



CONTRIBUTION TO THE KNOWLEDGE OF INDIAN MARINE MOLLUSCS WITH A NOTE ON THE NATIONAL ZOOLOGICAL COLLECTIONS FROM OTHER COUNTRIES – FAMILY: CHAMIDAE

MAHAMMAD HAFIZ AND BASUDEV TRIPATHY

Zoological Survey of India, M-Block, New Alipore, Kolkata-700053

E-mail: hafizsi12@gmail.com

INTRODUCTION

Bivalves is the second most diverse group of molluscs behind gastropods and one of the most important members of most marine and freshwater ecosystems. The first occurrences of Bivalvia are found in lower Cambrian deposits. Bivalves are easily recognised by their two-halved calcareous shells that are hinged dorsally.

The family Chamidae is considered the only single family under the superfamily Chamoidea, representing about 70 species under the 6 genera worldwide (Huber, 2010). It is a consecutive series and the present work on Chamidae is seventh in the series for updating the knowledge of Indian marine molluscs after presenting the previous contribution on the families; Mitridae (Subba Rao and Dey, 1984), Donacidae (Subba Rao and Dey, 1986), Muricidae (Subba Rao and Surya Rao, 1993), Tellinidae (Dey, 2006), Terebridae (Venkitesan and Mukherjee, 2011) and Turritellidae (B. Tripathy *et. al.*, 2013). It is our aim to provide an account of possible details on Indian chamids as well as a note of foreign specimens kept in NZC as a comprehensive measure for future workers.

Previous works: It is one of the most difficult families in bivalves. Though considerable interest has not been shown by the Indian workers on this single family due to confusion in nomenclature and lack of proper literature but a few authors from abroad, mainly Chenu (1845-46), Reeve

(1846), Lamy (1928), Delsaerdt (1986), and Oliver (1992) have contributed a great knowledge on this difficult family. Though Reeve (1846) described 55 chamid species in his Monograph in 'Conchological Iconica' but recent work of Huber (2010) showed 1/3 of 55 species were over stated intraspecific differences and inflated the number of species. Lamy (1928) reviewed the family but without presenting keys, illustrations or sufficient descriptions for many species. Before Reeve, Lamarck (1819), Broderip (1835) and Conrad (1837) described many new species in their usual manner. Matsukuma (1996) well characterized the 6 extant genera within chamidae. In India, Chamids were reported in a casual way by some Indian workers as part of their general reports on the molluscs of India. 9 species were reported from the Indian waters by our Indian workers, especially by Thurston (1895), Gravely (1941), Satyamurti (1956), Kundu (1965), Tikader *et. al.* (1986), Rao *et. al.* (1991) and Subba Rao *et. al.* (2000) but they did not give any keys or diagnostic characters upto species level properly. Beside this, some of the Indian species have been synonymized by Delsaerdt (1986) and confirmed by Huber (2010). The above fact encourage us to give an up-to-date account of the family.

Diagnostic Features and General Account of the Family: Chamidae are commonly known as 'jewel boxes', shell thick, strongly inequivalve and equilateral, sessile, spirally coiled prosogyrate

umbones, ligament external. Sculpture rough, scaly or spinous, rarely smooth. They are very much intraspecific or ecophenotypic variability in colour and shape, giving the complicating of their taxonomy. Epifaunal and heterodont bivalves, possess a thick oblique transverse tooth, in general crenulated or grooved, fitting into a corresponding cavity in the lower left or right valve, cemented to a hard substratum like rocks, corals or other shells. Some are unattached in deep sea water. Living mainly in shallow water occasionally up to 200m. Suspension feeders, mainly dioecious, planktonic larvae. Chamids are very much resemble with other cemented clams like spondylids or ostreids but the former have two adductor muscle scars, a parivincular ligament, a heterodont hinge and a pair of short siphon. Pallial line without a sinus. Marine in nature but restricted to warmer seas with an exception.

About 70 species (Huber' 2010) are recorded under 6 genera in this medium sized family throughout the world. India witnessed 9 species of chamids under 2 genera before being synonymized some species. Delsaerd (1986) reviewed the family chamidae and came across many intraspecific and ecophenotypic variations in the same species and later on, he synonymized many chamid species in a well manner. All synonyms of Delsaerd have been examined and confirmed by Huber (2010) in his recent work on 'Compendium of Bivalves'. As a result the number of Indian species have been come down to 8 instead of 9 in which two species belonging to the genus *Chama* have been declared *nom.dub.* by ICZN due to loss of their types species (Huber, 2010).

Classification followed in this work of Bouchet *et. al.* (2010).

Abbreviation used:

BMNH = British Museum of Natural History, London

ex = example

exs. = examples

Coll. = Collector

mm = Millimetre

Regd. No. = Registration number

ICZN = International Commission on Zoological Nomenclature

nom. dub. = nomen dubium

NZC = National Zoological Collection

MNHN = Museum National d'Histoire Naturelle, Paris

SYSTEMATIC ACCOUNT

Phylum MOLLUSCA

Class BIVALVIA

Subclass HETERODONTA

Order VENEROIDA

Superfamily CHAMOIDEA

Family CHAMIDAE

Genus *Chama* Linnaeus, 1758

1758. *Chama* Linnaeus, *Syst. Nat.*, ed. 10: 691

Type species: Chama lazarus Linnaeus, 1758 (Subsequent designation by Children, 1823).

Diagnostic characters: Possess a thick oblique transverse tooth, resembling a lengthened callosity, in general crenulated or grooved, fitting into a corresponding cavity in the lower valve: the shell is inequivalve, irregular, heavy, rough, scaly or spinous; having the faculty of affixing itself to other hard substratum such as rocks, corals, plants or other shells by means of its left lower valve. Apices unequal and recurved. Hinge, one thick oblique tooth, subcrenated, articulating into a cavity of the opposite valve; two distant lateral muscular impression, pallial line without sinus. Ligament external and inserted. Spirally coiled prosogyrate umbones.

Key to the Species

1. Interior margin of the valves smooth 2
Interior margin of the valves crenulated 3
2. Lamellae foliaceous in lower valve, interior margin with deep purple colour
..... *Chama limbula* Lamarck
Lamellae foliaceous with leaf like expansions in both valves, interior margin white
..... *C. lazarus* Linnaeus

Lamellae broad, fluted, interior margin with pale tinge of mauve colour

.....*C.brassica* Reeve

3. Upper valve with dense array of narrow flat spines with a weak or obsolete posterior sulcus

.....*C. pacifica* Broderip

Upper valve with dense, short, erect, fluted spines and no posterior sulcus

.....*C. asperella* Lamarck

1. *Chama limbula* Lamarck 1819

1819. *Chama limbula* Lamarck, *Hist. nat. Anim. Sans. Vert.*, 6: 95 (Type locality: "Nouvelle-Hollande").

1837. *Chama iostoma* Conrad, *J. Acad. nat. Sci. Philad.*, 7(2): 256 (Type locality: "Island of Atooi").

1991. *Chama isotoma*: Rao and Rao, *Fauna of Lakshadweep, State Fauna series*, 2: 351. *Zool. Surv. India*.

2000. *Chama isotoma*: Subba Rao and Dey, *Rec. zool. Surv. India, Occ. Paper No. 187*: 237.

2007. *Chama isotoma*: Dey and Ramakrishna, *Fauna of Andhra Pradesh, State Fauna series*, 5(7): 201. *Zool. Surv. India*.

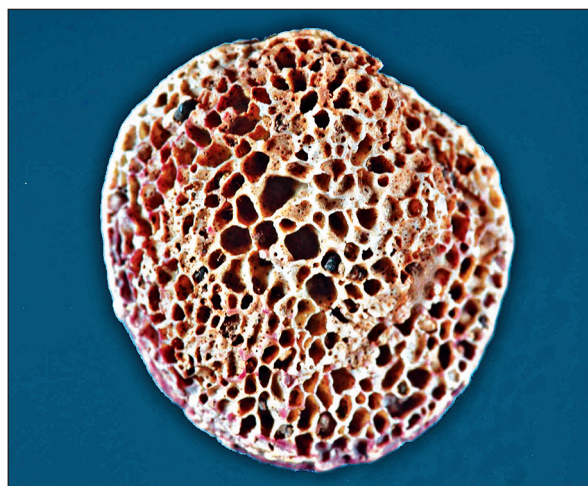
2010. *Chama isotoma*: Ramakrishna and Dey, *Rec. zool. Surv. India, Occ. Paper No. 320*: 144.

2010. *Chama limbula*: Huber, *Compendium of Bivalves*, p. 283.

Material Examined: i) 1 valve, Camorta Island, East of Camorta ferry, Andaman and Nicobar Islands, 1976, Coll. G. Ramakrishna and Party, Regd. No. M 27588/6; ii) 1 ex., Minicoy Island, Lakshadweep, 15.02.1986, Coll. D. R. K. Sastry, Regd. No. M23662/4.



Ventral view of *Chama limbula* Lamarck



Dorsal view of *Chama limbula* Lamarck (Right upper valve)



Ventral view of *Chama limbula* Lamarck (Right upper valve)



Dorsal view of *Chama limbula* Lamarck

Measurements (in mm.):

Length	Height	Depth
47.70	64.60	28.90
53.05	58.20	-

Description: Shell medium to large, somewhat orbicular, thick, solid, the lower valve with foliaceous lamellae and the upper valve with small squamae (lamellate arranged), both valves concentrically ornamented with a few short transverse ridges on the posterior side; interior smooth, white, umbones white with tinged purple, internal margin of the valves smooth and deep purple.

Remarks: *C. limbula* was first described by Lamarck (1819), after that the same was described by Conrad (1837) as a *C. iostoma*. During the revision work of chamidae, Lamy (1928), Delsaerd (1986) and Lamprell & Whitehead (1992) came across the syntypes in MNHN and synonymized the Conrad's *iostoma* with Lamarck's *limbula*. This species can not be easily distinguished due to occurrences of its great variations. Richard (1985) has studied the growth rates of this species. *C. limbula* generally inhabits lagoons and reef flats and often displays different phenotypes in different habitats. Specimens from the lagoons are larger and have smoother upper valve surfaces than do specimens from shallow sub-tidal or intertidal reef flats. Further, the valves of the lagoons lack the coarse crenulations found on the postero-dorsal inner edge of the valves of the reef flats. Wherever it occurs, *C. limbula* is unlike chamids in living exposed rather than hidden under rocks or crevices (Paulay, 1996).

Distribution: India: Andaman and Nicobar Islands, Andhra Pradesh and Lakshadweep. *Elsewhere:* Red sea to Hawaiian and Easter Islands, wide range in the Indo-Pacific (Prasad, 1932).

2. *Chama brassica* Reeve

1847. *Chama brassica* Reeve, *Conch. Icon.*, **4**, sp. no. 31, pl. 6, fig. 31 (Type locality: "Island of Cabul, Philippines").
1986. *Chama brassica*: Tikader, Daniel and Subba Rao, *Sea shore animals of Andaman and Nicobar Islands*, Zool. Surv. India, p. 176.
2000. *Chama brassica*: Subba Rao and Dey, *Rec. zool. Surv. India, Occ. Paper No. 187*: 237.
2007. *Chama brassica*: Dey and Ramakrishna, *Fauna of Andhra Pradesh, State Fauna series*, **5(7)**: 200. Zool. Surv. India.
2010. *Chama brassica*: Ramakrishna and Dey, *Rec. zool. Surv. India, Occ. Paper No. 320*: 144.
2010. *Chama brassica*: Huber, *Compendium of Bivalves*, p. 281.



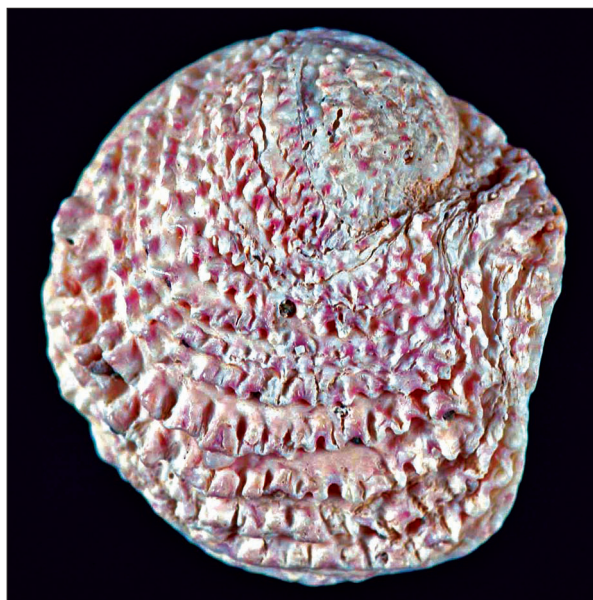
Dorsal view of *Chama brassica* Reeve (Left lower valve)



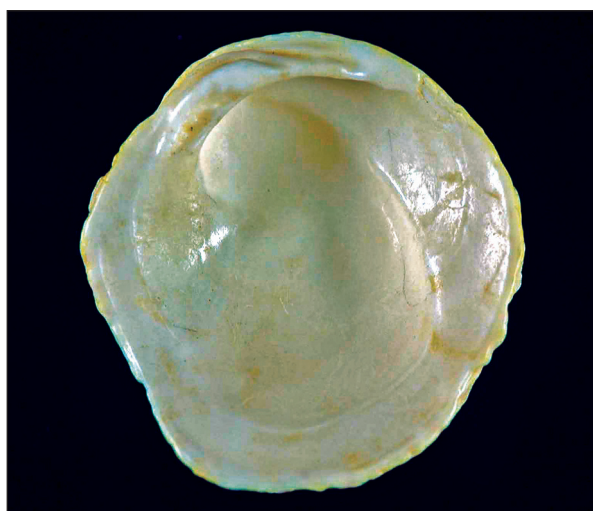
Ventral view of *Chama brassica* Reeve (Left lower valve)

Material Examined: (i) 1 valve, Andaman's, 1872, Coll. J. Wood Mason, Regd. No. 431; (ii) 2 valves, station No. 1a, near the guest house, Krusadai Island, Tamil Nadu, 1.5.1955, Coll. H. C. Ray, Regd. No. M27589/6; (iii) 1 valve, Nancowry, Andaman and Nicobar Islands, 31.1.1976, Regd. No. M27587/6, (iv) 1 valve, Malacca Jetty, Car Nicobar, Andaman and Nicobar

Islands, 7.2.1976, Coll. G. Ramakrishna and Party, Regd. No. M27584/6.



Dorsal view of *Chama brassica* Reeve (Right upper valve)



Ventral view of *Chama brassica* Reeve (Right upper valve)

Measurements (in mm.):

Length	Height	Depth
88	107.25	-
47.15	49.10	-

Description: Shell medium to large, solid, rougher, and roughly circular to oval, upper valve usually worn but sometime in reddish, posterior sulcus apparent; sculpture broad, fluted, interrupted lamellae, interior smooth, and dirty white, ventral margins smooth with pale tinged of mauve colour.

Remarks: This species found in intertidal areas in tropical seas, attached on rocks or stones. Delsaerdt (1986), described a new subspecies from Eilat (Israel) as *Chama elatensis*. This is mainly based on crenulated margins, compared to the smooth margined *Chama brassica*. However, Huber (2010) studied some *C. brassica* from Philippines and Japan and observed weak crenulation as well, very closed to specimens analysed from Eilat. As otherwise, sizes, colours, borders and lamellation are that close, *C. elatensis* is perceived the same. But *C. brassica* from Indian waters is still with smooth margins and no crenulation has been traced.

Distribution: India: Andaman and Nicobar Islands, Andhra Pradesh and Tamil Nadu.

Elsewhere: Tropical Pacific.

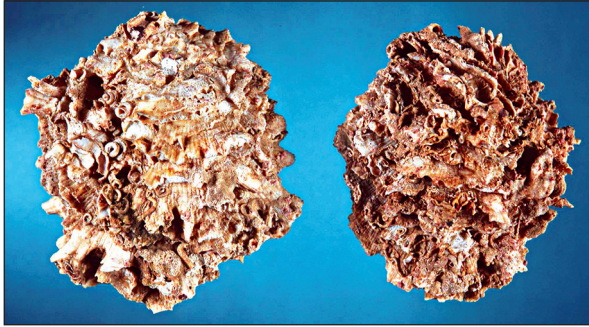
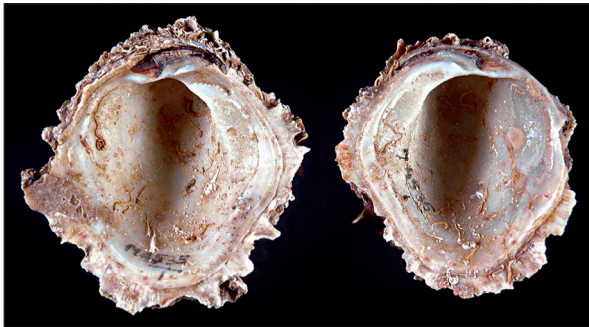
3. *Chama lazarus* Linnaeus

1758. *Chama*(*Chama*) *lazarus* Linnaeus, *Syst. Nat.*, ed. **10**: 691, sp.no. 129 (Type locality: "Mediterraneo, Americano").
1767. *Chama* (*Chama*) *lazarus* Linnaeus, *Syst. Nat.*, ed. **12**: 1139, sp.no.164.
1895. *Chama lazarus*: Thurston, *Madras Govt. Mus. Bull.*, **3**: 129.
1956. *Chama lazarus*: Satyamurti, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist.)*, **1** (2), Pt. 7: 87, pl. 13, figs. 2a and 2b.
1991. *Chama lazarus*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series* **1** (3): 120. Zool. Surv. India.
2000. *Chama lazarus*: Subba Rao and Dey, *Rec. zool. Surv. India, Occ. Paper No.*, **187**: 237.
2010. *Chama lazarus*: Ramakrishna and Dey, *Rec. zool. Surv. India, Occ. Paper No.*, **320**: 145, fig. 58 & 59.
2010. *Chama lazarus*: Huber, *Compendium of Bivalves*, p. 281.
2012. *Chama lazarus*: Pati and Sharma, *Fauna of Maharashtra, State Fauna series*, **20** (2), pp. 303-308. Zool. Surv. India.

Material Examined: (i) 1 valve, little Andaman, West Bay, 24.2.1966, Coll. Dr. A Daniel and party, Regd. No. M27586/6; (ii) 1 ex., Malacca Jetty, Car Nicobar, Andaman and Nicobar Islands, 7.2.1976, Coll. G. Ramakrishna and Party, Regd. No. M27585/6; (iii) 1 ex., Ganjam Coast, Coll. Bengal Fisheries, Regd. No. M4535/1.

Measurements (in mm.):

Length	Height	Depth
74.50	90.40	59.80
37.30	46.30	-

Dorsal view of *Chama lazarus* LinnaeusVentral view of *Chama lazarus* Linnaeus

Description: Shell medium to large, orbicular but often circular, solid, both valves externally with very long, branched, radially striated and concentrically foliaceous with leaf-like expansions from umbo to lower edge. Right (upper) valve is more leafy and convex compare to left (lower) valve. The outer surface of the shell is generally white but occasionally reddish or pale brown, often two or three reddish-violet rays from the umbones, inside of the valves smooth and white, ventral margins smooth.

Remarks: The shell has usually grows to about 75mm. with a maximum length of 140 mm. Young shells are more brighter. It can be found on rocks and corals in low intertidal zones and sub littoral to depths of about 30 m. Occasionally used for food by coastal populations, this species is nowadays mainly collected for its beautiful shell (Harasewych &Moretzsohn, 2010).

Distribution: India: Andaman and Nicobar

Islands, Maharashtra, Odisha and Tamil Nadu.
Elsewhere: Wide spread in the Indo-West Pacific.

Dorsal view of *Chama lazarus* LinnaeusVentral view of *Chama lazarus* Linnaeus

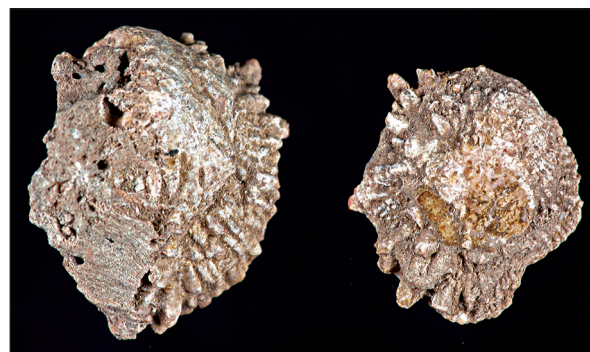
4. *Chama pacifica* Broderip

1835. *Chama pacifica* Broderip, *Trans. Zool. Soc.*, **1**:303, pl. 39, fig. 1 (Type locality: Lord Hood's Island, Pearl Islands).
1846. *Chama multisquamosa* Reeve, *Conch. Icon.*, **4**: *Chama* sp.no.12, pl.3, fig.12 (Type locality: Tatong, Island of Luzon, Philippines).
1846. *Chama reflexa* Reeve, *Conch. Icon.*, **4**: *Chama* sp. no.16, pl.4, fig.16 (Type locality: Damley Island, North Australia).
1941. *Chama reflexa*: Gravely, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist.)*, **5**(1):46, fig. 19b.
1949. *Chama reflexa*: Subrahmanyam, Karandikar and Murti, *J. Univ. Bombay*, **17**(5):56.

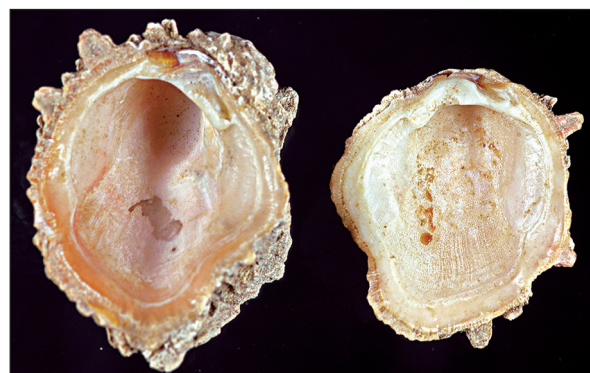
1956. *Chama reflexa*: Satyamurti, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist.)*, 1(2), pt. 7: 86, pl. 13, figs. 1a and 1b.
1965. *Chama reflexa*: Kundu, *J. Bombay Nat. Hist. Soc.*, 62(1): 101, pl. 13, figs. 45a and 45b.
1986. *Chama reflexa*: Tikader, Daniel and Subba Rao, *Sea shore animals of Andaman and Nicobar Islands*, Zool. Surv. India, p. 176.
1986. *Chama multisquamosa*: Tikader, Daniel and Subba Rao, *Sea shore animals of Andaman and Nicobar Islands*, Zool. Surv. India, p. 176.
1991. *Chama reflexa*: Rao, Rao and maitra, *Fauna of Orissa, State Fauna series*, 1(3):120. Zool. Surv. India.
1991. *Chama multisquamosa*: Rao and Rao, *Fauna of Lakshadweep, State Fauna series*, 1(3): 120. Zool. Surv. India.
1991. *Chama multisquamosa*: Rao and Rao, *Fauna of Lakshadweep, State Fauna series*, 2: 351. Zool. Surv. India.
2000. *Chama multisquamosa*: Subba Rao and Dey, *Rec. zool. Surv. India, Occ. Paper No. 187*: 238.
2000. *Chama japonica*: Subba Rao and Dey, *Rec. zool. Surv. India, Occ. Paper No. 187*: 237.
2007. *Chama reflexa*: Dey and Ramakrishna, *Fauna of Andhra Pradesh, State Fauna series*, 5(7): 201. Zool. Surv. India.
2010. *Chama reflexa*: Ramakrishna and Dey, *Rec. zool. Surv. India, Occ. Paper No.*, 320: 146.
2010. *Chama multisquamosa*: Ramakrishna and Dey, *Rec. zool. Surv. India, Occ. Paper No.*, 320: 145.
2010. *Chama pacifica*: Huber, *Compendium of Bivalves*, p. 284.
2012. *Chama pacifica*: Pati and Sharma, *Fauna of Maharashtra, State Fauna series*, 20(2): 303-308. Zool. Surv. India.

Material Examined: (i) 4 exs., Andaman's, 1872, Coll. J. Wood Mason, Regd. No. M27598/6; (ii) 3 exs. and 5 valves, Ganjam Coast, Madras presidency, 8th to 16th March, 1909, Regd. No. M4490/1 to M4497/1, (iii) 1 ex. and 2 valves, off Gopalpur, Odisha, Regd. No. M4337/1 to M4339/1, (iv) 1 ex., Black pagoda, Odisha, Regd. No. M4382/1, (v) 1 valve, Balasore bay, Odisha, Coll. Bengal fisheries, Regd. No. M4307/1; (vi) 2 exs., Aberdeen bay, Andaman & Nicobar Islands, 1.3.1959, Regd. No. M27593/6, (vii) 2 valves, Ross Island, south Andaman, 1.3.1959, Coll. K. K. Tiwari, Regd. No. M27594/6; (viii) 1 ex., Andaman's, 13.4.1970, Coll. B. K. Tikader, Regd.

No. 4541; (ix) 1 valve, Camorta Island (South), Andaman and Nicobar Islands, 12.2.1974, Regd. No. M27590/6, (x) 2 valves, Corbyn's cove, Andaman and Nicobar Islands, 24.2.1974, Coll. K. V. Surya Rao and Party, Regd. No. M27592/6; (xi) 1 ex., Havelock Island, South Andaman, 9.5.1978, Coll. B.P. Halder and Party, Regd. No. M27591/6; (xii) 1 ex., Andaman's, Coll.?, Regd. No. 4542; (xiii) 3 valves, Andaman's, Coll.?, Regd. No. M27595/6; (xiv) 2 exs. and 3 valves, Andaman's, Coll.?, Regd. No. M27597/6; (xv) 2 valves, Andaman's, Coll.?, Regd. No. M27146/5; (xvi) 2 valves, Nicobar, Coll.?, Regd. No. M27142/5; (xvii) 1 ex., Andaman's, Coll.?, Regd. No. M27167/5; (xviii) 1 ex., Vizagapatam, Andhra Pradesh, Coll. ?, Regd.No. M27159/5.



Dorsal view of *Chama pacifica* Broderip



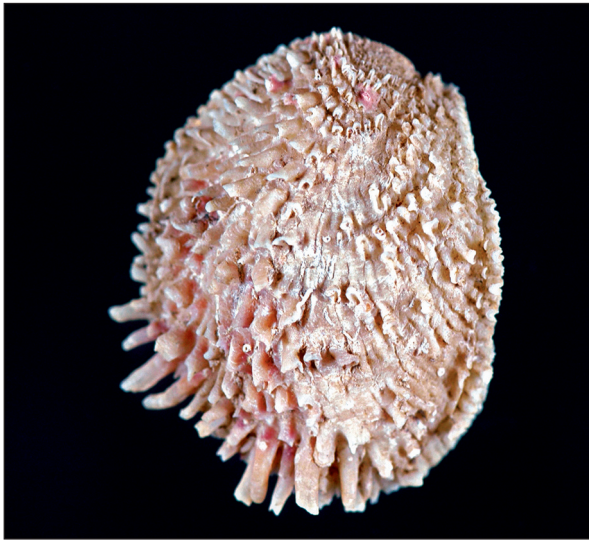
Ventral view of *Chama pacifica* Broderip

Measurements (in mm.):

Length	Height	Depth
43.30	56.90	30.25
14.80	14.90	12.85

Description: Shell from 57 mm. to 15 mm., circular to ovate, rather flat, both valves irregularly scaled, postero-dorsal area of upper valve with

radial rows of numerous spines or scales, scales of the upper valve somewhat erect, of the lower flatly pressed down or imbricated lamellae, upper valve with a weak or obsolete posterior sulcus, shell usually white with tinged purple, interior smooth and white, occasionally tinged with deep purple, ventral margins of the valves finely crenulated, hinge with single horizontal thick tooth on its right valve and corresponding groove on its left valve.



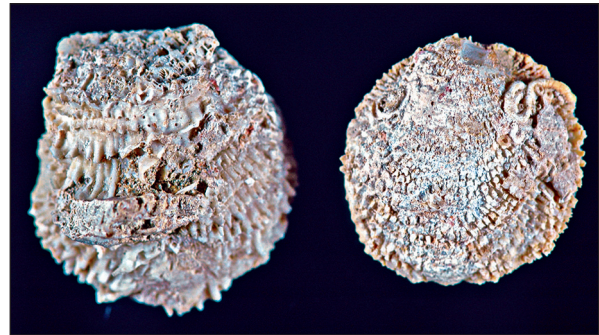
Dorsal view of *Chama pacifica* Broderip form *reflexa* Reeve



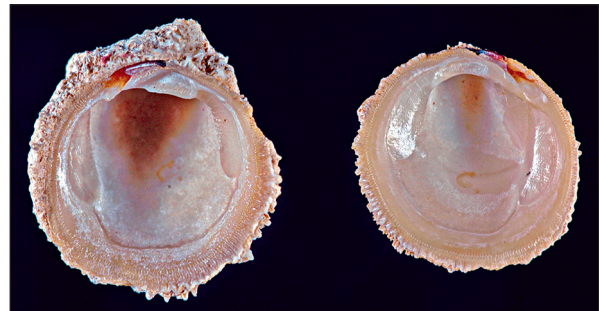
Ventral view of *Chama pacifica* Broderip form *reflexa* Reeve

Remarks: *Chama pacifica* is undoubtedly the most variable Indo-Pacific chamid as originally recognised by Broderip, 1835 and as excellently elaborated by Delsaerdt (1986). All synonyms of

Delsaerdt, notably *C. reflexa* and *C. multisquamosa* are here confirmed by Huber (2010). In shape, *pacifica* is typically ovate, internally white and usually almost half rose-red, with finely crenulate margins (Delsaerdt). *C. reflexa* is a somewhat finer spined form, but internally red with a fine crenulate margin as well (Delsaerdt). This synonymy has also been accepted by Lamprell and Whitehead (1992). Probably the most difficult synonym of Delsaerdt is *multisquamosa* with a fine and regular ribbing. However, Lamprell and Whitehead (1992, sp. no. 153a *pacifica*) closely approaches typical *multisquamosa* and the BMNH Holotype shows internally the typical *pacifica* features (Huber' 2010).



Dorsal view of *Chama pacifica* Broderip form *multisquamosa* Reeve



Ventral view of *Chama pacifica* Broderip form *multisquamosa* Reeve

Distribution: India: Andaman and Nicobar Islands, Andhra Pradesh, Gujarat, Lakshadweep, Maharashtra, Odisha, and Tamil Nadu. *Elsewhere:* Indo-Pacific and Mediterranean.

5. *Chama asperella* Lamarck

1819. *Chama asperella* Lamarck, *Hist. Nat. Anim. sans. vert.*, vol. 6 p. 95.
1835. *Chama spinosa* Broderip, *Trans. Zool. Soc.*, vol. 1, p. 306, pl. 38, figs. 8 and 9.

1965. *Chama spinosa*: Kundu, *J. Bombay Nat. Hist. Soc.*, **62**(1): 100, pl. 12, figs. 43a and 43b.
2000. *Chama japonica* non Lamarck: Subba Rao and Dey, *Rec. zool. Surv. India, Occ. Paper No. 187*: 237.
2010. *Chama japonica* non Lamarck: Ramakrishna and Dey, *Rec. zool. Surv. India, Occ. Paper No. 320*: 145.
2010. *Chama asperella*: Huber, *Compendium of Bivalves*, p. 281.

Measurements (in mm.):

Length	Height	Depth
20.40	21	-
17.15	18.70	-



Dorsal view of *Chama asperella* Lamarck



Ventral view of *Chama asperella* Lamarck

Material Examined: (i) 1 valve, chiriapapu, Andaman and Nicobar Islands, 17.1.1976, Coll. G. Ramakrishna and Party, Regd. No. M27594/6; (ii) 1 valve, Andaman's, Coll. ?, Regd. No. M27622/6.



Dorsal view of *Chama asperella* Lamarck form *spinosa* Broderip



Ventral view of *Chama asperella* Lamarck form *spinosa* Broderip

Description: Shell from 21 mm. to 19 mm, orbicular, much smaller than *pacifica*, spines are generally shorter and numerous. Upper valve densely and very minutely scaled, scales occasionally laminiferous towards the umbone, tubulous and spinous towards the margin, white internally and externally, but often reddish brown streaks, especially umbonally or on the

dorsal slope are found, occasionally brown streaks occur inside and occasionally almost all brown specimens are found (Huber), internal margins of the valves crenulated.

Remarks: In addition to the larger *pacifica*, another variable but smaller species occurs and equally widely distributed. By various authors, this species was described almost as often as *pacifica*. The earliest name is *Chama asperella* Lamarck, 1819. The lectotype is depicted in Delsaerdt pl. 1 fig. 1. It has a comparatively rough ribbing ventrally, is basically white, with some rust red and with crenulate margins. The base shape of *asperella* is ovate as well, but the size much smaller than *pacifica*, mostly between 25 and 35 mm. Delsaerdt considered the intergrading *Chama spinosa* (medium spined form) and *Chama asperella* (rougher spined form) synonymous (Huber, 2010).

Distribution: India: Andaman & Nicobar Islands, Andhra Pradesh, and Lakshadweep.
Elsewhere: Indo-Pacific and Mediterranean.

Genus *Pseudochama* Odhner, 1917

1917. *Pseudochama* Odhner, K. Svenska Vetensk. Akad. Handl., 52 (16): 28.

Type species: *Chama cristella* Lamarck, 1819 (Subsequent designation by Gardner, 1926)

Diagnostic Characters: Shell thick, strongly inequivalve and equilateral; heavy, rough, scaly or spinous, having the faculty of affixing itself to other hard substratum such as rocks and corals etc., affixed by side, exclusively or largely by means of its right lower valve, apex twisted to the left; possess a thick oblique transverse tooth, in general crenulated or grooved, fitting into a corresponding cavity in the lower right valve with an exception; two distant lateral adductor muscle scars, pallial line without sinus, spirally coiled prosogyrate umbones.

6. *Pseudochama cristella* (Lamarck)

1819. *Chama cristella* Lamarck, Hist. Nat. Anim. Sans. Vert., 6: 96.

1956. *Pseudochama cristella*: Satyamurti, Bull. Madras Govt. Mus. New Ser. (Nat. Hist.), 1 (2), pt. 7:88, pl. 13, figs. 4a and 4b.

2010. *Pseudochama cristella*: Ramakrishna and Dey, Rec. zool. Surv. India, Occ. Paper No. 320: 146.

2010. *Pseudochama cristella*: Huber, Compendium of Bivalves, p. 286.



Dorsal view of *Pseudochama cristella* Lamarck
(Left lower valve)



Ventral view of *Pseudochama cristella* Lamarck
(Left lower valve)

Material examined: 1 valve, Andaman's, 1976, Coll. G. Ramakrishna and Party, Regd. No. M 27582/6.

Measurements (in mm.):

Length	Height	Depth
39.85	45.20	-

Description: Shell medium, thick, solid, somewhat orbicular, valve concentrically ornamented with radial ridges, interior white, smooth, ventral margin smooth but traces of crenulations may be present along the dorsal margin; outside of the valve brownish white.

Remarks: *Pseudochama* has been controversial since inception. The majority of chamid occur in dextral and sinistral conditions. Although this mix appears much less common in Panamic waters than in the Indo-Pacific. *Pseudochama* is here used as weak genus, restricted for species exclusively or largely attached by the right valve and the apex twisted to the left (Huber' 2010). The present valve which was collected from Andaman Islands is an exception to the fact stated above. This is the only single valve from the Indian waters under the genus *Pseudochama* that present in NZC. After that no collection has been made so far. The valve is in dextral condition and the apex twisted to the right as in *Chama*. The above single left valve belonging

to this genus and represented in Ramakrishna's collection (1976), has been provisionally identified as *Pseudochama cristella*. But a more detailed examination of entire specimen and comparison with other authentically identified specimens are necessary to confirm this identification. Although, Satyamurti (1956) described one single left valve from Krusadai Island in the gulf of Manner and has been provisionally identified as *Pseudochama cristella* due to unavailable of authentically identified specimens. The authors did not make a chance to see the specimen personally which is kept in Madras Government Museum.

Distribution: India: Andaman Islands and Tamil Nadu. *Elsewhere:* Indo-Pacific, Atlantic Coast.

List of foreign species present in NZC

Sl. No.	Name of the species	Collector	Location	No. of examples/ Valves	Regd. No.
1.	<i>Chama brassica</i> Reeve	Unknown	Margui archipelago	1ex.	M27176/5
2.	<i>Chama lazarus</i> Linnaeus	Unknown	Singapore	1ex.	M27180/5
3	<i>Chama lazarus</i> Linnaeus	Unknown	Margui archipelago	1ex.	M27178/5
4.	<i>Chama lazarus</i> Linnaeus	Unknown	Diego Garcia	2exs.	M27175/5
5.	<i>Chama lazarus</i> Linnaeus	Dr. J. Anderson	Margui archipelago	1ex.	M27174/5
6.	<i>Chama lazarus</i> Linnaeus	Unknown	Mauritius	1ex.	4539
7.	<i>Chama lazarus</i> Linnaeus	Bengal fisheries	Ceylon	1ex.	M23997/5
8.	<i>Chama lazarus</i> Linnaeus	Dr. J. Anderson	Margui archipelago	1ex.	M27145/5
9.	<i>Chama lazarus</i> Linnaeus	Unknown	Singapore	1valve	M27165/5
10.	<i>Chama lazarus</i> Linnaeus	Unknown	Ceylon	1ex.	3019/1
11.	<i>Chama lazarus</i> Linnaeus	Unknown	Owen's Island	2exs.	M4165/1 & 4166/1
12.	<i>Chama pacifica</i> Broderip	Unknown	Muscat, Henjam Island	2exs. & 8 valves	M27184/5
13	<i>Chama pacifica</i> Broderip	Unknown	Abyssinia	1 valve	M27158/5
14	<i>Chama pacifica</i> Broderip	Unknown	Aden	1ex. & 5 valves	M27173/5
15	<i>Chama pacifica</i> Broderip	Unknown	Tahiti	2 valves	M27183/5
16	<i>Chama pacifica</i> Broderip	Unknown	Persia	1ex.	M27169/5
17	<i>Chama pacifica</i> Broderip	Unknown	Penang	1ex. & 3 valves	M27177/5

Sl. No.	Name of the species	Collector	Location	No. of examples/ Valves	Regd. No.
18	<i>Chama pacifica</i> Broderip	Unknown	Ceylon	1 valve	M27166/5
19	<i>Chama pacifica</i> Broderip	Unknown	Mauritius	1ex.	M27153/5
20	<i>Chama pacifica</i> Broderip	Unknown	Mauritius	1ex.	116
21	<i>Chama pacifica</i> Broderip	Unknown	Ceylon	5 valves	M27144/5
22	<i>Chama pacifica</i> Broderip	Unknown	Ceylon	1ex.	M27147/5
23	<i>Chama pacifica</i> Broderip	Unknown	Mauritius	2exs. & 1 valve	M27596/6
24	<i>Chama pacifica</i> Broderip	Unknown	Mauritius	2exs. & 2 valves	M27623/6
25	<i>Arcinella arcinella</i> (Linn.)	Unknown	Florida	1 valve	M27170/5
26	<i>Arcinella arcinella</i> (Linn.)	N. E. Schmidt	Florida	6exs.	M19453/3
27	<i>Arcinella arcinella</i> (Linn.)	Unknown	Florida	1ex. & 1 valve	4536
28	<i>Pseudochama exogyra</i> (Conrad)	Unknown	California	2exs.	M27155/5
29	<i>Pseudochama exogyra</i> (Conrad)	Unknown	Florida	1 valve	M27171/5
30	<i>Chama Coralloides</i> Reeve	Unknown	Panama	2 valves	M27163/5
31	<i>Chama Coralloides</i> Reeve	Unknown	Panama	2exs.	M27160/5
32	<i>Chama divaricata</i> Reeve	Unknown	Mauritius	1ex.	4538
33	<i>Chama lobata</i> Broderip	Unknown	Swatow, China	1ex.	M27156/5
34	<i>Chama lobata</i> Broderip	Prof. Max Weber	Siboga	1ex. & 2 valves	M13207/2
35	<i>Chama asperella</i> Lamarck	Unknown	West Indies	1 valve	M27162/5
36	<i>Chama pellucida</i> Broderip	Robert E. C. Stearns	California	1ex. & 2 valves	M27148/5
37	<i>Chama fragum</i> Reeve	Unknown	Australia	3exs. & 1 valve	M27161/5
38	<i>Chama gryphoides</i> Linnaeus	Unknown	Algeria	2 exs. & 1 valve	M27150/5
39	<i>Chama gryphoides</i> Linnaeus	Unknown	Algeria	1 ex.	M27149/5
40	<i>Chama gryphoides</i> Linnaeus	Unknown	Ceylon	1 valve	M27157/5
41	<i>Chama gryphoides</i> Linnaeus	Unknown	Mauritius	3 valves	M27152/5
42	<i>Chama gryphoides</i> Linnaeus	W.T. Blanford	Annesley bay	40 valves	M27151/5
43	<i>Chama limbula</i> Lamarck	Prof. Max Weber	Siboga	2exs. & 2 valves	M13208/2
44	<i>Chama limbula</i> Lamarck	Unknown	Muscat	5exs.	M27185/5
45	<i>Chama limbula</i> Lamarck	Unknown	Ceylon	2exs.	4540
46	<i>Chama limbula</i> Lamarck	Unknown	Cebu	1ex.	M27182/5
47	<i>Chama limbula</i> Lamarck	Unknown	Aden	1 valve	M27154/5

ACKNOWLEDGEMENTS

We are grateful to the Director, Zoological Survey of India for the encouragement and facilities. We are thankful to Dr. A. Dey, Ex-Scientist-D, Mollusca section, Zoological Survey of India for his valuable suggestions

and kindly going through the manuscript. We thank Mr. A.K. Mukhopadhyay, Assistant Zoologist at the Mollusca section for taking keen interest in our work. Our thanks are also due to Mr. Anup Biswas, Photographer for the illustrations.

REFERENCES

- Broderip, W.J. 1835. Descriptions of some species of *Chama*. *Proceedings of the Zoological Society of London*, **2**(24): 148-151.
- Chenu, J.C. 1845-46. *Illustrations Conchyliologiques ou description et figures de toutes les coquilles connues vivantes et fossiles*. A. Franck, Paris. pls. 7bis-8: 1845; **1-7**: 1846.
- Conrad, T.A. 1837. Description of new marine shells, from Upper California. *Journal of the Academy of natural sciences of Philadelphia*, **7**(2): 227-268.
- Delsaerdt, A. 1986. Revision of the Chamidae of the Red Sea, *Red Sea Malacology I. Gloria Maris* **25** (3): 73-125.
- Dey, A. 2006. Contribution to the knowledge of Indian marine molluscs (Part-IV). Family: Tellinidae. *Rec. zool. Surv. India, Occ. Paper No.*, **249**: 1-124, 38 pls.
- Dey, A. and Ramakrishna. 2007. Marine Molluscs: Bivalvia, Scaphopoda and Cephalopoda, *Fauna of Andhra Pradesh, State Fauna series*, **5** (7): 149 – 260. Zool. Surv. India.
- Gravelly, F.H. 1941. Shells and other animal remains found on the Madras beach. *Bull. Madras Govt. Mus. (Nat. Hist.)*, **5**(1): 1-112.
- Harasewych, M.G. and Fabio Moretzsohn. 2010. *The Book of Shells*. A life-size guide to identifying and classifying six hundred seashells. The University of Chicago Press, Chicago, pp. 1-655.
- Huber, M. 2010. *Compendium of Bivalves*. A full-colour guide to 3300 of the world's marine bivalves. A status on Bivalvia after 250 years of research. Hackenheim, Germany: Conch Books, pp. 1-901.
- Kundu, H.L. 1965. On the marine fauna of Gulf of Kutch, Part – III: Pelecypoda. *J. Bombay nat. Hist. Soc.*, **62**(1&2): 84-103, 211-236.
- Lamarck, J.B. 1819. *Hist. Anim. Sans. Vert.*, vol. **6**, pp.1-228. Paris.
- Lamprell, K.L. and T. Whitehead. 1992. Bivalves of Australia, Volume-**1**. *Crawford House Press*, Bathurst NSW Australia.
- Lamy, E. 1928. Revision des *Chama* vivants du MNHN de Paris. *Journal de Conchyliologie* **71**(1927): 293-383.
- Matsukuma, A. 1986. A new genus and four new species of Chamidae (Mollusca, Bivalvia) from the Indo-West Pacific with reference to transposed shells. *Bulletin du Mus. Hist. Nat.*, Paris, Section **A** (1-2): 23-53.
- Oliver, P.G. 1992. Bivalved seashells of the Red Sea. *National Museum of Wales*, UK, pp. 330.
- Paulay, G. 1996. New Records and Synonymies of Hawaiian Bivalves (Mollusca). *Bishop Museum Occasional Papers*, **45**: 18-29.
- Reeve, L. A. 1846. Monograph of the genus *Chama*. *Conchologia Iconica*, Vol. **4**, London.

- Richard, G. 1985. Croissance et production de *Chama iostoma* dans le lagon de Takapoto, Tuamotu, Polynesie francaise. *Atoll Research Bulletin*, **292**, 11-21.
- Satyamurti, S.T. 1956. The Mollusca of Krusadai Island (In the Gulf of Manner II), *Bull. Madras Govt. Mus. New. Ser. (Nat. Hist.)*, **1** (2), pt. **7**: 1-202, pls. 1-30.
- Subba Rao, N.V. and Dey, A. 1984. Contribution to the knowledge of Indian marine molluscs.1. Family: Mitridae. *Rec. zool. Surv. India, Occ. Paper No.*, **61**: 1-48, 3 pls.
- Subba Rao, N.V. and Dey, A. 1986. Contribution to the knowledge of Indian marine molluscs.2. Family: Donacidae. *Rec. zool. Surv. India, Occ. Paper No.*, **91**: 1-30, 4 pls.
- Subba Rao, N.V. and Dey, A. 2000. Catalogue of Marine molluscs of Andaman and Nicobar Islands. *Rec. zool. Surv. India, Occ. Paper No.* **187**: 1-323.
- Subba Rao, N.V. and Surya Rao, K.V. 1993. Contribution to the knowledge of Indian marine molluscs. 3. Family: Muricidae. *Rec. zool. Surv. India, Occ. Paper No.*, **153**: 1-133, 14 pls.
- Subba Rao, N.V., Surya Rao, K.V. and Maitra, S. 1991. Marine molluscs of Orissa. *Zool. Surv. India. Fauna of Orissa, State Fauna series*, **1**(3): 1-175.
- Surya Rao, K.V. and Subba Rao, N. V. 1991. Mollusca of Lakshadweep. *Fauna of Lakshadweep, State Fauna series*, **2**: 273-362, *Zool. Surv. India*.
- Thurston, E. 1895. Fauna of Gulf of Mannar and Rameswaram Island. *Madras Govt. Mus. Bull.*, **3**: 80-138.
- Tikader, B.K., Daniel, A. and Subba Rao, N.V. 1986. Sea shore animals of Andaman and Nicobar Islands. *Zool. Surv. India*: 1-188.
- Tripathy, B., Mukhopadhyay, A., Hafiz, Md. And Ghosh, A. 2013. Contribution to the knowledge of Indian marine molluscs with a note on the national zoological collections from other countries. Family: Turritellidae. *Rec. zool. Surv. India*, **113**(Part-2): 123-136.
- Venkitesan, R. and Mukherjee, A.K. 2011. Contribution to the knowledge of Indian marine molluscs. Family: Terebridae. *Rec. zool. Surv. India*, **111**(Part-3): 49-77.