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Distribution of freshwater Mollusca in Koothaippar wetland ecosystem Tiruchirappalli District Tamil Nadu

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Abstract

Freshwater Mollusca form an important animal group of the wetland ecosystems. The distribution and availability in terms of number of species needs scientific attention. Present study is an attempt to document the available Molluscan forms in Koothaippar wetlands of Tiruchirappalli District. This study was carried out between summer 2013 to post-monsoon 2017. Nine species were recorded and among them 6 species belong to Gastropoda representing 2 orders, 3 families, 3 genera while 3 species were bivalves representing 1 order, 1 family and 2 genera. Bellamya bengalensis, Lamellidens marginalis and Pila globosa were the predominantly present molluscan fauna and are distributed throughout the year. Five species of Molluscan fauna *(Pila virens, Pila scutata, Bellamya dissimilis, Indoplanorbis exustus and Lamellidens corrianus)* are less abundant and *Parreysia favidens* was found to be rare species of the ecosystem. These Molluscan forms, representing different families ranging from 34% of Ampullariidae, 33% of Unionoida, 22% of Viviparoidae and 11% of Planorbidae. Percent distribution of these shelled organisms indicate that they represent 3 orders viz., 56% of Architaenioglossa, 33% of Unionoida and 11% of Hygrophila.

Keywords: Checklist; Distribution; Freshwater Molluscan; Koothaippar wetland

1. Introduction

Global freshwater is the most precious human resource covering about 75% of the globe, but most of the water is saline. Less than 5% of water is fresh and much of this water is in the ice caps, glaciers and groundwater. Most of the remainder is in lakes, streams and soil moisture. All life depends on water and exists in nature in many forms like ocean, river, lake, cloud, rain, snow and fog. Lakes, one of the wetlands are highly complex water, land interactive system, and the most fertile productive ecosystems in the world. Aquatic ecosystem provides habitat for many varieties of life forms such as phytoplankton, zooplankton, aquatic plants, insects and Molluscan fauna. India has a total of 27, 403 wetlands of which 23,444 are inland with major river systems. Wetlands are one of the most productive ecosystems in the world which are natural or artificial, permanent or temporary water bodies with water that is static or running (Hilton and Phillips, 1982; Wetzel, 2001; Tuzen *et al.,* 2002; Sulekh Chandra, *et al.,* 2012; Parameswara Naik, 2012 and Rajakumar, 2012). Molluscan forms are one of the most threatened major taxonomic groups worldwide, comprising 42% and they are taxonomically classified into 7 classes, namely Aplacophora, Polyplacophora, Monoplacophora, Gastropoda, Bivalvia, Scaphopoda and Cephalopoda in diverse habitats and is generally categorized into freshwater, marine and terrestrial forms.

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Freshwater Molluscan play an essential role in the maintenance of wetland ecosystems due to their action on water quality and nutrient balance by their filtration activity and algae-grazing and they are the major food source for several fish species, birds, and other animals. They play a significant role in aquatic ecosystems and species like *Bellamya bengalensis, Pila virens and Lamellidens marginalis* are proven food species for many of the aquatic animals and human beings. Besides, *Lamellidens marginalis* and *Lamellidens corrianus* have also been used to produce pearls in some parts of India. Out of the seven classes of Molluscan forms, Gastropoda is the largest and most diverse class comprising 65000 to 75000 species including marine, freshwater and terrestrial forms many of which are important to man. They feed on algae, zooplankton and organic wastes and provide food for many types of fishes, birds and human beings. They play an important role in the freshwater ecosystem by providing food for many animals and by grazing on vast amounts of algae and detritus matter (Subba Rao and Dey, 1989; Vaught, 1989; Tulp *et al.*, 2010; Dillon, 2000; Agudo Padron, 2011 and Szabo and Amesbury, 2011 and Tacon and Metian, 2013). Koothaippar wetland is one such unique natural wetland ecosystem known for its agricultural and socio-economic importance, distributed in about 16 km length and 6 km width in the Tiruchirappalli District. There are 8 outlets in both the regions of the lake through which more than 25,000 acres of agricultural fields are getting irrigated. It provides a good natural habitat and an excellent feeding (foraging) ground for many waterbirds. This study is designed with the following objectives to fulfill the lacuna.

To survey, identify and to make a checklist of the available Molluscan forms

Classification of the species into families and orders.

2. Material and methods

2.1. Study area

Koothaippar Lake is situated 15 km South of Tiruchirappalli District (10°47'50''N; 78°46'16''E), Tamil Nadu, South India (Fig.1.). There are many small villages and towns on all sides of the lake which are dependent for their agricultural and domestic use. There are eight outlets in the lake through which more than twenty-five thousand acres of fields are getting irrigated. The lake is under the control of the Public Works Department. It offers a wide variety of microhabitats that provides suitable substrates for water birds. This lake is an attraction for many migratory birds such as Cormorants, Indian Darter, Asian Openbill Stork, White Ibis, Spotbill Duck and Pintail Duck. Besides, it also supports an enriched distribution of freshwater Molluscan forms. The Koothaippar lake and its watershed regions are situated in the rain shadow regions for southwest monsoon (June – August) and receive northeast monsoon (September – December) only. The climate is subtropical. Hot weather prevails from March to June, and the maximum temperature varies from 38 °C to 40 °C.

2.1.1. Regions of the lake

Based on the depth contour, distribution of aquatic vegetation (which plays a major role in the faunal distribution in the lake) and human disturbance, two regions [Region I (RI) and Region II (RII)] were demarcated in the lake artificially by imaginary boundaries for the present study.

Region I

This region is of open, shallow water and extends for about 5 km. It is highly polluted by domestic sewage and characterized by thick aquatic vegetation and dominated by *Ipomea aquatica*, *Cyperus* sp. and *Acacia* sp. This is nearer to the inlet of the lake. Cattle grazing is a major disturbance in this region. (Fig 2).

Region II

This region is of open, deep water habitat extending for about 5 km. On its western side patches of *Cyperus* sp. predominate. (Fig 2.1.).

2.1.2. Study period

The study was conducted and data were collected throughout the year from summer 2013 to post-monsoon 2017 to cover four seasons *viz.,* pre-monsoon (August and September), monsoon (October - December), post-monsoon (January – March) and summer (April-July) consecutively for four years.

2.1.3. Freshwater Molluscan Studies

Molluscan forms were collected from the bottom sediment using dredge (Peterson grab). In addition to this, they were also collected from the aquatic vegetation and from the floating objects. A scoop-net (30 cm × 30 cm frame of steel bars), wire netting, a scoop (10 cm deep with 8 cm wide blade soldered to the frame), and a wooden handle was used for the collection of Molluscan species on aquatic vegetation. The hand net or scoop net was dragged over the aquatic vegetation, and when it is filled with aquatic weeds, the contents were poured out on a spread - out cloth piece. Molluscan species were picked up with a pair of forceps from the weeds. While making the collections care is taken to use, boot and never with barefoot and hands and arms were repeatedly cleaned with 70% ethanol if bare hands were used to collect the Molluscan forms.

2.1.4. Fixation and preservation of Molluscan species

Identification of Molluscan species was not entirely based on shell characters alone especially for the members of the family Lymnaeidae as it is difficult to identify them by shell characters alone. Morphological details like the structure of radula, shape of the prostate gland were also examined to arrive at an accurate identification of a species. For this purpose, the soft parts of the animals were preserved along with the shell. Molluscan forms collected were placed in an enamel tray with source water. Finely powdered menthol was sprinkled over the water surface and covered by a suitable lid. The specimens were left for 24 hours. After narcotization, the snails have preserved inn 70 % ethyl alcohol.

2.1.5. Preparation of dry shell

After narcotization, the animal was extracted from the shell with a pair of curved forceps. Empty shells were boiled in water for about 30 minutes to an hour, to remove any soft tissues sticking inside the shell. The shells were further cleaned with a smooth brush and then dried in the air. In the case of operculate shells, operculum was retained by pasting it to the cotton wool plug inserted into the aperture of the shell. Dry shells were packed in the cotton wool in the small glass vials or the tubs or cardboard boxes depending upon the size of the shell. The packages were labelled with the relevant details such as place of collection, date and time of collection.

2.1.6. Collection of Molluscan species

Specimens were collected by handpicking method from dry parts of the regions, where water was shallow and hence scoop net was used. All the samples were transported to the laboratory in large plastic bottles. They were washed, counted, photographed, taxonomically identified and documented (Subba Rao, 1989). 1^3 (1 × 1 × 1) foot, quadrates were laid at the study area and Molluscan samples were collected, separated and the dead and live were brought to the laboratory for further identification. Quadrates are small plots of uniform shape and size, placed randomly in selected foraging sites for sampling purposes. The number of quadrates laid was based on the size of the foraging ground. Molluscan shells were collected by handpicking, scraping method. The shells were washed with water to remove adhering debris without damaging and then dried. The collected Molluscan specimens were identified with morphological characters. The gastropods were mainly identified based on the spire length and shape, mouth opening, operculum, umbilicus, colour and ornamentation and bivalves on the nature of hinge, interlocking dentition, with referred to elsewhere Subba Rao (2011), Ramakrishna and Dey (2010), Venkatraman and Venkatraman (2012) respectively.

2.1.7. Wet micro Molluscans

Wet specimens for anatomical study may be stored in a variety of preservatives, whereas for molecular work strong (>95 %) ethanol or freezing in liquid nitrogen at -190 ºC are the best preservatives. The particular fluid medium (e.g., water, ethanol, formalin, and gluteraldehyde) has little effect on the mechanics of the handling techniques.
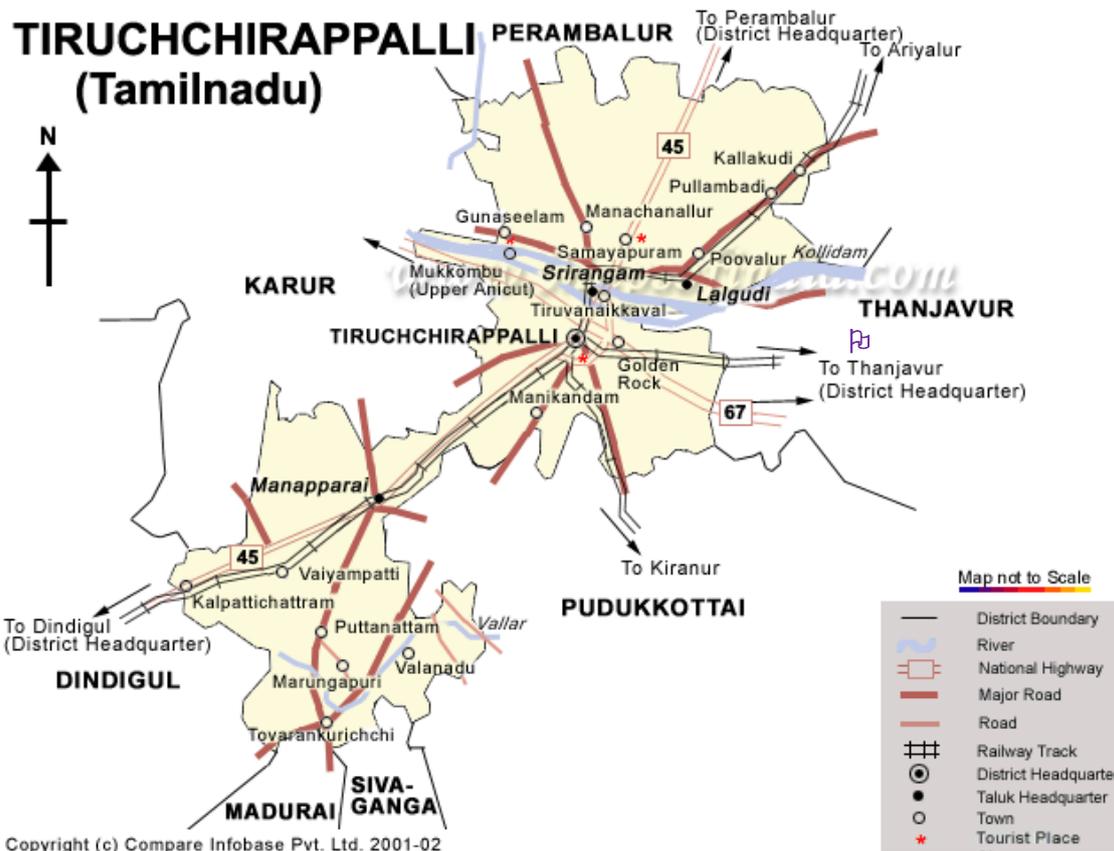
Figure 1 Study Area

☐ Indicates the location of the Koothaippar Lake at Tiruchirappalli

3. Results and discussion

3.1. Freshwater Molluscan forms

Documentation of different species of freshwater Molluscan forms from two different regions of Koothaippar wetland ecosystems of Tiruchirappalli District was done to understand its distribution as the study on this particular aspect is scarce and wanted. Totally nine species of freshwater Molluscan forms were recorded during the study period (2013 Summer to 2017 Post-monsoon), covering four seasons (Summer- April, May, June), (Pre-monsoon-July, August, September), (Monsoon - October, November, December) and (Post-monsoon – January, February and March. Out of which six species from Gastropoda and three species from Bivalvia were documented (Fig. 3.).

These freshwater Molluscan forms were representing four families (Ampullariidae, Planorbidae, Unionidae and Vivipariidae) belonging to five genera (Bellamya, Indoplanorbis, Lamellidens, Pila and Parreysia). Percentage distribution (Family-wise) of freshwater Molluscan forms revealed that 34 % are from Ampullariidae, 33 % of Unionoidae, 22 % of Viviparoidae and 11 % of Planorbidae (Fig. 4.). Further the distribution of the orders of these Molluscan forms reveals that the distribution is 56 %, representing the order Architaenioglossa, 33 % of Unionoida and 11 % of Hygrophila (Fig. 5.).

Identification of Molluscan species is carried out based on the size, shape, morphology, individual character and life history. 9 species of freshwater Molluscan forms were identified with the help of the standard identification manual (Subba Rao, 1989). *Bellamya bengalensis, Lamellidens marginalis* and *Pila globosa* were documented as the predominant species and are found to be present throughout the study period while the other five species of Molluscan forms *Pila virens, Pila scutata, Bellamya bengalensis, Indoplanorbis exustus* and *Lamellidens corrianus were* found to be less abundant and *Parreysia favidens* was classified as a rare species in this ecosystem. (Table.1.). Overall highest number of species was found during the summer season and lowest numbers were found during the winter season.

Figure 2 Views Of Study Area In Region I Koothaippar Wetland Ecosystem During The Study Period

Figure 3 Views Of Study Area In Region II Koothaippar Wetland Ecosystem During The Study Period
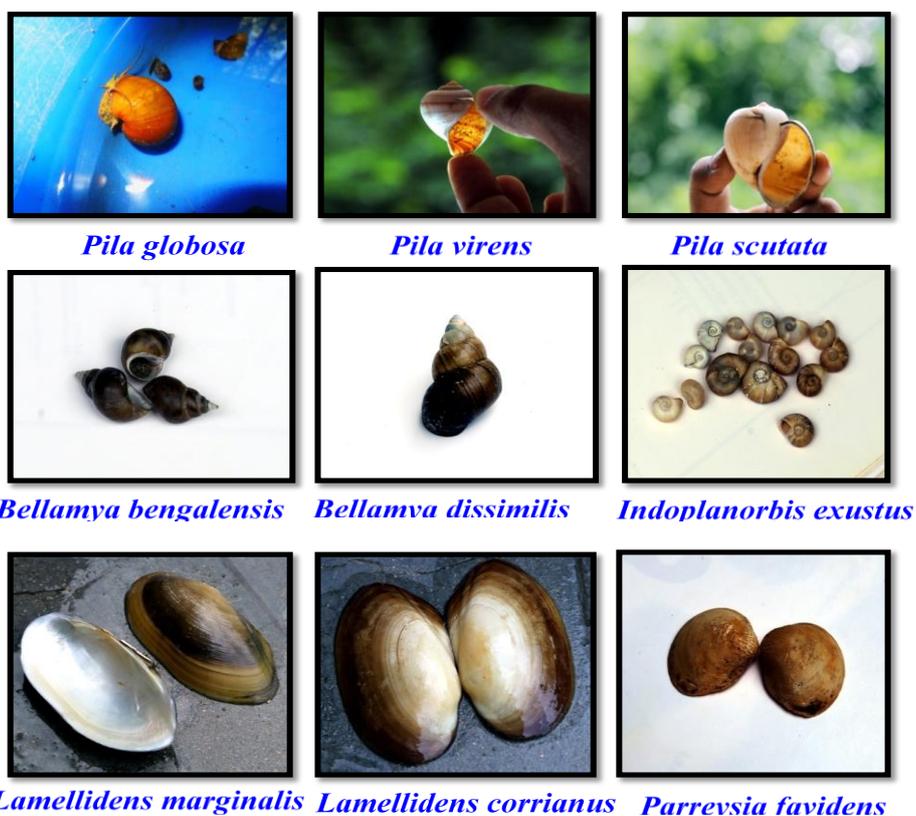
Figure 4 Check list of Freshwater Molluscan forms in Koothaippar wetland ecosystems Tiruchirappalli district

Table 1 Checklist Of Freshwater Molluscan Forms In Koothaippar Wetland Ecosystem

S.No.	Class	Scientific Name	Family	Order	Status
1.	GASTROPODA	*Pila globosa*	Ampullariidae	Architaenioglossa	++++
		Pila virens	Ampullariidae	Architaenioglossa	+++
		Pila scutata	Ampullariidae	Architaenioglossa	+++
		Bellamya bengalensis	Viviparoidae	Architaenioglossa	++++
		Bellamya dissimilis	Viviparoidae	Architaenioglossa	++
		Indoplanorbis exustus	Planorbidae	Hygrophila	++
2.	BIVALVIA	*Lamellidens marginalis*	Unionidae	Unionoida	++++
		Lamellidens corrianus	Unionidae	Unionoida	+++
		Parreysia favidens	Unionidae	Unionoida	+

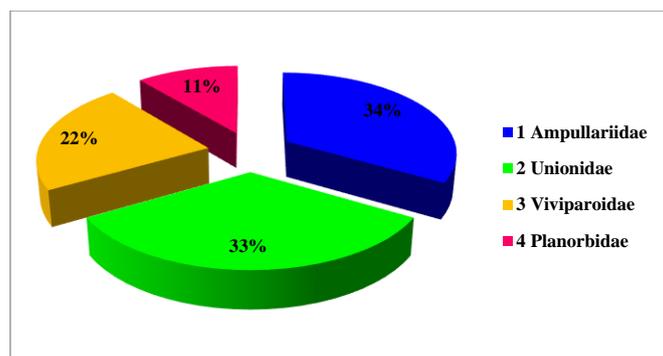(+++ +Abundant; +++Less Abundant; ++ rare; + Very rare)

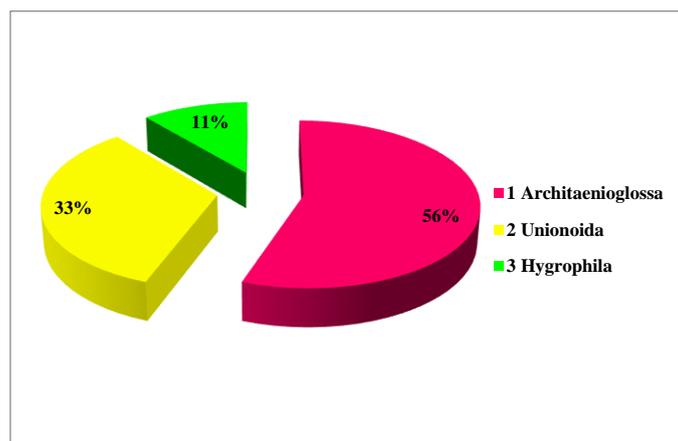**Figure 5** Pie chart representing the percent distribution of Molluscan forms of different families

Figure 6 Pie chart representing the percent distribution of Molluscan forms of different orders

4. Conclusion

Total of nine freshwater Molluscan species representing 3 orders, 4 families and 5 genera were recorded during the study period. Distributions of these organisms are also greatly influenced by many environmental parameters which require detailed study further. This ecosystem supports a wide variety of fresh water Molluscan species both in terms of number in a species and diversity. A detailed study on their seasonal distribution and fluctuations would help in the documentation of many unknown species also.

Compliance with ethical standards

Disclosure of conflict of interest

We disclose that there is no conflict between us for the publication of this research article in your journal.

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