I. MATERIALS FOR A GENERIC REVISION OF THE FRESHWATER GASTROPOD MOLLUSCS OF THE INDIAN EMPIRE.

No. 3. The Freshwater Genera of Hydrobiidae.

By N. Annandale, *D.Sc., F.A.S.B., Director, and* B. Prashad, *D.Sc., Assistant Superintendent, Zoological Survey of India.*

The small size and insignificant appearance of the members of this family have caused them to be generally neglected, and the classification of the Indian forms in the official *Fauna of British India* seems to be based on no principle at all. Indeed, one of the genera is even placed in the Littorinidae, apparently through inadvertence. The recent attempt[1] of one of us to revise the species assigned to *Bithynia*, Leach, was not, as Mr. A. S. Kennard has pointed out in a letter, sufficiently drastic, for some species distinct from it had been retained in the genus. For these species the name *Digoniostoma* has been already[2] proposed. We include here a detailed description of this new genus.

It will be convenient to begin our discussion of the genera with a key, in which we will ignore their distribution into subfamilies, the diagnostic features of which are concealed in some species by secondary modifications in such a way that it is sometimes easier on first examination to recognize the genus than the subfamily. The subfamilies, nevertheless, seem to be founded on good anatomical as well as conchological characters. We do not propose at present to discuss the estuarine and maritime genus *Stenothyra*, Benson, which calls for a special revision, or the brackish-water species called *Bythinella* or *Belgrandia miliacea* by Nevill[3] and *Bithinella canningensis* by Preston.[4] The true generic position of this species will be considered best in reference to *Stenothyra*.

Key to the Indian Freshwater Genera of Hydrobiidae.

I. Shell very small, thin, elongate, narrowly perforate or imperforate, with the columellar callus poorly developed and the lip thin. Operculum thin, horny, paucispiral. Central tooth of radula without basal denticulations. Male organ without lateral process ... ... *Tricula.*

II. Shell thick, globose, with the spire directed backwards and outwards, with the mouth broad and the columellar

---

[1] *Rec. Ind. Mus.* XIX, pp. 41—46 (1920).

[2] *Ind. Journ. Med. Res.* (paper in the press).

[3] *Hand-List Moll. Ind. Mus.* II, p. 52 (1885).

[4] *Ann. Mag. Nat. Hist.* (7), XIX, p. 216, fig. in text (1907), and *Fauna Brit. Ind. Freshw.-Moll.*, p. 66 (1915).

callus flattened and plate-like, occluding the umbilicus. Central tooth of radula with basal denticulations.

A. Lip of shell thickened. Operculum thick, calcareous, concentric. Male organ with a lateral process — *Paranerita.*

B. Lip of shell not or slightly thickened. Operculum horny, spiral ... ... — *Lithoglyphus.*

III. Shell more or less elongate, thick or moderately so, with the main axis of the spire and the body-whorl in the same straight line, and the mouth comparatively narrow. Operculum thick, calcareous. Male organ with a lateral process.

A. Shell turbinate, conspicuously perforate, ornamented with prominent spiral ridges. Operculum concentric externally. Central tooth of radula with a vertical lateral process on each side, but without basal denticulations ... ... — *Mysorella.*

B. Shell not turbinate, without (in Indian species) prominent sculpture. Central tooth of radula with basal denticulations.

1. Shell almost trochiform, shallowly but openly umbilicate, ornamented with spiral incised lines. Operculum concentric externally ... ... — *Sataria.*

2. Shell ovate, narrowly umbilicate or imperforate, with sculpture microscopic, except for a varix in some species.

a. Lip of shell distinctly thickened. Operculum concentric externally.

α. Columellar callus more or less flattened and plate-like; no channel proceeding downwards from the umbilicus; inner lower extremity of lip rounded ... — *Hydrobioides.*

β. Columellar callus ridge-like; a distinct channel proceeding downwards from the umbilicus; inner lower extremity of lip angulate and produced ... — *Digoniostoma.*

b. Lip of shell not distinctly thickened.

α. Operculum concentric ... ... — *Bithynia.*

β. Operculum spiral ... ... — *Amnicola.*

i. Operculum horny ... ... — subgenus *Amnicola* (s.s.)

ii. Operculum calcareous ... ... — subgenus *Alocinma.*

We divide these genera into four subfamilies, viz. Hydrobiinae (or Paludestrinae), Bithyniinae, Mysorellinae and Lithoglyphinae.

Subfamily *HYDROBIINAE.*

The representatives of this subfamily are small or minute. They may be recognized by their horny, paucispiral operculum, undivided foot, unbranched male organ [1] and by the absence of denticulations at the base of the central tooth of the radula. Their shells are never thick or inflated.

---

[1] In the European *Hydrobia* or *Paludestrina jenkinsi* males are seldom or never produced and the females are parthenogenetic. See Robson, ***Ann. Mag. Nat. Hist.*** (9), V, pp. 425—431, pl. xv (1920).

Genus **Tricula**, Benson (1843).

1843. *Tricula*, Benson, *Calcutta Journ. Nat. Hist.*, p. 467.
1851. *Bithinella* (in part), Moquin-Tandon, *Journ. Conchyliol.* II, p. 239 (footnote).
1892. *Bithinella* (in part), Kobelt in Rossmässler's *Icon. Land- u. Süsswass. Moll.* (2), V p. 36.

We can find no generic difference between the shell of the Himalayan species on which Benson founded his genus *Tricula*, and those assigned by most recent authors to *Bithinella*. Some of the figures published by Kobelt are very like the shells of *T montana*, the type-species, and we have been able to examine a considerable number of European specimens. There is nothing, moreover, in Benson's brief description of the animal to contradict this view.

T montana is the only described Indian species that can be assigned to this genus, but we have a second from the Central Provinces as yet undescribed. Nevill's *Bithinella miliacea* is not a *Tricula*. It is, however, an inhabitant of brackish water and need not be discussed here.

Subfamily *BITHYNIINAE.*

The great majority of the Indian genera and species belong to this subfamily, in which (except in *Amnicola*) the operculum is thick and calcareous, the male organ has a lateral appendage, the foot is simple (as it is in all Indian genera of the family) and the central tooth of the radula is provided with several basal denticulations.

Genus **Bithynia**, Leach (1818).

1920. *Bithynia* (in part), Annandale, *Rec. Ind. Mus.* XIX, p. 41.

In the recent notes on the Indian species of the genus *Bithynia* by one of us, certain characters in the mouth of the shell were overlooked. These, as Mr. A. S. Kennard suggests in a letter, for reconsideration of the generic position of *cerameopoma* and other true Indian species. For these the new name *Digoniostoma* has recently been proposed. There can be no doubt, however, that the Kashmir forms assigned provisionally to *B. tentaculata* (Linné) and *B. troscheli* (Paasch) have been placed in the correct genus. In *Bithynia* the lip of the shell is sharp and not at all thickened and the columellar margin is narrow and ridge-like.

The type-species is *Helix tentaculatus*, Linné.

Genus **Hydrobioides**, Nevill (1884).

1885. *Hydrobioides* (subgenus of *Bithynia*), Nevill, *Hand-List Moll. Ind. Mus.* II, p. 42.
1918. *Hydrobioides*, Annandale, *Rec. Ind. Mus.* XIV p. 117.
1920. *Hydrobioides*, *id.*, *ibid.*, XIX, p. 44.

Fully formed shells of this genus are easily distinguished from those of *Bithynia* by their thickened lip and much broader and flatter columellar margin. The channel leading from the umbilicus is also practically absent.

The type-species is *Fairbankia*? (an *Bithynia*?) *turrita*, Blanford, a form with a very narrow elongate shell. The genus is Burmese. Mr. Kennard tells us that he has seen a fossil (tertiary) species from the Loess of Lei Chung, west of Shun Le-fu, N. China.

Genus **Paranerita**, Annandale (1920).

1920. *Paranerita* (subgenus of *Hydrobioides*), Annandale, *op. cit.*, p. 45.

The structure of the animal and operculum in *P. physcus*, the only known species, is too close to that of *Hydrobioides* to permit of its expulsion from the Bithyniinae, but that of the shell is perhaps too different to allow its retention in the genus.

P. physcus is only known from the Shan Plateau in Upper Burma.

Genus **Digoniostoma**, Annandale (1920).

1920. *Bithynia* (in part), Annandale, *op. cit.*, p. 41.
1920. *Digoniostoma*, Annandale, *Ind. Journ. Med. Res.* (in the press).

The shell of this genus differs from that of the true *Bithynia* in the structure of the mouth. The lip is somewhat thickened, though usually less so than in *Hydrobioides*, and more or less laminate. It is produced and angulate at the inner lower extremity. The columellar callus is broad and stout and as a rule distinctly laminate, but not so flat as in *Hydrobioides*. Otherwise the two genera are closely related.

The type-species is *Paludina cerameopoma*, Benson, a common and widely distributed Indian mollusc.

Genus **Amnicola**, Gould and Haldeman (1841).

This genus is American and is distinguished from the other Bithyniine genera by its horny, spiral operculum and by the presence of only a single denticulation on each side of the base of the central tooth of the radula. Hutton's *Paludina parvula* [1] must be assigned to it provisionally as he says, "Operculum horny," and Hanley and Theobald [2] say that the shell is that of an *Amnicola*; but the species needs further investigation. It was found near Chaman, which is now on the Northern Afghan frontier of Baluchistan, and is not represented in the collection of the Indian Museum. Mr. G. C. Robson has kindly informed us that the opercula are no longer present in the two specimens figured by Hanley and Theobald, originally from Hanley's collection, and now preserved in the British Museum.

---

[1] *Journ. As. Soc. Bengal*, XVIII, p. 655, pl. ii (1849).
[2] *Conch. Ind.*, p. 61, pl. cli, figs. 8, 9 (1876).

The type-species of the genus is *A. porata*, Say, from Massachusetts, United States of America.

Subgenus **Alocinma**, Annandale and Prashad (1919).

1919. *Alocinma* (subgenus of *Amnicola*), Annandale and Prashad, *Rec. Ind. Mus.* XVIII, pp. 23, 24.
1920. *Alocinma*, Annandale, *ibid.*, XIX, p. 43.

This subgenus was recently established for *A. sistanica* and its Indian and Mesopotamian allies. Its distinguishing characters are noted in the two papers cited above.

The type-species of *Alocinma* is *A. sistanica*, Annandale and Prashad.

Genus **Sataria**, Annandale (1920).

1920. *Sataria*, Annandale, *Rec. Ind. Mus.* XIX, pp. 45, 46.

The genus *Sataria* was recently established for the species described by Blanford as *Bithynia everzardi* from Mahableshwar in the Satara district and from Khandalla in the Poona district of the Bombay Presidency. The shell is almost trochiform, ornamented with spiral incised lines, and is shallowly but openly umbilicate. The operculum is calcareous and externally marked with strong concentric ridges. The radula resembles that of *Bithynia*, but has blunter denticulations and there is a quadrate process on the disc of the central tooth.

S. everzardi is the only known species of the genus.

Subfamily *LITHOGLYPHINAE.*

The shells of this subfamily are among the very few freshwater forms that have the main axis of the spire not quite in the same straight line as that of the body-whorl. This, with their globose outline and plate-like columellar callus, gives them an almost neritiniform appearance. The true diagnostic features of the subfamily are, however, to be found in the structure of the operculum (see key) and possibly in that of the male organ, about which there is some conflict of evidence; their shell-characters are closely analogous to those of the genus *Paranerita*, which we see no reason to separate from the Bithyniinae.

Genus **Lithoglyphus**, Mühlfeldt (1821).

1821. *Lithoglyphus*, Mühlfeldt in Sturm's *Fauna* (*fide* Kobelt).
1892. *Lithoglyphus*, Kobelt, *op. cit.*, p 28.

Lithoglyphus martabanensis, the only species known from the Indian Empire, seems to be, so far as can be judged from the shell only, a normal species of the genus, to which the Chinese *L. liliputanus*, Gredler, certainly belongs.

The type-species of the genus is *L. eburneus*, Mag. v. Mühlfeldt.

Subfamily *MYSORELLINAE.*

Genus **Mysorella,** Godwin-Austen (1919).

1919. *Mysorella,* Godwin-Austen, *Rec. Ind. Mus.* XVI, p. 431.
1920. *Mysorella,* Annandale, *Rec. Ind. Mus.* XIX, p. 46.

In the second paper cited above, one of us has recently discussed the relationships of the genus and the subfamily and we have nothing to add to this account.

The genotype is *Paludina costigera* var. *curta,* Nevill. There are two local races of the only known species, the typical form from the plains of the southern part of the Madras Presidency and Ceylon, and the variety or subspecies *curta* from the Mysore Plateau. It is possible that the latter will ultimately be regarded as a distinct species.