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MUSSELS (MYTILIDAE: GENUS *PERNA*) OF THE INDIAN COAST

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The redesignation of the Indian species of mussels to the genus *Perna* instead of *Mytilus* has been done. Description of two species of *Perna* viz *P. viridis* and *P. indica* found along Indian coast is given, together with diagnostic features distinguishing both species.

INTRODUCTION

Working on the systematic position of the mussel species in India, Kuriakose and Nair (1976, *Aqua. Biol.*, 1: 25-36) concluded that the genus *Mytilus* does not occur in India and that the species *Mytilus viridis* (green mussel) should be redesignated as *Perna viridis* following their findings that the genus occurring in India is referable to *Perna*. The brown mussel was identified as a new species, *Perna indica* by them. Along the Indian Coast only these two species have been so far recorded. The present paper gives the details of taxonomy of the Indian species showing the distinguishing features of both.

Mussels belonging to the family 'Mytilidae' are easily recognised from other bivalve molluscs by the following characters :—

Shell equivalve, very inequilateral with prosogyre umbones near the anterior end ; ligament elongate, deep seated generally on nymphae, the inner resilial part typically connected with the nymphae by a calcareous white ridge, mantle lobes united below the anal siphonal opening, branchial opening confluent with the pedal opening ; posterior part of the mantle edges pigmented and furnished with papillae ; anterior adductor muscle absent and posterior adductor very prominent ; anterior byssal retractors small, fastened behind umbones ; posterior retractor generally confluent with the posterior adductor ; foot finger-shaped with a posterior furrow ; byssal gland behind the foot and highly functional ;

gills filibranch and ventricle embracing the rectum. (Soot-Ryen, 1955, *Allan Hancock Foundn. Pac. Expedns.* 20 : 1-154).

TAXONOMY

Phylum	Mollusca
Class	Pelecypoda
Order	Filibranchia
Sub-Order	Mytilacea
Family	Mytilidae
Genus	<i>Perna</i>

GENUS *Perna*

Perna is characterised by the presence of only one or two well developed hinge teeth ; the absence of anterior adductor muscle, the wide separation of the two posterior byssal retractors, the recurrent loop of the mid-gut lying at the left lateral side of the stomach and in the separation of the crystalline style-sac from the mid-gut. But in the case of *Mytilus* the hinge area consists of 3 to 5 teeth, anterior adductor muscle well developed, posterior byssal retractors of 5 to 7 muscle bundles which are closely arranged along the dorsal shell margin in front of the posterior adductor, the recurrent loop of the straight intestine lies at the ventral side of the stomach making a dorsal loop at the region of the oesophagus and the crystalline style-sac and the mid-gut conjointed (Table 1). *Perna* is more restricted in distribution than *Mytilus* which has a circumglobal distribution.

TABLE 1. Diagnostic Characters separating Genus *Perna* from Genus *Mytilus*

Diagnostic characters	<i>Perna</i>	<i>Mytilus</i>
External colour	Green or brown	Green, blue or bluish-green
Shape of the anterior end	Pointed, straight or little down turned	Pointed, more down turned
Hinge teeth	One or two	Three to five
Resilial ridge	Pitted	Compact
Anterior adductor muscle	Absent	Present
Posterior byssal retractors	Thick, split into two main bundles, widely separated	Thin, six to eight form a single bundle
Course of the pedal retractor before insertion to the shell	Through the anteriomedial aspects of posterior retractor	Through antero-lateral aspects of posterior retractor
Crystalline style-sac and mid-gut	Widely separated	Both conjoint

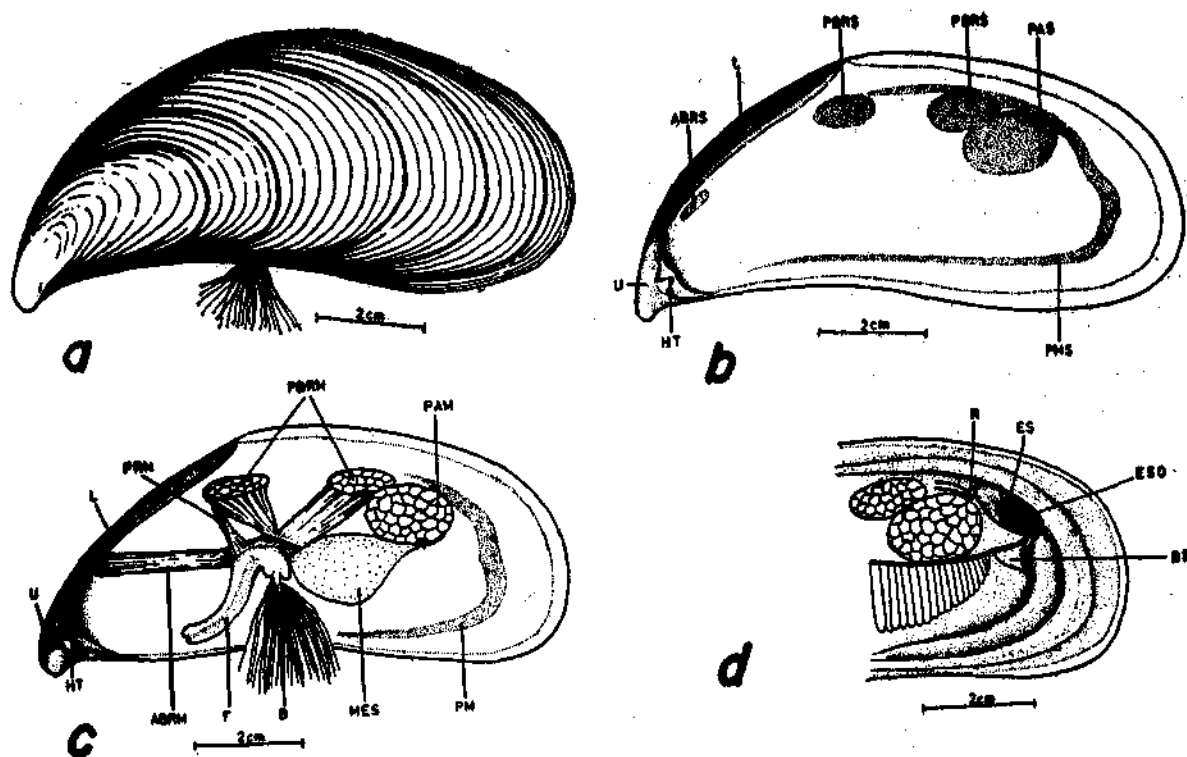


Fig. 1. *Perna viridis* (Linnaeus): a. Lateral view of the animal; b. Internal view of right valve showing muscle impressions, ligament and hinge teeth; c. Internal view showing the arrangement of muscles, foot and byssus apparatus; and d. Internal view of the posterior part showing the mantle margin and opening of the excurrent aperture into the mantle cavity. (Abbreviations used: ABRM—Anterior byssal retractor muscle, ABRS—Anterior byssal retractor muscle scar, AU—Auricle, B—Byssus, BS—Branchial septum, ES—Excurrent siphon, ESO—Excurrent siphonal opening, F—Foot, HT—Hinge teeth, L—Ligament, MES—Mesosoma, MG—Midgut, OES—Oesophagus, PAM—Posterior adductor muscle, PAS—Posterior adductor muscle scar, PBRM—Posterior byssal retractor muscle scar, PBRM—Posterior byssal retractor muscle scar, PM—Pallial muscle, PMS—Pallial muscle scar, PRM—Pedal retractor muscle, R—Rectum, RI—Recurrent intestine, SS—Style-sac, ST—Stomach, T—Tentacle, U—Umbo, and V—Ventricle).

Perna viridis (Linnaeus) 1758

(Fig. 1; a-d)

Myaperna Linnaeus, (1758, *Systema Naturae* ed. 10 : 671).

Mytilus (*Chloromya*) *viridis* Lyngé, (1909, *Mem. Acad. R. Sci. Lett. Denmark* : 5 : 23); Lamy (1937, *Journ. de Conchol.* 80 : 5-71; 99-132; 169-197).

Mytilus smaragdinus Annandale, (1916, *Mem. Ind. Mus.* 5 : 350-360), Hornell (1917, *Madras Fish Bull.* 11 : 1-51); Rao (1941, *Sci. Cult.* 7 : 69-78).

Mytilus viridis Hornell, 1921, p. 156; Gravely (1941, *Bull. Madras Govt. Mus.* 5 : 35-37; Paul (1942, *Proc. Ind. Acad. Sci.* 15 : 1-10); Jones (1951, *J. Bombay Nat. Hist. Soc.* 49 : 519-528); Satyamurti (1956, *Bull. Madras Govt. Mus. New Ser.* 1 : 1-202); Kundu (1956, *J. Bombay Nat. Hist. Soc.* 62 : 84-103); Menon et al. (1966, *Research Bull. (N.S.) Punjab Univ.* 18 : 317); Rao (1974, *CMFRI Bull. No.* 25 : 5-12).

Perna viridis Kuriakose & Nair (1976, *Aqua. Biol.* 1 : 25-36).

Description :

Shell thick, equivalve, inequilateral, elongate, triangularly ovate in outline reaching upto 230 mm in length and 72 mm in height. Umbo terminal, hinge plate well developed extending slightly ventrally, provided with two small teeth on the left valve and one large on the right valve. Dorsal ligamental margin curved, mid-dorsal margin arcuate; posterior margin rounded and ventral margin highly concave. Periostracum thick, smooth and shining. Sculpture consisting of irregularly spaced concentric ridges and growth lines. Ligament very thick, internal, extending from the umbo to one third of the dorsal shell margin, resilial ridge thick, white and pitted. External colour beautiful green, but in older specimens bluish-green at the anterior half. Interior of the shell margaritaceous and shining; muscle scar deeply impressed.

Anterior adductor muscle absent. Posterior adductor large, cylindrical, surface slightly elongate and located in the posterior half of the shell a little above the antero-posterior axis of the body. Anterior byssal retractors cylindrical, thin, elongate, and join the shell a little behind the umbonal cavity; posterior byssal retractor arise as a common bundle from the base of the byssus apparatus which splits into two short, thick bundles and diverge in the form of a 'V', the anterior bundle inserting the shell below the posterior termination of the ligament and the posterior bundle joining the shell along with the posterior adductor bundle at its antero-dorsal side. Pedal retractor muscle thin, elongate, arises from the base of the foot and inserts the dorsal shell margin after crossing through the anteromesial aspect of the anterior bundle of the posterior retractor. Mid-gut or straight intestine lies at the left

lateral side of the stomach. Crystalline style-sac and mid-gut widely separated, the former lying at the left ventral side of the latter. Mantle margin smooth, thin, slightly extensible and tentacles or papillae absent. The mouth of the excurrent aperture oval, wide and the passage into the mantle cavity very small being restricted by a septum; rectum and posterior adductor not visible through the opening. Foot finger-shaped, thick and extensible. Byssus apparatus large situated at the posterior base of the foot; byssus threads emanate from the byssus stem. The threads are long, thick, strong with a well developed attachment disc at their distal ends.

Distribution :

Northern Indian ocean and around the mainland coast of South-East Asia, the Philippines, South Africa and New Zealand (Barry Wilson, personal communication) China and Siam (Lamy, 1937). This species occurs all along the east and west coast of India. On the east coast it occurs as small beds along Chilka Lake, Visakhapatnam, Kakinada, Madras, Pondicherry, Cuddalore, Porto Novo and Port Blair. On the west coast extensive beds occur along Quilon, Alleppey, Cochin, Calicut to Kasargode, Mangalore, Karwar, Goa, Bhatia Creek, Malvan, Ratnagiri and Gulf of Kutch.

Habitat :

In addition to the rocky open coasts and harbours, these are found in the mouths of estuaries and rivers where the salinity is almost equal to the sea water. They occur from intertidal zone to a depth of 15 metres attached to rocks, pilings and other hard objects.

Perna indica Kuriakose and Nair, 1976.

(Fig. 2; a-f).

Description :

Shell thick, equivalve, inequilateral, elongate, triangularly ovate in outline reaching upto 121 mm in length and 48 mm in height. Umbos terminal, umbonal beaks poorly developed, terminal or slightly downturned in adults; hinge plate narrow and thin with a well developed tooth on the left valve fitting into a corresponding depression on the right valve. Dorsal ligamental margin straight; mid-dorsal margin highly angular with a well developed hump where the shell measures the maximum height; posterior margin rounded and the ventral margin straight. Ligament long, thick and internal; resilial ridge white and highly pitted. External colour dark brown and the interior highly margaritaceous and shining. Muscle scars deeply impressed.

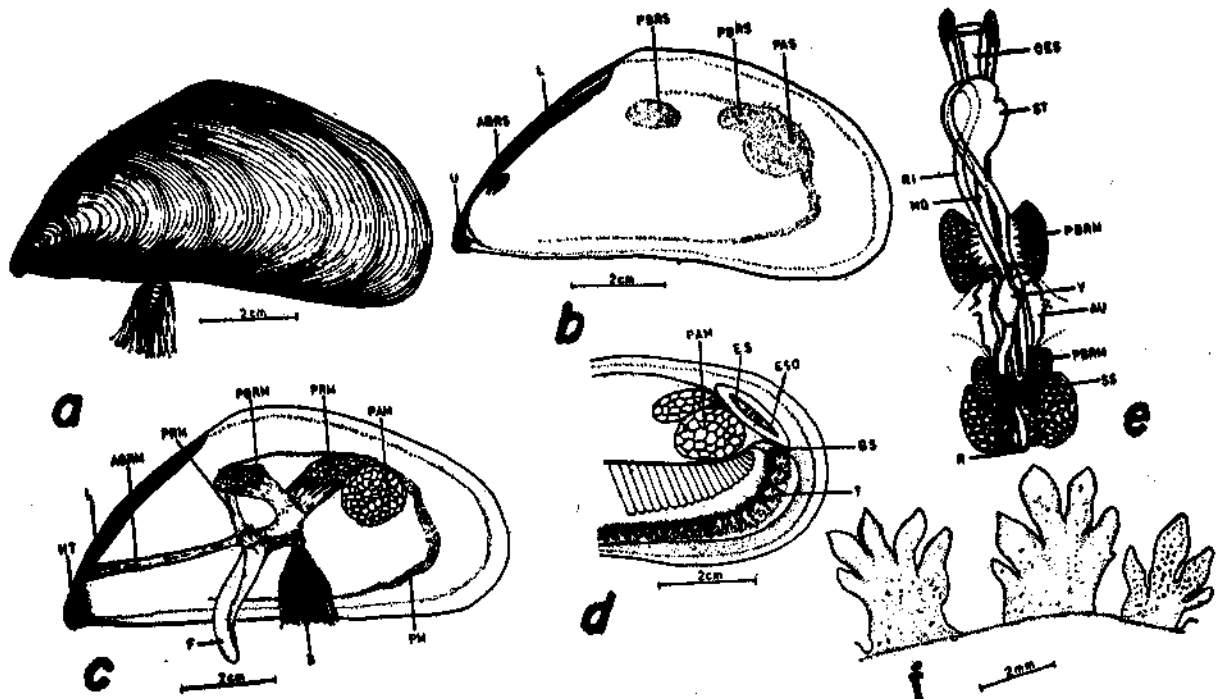


Fig. 2. *Perna indica* Kuriakose and Nair : a. Lateral view of the animal ; b. Internal view of right valve showing the muscle impressions, hinge tooth and ligament ; c. Internal view showing the arrangement of muscles, foot and byssus apparatus ; d. Internal view of the posterior part showing the branched tentacles on the ventral mantle margin and the opening of the excurrent aperture into the mantle cavity ; e. Dissection showing the disposition (dorsal view) of musculature, pericardium, alimentary tract and crystalline style-sac, and f. Enlarged view of the tentacles of the ventral mantle margin (Abbreviations as in Fig. 1).

Anterior adductor muscle absent. Posterior adductor muscle rounded, located towards dorsal shell margin at about mid-way between the posterior termination of the ligament and posterior shell margin. Anterior byssal retractors elongate, thin and insert at a little behind the umbonal cavity ; posterior retractors arising as a single bundle from the base of the byssus apparatus and split into two thick short bundles which diverge in the form of a 'V'. The anterior bundle inserts the dorsal shell margin below the posterior termination of the ligament and the posterior bundle inserts the shell together with the posterior adductor at its antero-dorsal side. Mid-gut or straight intestine reaches posteriorly over the posterior adductor and recurrent loop of straight intestine lies at left lateral side of the stomach. Crystalline style sac and mid-gut widely separated. Mantle margins bordering incurrent aperture very thick, non extensible ; inner fold of the mantle margins with 18-22 long, stout and brown branching tentacles. Excurrent aperture oval and wide ; its mouth and passage into the mantle cavity of uniform width ; rectum

and posterior adductor muscle prominently seen through the aperture. Foot finger-shaped, byssus apparatus large, located close to the base of foot. Byssus threads emanating from the byssus stem, are elongated and strong, with attachment discs at their distal ends. Distinguishing characters of *P. viridis* and *P. indica* are given in Table 2.

Distribution :

P. indica has a very restricted distribution occurring along the south west coast of India from Varkalai near Quilon to Cape Comorin and south east coast from Cape Comorin to Tiruchendur. Important Centres are Cape Comorin, Colachal, Muttom, Poovar, Vizhinjam, Kovalam, Varkalai and Quilon.

Habitat :

This species forms dense population along the rocky coasts from the intertidal region to a depth of 10 metres. Large sized mussels are found in 0.5 to 2 metre depth.

TABLE 2. *Diagnostic Characters separating the Species of Perna*

Diagnostic characters	<i>Perna viridis</i>	<i>Perna indica</i>
Shape of anterior end	Pointed, beak-like, downturned	Pointed and straight
Size of hinge plate	Thick, broad, extends slightly to the ventral border	Thick, narrow, terminal
Number and size of hinge teeth	Two small on the left valve and one on the right valve	One large on the left valve and a corresponding depression on the right valve
Dorsal ligamental margin	Curved	Straight
Mid-dorsal shell margin	Arcuate	A distinct dorsal angle or hump present
Ventral shell margin	Highly concave	Almost straight
External colour	Green	Dark brown
Maximum size (recorded length)	230 mm	121 mm
Mantle margin colour	Yellowish-green	Brown
Excurrent aperture opening	Mouth oval and wide; passage into the mantle cavity small; restricted by reatum and rectum and posterior adductor not visible through the opening	Mouth and passage into the mantle cavity are of same width; rectum and posterior adductor prominently visible through the opening
Ventral mantle margin	Inner fold of the posterior ventral mantle margin thin, extensible, smooth, tentacles or papillae absent	Inner fold of the posterior mantle margin very thick not extensible; provided with 18-22 thick branching tentacles
Posterior byssal retractors	Two, short, thick bundles; anterior bundle arises from the posterior and diverges in the form of a 'V'	Two, short, thick bundles; anterior bundle arises from the posterior and diverges in the form of a 'V'