XIV NOTES ON LAMELLIBRANCHS IN THE INDIAN MUSEUM.

By B. PRASHAD, *D.Sc., Offg. Superintendent, Zoological Survey of India.*

(Plate XV.)

3. THE GENUS *VILLORITA* GRIFFITH AND PIDGEON (=*VELORITA*, GRAY).

The genus *Villorita*, Griffith and Pidgeon, hitherto known from shell-characters only, has been the subject of interesting controversy. Some of the authorities did not consider it distinct from the genus *Cyrena*, Lamarck, but others, owing to the differences in the shape of the shell and the hinge-teeth in the two genera, separated *Villorita* as a distinct genus. The soft parts now described, uphold this latter view.

Iredale[1] recently has rightly questioned the propriety of the name *Velorita*, Gray, by which name the genus was hitherto known in literature. He considers that it should be replaced by Griffith and Pidgeon's name *Villorita*, which was by all subsequent authors regarded as only a misprint for Gray's *Velorita*. A short review of the whole question will not be out of place here. The type-species of the genus was described by Gray[2] as *Cyrena cyprinoides* in 1825, and figured by Wood[3] as *Venus cyprinoides* three years later. Griffith and Pidgeon[4] in 1833 published a figure of Gray's type-specimen under the name *Villorita cyprinoides* with the following meagre description in the alphabetical list of figures '*Villorita cyprinoides*, Gray (*Cyrena cyprinoides*, Wood). Olive green." Iredale assumes from this and the following note in Griffith and Pidgeon's preface "Most of the inedited shells in this work are from the collection in the British Museum" that Gray had, prior to 1833, probably labelled his specimens as *Villorita cyprinoides*, though in his later work[5] he published the name as *Velorita*. Whatever may have been the sequence of events, there is no doubt that Griffith and Pidgeon were the first authors to introduce the name *Villorita* in literature, and their name, prob-

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[1] Iredale, *Proc. Malacol. Soc. London* XI, p. 178 (1914); see also *ibid.*, X, pp. 294—309 (1913).

[2] Gray, *Ann. Philosophy*, n.s., IX, p. 136 (1825).

[3] Wood, *Index Test. Supplement*, pl. ii, fig. 14 (1828).

[4] Griffith's *Animal Kingdom*, XII, pl. xxxi, fig. 5 (1834), the date on the plate is 1833.

[5] Gray, *Syn. Brit. Mus.*, p. 149 (1840) and *ibid.*, p. 78 (1842).

ably also the original manuscript name of Gray, must have precedence over Gray's later name *Velorita*.

Gray believed his specimen of *V cyprinoides* to have come from Japan, but Prime[1] considered it doubtfully to be an inhabitant of the Philippines. The second species *V cochinensis*[2] was described by Hanley from Cochin on the Malabar Coast of Peninsular India, while Prime[3] was not sure as to the habitat of his new species *V parvula*. I know of no authentic records of the occurrence of this genus outside the limits of the Malabar Coast in Peninsular India since both Gray's and Prime's localities can not be accepted as correct, and all authentic specimens in the Indian Museum are from the same area. Fischer[4] considered the genus to be strictly confined to India, and Preston[5] following him was of the same opinion though, without giving any reasons, he included the Philippine Islands in the range of distribution of the genus. It appears, therefore, from all authentic records available, that the genus is a true Indian one occurring only in the brackish water areas on the Malabar Coast of Peninsular India.

Leaving aside the scattered references in literature to this genus the only works of importance are (i) Prime's Catalogue of of Corbiculidae (*loc. cit.*), (ii) Sowerby's Monograph in Reeve's Conchologia Iconica, (iii) Clessin's revision of the genus in Martini and Chemnitz's *Conch. Cab.*, and (iv) Preston's account of the two species (*loc. cit.*) and later his description[6] of a new species (*V delicatula*) from the Cochin backwaters. Prime's earlier papers on the various species are referred to in his later catalogue and need no further remarks, beyond the fact that from his short description it appears that his new species *V parvula* is probably a young shell of *V cyprinoides* only. His catalogue includes most of the earlier references on the subject. Sowerby's monograph as was shown in Smith's review[7] is not a work of any importance. Not only are references to the species *V recurvata* and *V parvula* omitted, but the species *V cochinensis* is erroneously referred to Smith instead of Hanley. His descriptions and figures also are very poor and the habitat of the two species dealt with is incorrectly stated. It may be noted here, that *V recurvata* is not a *Villorita*, but should, as Deshayes and Prime have done, be referred to the genus *Corbicula*. Clessin's Monograph, though better than Sowerby's, appears mainly to be a compilation. No critical analysis of the three species dealt with is given, and was very probably based on an examination of very scanty material of *V cyprinoides* alone. Preston omits all reference to *V. recurvata* and *V parvula*, and recognizes two Indian species *V cyprinoides*

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[1] Prime, Cat. Corbiculidae, in *Amer. Journ. Conch.* V p. 141 (1870).
[2] Hanley, *Proc. Zool. Soc. London*, p. 543 (1858).
[3] Prime, *Ann. Lyceum Nat. Hist. New York* VIII, p. 418 (1867).
[4] Fischer, *Man. Conchyliologie*, p. 1092 (1887).
[5] Preston, *Faun. Brit. Ind., Freshw.-Moll.* p. 209 (1915).
[6] Preston, *Rec. Ind. Mus.* XII, p. 37, figs. 13, 13*a*, *b* (1916).
[7] Smith, *Journ. Conchyliologie*, XXIX, pp. 38—42 (1881).

and *V cochinensis*. As stated already he later described a new species from the Cochin backwaters as *V delicatula*. I have examined the types of this species and find that it is based on very young shells, this is discussed fully further on.

The collections in the Indian Museum have recently been greatly enriched by a large series of specimens of both dry shells and spirit preserved specimens from Travancore backwaters on the Malabar Coast received through the courtesy of Mr. N. P. Panickkar of the Travancore Fisheries Department. This large collection has rendered it possible to go into the question of the validity of the different species of the genus, and to describe the soft parts of this interesting genus.

Villorita, Griffith and Pidgeon.

1825. *Cyrena* (in part), Gray, *Ann. Philosophy*, n.s., IX, p. 137.
1828. *Venus* (in part), Wood, *Index Test. Supplement*, pl. ii, fig. 14.
1834. *Villorita*, Griffith and Pidgeon, *Animal Kingdom* XII, pl. xxxi, fig. 5.
1847. *Velorita*, Gray, *Proc. Zool. Soc. London* XV p. 184.
1853. *Velorita*, Gray, *Ann. Mag. Nat. Hist.*, ser. 2, XI, p. 38.
1854. *Velorita*, Deshayes, *Cat. Brit. Mus. Conchifera* II, p. 240.
1858. *Velorita*, Adams, H. and A., *Gen. Rec. Moll.* II, p. 449.
1878. *Velorita*, Sowerby, *Conch. Icon.* XX, p. 1, figs. 1*a*—*c*.
1879. *Velorita*, Clessin, *Cycladea* in Martini-Chemn., *Conch. Cab.*, p. 244.
1887. *Velorita*, Fischer, *Man. Conchyliologie*, p. 1092.
1914. *Villorita*, Iredale, *Proc. Malacol. Soc. London* XI, p. 178.
1915. *Velorita*, Preston, *Faun. Brit. Ind., Freshw. Moll.*, p. 209.

The question regarding the name and the validity of the genus has already been discussed in the introductory part. A detailed description of the genus was given by Fischer and a translation of it in English will be found in Preston's volume. No accurate description of the hinge has so far been published, I have, therefore, thought it desirable to give a detailed description of the two valves separately.

Right valve.—Anterior lateral tooth short and thick, nearly straight or only slightly slanting, with its posterior edge cut off at an obtuse angle and having a rather deep groove above it for the fitting in of the elbow-shaped anterior lateral tooth of the left valve; posterior lateral elongate, about 1½ times as long as the anterior, somewhat blade-like and extending up to the anterior border of the scar of the adductor muscle, of the three cardinal teeth, middle one best developed and the anterior one very small and feeble, all three slanting in an antero-posterior axis.

Left valve.—Anterior lateral fairly large, elbow-shaped, separated from the margin of the shell by a narrow chink but having a deep groove for the anterior lateral of the right valve, posterior lateral less developed than in the right valve, somewhat curved, arising as a thick ridge out of a cavernous hollow; of the three cardinal teeth the posterior most is the most feebly developed while the middle is the stoutest.

The muscle-scar for the anterior adductor muscle is somewhat pressed in below the anterior lateral tooth and is fairly deeply impressed, while that of posterior adductor is quite shallow. The palleal line shows a distinct though poorly developed sinus in its course very near its origin from the posterior adductor impression.

Soft parts.—A detailed description of the soft parts is given further on; the following characters may, however, be noted:—animal with the mantle having a regular row of finger-shaped papillae on its inner surface slightly internal to the edge; two siphons of moderate size, the anal much the shorter; siphonal orifices papillose; foot triangular, acutely pointed at the apex, rather large but not very muscular; gills of unequal size, inner much broader; palpi triangular, elongate.

As a result of a careful study of the large collection before me I am unable to recognize *V cochinensis*, *V parvula* and *V delicatula* as species distinct from *V cyprinoides*. Both *V cochinensis* and *V. delicatula*, however, are sufficiently characterized to be designated as distinct varieties, while *V parvula*, from its meagre description of the unique type of Prime, appears to be only based on young shells of *V cyprinoides*. I also take this opportunity to describe a very characteristic new species from Travancore under the name *V. cornucopia*.

Villorita cyprinoides (Gray).

Plate XV, figs. 1—4.

1825. *Cyrena cyprinoides*, Gray, *op. cit.*, p. 136.
1828. *Venus cyprinoides*, Wood, *op. cit.*, pl. ii, fig. 14.
1834. *Villorita cyprinoides*, Griffith and Pidgeon, *op. cit.*, pl. xxxi, fig. 5.
1854. *Velorita cyprinoides*, Deshayes, *op. cit.*, pp. 240, 241.
1870. *Velorita cyprinoides*, Prime, *op. cit.*, p. 141.
1878. *Velorita cyprinoides*, Sowerby, *op. cit.*, p. 1, figs. 1*a*, 1*b*, 1*c*.
1879. *Velorita cyprinoides*, Clessin, *op. cit.*, p. 244, pl. xlii, figs. 3, 4.
1915. *Velorita cyprinoides*, Preston, *op. cit.*, p. 209.

I give below a full description of the *forma typica*, as the previous descriptions of the species are not quite complete.

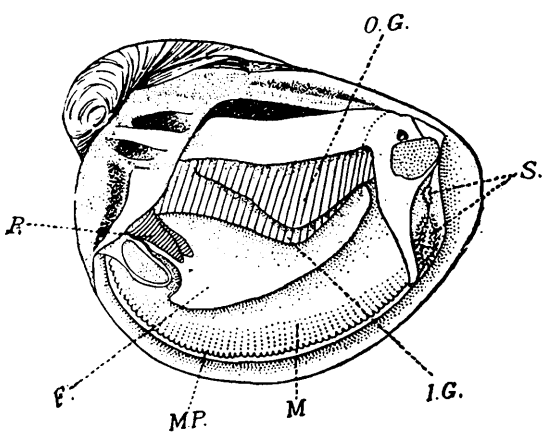
Shell fairly large, somewhat trigonal, cordate, very oblique; swollen in the umbonal and middle regions of the shell, greatly compressed below, umbones lying near the anterior margin being recurved anteriorly and somewhat inwards, hollow, separated from the hinge and one another by a narrow chink only, anterior margin short, regularly curved above, nearly straight in the middle, then rapidly curving backwards in continuation of the ventral border; the latter greatly curved upwards posteriorly to meet the posterior side in an acuminate or narrowly rounded point, posterior side nearly straight, much larger than the anterior and with a low keel; shell very thick with concentric ridges better marked in the anterior than in the posterior half, umbones also striated, often weathered, a narrow lunule anteriorly and a large, thick external ligament posteriorly; hinge as in the genus; epidermis olivaecous

to dark brown or even black, nacre whitish, light yellow near the margin and having a violet border.

Geographical Distribution.—The species, so far as is known, is endemic in Peninsular India on the Malabar Coast only. It occurs in brackish water areas though specimens are sometimes carried into nearly fresh water.

Soft parts.—The animal is somewhat trigonal, but the greater part of the umbonal region is occupied by a triangular structure formed by the union of the mantle flaps of the two sides only, the rest of the soft parts being somewhat elliptic in outline and lying below this hollow structure. Specimens preserved in spirit are of a whitish colour with dark brown black border in the region of the mantle papillae on the inner surface only, but seen through the translucent mantle flaps, the adductor muscles are dark yellow.

The mantle is very thin and translucent up to the palleal junction, below which, owing to the large numbers of radiating muscle fibres, it becomes much thicker; in the region of the papillae it is very thick and opaque. The border is entire without any papillae on the edge, but a continuous row of small finger-like papillae of a dark brownish colour with whitish tips is present on the internal surface a little distance from the margin. The papillae are of the same size throughout, and are not reduced in the middle region of the bucco-pedal orifice as in the genus *Corbicula*.[1] The papillae are also present on the line of union of the mantle flaps in the siphonal region above and below the two siphonal orifices. The two mantle flaps are united with each other anteriorly to a little above the anterior adductor muscle, the two then separate but in the region of the muscle itself the free portion is not very broad owing to the muscle lying near the border; behind the muscle, however, the two flaps are quite separate forming the large bucco-pedal orifice, which extends posteriorly in line with the posterior margin of the posterior adductor muscle. From the point of termination of the bucco-pedal orifice the siphonal orifice starts. The flaps of the mantle are united in this region in the situation of the mantle papillae except for the openings of the two siphons; the line of union is indicated by the row of papillae in this region.



TEXT-FIG. 1.—Soft parts of *V. cyprinoides* (Gray).

F. = foot; *I. G.* = inner gill; *M.* = mantle; *M. P.* = mantle papillae; *O. G.* = outer gill; *P.* palp; *S.* = siphons.

[1] Prashad, *Rec. Ind. Mus.* XVIII, pp. 209—211 (1920).

Above the siphonal orifice, which terminates about the middle of the posterior adductor muscle, the two flaps are again united intimately as on the anterior margin.

Of the two siphons the upper or the anal siphon is about two-thirds the size of the lower or branchial siphon. Both the siphons are fully retracted in the preserved specimens, but from their structure appear to be sufficiently extensile. The anal siphon has only a single circle of papillae surrounding the orifice, but the branchial has in addition another circle of much larger papillae situated inside the smaller papillae. Both the siphons are of a dark brown colour.

The two adductor muscles are of about the same size, but the posterior is more internally situated. The retractor muscles are similar to those of *Corbicula*. The radiating muscles of the mantle have already been mentioned; they arise from the palleal line and are connected with the papillae of the mantle. The siphonal retractor fibres are distinctly marked off from the rest and are connected with the siphonal sinus.

The attachments of the two pairs of gills are similar to those in the genus *Corbicula* except that a very narrow chink-like opening is distinguishable between the united edge of the inner lamellae of the inner pair of gills and the foot. The outer pair of gills is much narrower than the inner pair particularly in the anterior half.

The two pairs of palps are rather narrow, elongately triangular in outline; they are attached at the base with the apex pointing backwards and downwards. The surface of the palps is marked with very fine transverse ridges.

The abdominal mass is comparatively small, while the foot is of a fair size, not very thick, triangular and acutely pointed at the apex.

Var. **cochinensis** (Hanley).

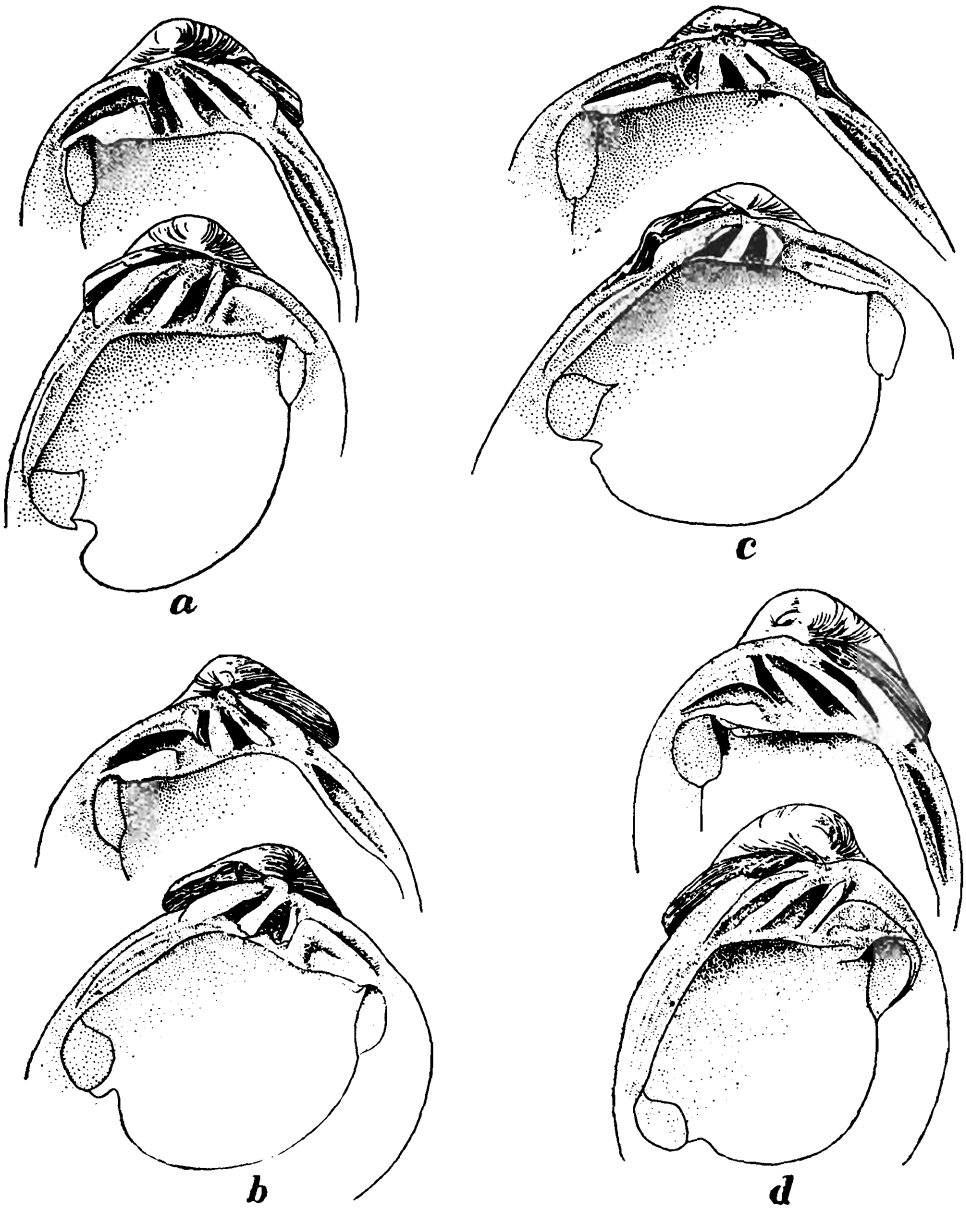
Plate XV, figs. 5—8.

1858. *Cyrena cochinensis*, Hanley, *Proc. Zool. Soc. London* XXVI, p. 543.
1860. *Cyrena corbiculiformis*, Prime, *Proc. Acad. Nat. Sci. Philadelphia*, p. 80.
1860. *Corbicula Quilonica*, Benson, *Ann. Mag. Nat. Hist.*, 3rd ser. VI, p. 260.
1866. *Velorita cochinensis*, Hanley, *Ann. Lyc. Nat. Hist. Soc. New York* VII, p. 236, fig. 6c.
1870. *Velorita cochinensis*, Prime, *op. cit.*, p. 141.
1878. *Velorita cochinensis*, Sowerby, *op. cit.*, p. 1, figs. 2*a*, 2*b*.
1879. *Velorita cochinensis*, Clessin, *op. cit.*, p. 225, pl. xxxvi, figs. 5, 6.
1915. *Velorita cochinensis*, Preston, *op. cit.*, p. 210.

Hanley's original description is very complete and needs no amplification. With a large collection before me I have found it impossible to consider Hanley's *V cochinensis* as a species distinct from *V cyprinoides*. The differences, however, are quite sufficient to recognize it as a distinct variety. These are:—(i) more centrally situated and less oblique umbones, (ii) much shorter and

more regularly curved anterior side, (iii) greatly reduced lunules, and (iv) the ridges on the surface more marked than in the typical form, but quite obsolete near the margins.

Geographical Distribution.—Hanley's specimens were collected in Cochin, while in the British Museum there are specimens from the Malabar Coast (precise locality not stated). In the Indian



TEXT-FIG. 2.—Hinge-teeth of *Villorita*, Griffith and Pidgeon.
(*a*) *V. cyprinoides* (Gray), typical form.
(*b*) *V. cyprinoides* var. *cochinensis* (Hanley).
(*c*) *V. cyprinoides* var. *delicatula* (Preston).
(*d*) *V. cornucopia*, Prashad.

Museum there are specimens from Beypore, south end of Vembanaad Lake, Travancore, and from various backwaters in Travancore. It appears, therefore, that the range of this variety is the same as that of the typical form of *V cyprinoides*.

The soft parts are similar to that of the typical form.

Var. **delicatula** (Preston).

Plate XV, figs. 9, 10.

1916. *Velorita delicatula*, Preston, *Rec. Ind. Mus.* XII, p. 37, figs. 13, 13*a*, *b*.

Preston described his new species from a series of four very young shells, one of these he designated as the type of his new species and the others as the co-types. The Indian Museum has since received many adult shells from Travancore, all of which show the distinctive characters of the young shells. As a result of the study of this large collection I do not think that Preston's species can be considered as distinct from *V cyprinoides*, though it must be designated as a distinct variety. The name *delicatula*, however, is unfortunate, since the full-grown shells are no more delicate than those of the *forma typica*, some indeed are even thicker and stouter.

The main distinguishing characters of this variety are the more triangular shape of the shells due to a great elongation in the antero-posterior axis and a corresponding shortening in altitude, the greatly produced posterior angle due to the posterior side being much longer, sloping rapidly backwards and meeting the distinctly rostrate lower margin in an angularly rounded point. The umbones though very oblique in the young shells are less so in adults and the lunule becomes more marked while the ligament becomes comparatively shorter. The hinge differs from that of the typical form in having all the teeth more delicate and much sharper, the laterals more slanting and the posterior laterals more elongate.

Geographical Distribution.—The type-series of young shells was collected in Cochin, in backwater near Ernakulam, while the adult shells are all from backwaters in Travancore. A full grown shell measures 32·2 mm. in length, 26 mm. in height and 20·5 mm. in maximum thickness.

The soft parts are identical with those of the typical form.

Villorita cornucopia, sp. nov.

Plate XV, figs. 11—14.

The shell of this species is large, subovoidal, very high and comparatively narrow, with a very prominent umbonal region; dark brown to black; both valves sculptured in the umbonal region with coarse concentric ridges, which become obsolete lower down, and are represented by the lines of growth only, part of the inwardly curved region of the umbones eroded, umbones solid, comparatively broad and high, retroverted inwards and somewhat to the anterior side; dorsal margin broadly arched, but the greater part of it hidden behind the prominent umbones; anterior margin comparatively long and regularly curved, a little below the middle the curve becomes very sharp and is continued

with the nearly straight ventral margin; posterior margin much longer than the anterior, very gradually sloping downwards and meeting the ventral margin in a broadly rounded angle, lunule very small or even absent, ligament very long and thick; hinge as in the genus but with short and nearly transverse anterior laterals and very long, curved posterior laterals, anterior adductor scar greatly impressed, that of the posterior adductor only feebly marked; palleal line greatly curved upwards anteriorly and with a very shallow sinus, nacre whitish with a narrow and indistinct violet band on the margin.

Measurements (in millimetres).

	1	2
Length	31·8	31
Height	44·6	41·8
Thickness	33·7	31·2

Type-specimen—No. M 11896/2 in the registers of the Zoological Survey of India (Indian Museum).

Locality.—Two dry shells of this species were collected by Mr. N. P. Panickkar at Komarakam in the Vempanad backwater, Travancore, with a large series of specimens of *V cyprinoides*. The shells of the genus *Villorita* are locally known in those parts as *kayal kaka* or backwater shells, no distinction being made between the various species.

Remarks—This new species is distinguished by the shells being much higher than broad, the very prominent and recurved umbones, irregular sculpture and the different type of hinge.