XVI NOTES ON LAMELLIBRANCHS IN THE INDIAN MUSEUM

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(Plate XX.)

4. INDIAN SPECIES OF THE GENUS *CYRENA*.

The present revision of the Indian species of the genus *Cyrena*, Lamarck, might appear superfluous in view of the recent treatment of the subject by Preston in his volume on Mollusca in the "Fauna of British India," but the above work is mainly a compilation from the earlier monographs by Prime,[1] Clessin[2] and Sowerby.[3] It was found on examination of the collections in the Indian Museum that the descriptions of the Indian species in these works were very faulty and inadequate being based on insufficient material and that too, in most cases, consisting of young or half-grown shells only. These descriptions, owing to the great changes that usually take place in the shape of the shells during growth, are not applicable to adult shells, and are incomplete so far as the description of the hinge is concerned, while the geographical distribution of the various forms is not correctly given. I have, therefore, thought it desirable to re-describe some of the species and in other cases to point out the distinguishing characters.

According to Preston the following species occurs within the limits of British India, Burma and Ceylon, *C. ceylonica*, *C. impressa*, *C. sinuosa*, *C. bengalensis*, *C. tennentii*, *C. proxima* and *C. galatheae*. Of these species *C. sinuosa*, Deshayes, was included in the list on Sowerby's authority. The species is known from Java and except for Sowerby no other author has recorded its occurrence in Ceylon. In the Indian Museum collection there are large collections from various parts of Ceylon, but none of these specimens are referrable to Deshayes' *C. sinuosa*, and I am very doubtful whether Sowerby's record can be accepted as correct. Sowerby probably confused some specimens of the nearly allied *C. ceylonica* with those of Deshayes' species or the localities on his specimens must have been incorrectly stated. With the above exception I have found Preston's list to be quite correct, but I have also to

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[1] Prime, Cat. Corbiculidae in *Amer. Journ. Conch.* V (1869—1870), and other papers cited further on.

[2] Clessin, *Cycladeen* in Martini and Chemnitz *Conch.-Cab.* (1879).

[3] Sowerby, *Conch. Icon.* XX (1878).

include *C. siamica*, Prime, in the list of Indian species, as there are specimens of this species in the Indian Museum collected at Rangoon, Burma and from the Nicobar Islands.

As to the grouping of the various species of this genus the two attempts of Deshayes [1] and von Martens [2] have to be considered. The former is only an arbitrary classification of all the species of the genus; von Martens' work, however, in which the shape and form of the shell are utilised for the grouping of the Indo-Pacific forms into four sections, is more satisfactory and is followed in this paper. The Indian species fall into the following groups :—

A. PROCLIVES	*C. bengalensis*, *C. siamica*, *C. impressa.*
B. SUBORBICULARES	*C. proxima*, *C. tennentii.*
C. EXPANSAE	*C. ceylonica.*
D. CYPERINOIDEAE	*C. galatheae.*

As a result of my study of the Indian Museum collection the geographical distribution of the various species has had to be greatly extended. *C. bengalensis* is confined to Bengal, *C. ceylonica* and *C. tennentii* are endemic in Ceylon, *C. galatheae* is widely distributed in the Andaman and Nicobar Islands, *C. siamica* has a wide range in Cochin-China, Siam, Burma and the Nicobar Islands, *C impressa* occurs in the Philippines, Dutch East Indies, Ceylon and on the West Coast of Peninsular India while *C. proxima* is found only in Siam and the Mergui Archipelago.

Cyrena bengalensis, Lamarck.

Plate XX, figs. 1, 2.

1915. *Cyrena bengalensis*, Preston, *Faun. Brit. Ind. Freshw. Moll.* pp. 205, 206.

Preston in the work cited above has given a complete synonymy of the species but the descriptions of the shell in all previous memoirs are very inadequate. I, therefore, give below a detailed description of the shell based on the large series of specimens in the Indian Museum.

Shell large, solid, subtrigonal, rather swollen but not very high, very inequilateral, covered with a brownish black epidermis with coarse striae, and with the regions of growth distinctly marked by still coarser lines; dorsal margin very small, somewhat angulate; anterior margin rather short, concave in its upper or proximal $\frac{3}{4}$ of the length then regularly curving round to the podium; posterior margin very long, high, markedly convex and regularly curving down to the gonium, where it meets the ventral border in a broadly rounded acute angle; ventral border nearly straight except in the podial and gonial angles where it is curved upwards; umbones of fair size, situated anterior to the middle,

[1] Deshayes, *Cat. Conchifera Brit. Mus.* I, pp. 241, 242 (1853).

[2] Von Martens in Max Weber's *Zool.-Ergeb. Nieder. Ost.-Ind.* IV, p. 9 (1897).

often weathered and wormed in fully grown specimens, greatly recurved anteriorly and separated from one another by a narrow chink only; lunule well marked rather narrow but deep; ligament prominent but not very thick, about thrice as long as the lunule. Hinge in general facies quite similar to that of *C. ceylonica*, but much more curved and with the lateral teeth more delicate though comparatively much longer; the cardinal teeth more slanting, stouter and not so deeply bifid.

Measurements (in millimetres).

Length	27	32·2	44	50	68	80
Height	23·5	30	39·4	43	62	72
Thickness	14	16	27	29·8	44	52

Distribution.—Clessin was certainly wrong in including the East Indies in the range of distribution of this species, as it is confined to Bengal only. In Bengal the species is fairly common in the estuarine areas of the Gangetic Delta and is burnt in large quantities for making lime. It is probably the species referred to by Benson as *C. sumatrana* from the Sunderbans.[1]

Remarks.—The species is distinguished from the other Indian species of the genus by its shape, the concave anterior border and the greatly recurved umbones.

Cyrena siamica, Prime.

Plate XX, figs. 3—5.

1861. *Cyrena siamica*, Prime, *Proc. Acad. Nat. Sci. Philadelphia*, p. 126.
1863. *Cyrena siamica*, Prime, *Cat. Corbiculidae*, p. 6.
1864. *Cyrena siamica*, Prime, *Ann. Lyceum Nat. Hist. New York*, VIII,, p. 86, fig. 35.
1869. *Cyrena siamica*, Prime, *Cat. Corbiculidae* in *Amer. Journ. Conch.* V, p. 147.
1879. *Cyrena siamica*, Clessin, *Cycladeen* in Martini-Chemn. *Conch. Cab.*, p. 123, pl. xix, fig. 4.
1897. *Cyrena siamica*, von Martens, *Süss. und Brackw. Moll.* in Weber's *Zool. Ergeb. Nieder. Ost. Ind.* IV, p. 91.

Two separate valves from Rangoon, Burma, two specimens from the Nicobars, one from Cochin-China and one from Cambodia in the Indian Museum collection belong to this species. The Nicobar and Cambodian species were found labelled *C. sumatrensis*, but they differ from the true *sumatrensis* in the shell being less tranverse, less inflated, the hinge more curved and broader, all the teeth stouter and the laterals much more solid and curved, the umbones less prominent and not so recurved and in colour.

I have nothing to add to Prime's description of the species, but give below measurements of the various specimens in the

[1] Benson, *Journ. As. Soc. Bengal* VII, pt. i, p. 421 (1838).

Indian Museum collection. Some of these shells are much larger in size than Prime's type-specimen.

Measurements (in millimetres).

	A.	B.	C.	D.	E.	F.
Length	68	66	55	49	43	70
Height	59	59	49	45	40	66
Thickness	38	39	31	27	—	—

Specimen A is from Cochin-China, B from Cambodia, C and D from the Nicobars while E and F are single valves only from Rangoon, Burma.

Distribution.—The species was hitherto known from Siam only but from the series of specimens in the Indian Museum collection it appears to have a very wide range from Cochin-China, Cambodia to Burma and the Nicobar Islands.

Cyrena impressa, Deshayes.

Plate XX, figs. 6, 7.

1854. *Cyrena impressa*, Deshayes, *Proc. Zool. Soc London*, p. 18.
1854. *Cyrena impressa*, Deshayes, *Cat. Brit. Mus. Conchifera* II, p. 249.
1863. *Cyrena eximia* (in part), Prime, *Cat Corbiculidae*, p 6.
1869. *Cyrena eximia* (in part), Prime, *Amer. Journ. Conch.* V. p. 144.
1879. *Cyrena ceylonica* (in part), Clessin, *Cycladeen* in Martini-Chemn *Conch.-Cab.*, p. 103, pl. xviii. figs. 1. 2.
1879. *Cyrena eximia* (in part) *id* , *ib.*, p. 239.
1897. *Cyrena impressa*, von Martens, *Süss und Brackw. Moll.* in Weber's *Zool. Ergeb Nieder. Ost.-Ind.* IV, p. 93.
1915. *Cyrena impressa*, Preston, *Faun. Brit. Ind. Freshw.-Moll.* pp. 202—204, figs. 25, 26.

Prime and Clessin after him considered *C. impressa* as a synonym of *C. eximia*, Dunker, but von Martens has shown that the two species are quite distinct and even belong to different groups in his scheme of classification cited already. Deshayes' description is fairly detailed and accurate, while von Martens added a few further notes on the species. Recently Preston has published good figures of the type-shell. The following distinguishing characters of *C. impressa* may, however, be noted. The anterior margin is straight or nearly so, while the posterior margin is only slightly convex in its upper or proximal half and then sharply turns down at an obtuse angle, this distal half is nearly straight and the margin here may be described as subtruncate, the ventral border is regularly but not greatly curved and the umbones are not very prominent.

Distribution.—According to Deshayes *C. impressa* is found in the Philippines, Java and Australia. Preston, on the basis of specimens in the British Museum, included Ceylon in the range of

distribution of this species. In the Indian Museum there are specimens from Ratnagiri near Bombay on the west coast of Peninsular India and from the west coast of India (exact locality not stated). All these specimens agree closely with Preston's figures of the type-specimen and with Deshayes' description. The species therefore, has a wide range comprising Australia, the Philippines, Dutch East Indies, Ceylon and Peninsular India. The following are the measurements of the specimens from the two localities in the Indian Museum collection.

Measurements (in millimetres).

	Ratnagiri.			West Coast of India.	
Length	87	64	55	61	52
Height	81	58	51	60	48
Thickness	47	35	30	33	31

Cyrena proxima, Prime.

Plate XX, figs. 8, 9.

1863. *Cyrena proxima*, Prime, *Cat. Corbiculidae*, p. 6.
1864 *Cyrena proxima*, Prime, *Ann. Lyceum Nat. Hist. Soc. New York*, VIII, p. 85, fig. 34.
1869. *Cyrena proxima*, Prime, *Cat. Corbiculidae* in *Amer. Journ. Conch.* V, p. 147.
1879. *Cyrena proxima*, Clessin, *Cycladeen* in Martini-Chemn. *Conch.-Cab.* p. 127, pl. xxi, fig. 2. [165.
1889. *Cyrena proxima*, von Martens, *Journ. Linn. Soc. Zool.* XXI, p.
1915. *Cyrena proxima*, Preston, *Faun. Brit. Ind. Fresh-Moll.* pp. 206, 207.

In the Indian Museum collections *C. proxima* is represented by a large series of shells collected by Dr. J Anderson in Sullivan Island (not Sulliman Is.) in the Mergui Archipelago, and referred to by the late Dr. E. von Martens in the paper cited above. The specimens are stated to have been collected in fresh water, but it is unlikely that the water was quite fresh as no species of the genus occur in quite fresh water. It is probable that the water in the streams, from which the specimens were collected, was subject to the influence of the tides and had variable salinity, as is the case with the estuarine areas in the streams of the Gangetic Delta where *C. bengalensis* is found.

The distinguishing characters of the species are the suborbicular and nearly equilateral shell with the anterior and posterior borders curving regularly downwards to the podial and gonial angles, the greatly arcuate ventral border and the inwardly curved and somewhat approximate beaks.

The largest specimen in the Indian Museum measures 64 mm. × 59 mm. × 37 mm., and is much larger than the specimens in the British Museum.

The species is known from Sullivan Island and Siam only.

Cyrena tennentii, Hanley.

Plate XX, fig. 10.

1858. *Cyrena tennentii*, Hanley, *Proc. Zool. Soc. London* XXVI, p. 23.
1869. *Cyrena tennentii*, Prime, *Amer. Journ. Conch.* V, p. 148.
1879. *Cyrena tennentii*, Clessin, *Cycladeen* in Martini-Chemn. *Conch. Cab.*, p. 240.
1915. *Cyrena tennentii*, Preston, *Faun. Brit. Ind. Freshw.-Moll.*, p. 206.

The two specimens from Ceylon, which I assign to this species, agree fairly well with Hanley's description except that the shells of both these specimens, owing to the greatly arcuate ventral border, have become suborbicular instead of being ovato-subtrigonal. This might partly be due to age as the larger of my specimens is much larger than Hanley's, while both the specimens are much deeper. I figure the larger of the two specimens and give below the measurements.

Measurements (in millimetres).

Length	42	37
Height ..	40	35
Thickness	21	20

Habitat.—The species is only known from Ceylon. Hanley's specimens were taken in the Ariho River flowing into the Gulf of Manaar, but the exact locality of the specimens in the Indian Museum is not stated. It seems to be rather scarce in Ceylon also, as in the large collections made in the island by the late Mr. G. Nevill no specimens of the species are present.

Remarks.—The shell of this species is comparatively thinner and shorter than that of the other Indian species of the genus. The hinge is comparatively broad and greatly curved, the umbones are small but prominent, recurved anteriorly and inwards and nearly approximating with each other in the middle line. The shape of the shell and the position of the umbones is very characteristic of this species and easily distinguishes it from all other Indian forms.

Cyrena ceylonica (Chemnitz).

Plate XX, figs. 11—13.

1915. *Cyrena ceylonica*, Preston, *Faun. Brit. Ind. Freshw.-Moll.*, p. 202.

Preston's work cited above gives all references to literature, but the description of the species taken from Sowerby's *Conchologia Iconica* is very inadequate, nor is there any other complete account of the shell available. I have, therefore, thought it desirable to give a detailed description.

Shell very large, solid, oblong-ovate or even sub-rhomboidal, somewhat compressed, very high, markedly inequilateral; covered with a thin dark yellowish to brownish or even black epidermis with thin fringed striae, regions of growth marked as coarser and

deeper ridges; dorsal margin short, regularly curved, convex; anterior margin fairly large but shorter than the posterior, concave and rather sinuous in the proximal or upper half, then regularly curved to the broad podium, from the latter the ventral margin sharply curves downwards and backwards until in line with the umbo it forms a broad arc and then rapidly curves up again to the gonium; posterior margin biangulate, regularly and convexly curved above in continuation of the dorsal margin but nearly straight below the upper obtuse angle; umbones prominent but rather small, curved inwards and forwards and separated from one another in the middle line; ligament long and thick but not greatly projecting; lunule broad, but not very deep, carinate in the middle. *Hinge.*—Right valve with four laterals, two anterior and two posterior; upper anterior small but thick and knob-like; lower, seen from above, triangular, thick, pad-like with the anterior and posterior margins of approximately the same length; upper posterior more elongate but less prominent than the upper anterior, appearing only as a slight callosity; the lower one elongate, ridge-like but with a low apex a little further off from the centre; between the two anterior and two posterior laterals there is a deep concavity for the fitting in of the single laterals of the opposite valve, the anterior concavity is much the deeper of the two, of the three cardinals the anterior one is sharp or with only a very shallow furrow across its free edge; it is inclined forwards, the middle and posterior are both deeply furrowed, appearing somewhat bifid and both inclined backwards. Left valve with two laterals, anterior one very short, thick and stumpy, somewhat conical; posterior elongate, triangular with the apex lying further from the middle, 3 cardinals, anterior forwardly inclined, middle and posterior backwardly, the first two deeply bifid, posterior single. Pallial line with only a shallow sinus. The young shells differ from the adult in being subtrigonal or even subcircular, with the anterior margin nearly straight in its proximal portion and evenly rounded below without a projecting podium; the posterior margin not or only indistinctly showing the biangulate nature; the shells are comparatively thicker in diameter, the umbones a little more prominent and the periostracal ridges comparatively more regular and distinct. The series of shells in the Indian Museum well illustrates the change in shape from the young to the adult form.

Measurements (in millimetres).

Length	46	52	54	63	74	88	90	103
Height	44	48	51	62	73	85	85	87
Thickness	26	27.5	28·4	34	38·2	50	52	53

Distribution.—According to the earlier authors the species was considered to have a wide range from Ceylon to Java, but it has been established by later workers that the Javanse species is quite distinct, and that *C. ceylonica* is confined to Ceylon only.

Remarks.—This species along with other species of the group are distinguished by their somewhat elongate, comparatively narrow and rather compressed shells. *C. ceylonica* is characterized by the rather large and sinuous anterior border, broadly truncate and elongate posterior border and the forwardly recurved um bones; the hinge of this species is also very different from that of the other Indian species.

Cyrena galatheae Mörch.

Plate XX, figs. 14—17.

1915. *Cyrena galatheae*, Preston, *Faun. Brit. Ind. Freshw.-Moll.*, p. 207.

I give below a detailed description of the shell of this species as the original description by Mörch is not quite complete.

Shell very large, solid, thick, greatly swollen in the upper third, compressed below, roughly trigonal, much longer than high, very inequilateral with the umbones situated much nearer to the anterior than the posterior edge, with a yellowish brown to blackish epidermis with regular concentric striae, growth-regions not distinctly marked; anterior margin much shorter than the posterior, somewhat concave in the upper region or just next to the umbones, then after a short straight course curving in to form the podium; posterior margin in its proximal part only slightly curved, but rapidly descending downwards, further part straight owing to the truncate nature of the region next to the gonium, with an obtuse angle between the straight lower and the slightly curved upper region; ventral border only slightly arched; umbones prominent, greatly eroded in adult shells, in young shells recurved forwards and inwards but not meeting each other in the middle line, and sculptured with closely situated concentric striae, with a broad but shallow lunule, carinated in the middle; ligament long, thick and prominent. *Hinge* as in the genus but greatly curved and rather forwardly placed owing to the position of the umbones, with the lateral teeth more compact and solid, the upper pair of laterals in the right valve reduced to small thickenings only; cardinals very slanting and strong.

Measurements (in millimetres).

	a.	*b*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*	*i.*	*j.*
Length	31	49	80	78	94	95	121	104	98	120
Height	27	41	68	73	85	84	105	92	82	106
Thickness	16	25	49	47	55	51	71	52	51	75

Specimens *a*—*c* are from the Andaman Islands, *d* from John Lawrence Island, *e* from Kondul Island, *f*, *g*, from Trinkat Island and *h*—*j* from the Nicobars.

The specimens from various localities differ to some extent

as regards proportionate measurements, but in the large series before me intermediate forms connecting the different types from the different localities are present, and I have found it impossible to detect any constant differences between them. A few notes on the form of the young shells may be included here. The young shells are nearly subtrigonal with the posterior margin regularly arched the truncate distal half being not distinctly marked as yet, the umbones are placed more symmetrically and the hinge is of a more normal type.

Distribution.—*C. galatheae* had hitherto been recorded from the Galatea River in the Nicobar Islands; in the collections of the Indian Museum it is represented by a large series of specimens from the Nicobars (Kar Nicobar, Kondal and Trinkat Islands in the Nicobar group) and Andaman Islands (John Lawrence and Havelock Islands in the Andaman group). The species, therefore, has a wide range in the Andaman and Nicobar Islands.

Remarks.—A few specimens of this species in the collection were found labelled *C. patima*, Benson, which is apparently a manuscript name only as I have been unable to find any reference to it in literature except in Theobald's catalogue.[1]

The shells of this species are of a very characteristic type and are easily distinguished by the greatly inequilateral, greatly vaulted shells with a highly truncate distal half of the posterior margin, anteriorly placed umbones and the curved and forwardly placed hinge with very compact but strong laterals.

5. INDIAN SPECIES OF THE GENUS *BATISSA.*

Up till recently the only known species of the genus *Batissa*, Gray, from within the limits of India, Burma and Ceylon were *B. similis* and *B. inflata* described by Prime from the Nicobar Islands in 1859[2] and 1860[3] respectively. In 1908[4] Preston described a unique specimen from the Andaman Islands, collected by the late Rev. J Warneford, under the name *B. capillata*. In the Indian Museum collection I found two boxes of specimens from the Andaman Islands provisionally labelled *B. violacea*, Brug., by the late Mr. G. Nevill; in addition there were a fair number of specimens from the Andaman Islands which had not been identified. Through the courtesy of Professor Max Weber I received a specimen of *B. violacea* var. *celebensis*, Martens,[5] collected by Prof. M. Weber in the Celebes and identified by the late Dr. E. von Martens. The specimen is preserved in spirit and is in an excellent state of preservation. With this material I have drawn up the following notes on the collection in the Indian Museum including a detailed description of the soft parts of the genus *Batissa*

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[1] Theobald, *Cat. Rec. Shells, Mus. As. Soc. Bengal*, p. 140 (Calcutta, 1860).
[2] Prime, *Ann. Lyceum Nat. Hist. Soc. New York* VII, p. 112 (1859).
[3] *Id.*, *Proc. Zool. Soc. London* XXVIII, p. 320 (1860).
[4] Preston, *Rec. Ind. Mus.* II, p. 207, pl. xvi, fig. 39 (1908).
[5] Von Martens, *Süss. und Brackw.-Moll.* in *Zool. Ergeb. Nieder. Ost. Ind.* IV p. 104 (1897).