

**NEW RECORD OF SOME FRESHWATER MUSSELS (BIVALVIA: UNIONIDAE)
FROM NORTH-EAST BANGLADESH**

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Abstract: A total of 6 species of freshwater mussels under the family Unionidae, order- Unionoida were collected, which are new records for Bangladesh. The information on the distribution and ecology, population density and seasonal variation of *Lamellidens phenchoogarjensis*, *L. indawgyiensis*, *L. generosus*, *Parreysia (Parreysia) favidens* var. *assamensis*, *P. (P.)* var. *marcens* and *P. (P.)* var. *viridula* were provided in this paper. Population density and morphometric parameters were measured. Moreover, economic importance and economic role were stated.

Key words: Freshwater Mussels, Bivalvia, Unionidae, Bangladesh, new records.

INTRODUCTION

Freshwater mussels of the bivalves under order Unionoida have world wide distribution, presently occurring on all non glaciated continents in all types of inland waters. Estimates of global freshwater mussel diversity have in the modern era ranged from less than 850 to 1200 species (Cumming and Graft 2005). Most species are lotic but many species are well suited for lentic environments. The unionids are unique among mussels, having obligate parasitic larval stage on gills, fins or sides of a host fish (Wachtler *et al.* 2001). Majority of the mussels are infaunal organisms burrowing into substrates varying from sand to gravel but few species exploit the exposed hard surface by attaching to hard surface with byssal threads.

Freshwater mussels are important to both man and the aquatic environment. In one hand, they are filter feeders and act as a natural water cleaners and indicators of water quality (Hua Dan *et al.* 2001). On the other hand, they are edible to both human and animals. Bivalves remove suspended algae and Particular Organic Matter (POM) from the water column. Mussels process large volumes of water and therefore exposed to dissolved toxic substances such as heavy metals (Imlay 1982, Metcalfe and Green 1992,). Freshwater mussel communities are important components of food webs and they link to multiple trophic levels.

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Our knowledge on freshwater mussels of Bangladesh is very scanty. Ali and Begum (1976) described only four species of bivalves from Dhaka city. Begum *et al.* (1989) reported 10 species of freshwater mussels from Bangladesh. Begum *et al.* (1990) studied on pearl culture in freshwater mussel *L. marginalis* in Fisheries Research Institute Pond, Mymensingh. Recently Siddiqui *et al.* (2007) described 6 freshwater mussel species of Bangladesh in their book.

Some studies on ecology, population density, conservation, biodiversity and economic importance of freshwater mussel of the world have been reported by Vaughn and Pyron (1995), Vaughn *et al.* (2008), Outeiro *et al.* (2008) and Prez-Quintero (2011). The present study was to identify, morphometrics, population density and economic importance of freshwater mussel collected from Brahmanbaria, Comilla, Habiganj, Moulvibazar, Sylhet and Sunamganj districts of North-East Bangladesh

MATERIAL AND METHODS

Study area: The Northeastern region of Bangladesh includes the present districts of Brahmanbaria, Comilla, Habiganj, Moulvibazar, Sylhet and Sunamganj. This region covers a land area of 13,938.65 sq.km situated between 23°2' to 25°2' N latitude and longitude 91°7' to 92°41' E. The region abounds in freshwater systems including wetlands in the floodplains crossed by rivers like Surma, Khusiyara, Peeyain, Saree, Gowain, Khowai, Sonai, Meghana, Titas, Gomoti and their tributaries, tanks, streams, pools and marsh lands (Fig 1).

Triplicate sampling were done in ponds from each districts of Brahmanbaria, Comilla, Habiganj, Maulvibazar and Sylhet and five sampling sites each in the river Surma, Khusiyara, Ratna, Titas and Gomoti representing lotic habitat. From each site three quadrates of 1m² area were taken according to the depth of water (*viz.* 0-50cm, 50-100cm and 100-200cm) in respect of Summer, Monsoon and Winter season. A total of 540 quadrates were explored in course of two years (2005-2007) study period.

Collection method: Mussels were collected by hand dredge. By hand picking in cases of bigger specimens from the small ponds and slow moving river. In small ponds the collection made by scooping the bottom mud and then put into sieve and washed with water. Some cases in river samples were collected by Ekman dredge.

Cleaning: Mussels shells were washed and cleaned by (i) Bleaching method: 300 grams of bleaching powder was dissolved in 4 liters of tap water. Shells were left for 24 hours. After the shells were taken on a tray and cleaned foreign particles (sand, mud *etc.*) by using brush and rewashed. After washing the shells were dried in sunlight. (ii) HCl acid wash: A mixture of concentrated

hydrochloric acid and water in ratio of 1:7 was prepared. Treatment time depends upon the thickness and dirtiness of the shells. After acid wash the shells were dried in sunlight.



Fig 1. Map of Northeastern region indicating sampling sites

Preservation: For biometric analysis mussels were preserved in the 70% ethyl alcohol in plastic jars for further studies.

Identification: Dry shells were separated on the basis of similarities and dissimilarities of characters and packed in small polythene bags and records

were maintained. Then following books *viz.*, Preston (1915), Subba (1989) and Ramakrishna and Dey (2007) were consulted for identification of species and confirmed from the Mollusca Division of the Zoological Survey of India, Kolkata.

Morphometrics: Various morphometric measurements were taken with the help of a divider and slide calipers from randomly collected species from the natural habitats. Photographs were taken by Olympus FE-230.

RESULTS AND DISCUSSION

Six freshwater mussel species belonging to the two genera of Unionidae family, order-Unionida under class Bivalvia were recorded for the first time from Bangladesh. The species were *Lamellidens phenchooganjensis*, *L. indawgyiensis*, *L. generosus*, *Parreysia (Parreysia) favidens var. assamensis*, *P. (P.) var. marcens* and *P. (P.) var. viridula*. Population densities are presented in the Table 1.

The population density of *L. phenchooganjensis* was found highest (2.66/m²) in winter in Khushiyara River and lowest (0.22/m²) in monsoon and summer in both Khusyara and Ratna River. *L. generosus* was found only in a pond of Habiganj. The population density of *L. generosus* was highest (1.60/m²) in winter and lowest (0.66/m²) in monsoon in the same pond of Habiganj. *L. indawgyiensis*, *P. favidens var. assamensis*, *P. (P.) favidens var. marcens*, *P. favidens var. viridula* were found sporadic in distribution. So their population density could not be recorded.

Identification key of mussels species found in the north eastern region of Bangladesh.

Key to Class Bivalvia

- 1 Shell internally nacreous (2)
- Shell internally non-nacreous (3)
- 2 Beak sculpter concentric-radial and rudimentary; only two outer gills marsupials *Unionidae*
- Beak sculpture radial and well developed; all four gills marsupials *Amblemidae*
- 3 Shell thick, and strong, with strong and blunt ribbing, above 10mm thickness *Corbiculidae*
- Shell thin, and fragile, with fine ribbings, below 10mm thickness (4)

Table 1. Population densities of *Lamellidens phenchooganjensis*, *L. indawgyiensis*, and *L. generosus* in different habitat and season

Species & habitats	<i>L. phenchooganjensis</i>				<i>L. indawgyiensis</i>				<i>L. generosus</i>			
	Summer	Monsoon	Winter		Summer	Monsoon	Winter		Summer	Monsoon	Winter	
Pond Sylhet	-	NF	-		NF	NF	NF		NF	NF	NF	
Pond Habiganj	NF	NF	NF		NF	NF	NF		1.05 ± 0.27	0.66 ± 0.22	1.60 ± 0.38	
Surma	1.16 ± 0.27	-	2.13 ± 0.25		SF	-	SF					
Khusyara	0.22 ± 0.22	0.42 ± 0.09	2.66 ± 1.11		-	-	-					
Ratna	1.10 ± 0.11	0.22 ± 0.22	0.55 ± 0.55									
Titas	0.60 ± 0.38	0.33 ± 0.33	0.33 ± 0.33									
Gomti	-	-	-		-	-	-		-	-	-	

NF- Not found, SF- Sporadic found

Family: Unionidae

Key to the species

- 1 Posterior wing developed*L. generosus* (Gould)
- Posterior wing feebly developed or absent (2)
- 2 Posterior end elongate, shell narrow (3)
- Posterior end not elongate, gradually sloped, shell broad (4)
- 3 Shell elongately ovate, less thick umbones flat, anterior side angled, posterior margin obtusely rounded*L. phenchooganjensis* Preston
- Shell transversely elongated, thick broader umbones, more distinct and convex, anterior end short and rounded, posterior side sloping*L. jenkinsianus* (Benson)
- 4 Shell broad, dorsal margin obliquely truncatate posterior end *L. consobrinus* (Lea)
- Shell narrower, dorsal margin gradually sloping posterior (5)
- 5 Umbo prominent, colour brown with a lighter band along the margin*L. marginalis* (Lamarck)
- Umbo less prominent, colour uniformly dark *L. corrianus*

Family: AmblemidaeGenus: *Parreysia*

Key to Subgenera

- 1 Shell oval to elliptical, centre of ventral margin swollen, thick, strong beak sculpture*Parreysia* s.str
- Shell elongate, with almost straight ventral margin, comparatively thin, sculpture not so strong*Radiatula* Simpson

Subgenus - *Parreysia* s.str.

Key to Species

- 1 Central teeth very strong, 3 or more in number*P. favidens* (Benson)
- Central teeth very strong, less than 3 in numbers *P. corrugata* (Mueller)

Species 1. *Lammelidens phenchooganjensis* Preston, 1912**Synonyms:**

1915. *Lamellidens phenchooganjensis* Preston, *The Fauna of British India including Ceylon and Burma, Mollusca* (Freshwater Gastropoda and Pelecypoda) London. Taylor and Francis, p 190.

English name: Freshwater mussel

Local name: Jhinuk, Chinai, Jhinai and Kafna

Description: Shell very elongate ovate. Pictorially obtusely rostrate dark blackish-brown, with umbones flat, much enrolled, anterior side angled above,

gently rounded below posterior margin obtusely rounded antero-dorsal margin gently sloping, Postero-dorsal margin more rapidly sloping in slight curve. Anterior scars ovate moderately impressed; Posterior scars roughly triangular, not well impressed; interior of shell shading from plate brown to bluish, nacreous, and marked especially towards the anterior ventral region, with very shallow radiate furrows.

Size: Average adult valve length of shell and width are 87.33 ± 15.85 and 43.66 ± 8.04 mm respectively.

Habit: Filter feeder, feeds on microscopic plants (diatoms), animals (Protozoa, water fleas, etc.) and organic detritus brought in current of water caused by ciliary movement.

Habitat: Found in rivers, haors, beel and streams. They are more abundant near the bank and bottom of the river.

Population density: The estimated population density of the mussel was highest minimum ($2.66/\text{m}^2$) in winter in Khushyara River, Sylhet and minimum ($0.22/\text{m}^2$) in summer in Khushyara River and Monsoon in Ratna Rive, Habiganj.

Distribution: Brahmanbaria, Habiganj, Maulvibazar and Sylhet Districts.

Elsewhere: India

Economic importance: Mussels flesh used as poultry feed. The shell is also used for ornamental inlay work, lime production, making buttons, knife handles etc.

Ecological role: They are filter feeder and act as natural water cleaner and indicator of water quality conditions.

Species 2. *Lamellidens indawgyiensis* Prasad, 1930

Synonyms:

1930. *Lamellidens indawgyiensis*, Prasad, *Rec. Indian Mus.*, **32**: 253, Pl. viii, figs 9, 10.

1989. *Lamellidens indawgyiensis*: Subba Rao, *Hand Book of Fresh Water Molluscs of India*, P. 166, Figs. 408, 409.

English name: Freshwater mussel

Local name: Jhinuk, Chinai, Jhinai and Kafna

Description: Shell large (more than 100mm) elongate-ovate, rather thick, moderately inflated surface with low, concentric ridges, umbones anterior not prominent, dorsal margin almost straight, ventral margin some what arched, anterior end short and broad, posterior rostrate, with well-marked post-dorsal wing.

Size: Average valve of adult shell length and width 106.00 ± 19.80 and 53.05 ± 12.02 mm respectively.

Habit: Filter feeder, feeds on microscopic plants (diatoms), animals (Protozoa, water fleas, etc.) and organic detritus.

Habitat: Found in aquatic habitat *viz.* lakes, rivers and streams. They are more abundant near the bank and bottom of the Beel and river.



Plate 1. 1a. Outer View of *Lamellidens phenchooganjensis* (Scale: Length, 1 mm = 1.27 mm and width, 1 mm = 1.30 mm), 1b Inner View of *L. phenchooganjensis* (Scale: Length, 1 mm = 1.16 mm and width, 1 mm = 1.20 mm), 2a . Outer View of *L. indawgyiensis* (Scale: Length, 1 mm= 1.93 mm and width 1 mm = 2.12 mm), Fig. 2b. Inner View of *L. indawgyiensis* (Scale: Length, 1 mm= 2.03 mm and width, 1 mm = 2.22 mm), 3a. Outer View of *L. generosus* (Scale: Length, 1 mm= 1.12 mm and width 1mm =1.07 mm), Fig. 3b. Inner view of *L. generosus*, (Scale: Length, 1 mm= 1.13 mm and width, 1mm =1.04 mm)

Population density: These individuals were found occasionally; their population density was not determined.

Distribution: Habiganj, Maulvibazar and Sylhet districts.

Elsewhere: Myanmar

Economic importance: Mussel flesh used as shrimp and poultry feed. The shell is also used for ornamental inlay work, lime production, making buttons, knife handles.

Species 3. *Lamellidens generosus* (Gould, 1847)

Synonyms:

1847. *Unio generosus* Gould. *Proc. Boston Soc. nat. Hist.*, 2:220.
 1922. *Lamellidens generosus*: Prasad, *Rec. Indian Mus.* 24: 107, Pl 2, Fig 12-17.
 1989. *Lamellidens generosus*: Subba Rao, *Hand Book of Fresh Water Molluscs of India*, P. 165, Figs. 388, 389.
 2004. *Lamellidens generosus* :Surya Rao, Mookerjee, Mitra, Manna and Barua, *Fauna of Manipur, State Fauna Series*, 10.p.86. *Zool Surv. India*.

English name: Freshwater mussel

Local name: Jhinuk, Chinai, Jhinai and Kafna

Description: Shell solid, oblong-ovate, anterior rounded posteriorly oblique subrostrate, dorsal margin straight, ventral margin arcuate, posterior wing narrow in adults.

Size: Average adult shell length and width about 79.2 ± 20.74 and 43.66 ± 12.34 mm respectively.

Habit: Filter feeder, feeds on microscopic plants (diatoms), Protozoa, water fleas, etc.

Habitat: Found in aquatic habitat *viz.* ponds, lakes, rivers and streams. They are more abundant near the bank and bottom of the river.

Population density: These individuals were found occasionally. So their population density was not determined.

Distribution: Brahmanbaria and Habiganj, Maulvibazar and Sylhet District.

Elsewhere: India, Myanmar.

Economic importance: Mussel flesh used as shrimp and poultry feed. The shell is also used for ornamental inlay work, lime production, making buttons, knife handles, etc. *Lamellidens generosus* are edible food to people of Manipur (States of India).

Species 4. *Parreysia (Parreysia) favidens var. assamensis* Preston, 1912

Synonyms:

1989. *Parreysia (Parreysia) favidens* subsp. *assamensis*: Subba Rao, *Handbook Freshwater Molluscs of India* P. 181, figs. 468, 469.

2000. *Parreysia (Parreysia) favidens* subsp. *Assamensis*: Takur et al. *Fauna of Tripura, State Fauna Series*, 7, p.337, *Zool.Surv. India*.

English name: Freshwater mussel

Local name: Gol jhinuk, Sobuj jhinuk



Plate 2. 4a. Outer view of *Parreysia favidens* var. *assamensis*, Fig. 4b. Inner view of *P. favidens* var. *assamensis* (Scale: Length, 1 mm = 0.68 mm and Width 1 mm = 0.62 mm), Fig. 5a. Outer view of *P. (P.) favidnes* var. *marcens* (Scale: Length, 1 mm = 0.74 mm and width 1 mm = 0.78 mm), 5b. Inner view of *P. (P.) favidens* var. *marcens* (Scale: Length, 1 mm = 0.80 mm and width 1 mm = 0.80 mm), 6a. Outer View of *P. (P.) viridula*, 6b. Inner View of *P. (P.) viridula* (Scale: Length, 1 mm = 0.70 mm and width 1 mm = 0.66 mm).

Description: Shell more convex than typical form, dorsal margin rather less posteriorly angled, anterior side is more rounded and posterior slightly more nuchate.

Size: Average adult valve length and width about 48.33 ± 0.77 and 30.41 ± 3.95 mm respectively.

Habit: Filter feeder, feeds on microscopic plants (diatoms), animals and organic detritus brought in through current of water.

Habitat: The specimens found in aquatic habitat *viz.* lakes, ponds, rivers and streams. It lives nearly buried in mud or sand bottom, with only the posterior tips of the shell valves exposed.

Population density: The species have been collected sporadically. So the population density was not estimated.

Distribution: Brahmonbaria, Comilla and Sylhet Districts.

Elsewhere: Assam: Digong; Bihar: Arrah; Mizoram and Tripura (Indian states).

Economic importance: Mussel's flesh used as shrimp and poultry feed, crushed shell used as poultry feed ingredients. The shell is also used for ornamental inlay work, lime production, making buttons, knife handles, etc.

Ecological role: These mussels are filter feeders and act as natural water cleaner and indicators of water quality conditions.

Species 5. *Parreysia (Parreysia) favidens var. marcens* Benson 1862

Synonyms:

1862. *Unio favidens var. marcens* Benson, *Ann. Mag. nat. Hist.*, **3**(10): 188.

1992. *Parreysia (Parreysia) favidens var. marcens* :Mitra and Dey, *State Fauna Series*, 3: *Fauna of West Bengal*, part **9**:31, Zool.Surv. India.

2005. *Parreysia (Parreysia) favidens var. marcens* :Ramakrishna *et al.*, *Fauna of Andhra Pradesh, State Fauna Series*, 5(Part-5), p.215, Zool.Surv. India.

English name: Freshwater mussel

Local name: Gol jhinuk

Description: Shell large, more elongate dark brown, umbonal region weakly sculptured, posterior margin broadly rounded.

Size: Average adult valve length and width about 52.30 ± 8.02 and 33.44 ± 5.69 mm respectively.

Habit: Filter feeder, feeds on microscopic plants (diatoms), animals and organic detritus brought in through current of water.

Habitat: The specimens found in aquatic habitat *viz.* lakes, rivers and streams. It lives nearly buried in mud or sand bottom, with only the posterior tips of the shell valves exposed.

Population density: The species have been collected sporadically. So the population density was not estimated.

Distribution: Comilla, Sylhet.

Elsewhere: Andra Pradesh: Khammam, Srikakulum, Assam, Maharashtra, West Bengal: Bardhaman, Kolkata.

Economic importance: Mussel's flesh used as shrimp and poultry feed, crushed shell used as poultry feed ingredients. The shell is also used for ornamental inlay work, lime production, making buttons, knife handles, *etc.*

Ecological role: These mussels are filter feeders and acts as natural water cleaner and indicators of water quality conditions.

Species 6. *Parreysia (Perreysia) favidens* var. *viridula* Benson, 1862

Synonyms:

1862. *Parreysia favidens* var. *viridula* Benson, *Ann. Mag. nat. Hist.*, **10**(3): 189.

1989. *Parreysia favidens* var. *viridula* : Subba Rao *Handbook Freshwater Molluscs of India* P. 182, figs. 474, 475.

English name: Freshwater mussel

Local name: Gol Jhinuk

Description: Shell compressed; cardinal teeth broad; nacre bluish white; umbonal rugae strong and extended.

Valve length and width and thickness about 47.5 ± 0.7 and 30.50 ± 0.7 mm respectively.

Habit: They are too filter feeder, feeds on microscopic plants (diatoms), animals and organic detritus brought in through current of water.

Habitat: The specimens found in aquatic habitat *viz.* lakes, rivers and streams. It lives nearly buried in mud or sand bottom, with only the posterior tips of the shell valves exposed.

Population density: The species have been collected sporadic. So the population density was not estimated.

Distribution: Sylhet (Fenchugonj).

Elsewhere: India

Economic importance: Mussel's flesh is uses as shrimp and poultry feed, crushed shell used as poultry feed ingredients. The shell is also used for ornamental inlay work, lime production, making buttons, knife handles, *etc.*

Ecological role: These mussels are filter feeders and acts as natural water cleaner and indicators of water quality conditions.

In the present study and past is total of 22 freshwater bivalves were recorded from the different habitats of Bangladesh. Out of these, ten species were reported by Ali and Begum (1976) and Begum *et al.* (1989). In this study six new records were reported from Bangladesh. *P. (R) caerulea* sub sp. *gaudicaudi*, *P. (R.) occata* and *Pisidium clarkeanum* were reported earlier in Fauna of British India from the study area but did not encounter during the present investigation.

Freshwater mussels are a guild of sedentary, suspension feeding bivalves that perform import functions in lakes and streams (Vaughn and Hakenkamp 2001). These large, long lived invertebrates can be considered ecosystem engineers because they modify habitat, making it more suitable for conspecifics and other organisms (Gutierrez *et al.* 2003 and Spooner and Vaughan 2006). Mussels transfer nutrients and energy from the water column to the sediments through their filtering and stimulate production across trophic levels (Howard and Cuffey 2006, Spooner and Vaughan 2006, Vaughan *et al.* 2007). The decline of bivalve mollusc is driven by habitat degradation and siltation of pond, rivers and other aquatic habitat. Pollution from industries, agriculture and erosion have serious threat to gastropod and mussels. To explore and conservation of freshwater mussel in the Bangladesh is urgently needed and more comprehensive studies should be carried out.

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