The molluscs described or discussed in this paper live in the waterways of the Gangetic Delta or lead an amphibious existence on their shores. A large proportion of the species that do so in the delta have already been described by Benson, Stoliczka, Blanford or Nevill, or by more than one of these authors, to all of whom we owe invaluable information about the brackish-water fauna of the Indian estuaries. It is much to be regretted that Nevill did not live to complete his Hand List of the Molluscs in the Indian Museum, in which work almost alone exact data as to localities are to be found. We hope later to discuss the invertebrate fauna of the lower part of the delta as a whole; for the present we will consider only those Gastropods about which we have something new to say from a strictly taxonomic point of view.

We have figured the radular teeth of most of the species discussed, but it has seemed to us unnecessary to give elaborate descriptions of these teeth. Our figures, if they are as correct as we believe them to be, should prove much clearer than any written description. We have to thank Babu D. N. Bagchi for the accuracy with which he has drawn the figures under our supervision. The figures of the shells have been prepared with equal care by Babu A. C. Chowdhury.

We have also to thank Mr. T. Southwell, Director of Fisheries, Bengal, Bihar and Orissa, for the facilities that he has given us in collecting specimens. The majority of those on which we base the following notes were collected by Mr. S. W. Kemp and ourselves on a recent trip from Calcutta to Khulna on board the Bengal Fishery launch "Kitty."

Family NERITIDAE.

Genus **Dostia**, Gray.

1840. *Dostia*, Gray, *Syn. Contents Brit. Mus.*
1879. *Neritaeae Mitrulae*, von Martens, *Neretina* in Chemitz's *Conch. Cab.*, pp. 16, 37.
1915. *Septaria*, Preston, *Faun. Brit. Ind., Freshwater Moll.*, p. 6 (in part).

This genus seems to us to be well characterized by the following features :—

(i) The spire is vestigial, but distinctly lateral and spiral.

(ii) The shell has no wing-like lateral projections.

(iii) The columellar plate extends as a transverse septum along the aperture of the shell for at least half its length.

(iv) The operculum is semicircular and completely exposed.

Preston (*op. cit.*) includes species of *Dostia* in *Septaria*, Fér., but this genus differs in the still more reduced spire, which is hardly coiled and does not project at its base beyond the body-whorl ; in its much narrower columellar plate, and specially in the fact that the operculum, which is nearly square, is concealed in the muscles of the foot.

We are convinced by a study of specimens from a number of different localities that at least three distinct species can be distinguished in the Gangetic Delta alone, and that none of these are synonymous with the true *D. violacea* (Gmelin). Two of these species have already been described by Benson, but we can find no record of any form with which the third can be identified.

Dostia cornucopia (Benson).

(Plate XX, fig. 2*a*).

1836. *Neretina cornucopia*, Benson, *Journ. Asiat. Soc. Bengal*, V, p. 748.
1867. *Neretina* (*Dostia*) *cornucopia*, Blanford, *Ibid.*, XXXVI, pt. 2, p. 60, pl. xii, figs. 23–25.

In this species the shell is relatively large, porcellaneous, thin and high. The columellar plate extends very little more than half way across the true mouth of the shell, *i.e.* the part occupied by the operculum when the soft parts are retracted. The periostracum is pale olivaceous, sometimes with well-defined transverse zig-zag black lines. The collumellar plate is blackish and there is a blackish margin to the true mouth of the shell.

The differences between shells from the Irrawady Delta and those from that of the Ganges noted by Blanford are not constant.

The operculum is relatively short, its breadth being two-thirds of its length. The lateral projection is stout and blunt, but of considerable length. Its distinctive features in other respects can be seen from our figures.

We have examined specimens of this species from the upper part of the Gangetic Delta, from that of the Irrawady, from the Patani river on the east coast of the Malay Peninsula and from Cochin-China.

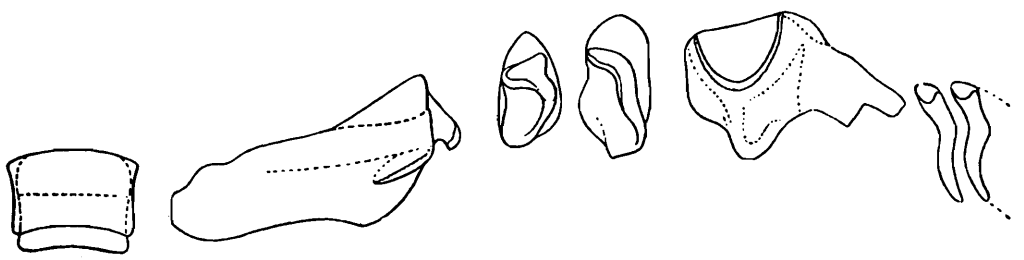
Blanford says that in the Irrawady Delta *D. cornucopia* is usually found on tree-trunks covered at high-tide by brackish water. In the delta of the Ganges, however, it seems to occur chiefly, if not exclusively, at the edge of creeks of fresh or almost fresh water near the upper limits of tidal influence. The species is, however, scarce in Bengal.

Dostia depressa (Benson).

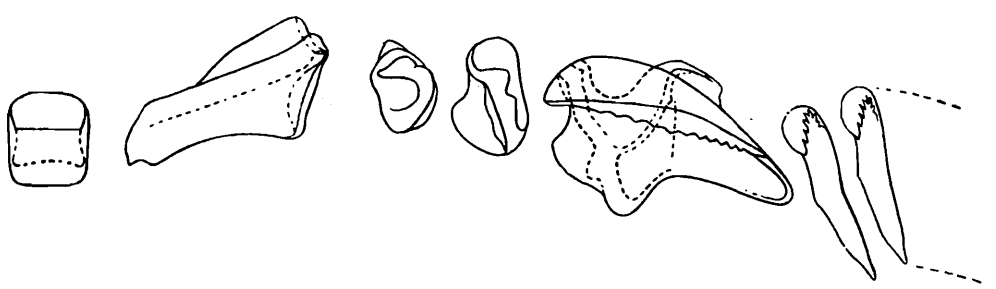
(Plate XX, fig. 2*b*).

1836. Benson, *op. cit.*, p. 748.
1868. Blanford, *op. cit.*, p. 60.
1915. *Septaria crepidularia* and *S. depressa*, Preston, *Rec. Ind. Mus.*, XI, p. 480.

The shell of this species differs from that of *D. cornucopia* in being as a rule narrower in proportion to its length, in having the true mouth still smaller, in the smoother edge of the columellar septum and in colour. The shell substance is rather thicker and has a yellowish tinge. The columellar plate and the outer lip are tinged more or less deeply with orange or coral-red, but this tint is somewhat evanescent. The periostracum is brownish, sometimes



a.



b.

TEXT-FIG. 1.—Radular teeth of Gangetic species of *Dostia*.
(*a*) *D. depressa*, Benson. (*b*) *D. platyconcha*, sp. nov.

with transverse greenish lines, and occasionally marbled with green. When the periostracum is worn away, the surface of the shell is whitish with transverse zig-zag pink or purple lines and stripes. The operculum differs from that of *D. cornucopia* in being relatively broader, in having the lateral process longer and more pointed, and in other characters shown in our figure.

We have seen this species from the deltas of the Ganges and the Irrawady, where it is usually found in slightly brackish water. It is common on the banks of the Hugli about twenty miles below Calcutta. Captain R. B. Seymour Sewell, I.M.S., has recently sent us specimens from swampy pools at Calicut on the

Malabar coast, and from a small stream twenty-eight miles east of that place.

We figure (fig. 1*a*) the radula of a specimen from the Hugli. Both the lateral and marginal teeth differ considerably from those of the next species; the marginals being considerably smaller and having the denticulation stronger. The differences between the laterals are of a very complicated nature, and will be understood best by a reference to the figures.

Dostia platyconcha, sp. nov.

(Plate XX, figs. 1, 2*c*).

This species differs from both the other Gangetic forms and from all others of the genus known to us in its much thinner and more transluscent shell, its depressed form and non-protruding spire. Its lateral profile is regular and forms an arch, less than a semicircle; the spire hardly protrudes beyond the anterior margin of the body-whorl. The spire though very minute is, however, distinctly lateral and spiral. In ventral view the shell is broadly oval, slightly truncated posteriorly. The upper part of the shell is invisible or practically invisible in this view. The columellar plate is separated from the lower margin of the shell, and extends considerably more than half way across its true mouth. The margin is irregularly and minutely crenulated. The posterior lip is very broad below the anterior margin of the true mouth of the shell. The dorsal surface is marked with well defined and regular transverse striae; minute longitudinal striae can also be detected with a strong lens. The periostracum is dull olivaceous green with minute black specks and with obscure longitudinal rays. The interior of the shell including the columellar plate has a faint glaucous tinge and is very highly polished.

The operculum is rather short and instead of bearing a single prominent lateral process has two short rather broad tubercles one of which may be obscure.

We figure the radular teeth (fig. 1*b*).

Type specimen: M $\frac{11\frac{4}{2}0}{}$ in the collection of the Zoological Survey of India.

Locality.—The species is not uncommon in the lower parts of the Gangetic Delta, on bushes at the edges of creeks containing brackish water of considerable salinity.

Family LITTORINIDAE.

Genus **Littorina**, Férussac.

A number of species of this genus lead an amphibious or almost terrestrial existence on the banks of the waterways in the lower part of the Gangetic Delta. At present we will deal with only three of these, namely *L. melanostoma*, Gray, *L. subintermedia*, Nevill and *L. delicatula*, Nevill.

Littorina melanostoma, Gray.

1882. *Litorina melanostoma*, Weinkauff, "Die Gatt. *Litorina*" in Chemitz's *Conch. Cab.*, p. 41.
1887. *Littorina melanostoma*, von Martens, *Journ. Linn. Soc. Zool.*, XXI, p. 170.

This is by far the commonest of the Gangetic Littorinidae. It occurs in large numbers on grass and bushes exposed at low tide, but submerged when the tide rises. The geographical range extends to the Malay Archipelago.

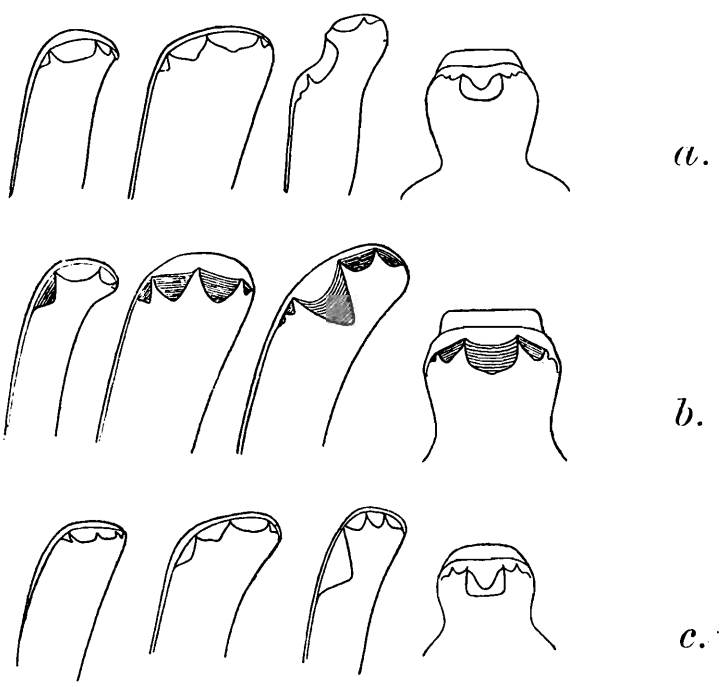
We figure the radular teeth (fig. 2*a*); their most remarkable feature is the assymetrical form of the inner lateral tooth.

Littorina subintermedia, Nevill.

(Plate XX, fig. 3).

1884. *Littorina conica* var. *subintermedia*, Nevill, *Hand-list Moll. Ind. Mus.*, II, p. 149.

This form appears to be less like *L. conica* and the true *L. intermedia* than Nevill thought, and we think it best to regard



TEXT-FIG. 2.—Radular teeth of Gangetic species of *Littorina*.
(*a*) *L. melanostoma*, Gray. (*b*) *L. subintermedia*, Nevill.
(*c*) *L. delicatula*, Nevill.

it as distinct. The shell is much thinner than that of either of Philippi's species, and has a slightly transluscent appearance. It is also narrower and more conical, and the sculpture is more delicate. The columella is narrow, but has a very distinct spindle-shaped depression upon its surface. The body-whorl is hardly angulate. The colour of all the shells we have seen is pale-yellow-

ish profusely spotted with dull purplish-brown. The spots are transversely elongate in the lower parts of the whorls, and often alternate with shorter spots of a whitish colour. Towards the upper part of the three lowest whorls the dark marks tend to take the form of longitudinal streaks nearly as broad as the pale interspaces.

The most striking feature of the radular teeth (fig. 2*b*) is that the central cusp of the central tooth is very large, with a distinct lateral cusp on either side; the thicker more prominent part of the former extends right across the cusp and occupies more than one half of its area. Most of the denticulations of all the teeth are transversely striate.

The species is only known from the lower parts of the Gangetic Delta.

Littorina delicatula, Nevill.

(Plate XX, fig. 4).

1884. *Littorina conica* var. *delicatula*, Nevill, *op. cit.*, p. 150.

The shell of this form is thinner than that of any other species of the genus we have examined, and is always very brightly coloured when fresh. The colours, however, as Nevill has noted, are somewhat evanescent. The columella is shorter than in *L. subintermedia* and the longitudinal depression upon it is much less well defined. The body-whorl is distinctly angulate in adult shells owing to one of the ridges being much more strongly developed than the others, but as this ridge is situated not very far from the anterior margin of the whorl, it is not found in young shells.

We figure the radular teeth (fig. 2*c*). The central tooth is smaller than in the other two species we have discussed; its central cusp somewhat resembles that of the central tooth of *L. melanostoma*, but is much smaller, and has the membranous marginal portion less well developed. The inner lateral is much more symmetrical.

This species, like the last, is apparently endemic in the lower parts of the Gangetic Delta. The two are often found together on trees and bushes far above high-tide mark. They seem to be very largely terrestrial in habits.

Family HYDROBIIDAE.

Genus **Stenothyra**, Benson.

This is one of the most characteristic genera of the upper estuarine waters of South-eastern Asia. It is often found in fresh water, but rarely in places permanently unaffected by tidal influence. Both the species here described are from water that was quite fresh at the time of their capture, but is slightly brackish at other seasons.

Stenothyra echinata, sp. nov.

(Plate XX, fig. 5).

The shell is small, solid, transluscent and pale in colour. It has a very regular conoidal form except that the ventral surface of the body-whorl is flattened and the anterior part narrowed. The apex is pointed but not acutely. There are $5\frac{1}{2}$ whorls. The suture is not deeply impressed, but is oblique and irregular; the whorls of the spire increase gradually and evenly. The body-whorl is broad; in dorsal view it appears to be transverse and almost quadrate, but as seen from below it is truncato-ovoid, the truncation being posterior. The mouth of the shell is very small and oblique; it has a regularly oval form. Its rim projects little and the shell is not umbilicate. The whorls of the spire are apparently smooth, but are covered with a deposit in the specimen examined. The penultimate whorl and the one behind it bear a single spiral row of sharp, flattened, horny spines, which are directed towards the apex and slightly inwards; they have a golden yellow colour. The body-whorl is sculptured with the spiral punctured lines common to most species of the genus.

The operculum is thin and horny, of the normal paucispiral type.

Measurements of type-shell (in millimetres).

Length	4·0
Breadth of body-whorl	2·5
Length of spire (dorsal view)	1·6
Breadth of spire (dorsal view)	2
Length of aperture	1·2
Breadth of aperture	1 0

Type-specimen: M $^{11}_{2}{}^{39}$ in the collection of the Zoological Survey of India.

Locality.—A single specimen was found among semi-aquatic vegetation at the edge of the river Pussur at Khulna, July 22nd, 1918.

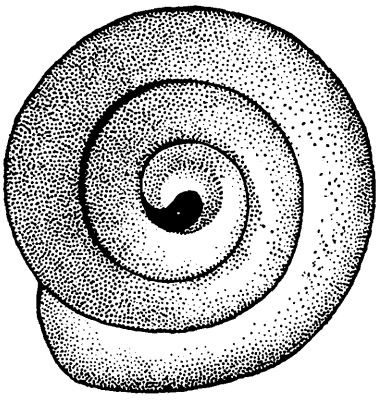
The most characteristic feature of the shell is the row of spines on the basal part of the spire. Otherwise it is very like that of *S. deltae* (Benson), specimens of which were found with it, but it is much smaller, narrower and less inflated in the body-whorl and the mouth is a little larger and relatively narrower.

Stenothyra soluta, sp. nov.

(Plate XX, fig. 6).

The shell is of moderate size, thick, globose, with the spire flattened, concave at the apex (fig. 3); the whorls are very distinct

and swollen and the body-whorl relatively short and stout, not at all flattened on the ventral surface. The suture is barely impressed. There are three and a half whorls. The aperture is large, oval, rounded posteriorly very prominent, and with the peristome thick and somewhat plicated concentrically There is no umbilicus. The periostracum is olive-green, opaque; the surface is smooth, but not highly polished; minute longitudinal striae and still more minute transverse striae are present, but punctured lines are entirely absent.



TEXT-FIG. 3.—*Stenothyra soluta*, sp. nov., view of the shell-whorls as seen from above.

Measurements of type-shell (in millimetres).

Length	4·1
Breadth of body-whorl	2·8
Length of spire (dorsal view)	1·5
Breadth of spire (dorsal view)	2·4
Length of aperture	2·0
Breadth of aperture	1·6

Type-specimen: M $\frac{11442}{2}$ in the collection of the Zoological Survey of India.

Locality.—A single specimen was found in flood refuse at the edge of a creek in the Gangetic Delta at Basanti, July 20th, 1918.

The species is distinguished by the looseness of its spire, its swollen whorls, the flattened apex, and the absence of punctured spiral lines; the peristome is well developed. Although the shell has a somewhat abnormal appearance, we know of no species to which it could be assigned as an aberration.

Genus **Bithinella**, Moquin-Tandon.

So far as we have been able to discover, only one species of this genus has as yet been found in India. This species is confined to brackish water of considerable but variable salinity.

Bithinella miliacea (Nevill).

1880. *Hydrobia (Belgrandia) miliacea*, Nevill, *Journ. As. Soc. Bengal*, XLIX, p. 161, pl. viii, fig. 7.

1884. *Hydrobia (Bythinella) miliacea*, Nevill, *Hand-list Moll. Ind. Mus.*, II, p. 52.

1907. *Bithinella canningensis*, Preston, *Ann. Mag. Nat. Hist.* (7) XIX, p. 216 (fig. in text).

We have compared Nevill's types with Preston's, and can find no difference. The species appears to be very variable and the varieties described, or rather named, by Nevill in his Handlist are possibly mere individual variations. The var. *minor*, however, may be worthy of varietal nomenclature.

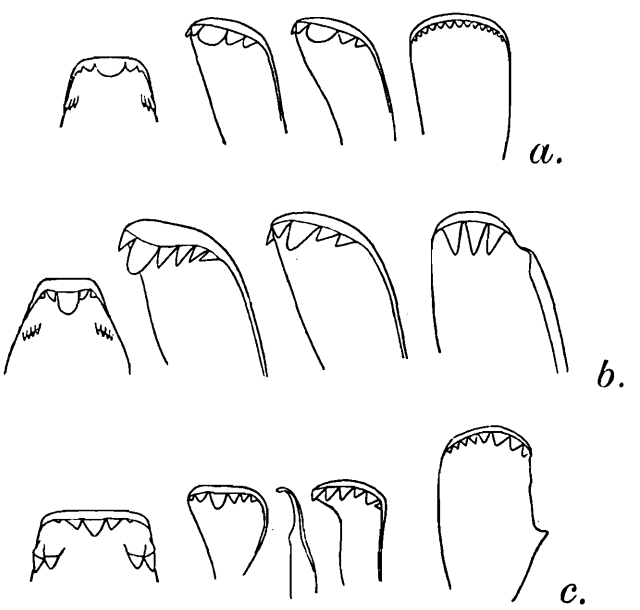
The species is very common among weeds in pools of brackish water at Port Canning.

Family ASSIMINEIDAE.

Genus **Assiminea**, Leach.

1887. *Assiminea*, Böttger, *Jahrb. deutsch. Malalakozool. Ges.*, XIV p. 158.
1880? *Assiminea*, Heude, "*Moll. Terr. Mem. Hist. Nat. Chin.*," I, p. 82.
1897. *Assiminea*, von Martens in Weber's *Zool. Ergeben. Neiderl. Ost.-Ind.*, IV, p. 212.

Böttger in his monograph of the genus arranges the species alphabetically; among the Chinese forms Heude recognizes three



TEXT-FIG. 4.—Radular teeth of Gangetic species of *Assiminea*.
(*a*) *A. brevicula* (Pfr.). (*b*) *A. beddomiana*, Nevill.
(*c*) *A. francesiae* (Gray).

divisions, which he calls Euassimineae, Pseudomphalae and Salenomphalae; while von Martens, discussing the species of the Malay Archipelago, divides the genus into two groups, *Cyclotrophis* and *Assiminea*, *s.s.*, which is distinguished from *Cyclotrophis* by the presence of a sharp rim at the inner edge of the umbilicus of the shell. We have here to consider three species, two of which [*A. brevicula* (Pfr.) and *A. beddomiana*, Nevill] belong to *Assiminea*, *s.s.*, while the third [*A. francesiae* (Gray)] perhaps represents *Cyclotrophis* but may ultimately call for generic distinction.

Assiminea brevicula (Pfr.).

1887. *Assiminea brevicula*, Böttger, *op. cit.*, p. 163.
1897. *Assiminea brevicula*, von Martens, *op. cit.*, p. 213.

Further references will be found in the papers cited.

We have nothing fresh to say about the shell or the living animal. We figure the radular teeth (fig. 4*a*), they are not unlike those of *A. violacea* as figured by Heude,[1] but the upper part of the central tooth is still more constricted, its cusp is larger, and it has four basal denticulations on each side; the denticulations of the lateral teeth are also better developed.

The species is very common on mud between the tide-marks in the lower part of the Gangetic Delta. Its distribution extends from the estuaries of the Ganges to those of Central China.

Assiminea beddomiana, Nevill.

1881. *Assiminea beddomiana*, Nevill, *Journ. As. Soc. Bengal*, L (ii), p. 158, pl. vii, fig. 3.

The animal is very like that of *A. brevicula*, but the radula differs considerably (fig. 4*b*), in that the upper part of the central tooth is not constricted, the denticulations at its base are feebly developed and its cusp is smaller. The denticulations of the lateral teeth are also less well developed, and those of the marginal, which is more symmetrical, are much smaller and more numerous.

This species occurs with *A. brevicula*, but is much less abundant. It is only known from the estuaries of the Ganges and the Irrawady and from intermediate localities.

Assiminea (? Cyclótrophis) francesiae (Gray).

(Plate XX, fig. 7).

1887. *Assiminea francesi*, Böttger, *op. cit.*, p. 176.

The shell of *A. francesiae* is, as Böttger points out, extremely variable. We do not think that the different forms named by Nevill as varieties or sub-varieties should be regarded as distinct. At some localities, however, notably at the edge of the river Pussur at Khulna, many adult shells have a number of ridges or varices running across the lower part of the body-whorl and probably representing periods of aestivation.

The radula (fig. 4*c*) differs considerably from that of the two species we have just discussed, and also from that of *A. scalaris*, Heude, which on shell characters alone comes in the same group.[2] The chief differences are: (*a*) there is a minute but elongate bifid

[1] *Op. cit.*, XXI, fig. 4*c*.

[2] See Heude, *op. cit.*, XXI, fig. 5. We have examined a radula of this species and find that while there are small variations in the denticulation of the teeth, the general outline as shown in Heude's figure is correct.

tooth interpolated between the two laterals on either side; the dental formula thus being 1.3 1.3.1. instead of 1.2.1.2.1. (*b*) The central tooth is quadrangular and broadly transverse; it has three stout subequal cusps and a pair of extremely large denticulations arranged side by side at each side of its base. (*c*) The denticulation of both the lateral teeth is very coarse but short. (*d*) That of the marginal tooth is similar to and intermediate between that of *A. brevicula* and *A. beddomiana*; there is besides on the outer margin of the tooth a peculiar pointed, but apparently membranous process.

It is possible that this species may have ultimately to be recognized as a distinct genus, but we have no information as to the radular characters of the typical species of *Cyclotrophis*—*C. papuensis* (Albts.), which was found on the south coast of New Guinea. As we have shown above, those of the Chinese *A. violacea*, which would be assigned to this group on shell characters alone, are quite different from those of *A. francesiae*.

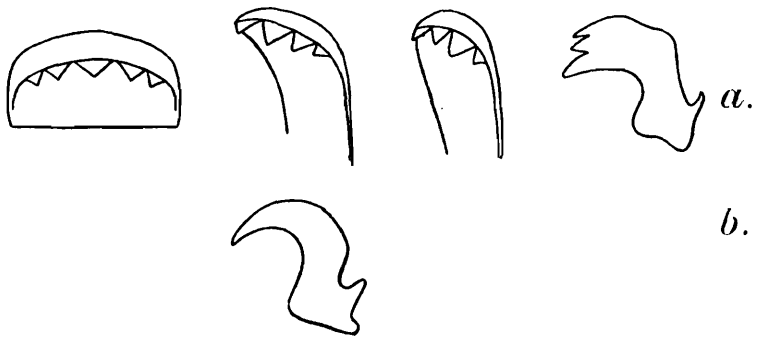
Family MELANIIDAE.

Genus **Melania**, Lam.

Sub-genus **Mainwaringia**, Nevill.

1886. *Mainwaringia*, Nevill, *Hand-List Moll. Ind. Mus.*, II, p. 286.

Although Nevill refers to the only known species as a "new generic type," he places it as a sub-genus of *Melania*, a view with



TEXT-FIG. 5.—Radular teeth of *Mainwaringia paludomidea*, Nevill.
(*a*) Teeth viewed from above. (*b*) Lateral view of marginal tooth.

which we agree. His statement that it is intermediate between that genus and *Paludomus* seems to be based on the form of the operculum, and perhaps on the consistency of the shell. Both Blanford,[1] however, and the Sarasins[2] have shown from different points of view that the former can hardly be regarded as of great generic importance in the Melaniidae. The form of the shell differs little from that of *Melania*, and we are of the opinion

[1] *Trans. Linn. Soc.*, XXIV, pp. 166–167 (1864).
[2] *Die Susswasser Mollusken von Celebes*, pp. 5–9 (1898).

that the only known species is a depauperated form modified in accordance with an amphibious life partly spent in water of considerable salinity.

The sub-genus may be redescribed as follows, using Nevill's terms to a large extent:—Melaniidae with imperforate, conically produced shell; its spire turretedly acuminate; shell-substance thick and almost porcellaneous, but becoming much thinner in the lower part of the body-whorl; columella strongly arched, not greatly incrassate, outer lip sharp; external surface decorated with deep-cut spiral striae; a thin epidermis present, bearing minute scattered hairs or chaetae. Operculum horny, extremely thin, paucispiral, with the nucleus eccentric.

Animal differing from that of the groups *Plotia*, *Striatella*, *Melanoides*, and *Tarebia* in the following characters:—Foot pointed and produced into a short filamentous process behind; a distinct mid-dorsal groove on posterior part of the foot extending on to the terminal process. Radula (fig. 5*a*) like that of *Melania*, but without a distinct cusp to the median tooth and with marginal teeth of peculiar form (see figure 5*b*).

Type: Mainwaringia paludomidea, Nevill.

Distribution.—Only known from the lower parts of the Gangetic Delta.

Melania (Mainwaringia) paludomidea, Nevill.

(Plate XX, fig. 8).

Nevill's description of the shell, which is quoted by Preston on p. 37 of his volume in the "Fauna," needs no elaboration. The animal has the characters noted above. Its foot is rather small; the tentacles are very long, slender and tapering, with the eyes situated on distinct prominences at their base externally. The snout is prominent, blunt and slightly notched in front. The foot and tentacles are transluscent white, suffused with black pigment above; the snout is brownish. The branchial chamber resembles that of *Melania*, but the branchial folds are exceptionally deep. The osphradium is well developed and ridge-like.

The species is not uncommon between tide-marks in the lower parts of the Gangetic Delta. At low-tide it adheres tightly by means of a gummy secretion to the trunks of trees, and particularly to the upright aërating roots of mangroves. When placed in water it emits a bubble of air and immediately becomes active. It would seem, therefore, to breathe air while in a comatose condition at low-tide, but never to be active while doing so.

Family NASSIDAE.

Genus **Nassa**, Lamarck.

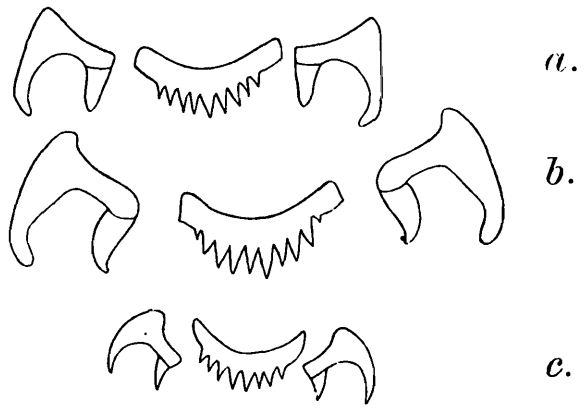
The small species of this genus that occur in brackish water on the coast of India, all of which have recently been described by Preston, seem to form a very distinct little group, in which

the radula is somewhat simplified, while the shell is remarkable for its small size and elongate form. These species are—*N. denegabilis*, *N. orissaensis* and *N. ennurensis*, to all of which we refer in the following note.

Nassa ennurensis, Preston.

1916. *Nassa orissaensis* var. *ennurensis*, Preston, *Rec. Ind. Mus.*, XII, p. 28, figs. 2, 2*a*.

This form appears to us to be specifically distinct. In addition to the differences between it and the typical *N. orissaensis* noted by Preston, we may draw attention to a very distinct feature, well shown in his figures, in the shape of the mouth of the shell, near the posterior extremity of the inner border of which there is always a blunt tooth in fully adult shells of *N. ennurensis*, while no such projection ever occurs in *N. orissaensis*. The typical form of the former, which reaches a length of over 10 mm., has



TEXT-FIG. 6.—Radular teeth of brackish water species of *Nassa*.
(*a*) *N. orissaensis*, Preston. (*b*) *N. denegabilis*, Preston.
(*c*) *N. ennurensis* var. *depauperata*, nov.

been recorded from the outskirts of Calcutta by Preston. A smaller form with a rather broader aperture, and a much thinner shell is common in the lower part of the Gangetic Delta. For this form we propose the name :—

var. depauperata, nov.

(Plate XX, fig. 9).

We have already stated the characters by which the shell of this form can be distinguished. The animal is very like that of *N. orissaensis*,[1] but differs in the following characters: (*a*) The foot is proportionately narrower and a little more deeply notched posteriorly, the two posterior lobes being distinctly pointed. (*b*) The anterior processes of the foot and also the tentacles are

[1] See Annandale and Kemp, *Mem. Ind. Mus.*, V, p. 343, fig. 1.

rather longer and more slender. (*c*) The siphon is shorter than the shell.

The whole animal is transluscent white, there is a tinge of pale grey on the siphon and the dorsal surface of the foot. The eyes are small but quite distinct.

The radula (fig. 6*c*) is very similar to that of *N. denegabilis* (fig. 6*b*) and *N orissaensis* (fig. 5*a*); all of which we figure. The lateral teeth have two distinct branches, which are quite smooth.

N. orissaensis var. *depauperata* lives in creeks of brackish water (sp. gravity corrected to 15°C. 1·01175–1·01725) on a muddy bottom at a depth of 4–6 fathoms. It crawls with extreme rapidity both in water and on damp surfaces, and can float adhering shell downwards to the surface film by means of the foot.

Type-specimen: M $\frac{11}{2}\frac{4}{4}\frac{8}{8}$ in the collection of the Zoological Survey of India.

Locality.—Kaikal Maree near Port Canning, Gangetic Delta; 17th July, 1918.

Family RINGICULIDAE.

Genus **Ringicula**, Deshayes.

1844. *Ringicula*, Hinds, *Proc. Zool. Soc. London*, XII, p. 97.
1875. *Ringicula apicata*, Nevill, *Journ. As. Soc. Bengal*, XLIV (ii), p. 101.
1878. *Ringicula*, Morelet, *Journ. de Conch.*, (3) XVIII (xxvi), pp. 113–133, pls. v–viij.
1878. *Ringicula* (Anatomie de l'animal), Fischer, *Ibid.*, pp. 114–115.
1884. *Ringicula*, Watson, *Journ. Linn. Soc. London*, XVII, p. 291.

Ringicula caeca, sp. nov.

(Plate XX, fig. 10).

The shell is small, very solid and of the usual shining white colour. The spire is narrow, conical and sharply pointed, about half as long as the body-whorl, which is relatively broad and nearly square. The main axis of the shell occupies a line much nearer the inner than the outer margin of this whorl, which projects inwards at an angle from the base of the spire. The suture is impressed and the whorls somewhat flattened outside it. The mouth of the shell is contracted but relatively long, extending backwards at an acute angle with the main axis to a point at about four-fifths the length of the body-whorl. The lips are very thick. The outer lip runs nearly straight for the greater part of its length, and turns inwards somewhat abruptly, but at an angle less than a right angle, in front; at the point at which it does so it bears a broad oval prominence. The outer callus extends about half way up the outer surface of the shell, and is strongly corrugated. The siphonal notch is well developed, but not very prominent. The columella is oblique and has three very prominent folds; the posterior fold is very broad, the median fold ridge-like and

the anterior fold intermediate. The columellar callus is well developed. The surface of the shell is polished, shining and somewhat opalescent, but is partly covered by a thin blackish-brown deposit. There are two fine but clear-cut spiral ridges on the whorls of the spire, extending on to the upper part of the body-whorl, the central region of which is quite smooth. At the base of the body-whorl there are five other still finer spiral ridges, which are more closely approximated behind than in front.

Measurements of type-shell (in millimetres).

Length	3·25
Breadth of body-whorl	2·0
Breadth of spire at base (dorsal view)	1·0
Length of spire (dorsal view) .	1·0
Length of aperture .	2·2
Breadth of aperture .	0·5

The living animal is devoid of external pigment and is of much the same shade as the shell. There are no eyes. The foot is relatively small, broadly rounded behind, expanding in front into a flattened, bluntly pointed almost triangular process on each side. The cephalic disc is large and extends over the anterior part and the lateral margins of the shell; in front it is notched in the middle line, and it is expanded at each side into a broad flattened process like that of the foot, but larger; the posterior margin is nearly straight, but folded in the middle line in such a way as to form an incomplete siphon, which, however, hardly projects at all.

Type-specimen: M $\frac{11\frac{1}{2}38}{2}$ in the collection of the Zoological Survey of India.

Locality.—Creek at Kaikal Maree, near Port Canning, Gangetic Delta, from a muddy bottom in 4–6 fathoms: specific gravity of water (reduced to 15°C) 1·01725.

The shell resembles that of *R. apicata*, Nevill, in some respects, but is larger and has the body-whorl much broader, the mouth more contracted and the lateral callus much more strongly developed.

The animal differs from that of *R. auriculata* as figured by Fischer (*Man. Conch.*, p. 36, fig. 322, 1887) in being devoid of eyes, in the different shape of its foot and cephalic disc, and in its much less well-developed cephalic siphon.

Family AURICULIDAE.

Genus **Auricula**, Lam.

At least three species of this genus, to which we give a somewhat broad application, occur commonly in the lower parts of the Gangetic Delta, namely—*A. auris-judae*, Lam., *A. gangetica*, Benson, and the form we describe below. Benson, Stoliczka and

Nevill seem to have regarded this last as a dwarfed form of *A. gangetica*, but it appears to us to be perfectly distinct.

Auricula translucens, sp. nov.

(Plate XX, fig. 11).

The shell is small, exceptionally thin, colourless, transluscent and (without the periostracum) semi-hyaline; the periostracum is thin and of a pale greenish olivaceous tint. The shape is elongate-ovate; the apex is bluntly pointed; there are $5\frac{1}{2}$ or 6 whorls, but the apical whorl is usually eroded. The spire is short, less than a third as long as the body-whorl in dorsal view. Though the whorls increase gradually and evenly, the suture is narrowly impressed; it is not markedly oblique. The body-whorl is long and narrow, distinctly spindle-shaped and almost pointed anteriorly; its inner profile is regularly arched, but its outer profile, proceeding from behind forwards, first slopes outwards and backwards for a short distance, then runs almost straight backwards for the greater part of its length, and finally becomes concave and slopes inwards to the anterior extremity. The mouth of the shell is long and narrow, extending backwards for nearly six-sevenths of the length of the body-whorl, curving inwards posteriorly and tapering to a point; anteriorly it is very narrowly rounded. The margin of the outer lip is thin, but there is a slight and perfectly smooth ridge running parallel to it just inside the mouth, and the anterior margin is slightly thickened. Only two columellar folds are visible; they are not very prominent and are situated in the anterior third of the aperture. The external surface of the shell is marked with fine longitudinal, rather widely separated curved striae, and with much finer and more numerous transverse striae; it is also minutely and lightly pitted. The pits or punctures are much larger and deeper on the posterior part of the body-whorl and on the spire than on the anterior two-thirds of the former. The inner surface is highly polished, iridescent, and microscopically transversely striate.

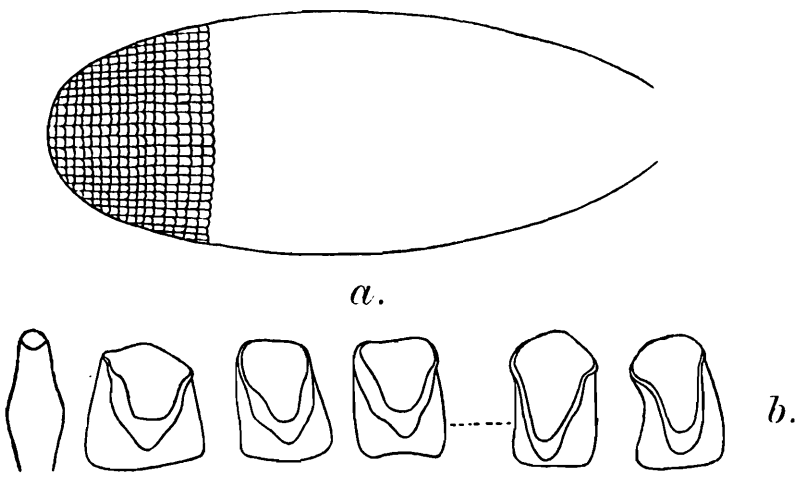
Measurements of shells (in millimetres).

	Type.		
Length of shell	8·5	8·1	·8
Greatest breadth of body-whorl	3·6	3·4	3·5
Breadth of spire at base	2 3	2·1	2·3
Length of spire	1·4	1·1	1·2
Length of aperture	6·2	6·1	6·3
Greatest breadth of aperture	1·6	1·5	1·8

The animal is white and transluscent, with a brownish tinge on the tentacles. The foot is rounded, slightly emarginate in front and rounded behind. The tentacles are long and slightly inflated at the tips, which are often invaginated when the animal

is crawling. The eyes are visible as small black spots at the base of the tentacles.

The upper jaw, which is very conspicuous in the living animal, is fully cornified and lunate in form; there is a broad transverse thickened median region, the anterior and posterior regions being almost membranous. The radula is narrowly tongue-shaped (fig. 7*a*), and bears about 60 transverse rows of teeth; these rows are practically straight. There are about 27 longitudinal rows; the dental formula being 7·6·1·6·7. The central tooth (fig. 7*b*) is minute, with a single cusp, which is nearly symmetrical and ob-



TEXT-FIG. 7.—Radula of *Auricula translucens*, sp. nov.
(*a*) Radula as a whole. (*b*) Radular teeth further enlarged.

scurely trilobed. The laterals are similar but much larger, and the marginals differ from the laterals in having the cusps narrower, simpler and directed somewhat inwards.

Type specimen: M $\frac{11+1+11}{2}$ in the collection of the Zoological Survey of India.

Locality.—A single living specimen of this species was taken in a creek at Basanti in the Gangetic Delta. In the collection of the Zoological Survey there are also a number of specimens from Port Canning which had hitherto been confused with *A. gangetica.*

The shell resembles that of *A socotrana*, Smith, in sculpture and texture, and that of *A. layardi*, H. Adams, in shape.