MUDWHELKS (GASTROPODA: POTAMIDIDAE) FROM MANGROVES OF UJUNG KULON NATIONAL PARK, BANTEN

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ABSTRACT

A study of Potamididae snail from the mangrove ecosystem in Ujung Kulon National Park was conducted, regarding to its diversity, shell characters and habitat characters. This study was carried out in 2008 during drought and rainy season. At the eight stations observed, seven species and four genera of Potamididae snail were identified. Compared with previous study, this study added new information from obtaining one genus (*Cerithidea*) of three species (*Cerithidea weyersi, C. quadrata* and *Cerithideopsilla alata*)

Keywords: Potamididae, shell's characters, mangrove, Ujung Kulon.

INTISARI

Studi tentang keanekaragaman jenis, karakter morfologi cangkang serta karakter fisika lingkungan pada siput Potamididae dari ekosistem mangrove di Taman Nasional Ujung Kulon telah dilakukan. Studi ini dilakukan pada musim kemarau dan penghujan di tahun 2008. Pada delapan stasiun yang diteliti berhasil diidentifikasi tujuh jenis dan empat marga dari suku Potamididae. Dibanding dengan studi terdahulu, hasil studi ini memberikan informasi tambahan berupa ditemukannya satu marga (*Cerithidea*) dan tiga jenis lainnya (*Cerithidea weyersi, C. quadrata* and *Cerithideopsilla alata*).

Kata kunci: Potamididae, karakter cangkang, mangrove, Ujung Kulon

INTRODUCTION

The ecosystem of mangroves provides an important role as habitat for associated living animal. Snails become one of the most common associated animal living in mangrove forest. Mudwhelks (Potamididae) are sometimes dominant and found in very dense population (Wells, 1983). Most of 29 living species show a close association with mangrove forest. The trees provide snail with shelter, protection from predator and also for food (Reid *et al.*, 2008).

Java has been lost almost 90% of its mangrove forest which only a little area left protected (Noor *et al.*, 2006). The one which still remain is in Ujung Kulon National Park (Ind : TNUK) located between 102º02'32''-105º37'37''E and 06º30'43''-06º52'17''S, belongs to Sumur and Cimanggu sub-district, Pandeglang district and Banten Province (Julianto *et al.*, 2007).

TNUK has an important role as one of The Natural World Heritage Site since 1992. It has 122.956 ha wide, consist of 76.214 ha terrestrial and 44.337 ha aquatic area(Julianto *et al.*, 2007). Considering the reduction of mangrove forest in Java still continue (and perhaps also occur in TNUK) which has an impact on the snail diversity and to re-validate the data of Potamididae snail, a field research located in mangrove forest of TNUKwas conducted in TNUK.

MATERIALS AND METHODS

The field research was done twice, on dry season (9-25 June 2008) and rainy season (3-22 November 2008). Most of the stations chosen are near riverbank (Pinanggading, Tamanjaya, Cilintang, Prepet, Cigenter, Cikawung and Cibariang) only one is on an island (Boboko). Collection of mollusc was done by handpicking technique. Some physical characters of the habitat also measured. Salinity was measured by ATAGO® Hand Refractometer, temperature was measured by mercury thermometer, water acidity (pH) was measured by MERCK® universal indicator paper 0-14. Measurement of the shell using caliper "Mitutoyo" No 505-633 and 505-634 (0.05 mm accuracy). The shell characters measured are shell length (SL), shell width (SW), length of body whorl (LBW) and number of whorl (NW). The physical characters of each research station are presented in Tabel.1. Identification of the specimen was done according to studies by Jutting (1956) and Reid *et al.* (2008).

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Tabel.1. The physical character of each research station

No	Location	Physical character
1	Tamanjaya estuary 6°47'4.3" S. 105°30'3.5" E.	Salinity 3 ppt, temperature 31°C and pH 8. Sandy substrates, degraded mangrove vegetation.
2	Cikawung estuary 6°47'47.9" S. 105°29'47.9" E.	Salinity almost 0 ppt, temperature 27°C and pH 6. Muddy substrates, degraded mangrove vegetation.
3	Pinanggading estuary 6°46'49" S. 105°30'10" E.	Salinity 2 ppt, temperature 29°C and pH 7. Sandy substrates, degraded mangrove vegetation.
4	Cilintang estuary 6°49'13.1" S. 105°28'40.7" E.	Salinity 0-27 ppt, temperature 26-27°C and pH 6-7. Sandy and muddy substrates, a good condition of mangrove vegetation.
5	Prepet estuary 6°49'40,8" S. 105°28'10.2" E.	Salinity 0-33 ppt, temperature 27-30°C and pH 6-8. Sandy substrates, a good condition of mangrove vegetation.
6	Cibariang estuary 6°38'18,9" S. 105° 13'6.8" E.	Salinity 32 ppt, temperature 28°C and pH 6. Sandy and muddy substrates, a good condition of mangrove vegetation.
7	Boboko estuary 6°46'20,4" S. 105°26'6.8" E.	Salinity 35 ppt, temperature 30°C and pH 9. An island, separates from Java plate. Sandy substrates, a good condition of mangrove vegetation.
8	Cigenter estuary 6°44'57.4" S. 105°24'9.8" E.	Salinity 10 ppt, temperature 30°C and pH 8. Muddy substrates, a good condition of mangrove vegetation.

RESULTS

There were 89 specimen of Potamididae snail collected from 8 stations observed, consist of 4 genera and 7 species. The picture of each species is presented in Figure. 1.

Species identification are based on studies by Jutting (1956) and Reid *et al.* (2008) with modifications as follows :

1. a. Shell large, more than 50 mm long, with spiral ridge along columella 2.a
   b. Shell small-medium, not more than 50 mm, spiral ridge absent.. ……..…….3.a
2. a. Spire with broader whorls, with axial and spiral sculpture…….....***Terebralia***
   b. Spire with many narrow whorls, only spiral sculpture present…..***Telescopium***
3. a. Shell thin, about 18 spiral ribs on adult whorls…….....……..***Cerithidea***
   b. Shell rather thick, 3 spiral ribs on adult whorls…….....***Cerithideopsilla***

Telescopium Montfort, 1810

Shell large, elongate conic with spire angles 30-40° (narrowly subovately conic). Shell dextral, thick and not transparent. Shell color dark brown on base and lighter to apex. Only spiral ribs (3) present on spire. Apex not sharp and often eroded. Spire high and regularly increasing in size. Body whorl flattened, about 0.26 of total shell length. Suture shallow. Aperture obliquely quadrangular. Peristome curved, not sharp and not continuous, apertural lip sinuate but not flared and thickened. Two thickened spiral growth line present on the base of apertural lip. Collumela thick, twisted and color brown. Operculum circular, corneous, with central nucleus and many concentric whorls.

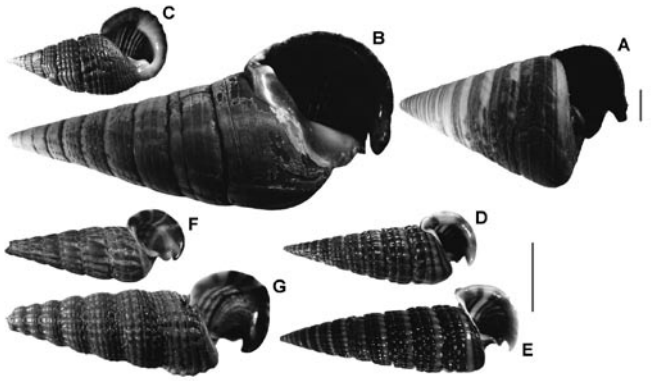

Figure. 1. Potamididae snail found in Ujung Kulon National Park. A) *Telescopium telescopium*; B) *Terebralia palustris*; C) *T. Sulcata*; D) *Cerithideopsilla cingulata*; E) *C. Alata*; F) *Cerithidea weyersi*; G) *C. quadrata*. Scale : 1 cm.

Telescopium telescopium Linnaeus, 1758.

Only one species found and the description is same as above.

Specimen examined: MZB.Gst.14.352 Cigenter 3ex-rainy season. (Figure.1.A). SL : 44.4-78.85 mm (r : 63.68; sd : ±17.47), SW : 23.7-36.9 mm (r :30.92; sd : ±1.95), LBW : 13.65-21,.25 mm (r : 17.07; sd : ±3.86), NW : 11-15 (r : 13.83; sd : ±2.02). Habitat : creeping on sandy or muddy substrate.

Terebralia Swainson, 1840

Shell medium to large size, elongate conic with spire angles 30-40° (narrowly subovately conic). Shell dextral, thick, not transparent, color brown, both spiral and axial ribs present. Spire high, regularly increasing in size. Suture deep, peristome straight, not sharp and not continuous. Apertural lip flared and thickened. Collumela twisted, whitish brown with basal projection. Strong varix present on the left side of the body whorl. Operculum oval, rather thick, multispiral with central nucleus. Two species found are :

1. a. Shell large and elongate conic, whorls almost flat..…….....…….....palustris
   b. Shell high-conical and smaller, whorls convex …….....sulcata

Terebralia palustris Linnaeus, 1767.

Shell large, elongate conic with spire angles 30-40° (narrowly subovately conic). Shell dextral, thick and not transparent. Color brown, often fading toward apex. Axial ribs stronger than spiral ribs. Apex often eroded, spire high, regularly increasing in size. Body whorl flattened, about 0.45 of total shell length. Apertural lip flared and thickened. Peristome straight, not sharp and not continuous. Collumella twisted, thick, basal projection opened. Upper part of apertural lip attached to body whorl and often grooved in fully mature specimen. Strong varix present on the left side of the body whorl, crossed by the thickened of lower apertural lip. Operculum oval, rather thick, multispiral with central nucleus.

Specimen examined: MZB.Gst.14.353 Boboko 1ex-dry season; MZB.Gst.14.478 Cibariang 6ex-rainy season. (Figure.1.B). SL : 94.05-156.2 mm (r : 116.14; sd : ±21.50), SW : 43,5-58,75 mm (r : 50.78; sd : ±5.67), LBW : 43.2-60.15 mm (r : 51.46; sd : ±5.32), NW : 6-15.5 (r : 8.86; sd : ±3.31). Habitat : creeping on sandy or muddy substrate.

***Terebralia sulcata* (Born, 1778).**

Shell smaller than previous species, elongate conic with spire angles 30-40º (narrowly subovately conic). Color brown. Axial spiral ribs equal. Apex sharp, sometimes eroded, spire high, regularly increasing in size. Body whorl rather rounded, about 0.45 of total shell length. Apertural lip flared and thickened. Peristome straight, not sharp and not continuous. Collumella twisted, thin, basal projection closed. Upper part of apertural lip not attached to body whorl but grooved, lower part of apertural lip attached to collumela. Strong varix present on the left side of the body whorl, not crossed by the thickened of lower apertural lip. Operculum oval, rather thick, multispiral with central nucleus.

Specimen examined: MZB.Gst.14.354 Boboko 4ex-dry season; MZB.Gst.14.479 Cibariang 19ex-rainy season. (Figure.1.C). SL : 37.15-50.15 mm (r : 44.23; sd : ±3.93), SW : 18.4-23.6 mm (r : 21.68; sd : ±1.59), LBW : 21.6-27.3 mm (r : 24.50; sd : ±1.83), NW : 6-12 (r : 9.2; sd : ±1.95). Habitat : attached to the roots and stem of mangrove tree.

***Cerithideopsilla* Thielle, 1929**

Shell medium size, elongate conic, rather thick and dextral. Shell color yellowish-brown to reddish-brown. 3 spiral ribs, 1 and 2 light brown and 3 dark brown. Numerous axial ribs. Spiral and axial ribs equal. Apex sharp and acute. Spire high, regularly increasing in size. Body whorl flattened, about $^1/_3$ of total length shell. Suture shallow. Aperture triangular, flared and thickened. Peristome continuous with basal projection defining anterior canal. Operculum corneous, thin and circular with multi spiral and central nucleus. Two species are found :

1. a. Upper part of aperture attached to body whorl. .....cingulata
   b. Upper part of aperture not attached but extending upward and pointed.....alata

***Cerithideopsilla cingulata* Gmelin, 1791**

Shell medium size, elongate conic, rather thick and dextral. Shell color yellowish-brown to reddish-brown. 3 spiral ribs, 1 and 2 light brown and 3 dark brown. Numerous axial ribs. Spiral and axial ribs equal. Apex sharp and acute. Spire high, regularly increasing in size. Body whorl flattened, about $^1/_3$ of total length shell. Suture shallow. Aperture triangular, flared and thickened. Upper part of aperture attached to body whorl. Peristome continuous with basal projection defining anterior canal. Operculum corneous, thin and circular with multi spiral and central nucleus.

Specimen examined: MZB.Gst.14.349 Prepet 2ex-dry season; MZB.Gst.14.481 Cikawung 3ex-rainy season. (Figure.1.D). SL : 19.95-32 mm (r : 28.21; sd : ±3.14), SW : 10.5-12.9 mm (r : 11.35; sd : ±0.66), LBW : 7.8-11.6 mm (r : 10.2; sd : ±0.97), NW : 7-13.5 (r : 11.53; sd : ±1.77). Habitat : mangrove's substrate.

***Cerithideopsilla alata* Philippi, 1849**

Shell medium size, elongate conic, rather thick and dextral. Shell color yellowish-brown to reddish-brown. 3 spiral ribs, 1 and 2 light brown and 3 dark brown. Numerous axial ribs. Spiral and axial ribs equal. Apex sharp and acute. Spire high, regularly increasing in size. Body whorl flattened, about $^1/_3$ of total length shell. Suture shallow. Aperture triangular, flared and thickened. Upper part of aperture not attached to body whorl but extending upward and pointed. Peristome continuous with basal projection defining anterior canal. Operculum corneous, thin and circular with multi spiral and central nucleus.

Specimen examined : MZB.Gst.14.348 Tamanjaya 10ex-dry season; MZB.Gst.14.482 Cilintang 3ex-rainy season; MZB.Gst.14.483 Cikawung 5ex-rainy season. (Figure.1.E). SL : 27.6-36.2 mm (r : 32.23; sd : ±2.25), SW : 11.5-13.7 mm (r : 12.65; sd : ±0.70), LBW : 9.95-12.55 mm (r : 11.06; sd : ±0.79), NW : 10-15 (r : 12.58; sd : ±1.51). Habitat : mangrove's substrate.

***Cerithidea* Swainson, 1840**

Shell medium to large size, elongate conic, dextral, thin and not transparent,. Shell color brown. Sculpture granules, apex not sharp and often eroded. Spire high, regularly increasing in size. Suture shallow. Peristome straight, not continuous and not sharp, apertural lip flared and thickened. Collumela twisted, color brown. Operculum corneous, thin and circular with multi spiral and central nucleus. Two species are found in here :

1. a. Shell small, only axial ribs present, aperture triangular.….....….weyersi
   b. Shell medium, both spiral and axial ribs present, aperture quadrangular .....quadrata

***Cerithidea weyersi* Dautzenberg, 1899**

Shell small, narrowly conic with spire angles 30-40º (narrowly subovately conic). Shell dextral, thin and not transparent. Shell color dark brown on base and lighter toward apex. There are three spiral ribs present on spire, axial ribs absent. Apex not sharp and often eroded. Spire high and regularly increasing in size. Body whorl flattened. Suture shallow. Aperture triangular. Peristome straight, not continuous and not sharp, apertural lip flared and thickened. Collumela rather thick, twisted, color brown. Operculum circular, corneous, with central nucleus and many concentrical whorls.

Specimen examined: MZB.Gst.14.351 Tamanjaya 2ex-dry season; MZB.Gst.14.487 Tamanjaya 3ex-rainy season. (Figure.1.F). SL : 20.5-24.7 mm (r : 23.25; sd : ±1.64), SW : 9.35-10.45 mm (r : 10.12; sd : ±0.45), LBW : 10.4-11.1 mm (r : 10.73; sd : ±0.32), NW : 5.5-7 (r : 6.10; sd : ±0.65). Habitat : attached to the roots and stem of mangrove tree.

***Cerithidea quadrata* Sowerby, 1866**

Shell small, elongate conic with spire angles 30-40º (narrowly subovately conic). Shell dextral, thin and not transparent. Shell color dark brown on base and lighter to apex. Both spiral and axial ribs present on spire, equal in strength. Apex not sharp and often eroded. Spire high and regularly increasing in size. Body whorl rounded. Suture rather deep. Aperture quadrangular. Peristome straight, not continuous and not sharp, apertural lip flared and thickened. Collumela thin, twisted, color brown. Thick varix present in upper left of aperture. Operculum circular, corneous, with central nucleus and many concentrical whorls.

Specimen examined: MZB.Gst.14.350 Cigenter 8ex-dry season; MZB.Gst.14.484 Prepet 8ex-rainy season; MZB.Gst.14.485 Cilintang 6ex-rainy season; MZB. Gst.14.486 Cikawung 6ex-rainy season. (Figure.1.G). SL : 34.8-42,6 mm (r : 39.01; sd : ±2.38), SW : 13.5-17.65 mm (r : 15.79; sd : ±1.13), LBW : 14.65-19.5 mm (r : 16.77; sd : ±1.09), NW : 6.5-10 (r : 7.20; sd : ±0.85). Habitat : attached to the roots and stem of mangrove tree.

DISCUSSION

Potamididae is a molluscan family found among mangroves, has a thick and solid shell, tapering, high-conical, with many flattened or slightly convex spire whorls. Sculpture generally coarse, with spiral grooves or cords and often axial ribs, giving a reticulated to nodular aspect. Periostracum usually well developed, brownish to corneous. Aperture relatively small, with a short and deep anterior siphonal canal. Apertural lip often thickened and flaring. Operculum rounded, corneous, with many spiral coils and a sub central nucleus (Carpenter and Niem, 1998).

The distribution *Telescopium telescopium* Linnaeus, 1758 seems to be restricted in Cigenter only. All are dead specimen which found on the mud surface. All the specimen similar with "the typical form" which shows a regular conical shape with strong spiral grooves as mentioned by Budiman (1988). This species lives in mud flats with high salinity (Carpenter & Niem, 1998), but Cigenter has low salinity.

Apparently the living animals came from around Cigenter, then shells carried by spring tide into Cigenter. Previous studies have also found this species in Panaitan (Reksodihardjo *et al.*,1987) and Cilacap (Sabar *et al.*,1979). Outside Java, this species also found in Way Sekampung-Lampung and Malili-South Sulawesi (Sabar *et al.*,1979).

Terebralia palustris Linnaeus, 1767 was found as aggregates in hundreds of snail in Cibariang. As many as 15 snails could be found in 1 m^2 around Cibariang. Even they can live around environment which full of domestic waste, as observed in the left side of this river. They creep on muddy or sandy floor and never found climbing on the root or stem. It seems that they prefer living in sandy or muddy substrate with high salinity at a good mangrove vegetation. One of the seven specimen has a smooth appearance, probably because their shell eroded by the acidity of the soil. Two of the seven specimen with groove at the upper part of peristome. Needs further study to know the consistency of this character.

Terebralia sulcata Born, 1778 was rarely found in high number, only five specimen in one spot. They often attach on mangrove roots andcreep on the substrate. Apparently they prefer living in sandy or muddy substrate with high salinity at a good mangrove vegetation.

The distribution of *Terebralia* seems restricted only in Boboko and Cibariang where the salinity always high. They were more active during spring tides when the sediment surface was wet (Wells and Lalli, 2003). In both locality they found inactive, just lying on the floor. Possibly because the observation was done in the daytime during neap tide. The adults graze on plant materials such leaf litter, mangrove propagules and fruits (Pape *et al.*, 2008). The animals high abundance on the mangrove's floor apparently searching for fallen leaf as their main food. There are three living *Terebralia* around Indo-Pacific (Reid *et al.*, 2008), only two species found in TNUK, the other species, *T. semistrata* was not found in this area.

Previous studies have also found both species around TNUK such Panaitan (Jutting,1956; Reksodihardjo *et al.*,1987), but only *T. sulcata* which found in Handeuleum (Yasman,1998), an island near Panaitan. Outside Java, both species also found in Batumenyan-Lampung (Sabar *et al.*,1979).

Cerithideopsilla cingulata Gmelin, 1791 was found in Cikawung crawling in numerous individual on the surface of wet and muddy floor, they form aggregates and making colonies consist of hundred of snails along the left sides of the river mouth. They were exposed to the sun light. Only few individual found in Prepet, probably because the mud was dried and lack of water during dry season make them moving away to find wet and comfortable places. Apparently that they can live in sandy or muddy floor and also tolerate wide range of salinity around both good or damaged mangrove vegetation.

Unlike the previous species, *C. alata* rarely found in a numerous number on the same place. Only as much as 10 snails observed in the same place. The specimen found in Tamanjaya were immersed in water, and

crawling on mud surface in two other location, they were not exposed but rather covered under the tree canopy. It seems that they can live in sandy or muddy floor and also tolerate wide range of salinity around both good or damaged mangrove vegetation.

Cerithideopsilla used to be a sub genus of *Cerithidea* until Reid *et al.* (2008) revised them and raised into generic level. All member of the genus *Cerithideopsilla* found were mud creeper since they never found climb up the mangrove tree. Houbrick (1984) explained that *Cerithideopsilla* live mainly on floor in intertidal mud flats. They feed on macro algae in the algal patches on tidal flat (Doi *et al.*, 2008). The dense aggregations of *C. cingulata* observed in Cikawung was supported by Reid *et al.* (2008) statement. Both species found on the floor far enough from mangrove tree. Apparently both species were not associated with mangroves (Houbrick, 1984). *Cerithideopsilla* is predicted to have ancestor from non-mangrove habitat (Reid *et al.*, 2008). There are four living *Cerithideopsilla* around Indo-Pasific (Houbrick, 1984). Two other species which not found are *C. microptera* and *C. djajariensis*.

Previous studies have also found *C. cingulata* around TNUK such Handeuleum (Yasman, 1998). Djuwito (2007) reported this species found in Kendal-Central Java which became a serious pest on local brackish water ponds. This snail also considered as a pest in Philippines (Bagarinao and Lantin-Olaguer, 2000). So far there is no record of both species outside Java.

The distribution of *Cerithidea weyersi* Dautzenberg, 1899 seemed restricted in Tamanjaya only. All are dead specimen which are found in the bottom of small pool . Because of the smallness of the shell, it was difficult to find. It seemed they prefer living in sandy substrate with low salinity around the damaged mangroves.

Cerithidea quadrata Sowerby, 1866 is a good climber. In Cilintang a snail was found climbing and attached to the stem 193 cm above the ground. They also found in Cikawung attached to the stem of *Acanthus ilicifolius* which covered with numerous sharp spine. It seemed they can live in sandy or muddy substrate and also tolerate at wide range of salinity, both at the good or damaged mangrove vegetation.

Both of the *Cerithidea* found have a thinner shell and almost transparent. A thinner shell usually has a light weight, so the animal could carry their shell easily while they climbing up the roots. This character is better adapted to tree-climbing behavior which apparently connected with avoidance from predatory fish and crab that enter the forest at high tide (Houbrick, 1984; Reid *et al.*, 2008). The snail found attached to the mangrove's stem or root using the mucus they secreted. It will attached the apertural lip to the stem above, when it dried. *Cerithidea* feeds on algae growing at the roots and stems of mangroves (Houbrick, 1984).

Possibly another *C. weyersi* living snail in Tamanjaya could be found climbing roots or stems. This species perhaps a rare one, difficult to find. Wells (1983) found only in 1 from 12 stations he observed in Hongkong. Again, this was proven if *C. weyersi* is rarely and difficult to find.

About 6 spiral ribs presents in the whorl of *C. quadrata.* 1-3 dark brown, while 4-6 bright brown. But this character not found in *C. weyersi* whose only axial ribs on their whorl. There are seven living *Cerithidea* around Indo-Pasific (Houbrick, 1984; Reid *et al.*, 2008). Five other species which not found are *C. anticipata, C. decollata, C. obtusa, C. rhizophorarum* and *C. largillerti*

Previous studies have also found *C. quadrata* in Cilacap. Outside Java, both species also found in Way Sekampung-Lampung, but only *C. quadrata* which also found in Batumenyan-Lampung and Malili-South Sulawesi (Sabar *et al.*,1979).

CONCLUSION

This study has found four genera and seven species of Potamididae, whereas previous study in Panaitan and Handeuleum only found three genera and four species, therefore it has added a new information from obtaining one genus (*Cerithidea*) of three species, namely *Cerithidea weyersi, C. quadrata* and *Cerithideopsilla alata*.

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