

3. REVIEW OF LITERATURE

3.1 Importance of Molluscs

Aquatic ecosystem provides a home to various kinds of biota, including phytoplanktons, zooplanktons, aquatic plants, insects, molluscs etc. They are organized at many levels from smallest building blocks of life to complete ecosystems, encompassing communities, populations, species and genetic levels. The representatives of phylum Arthropoda and Mollusca generally colonize all aquatic ecosystems around the globe. The meaning of “Mollusca” is "Soft bodied animal", (from the Latin word “**Mollis**”, the word mollusca was derived, which means “**Soft**”). On the other hand, by the way, the field of biology dealing with molluscs is called “Malacology”. From the Greek word “**Malakos**”, the word malacology was derived, it bears the meaning also soft (Nordsieck, 2012). Mollusca, the second largest metazoan taxon after arthropoda. Molluscs consist of Aplacophora, Polyplacophora, Monoplacophora, Gastropoda, Cephalopoda, Bivalvia, and Scaphopoda. There are about 55,400 numbers (no.) of molluscan community were reported to be available in this world. Among these molluscan community “Gastropods” confirm their lion share (43,000 no.), followed by “Bivalvia” (10,000 no.), “Cephalopoda” (650 no.) and others groups (Nordsieck, 2012). According to the archaeological findings, molluscs have been used since the dawn of humankind. Mussels and later snails were collected for eating, as well as for the fabrication of different types of furniture and household items. Today regarding their commercial significance, people are thinking about their sustainable development at the farms in several parts of the world. Even today, certain ethnic groups use sea shells as ceremonial trumpets (Nordsieck, 2012). However in West Bengal, *Bellamyia bengalensis*

regarded as dominating fresh water gastropod (according to demand and economical importance) followed by *Lamellidens* spp. (bivalvia).

3.2 Taxonomical and biological features of *Bellamyia bengalensis* and its allied Genera

Mollusca is the dominant group of animal among the benthic inhabitant. Benthic invertebrates occupy the bottom of water body. The functional role of benthic communities in the trophic dynamics of aquatic ecosystem is well acknowledged. The composition, distribution of these benthic organisms over a period of time provide index of the ecosystem (Pir *et.al.*,2010). Regarding taxonomical and distributional work of this fresh water snail Choubisa (1992) collected 32 species of molluscs from various freshwater habitats of southern Rajasthan. Where as Clarke (1979) attempted to show the utility of molluscs in primary classification of the rivers in their various trophic stages.

3.2.1 Systematic Position

Kingdom:	Animalia
Phylum:	Mollusca
Subphylum:	Conchifera
Class:	Gastropoda
Subclass:	Prosobranchiata
Order:	Caenogastropoda
Suborder:	Mesogastropoda
Family:	Viviparidae
Subfamily:	Bellamyinae
Genus:	<i>Bellamyia</i>
Species:	<i>B. bengalensis</i> (Lamarck)

3.2.2 Synonyms

Vivipara bengalensis Preston (1915), *Filopaludina (Filopaludina) bengalensis* (whilst Nesemann *et al.* 2007).

3.2.2.1 Taxonomic Note

Brandt (1974) treated *Bellamyia bengalensis* as *Filopaludina (Filopaludina) bengalensis* while Neesemann *et.al.* (2007) treat *B. bengalensis* as *Bellamyia (Filopaludina) bengalensis* (Lamarck, 1822). Based on the shell characteristics 22 forms have been recognized by Annandale (1921), including *B. bengalensis f. balteata*, *B. bengalensis f. typica*, *B. bengalensis f. annandalei*, *B. bengalensis f. mandiensis*, *B. bengalensis f. colairensis*, *B. bengalensis f. doliaris*, *B. bengalensis f. nepalensis* and *B. bengalensis f. eburnea* etc.

3.2.3 Geographical Distribution

Bellamyia bengalensis is a hardy, common freshwater mollusc which is widely distributed in south-east Asia. Found in both lentic and lotic habitat. It is found in both lentic and lotic habitats in India (Andaman and Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chandigarh, Dadra-Nagar-Haveli, Daman and Diu, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu-Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Mahe, Manipur, Meghalaya, Mizoram, Nagaland, Odissa, Pondicherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttaranchal, Uttar Pradesh, **West Bengal**), Bangladesh, Iran, Islamic Republic of Myanmar, Nepal, Pakistan, Sri Lanka etc (Ali and Chakraborty, 1992; Budha, *et.al.* 2010; Saha *et. al.*, 2013).

3.2.4 Population

Population size and trends of this species is not well known. However, it is a common and abundant species found in high numbers in all kinds of freshwater bodies (Budha, *et.al.* 2010).

3.2.5 Habitat and Ecology

This species is present, in almost all types of lowland water bodies, mainly stagnant water and low saline water resources such as rivers, streams, lakes, ponds, wetlands, marshes, ditches, paddy fields, etc. It can tolerate a maximum level of salinity of 0.2 mg/l (Ramakrishna and Dey, 2007, Budha *et.al.*2010, Saha *et.al.*, 2013).

3.2.6 Diagnostic characters

The shell of *B. bengalensis* is more or less oval in shape and acuminate which consist of calcareous shell. The upper part of the shell is slightly conoidal. The body whorl is evenly convex in pro-file. The aperture is sub-circular and has a narrow black margin. It is slightly oblique. The umbilicus is narrow (Saha *et.al.*, 2013). Beside these typical characters of the molluscs, it consists head with mouth and sense organs, eye, one gill, one nephrdium, and one atrium are present. A visceral mass containing gut, heart, gonads, kidney, tentacles, a ventral muscular foot, a shell mantle and radula. *B. bengalensis* has operculum, this operculum is moderately thin, deep brownish complexion with teardrop-shaped disk of flexible protein that forms a door close like aperture. The external surface of operculum is convex, the outer margin is strongly curved, the inner margin is slightly sinuate and the posterior margin bluntly pointed. It has two long cephalic tentacles which are located dorsally beside the base of the snout (Ghobadi. and Farahnak., 2004). The colouration varies considerably but it is never brilliant (Saha *et.al.*, 2013). The ground colour is greenish gray and opaque. The brown dark bands are variable and irregular. As this snail is viviparous, the females release fully developed small snails, hence it is commonly called as "live-bearing snail"

3.2.7 Use and trade

Bellamya bengalensis is commonly used as food in Nepal, Bangladesh. In India it was observed for commonly use in Bihar, Jharkhand, Meghalaya, Odisha and West Bengal (Baby *et al.* 2010; Mahata, 2012, Chakraborty *et al.* 2014).

3.2.8 Assessment Information

Bellamya bengalensis is very common species for selling and edible purpose and it also poses ethno medicinal values mainly to the rural people. This fresh water snail carries indispensable nutrients in very cheap rate in term of money than other edible animal sources (fish, meat, egg etc) (Mukherjee and Basu,2008). This species is harvested from the different kinds of water bodies. At current levels, this species is assessed as “Least Concern” as per IUCN categories red list categories Ver. 3.1 (Budha, *et.al.*2010).

3.2.9 Characteristic features of other *Bellamya* Genera

The typical characteristic features of these viviparous snails that, they are not amphibious in nature, do not have lung, do not respire in air, and do not lay eggs. There are several types of *Bellamya (Vivipera)* species and they are differ from each other by their shell structures, shape of the apex, colour pattern etc. However, in some times identification becomes difficult due to unclear and contradicting descriptions in the literatures (Falkner 1989; Falniowski *et. al.* 1998; Glöer 2002). There are various other more or less similar species of *Viviparus* and related genera, especially, southeastern Europe and Asia. Shells of *Bellamya (Cipangopaludina) chinensis* and *B. (C.) japonica* (Asian viviparid species introduced in North America) are somewhat similar, especially *B. japonica* has acute apex, but differ, among others, by their unbranded shells and

different of the first whorls (Khan and Chaudhuri,1984). Beside *Bellamyia bengalensis* there are another species *Bellamyia crassa* which is made of strong sub-globe shell and it is riverine form which occurs in river with sandy bed, at lower part of this state. This species observed only in the Churni river at Nadia, West Bengal (Thakur and Mitra. 1992). But as per the 1996, IUCN Red List *B. crassa* was declared as threatened specimen (Nesemann *et. al.* 2007).

3.3 Ecological Importance of *Bellamyia bengalensis*

Bellamyia bengalensis have great significance role in aquatic ecology. Because they form the food of fishes and their productivity play an important link in the food chain. *Bellamyia bengalensis* are mainly filter feeder and detritivore, that's why they can able to form an important link in the food chain. On account of their ability to convert low quality and low energy detritus into better quality food for higher organisms in the food web with the unfolding of importance of benthos in food chain. And thus benthic productivity has been correlated with fish resources. Especially these snail communities are the good indicators of localized conditions, indicating the water quality. The presence of thriving populations of *B. bengalensis* indicates, the aquatic body is not acidic, hardly this species survive beyond a pH of 5 (Browne, 1978).

3.4 Behavioral pattern of *B. bengalensis*

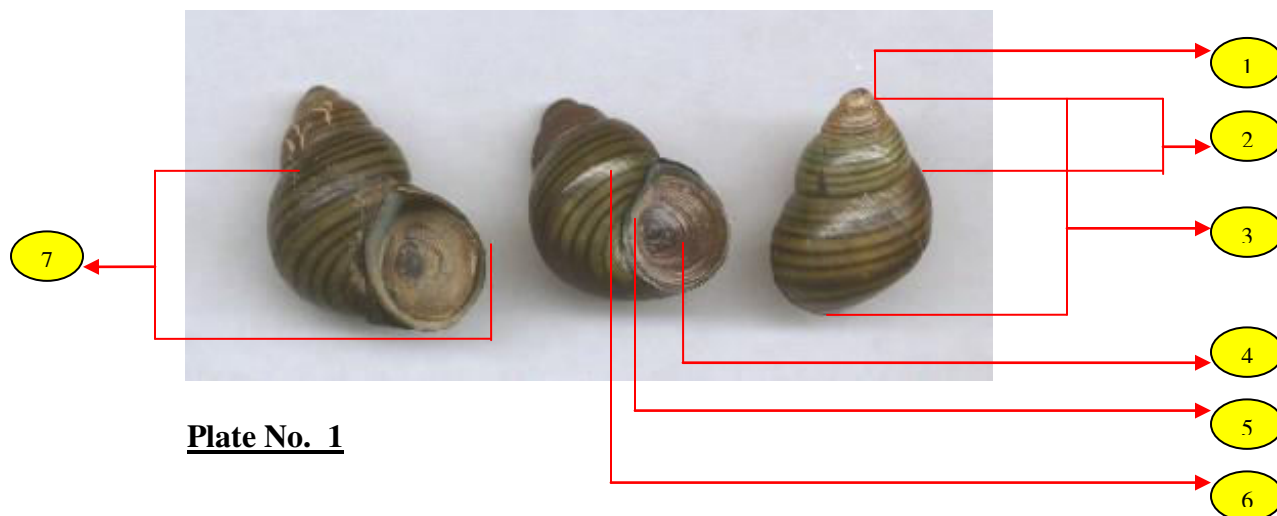
In nature *B. bengalensis* distributed from the shore line to 3 m depth, in all types of sediments. Higher abundance of snails with increased water, temperature and decomposed organic matter has been also reported by Bath *et.al.* (1999).

Several authors (Shrivastava,1956 and 1959; Michael, 1968; Gupta,1976; Krishnamoorthi, 1979 and Sharma, 2006) observed *Vivipara (B.) bengalensis* as one of

the major species among the aquatic benthic fauna. Another interesting point is, this snail communities are good indicators of localized conditions, indicating the water quality. It was observed that viviparids are gonochoric. Here females of *B.bengalensis* retain and gestate eggs in an enlarged uterine region of the pallial oviduct. Large shelled juveniles are released by the female at short intervals (Tanveer, 1992).

3.5 Bio-economical aspects of *B. bengalensis* towards its industrial significance

It was previously stated that, neither in India nor in West Bengal commercial utilization of *Bellamyia bengalensis* was noticed, till now. But regarding, ethno medicinal importance of this snail (Pravakar and Roy,2008), people of the north-eastern sector of India was observed to take this snail as their edible item. Not only of its cheap rate compared to other commodities but also it has good nutritional value compared to the other edible commodities (Mukherjee and Basu, 2008). But till now, no any detailed study was observed, regarding the marketing, nutritional and value addition aspects of *B. bengalensis*, towards its commercialization.



Terminology

1- Apex

4- Operculum

7- Width of shell

2- Spire

5- Umbilicus

3- length of shell

6- Body whorl