

THE FIRST REPORT ON THE FRESHWATER MALACOFUNA OF NEWASA TAHSIL FROM UPPER GODAVARI BASIN, MAHARASHTRA

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ABSTRACT

The Newasa tahsil is an important administrative block within Ahmednagar district, Maharashtra. Although small in area, the Newasa tahsil is drained by the Godavari, the longest river of South India. The tahsil is known for its vast sugarcane fields and sugar factories. This area also has a rich network of canals, seasonal ponds, and backwaters of the famous Nathsgar dam. The area has great potential for harboring aquatic mollusks. With no record of any previous study on malacofauna, the present study was undertaken to investigate the diversity, distribution and importance of the freshwater malacofauna of Newasa tahsil. The study included a malacofaunal survey of 9 different water bodies which included rivers, canals, ponds, and lakes. A total of 17 different species of freshwater mollusks were recorded. The mollusks species recorded include 12 gastropods representing 5 families and 9 genera. The bivalves recorded include 5 species representing 2 families and 2 genera. The study is highlighted by the new locality record for *Amerianna carinata* as it is recorded for the first time from the Godavari river. Many of the gastropod species recorded in the present study have been reported earlier to be of medical, veterinary, and economic importance.

INTRODUCTION

The mollusks form the second most diverse group of animals after arthropods—with estimates of 80,000 to 100,000 described species (Strong *et al.*, 2008). Freshwater mollusks inhabit every continent except Antarctica and occur in nearly all inland aquatic habitats. The freshwater mollusks are common inhabitants of inland freshwater bodies such as rivers, lakes, dams, wetlands, backwaters, streams, canals, ponds and seasonal water ditches (Cummings and Lydeard, 2019). Most live submerged, and many are specialized for particular habitats—aquatic vegetation, stones, rocks, wood, and other solid surfaces, or soft sediment. India, with a mere 2.4% of the world's area, accounts for 7.31% of the global faunal total with a faunal species count of 89,451 species (Alfred, 1998). The malacofauna of India is represented by 5070 species which include 3371 species of marine mollusks and 1671 species of non-marine mollusks. According to recent estimates, India has about 203 freshwater mollusk species belonging to 59 genera and 26 families (Ramakrishna and Dey, 2007). A number of distinguished malacologists such as Annandale, Prashad, Rao, and many others from the Zoological Survey of India have contributed a lot to our knowledge of freshwater mollusks of the Indian subcontinent (Subba Rao, 1989). The significant contributions to the malacofauna of the Maharashtra state were made by a number of researchers (Tonapi and Mulherkar, 1963; Tonapi, 1971, 1980; Nagabhushnam and Kulkarni, 1973; Surya Rao *et al.*, 2002; Patil and Talmale, 2005). However, after Patil and Talmale (2005), there is no updated information on

this group in Maharashtra.

The Newasa tahsil within Ahmednagar district is part of the upper Godavari basin and drained by rivers such as the Godavari, Pravara, and Mula. The Newasa tahsil also has many seasonal ponds, irrigation canals, dam backwaters, and seasonal streams. The region, thus, has vast potential for harboring freshwater mollusks. The perusal of literature shows that there is no published record of study on the malacofauna of the Newasa tahsil. The information on malacofaunal resources is highly useful in the taxonomy, distribution, conservation, and management of the fauna. A number of freshwater gastropods serve as a vector for trematode parasites (Agrawal *et al.*, 2000a, b). The information on the diversity and distribution of vector snails is pivotal in formulating strategies for their control and management. In light of this, the present investigation was undertaken to study the diversity, distribution, and importance of freshwater malacofauna of selected water bodies from Newasa tahsil.

MATERIALS AND METHODS

Study area

Newasa tahsil is an administrative block within Ahmednagar district located in the state of Maharashtra with an area of 1343 km² [Fig. 1]. It is one of the most irrigated areas of Ahmednagar district and is well known in the state for its vast sugarcane fields. The Newasa tahsil area is drained by rivers such as the Godavari, Pravara, and Mula.

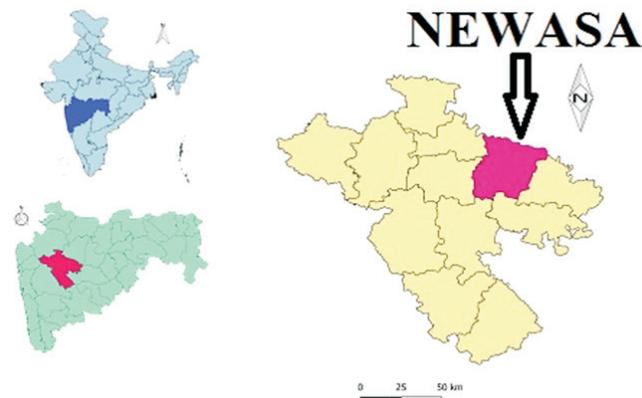


Figure 1: Study area map

The study area is also having a good network of irrigation canals, backwater, lakes, ponds, seasonal streams, and ditches. The present investigation included the malacological survey of 9 freshwater bodies from the study area [Table 1].

Collection and Maintenance: Malacological surveys were carried as per the methodology described in handbooks on freshwater mollusks of India by Zoological Survey of India (Subba Rao, 1989; Ramakrishna and Dey, 2007). The mollusk specimens were collected using the aquatic net or directly by handpicking. The collected specimens were preserved in 70% ethanol. The specimen bottles were labeled with respect to the date of collection, name of the water body, and name of the collector.

Identification

The snail and bivalve specimens were sent to the Zoological Survey of India, Western regional station, Pune, for identification. The voucher specimens were deposited in the ZSI, WRS, Pune. The experts from ZSI, identified mollusk specimens using identification keys in the handbook on the

Table 1: List of water bodies and sampling sites

Sr. No.	The water body/sampling site	GPS coordinates of sampling sites
1	Godavari river	
	Sampling site-I [At: Kaygaon –Toka village]	N 19°37.385' E 075°00.852'
	Sampling site-II [At: Pravara–Sangam]	N 19°37.377' E 075°00.966'
	Sampling site-III [At: Mangalapur village]	N 19°36.317' E 075°03.416'
2	Sampling site site-IV [At: Suregaon-Galnimb village]	N19°36'20.0" E 75°05'42.3"
	Pravara river [At: Devgad, Murme village]	N 19°36.509' E 074°57.565'
3	Mula river [At: Khedale-Paramanand village]	N 19°27.210' E 074°46.866'
4	Mula irrigation canal [At: Ghodegaon village]	N 19°21.345' E 074°52.487'
5	Nala-bundling [At: Ghodegaon village]	N 19°21.334' E 074°52.386'
6	Freshwater pond [At: Newasa Phata]	N 19°31.589' E 074°57.858'
7	Freshwater pond [At: Usthal-Dumala village]	N 19°29.2461' E 074°56.212'
8	Trimurti Lake-I [At: Military school campus, Newasa Phata]	N 19°32.078' E 074°58.138'
	Trimurti Lake-II [At: Military school campus, Newasa Phata]	N 19°32.531' E 074°58.348'

Table 2: The list of mollusks recorded from study area

Taxonomic group /species	Site wise distribution *
GASTROPODA	
Family-Lymnaeidae	
1. <i>Radix acuminata</i> (Lamarck, 1822) [Synonym: Lymnaea acuminata Lamarck, 1822]	1, 2, 3, 4, 5, 6, 8, 9, 11, 12.
2. <i>Radix luteola</i> (Lamarck, 1822) [Synonym: Lymnaea luteola Lamarck, 1822]	9, 12.
Family-Planorbidae	
3. <i>Cyraulox convexusculus</i> (Hutton, 1849)	1, 2, 3, 4, 5, 6, 8, 11.
4. <i>Amerianna carinata</i> (H. Adams, 1861). [Jr. Synonym <i>Bulinus indicus</i> Subba Rao, 1994].	1
5. <i>Indoplanorbis exustus</i> (Deshayes, 1834)	1, 2, 3, 4, 5, 6, 10, 11, 12.
Family-Physidae	
6. <i>Physella acuta</i> (Draparnaud, 1805)	1, 2, 3, 4, 6, 11.
Family-Viviparidae	
7. <i>Filopaludina bengalensis</i> (Lamarck, 1822)	1, 2, 3, 4, 5, 6, 8, 11.
8. <i>Idiopoma dissimilis</i> (Mueller, 1774)	1, 2, 3, 4, 6, 7, 11.
Family-Thiaridae	
9. <i>Tarebia lineata</i> (Gray, 1828)	1, 2, 3, 4, 5, 6, 7.
10. <i>Tarebia granifera</i> (Lamarck, 1822)	7
11. <i>Melanooides tuberculata</i> (Mueller, 1774)	1, 2, 3, 4, 5, 6, 7, 9, 11.
12. <i>Thiara scabra</i> (Mueller, 1774)	7
BIVALVIA	
Family-Unionidae	
13. <i>Lamellidens corrianus</i> (Lea, 1834)	1, 2, 3, 4.
14. <i>Parreysia caerulea</i> (Lea, 1831)	7
15. <i>Parreysia corrugata</i> (Mueller, 1774)	7
Family: Cyrenidae	
16. <i>Corbicula striatella</i> Deshayes, 1854	6, 7
17. <i>Corbicula peninsularis</i> Prashad, 1928	1, 2, 3, 4, 5, 6.

*Sites 1, 2, 3 and 4 = Godavari river sampling site-I, II, III and IV respectively. 5 = Pravara river; 6 = Mula river; 7 = Mula canal; 8 = Nala-bundling at Ghodegaon; 9 = Newasa-phata pond; 10 = Pond at Ustar-Dumala; 11 = Trimurti lake-I and 12 = Trimurti lake-II; **The mollusk classification is adopted from Bouchet and Rocroi (2005).

freshwater mollusks of India (Ramakrishna and Dey, 2007). The mollusk specimens were photographed by placing them upon a laminated graph paper with Nikon D5100 DSLR camera.

RESULTS AND DISCUSSION

The trematode parasites use snails as intermediate hosts and snails of the genus *Bulinus*, *Biomphalaria*, and *Oncomelania* are common vectors of schistosomiasis in African countries. At least 7 gastropod species recorded from the study area are of medical and veterinary importance. The gastropods *R. acuminata*, *R. luteola*, *I. exustus*, *G. Convexusculus*, *M. tuberculata*, *T. scabra* and *T. granifera* have been reported to serve as intermediate hosts for trematode parasites of medical and veterinary importance (Agrawal *et al.*, 1991; Pinto and de Melo, 2011; Agrawal *et al.*, 2000a,b; Jauhari and Nongthombam, 2014). The snail *M. tuberculata* has been shown to serve as a vector for 30 species of trematodes (Pinto and de Melo, 2011). In one of the studies, snails *R. luteola* and *I. exustus* were found to harbor cercariae of *Schistosoma incognitum*, *Orientobilharzia dattai*, *S. spindale*, *S. indicum* and *S. nasale* (Agrawal *et al.*, 1991). A recent study confirms the role of snails such as *I. exustus*, *M. tuberculata*, *G. convexusculus*, and *R. acuminata* in the transmission of cercarial dermatitis in India (Jauhari and Nongthombam, 2014). The occurrence of schistosomiasis in Maharashtra has been reported from the Ratnagiri district (Gaitonde *et al.*, 1981). In the Newasa tahsil, like in other parts of the country, it is a

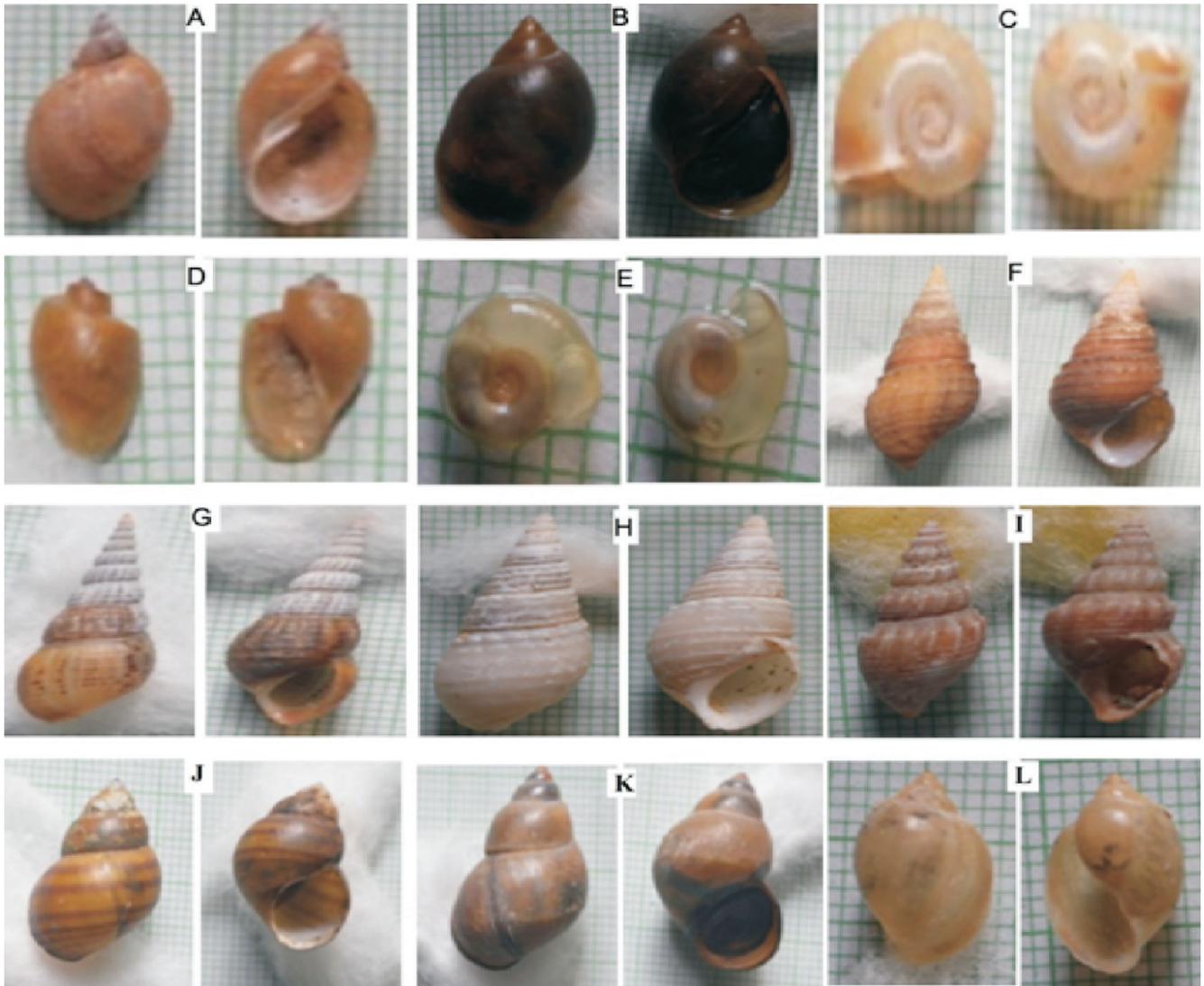


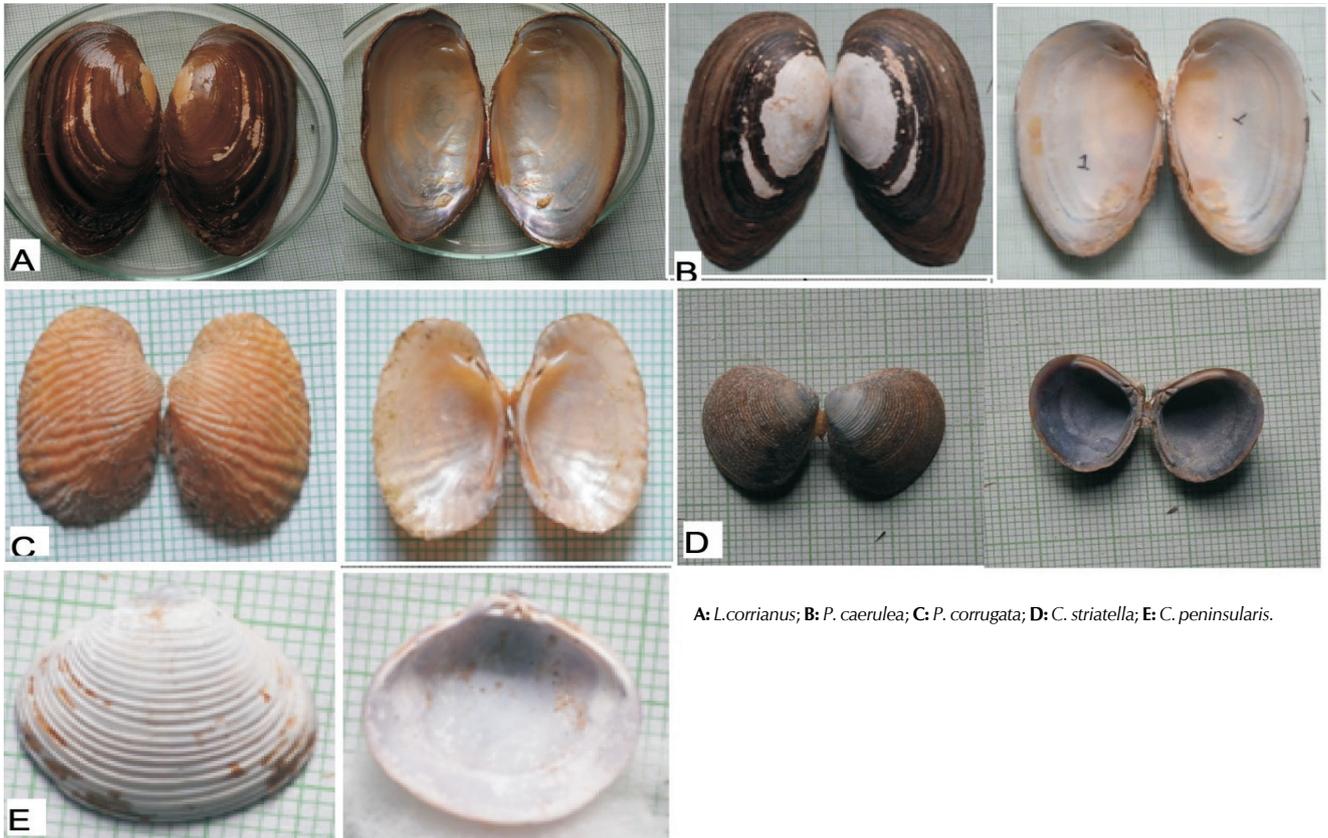
Figure.2: Freshwater gastropods from study area:

A: *R. acuminata*; **B:** *R. luteola*; **C:** *Cl. exustus*; **D:** *A. carinata*; **E:** *G. convexusculus*; **F:** *T. lineata*; **G:** *M. tuberculata*; **H:** *T. granifera*; **I:** *T. scabra*; **J:** *F. bengalensis*; **K:** *I. dissimilis*; **L:** *P. acuta*.

traditional common practice among the farmers to use water from river and pond as drinking water for their cattle. The swimming in rivers and ponds is common in summer among the local population. The local fishermen carry out fishing activities many times a year. The proximity of people and cattle with local water bodies creates high chances for infection by trematode larvae released by snails. However, there has been no official or published record regarding schistosomiasis infection in the study area. Hence, scientific research is highly needed in this regard. Some of the mollusks from the study area are edible. The two gastropod species: *F. bengalensis* and *I. dissimilis*, and two bivalve species: *L. corrianus* and *P. caerulea* from the study area has been reported as being used as food in some of the Indian states (Subba Rao and Dey, 1986; Mahata, 2002; Ramakrishna and Dey, 2007). However, these edible mollusks are not used as a source of food by any of the local communities as per our inquiry. There is no published record of the use of

mollusks as food by local communities from Newasa tahsil.

The present investigation is the first exclusive report on freshwater mollusk fauna from the Newasa tahsil of Ahmednagar district that lies within the upper Godavari basin. A total of 17 mollusk species were recorded that highlight the malacofaunal richness of the study area and the suitability of the study area as a habitat for the mollusks. This is a good indication that further investigations are needed on the malacofauna of the region. This study reports a new locality (*i.e.*, the Godavari river site I, Ahmednagar district), for the snails *Amerianna carinata* which was earlier reported for the first time in India from Pune district of Maharashtra (Subba Rao *et al.*, 1994). The snail *A. carinata* was by mistake identified as new species *Bulinus indicus* in India (Subba Rao *et al.*, 1994) which was later corrected by Brown (1997). The snail *A. carinata* is native of the Australian region and found in many parts of the World. All other gastropod species recorded from the study area have been recorded earlier from



A: *L. corrianus*; B: *P. caerulea*; C: *P. corrugata*; D: *C. striatella*; E: *C. peninsularis*.

Figure 3: Freshwater bivalves from study area

Table 3: Waterbody-wise list of mollusk species

SR. no.	Name of water body	Names of mollusk species
1.	Godavari River	Gastropods: <i>R. acuminata</i> , <i>G. convexiusculus</i> ; <i>A. carinata</i> [<i>B. indicus</i>], <i>I. exustus</i> , <i>B. bengalensis</i> , <i>B. dissimilis</i> , <i>P. acuta</i> , <i>T. lineata</i> , <i>M. tuberculata</i> .
	Site-I Godavari River	Bivalves: <i>L. corrianus</i> , <i>C. peninsularis</i> Gastropods: <i>R. acuminata</i> , <i>G. convexiusculus</i> , <i>I. exustus</i> , <i>B. bengalensis</i> , <i>B. dissimilis</i> , <i>P. acuta</i> , <i>T. lineata</i> , <i>M. tuberculata</i> .
	Site-II Godavari River	Bivalves: <i>L. corrianus</i> , <i>C. peninsularis</i> Gastropods: <i>R. acuminata</i> , <i>G. convexiusculus</i> , <i>I. exustus</i> , <i>B. bengalensis</i> , <i>B. dissimilis</i> , <i>P. acuta</i> , <i>T. lineata</i> , <i>M. tuberculata</i> .
	Site-III Godavari River	Bivalves: <i>L. corrianus</i> , <i>C. peninsularis</i> Gastropods: <i>R. acuminata</i> , <i>G. convexiusculus</i> , <i>I. exustus</i> , <i>B. bengalensis</i> , <i>P. acuta</i> , <i>T. lineata</i> , <i>T. scabra</i> , <i>M. tuberculata</i> .
2.	Site-IV Pravara River	Bivalves: <i>L. corrianus</i> , <i>C. peninsularis</i> Gastropods: <i>R. acuminata</i> , <i>G. convexiusculus</i> , <i>I. exustus</i> , <i>B. bengalensis</i> , <i>P. acuta</i> , <i>Tarebia lineata</i> , <i>M. tuberculata</i> , <i>Tarebia lineata</i> , <i>M. tuberculata</i>
	3	Bivalves: <i>C. peninsularis</i> Gastropods: <i>R. acuminata</i> , <i>G. convexiusculus</i> ; <i>I. exustus</i> , <i>B. bengalensis</i> , <i>B. dissimilis</i>
4	Mula river	Bivalves: <i>C. striatella</i> , <i>C. peninsularis</i>
		Gastropods: <i>B. dissimilis</i> , <i>Tarebia lineata</i> , <i>T. granifera</i> , <i>M. tuberculata</i> , <i>T. scabra</i> . Bivalves: <i>P. corrugata</i> , <i>P. caerulea</i> , <i>C. striatella</i> .
5	Nala-bunding	Gastropods: <i>R. acuminata</i> , <i>G. convexiusculus</i> , <i>B. bengalensis</i>
6	Newasa Phata Pond	Gastropods: <i>R. acuminata</i> , <i>R. luteola</i> , <i>M. tuberculata</i>
7.	Ustar-Dumala Pond	Gastropods: <i>R. luteola</i> , <i>I. exustus</i>
8	Trimurti Lake-I	Gastropods: <i>R. acuminata</i> , <i>R. luteola</i> , <i>G. convexiusculus</i> ; <i>I. exustus</i>
		<i>B. bengalensis</i> , <i>B. dissimilis</i> , <i>P. acuta</i> , <i>M. tuberculata</i> .
9	Trimurti Lake-II	Gastropods: <i>R. acuminata</i> , <i>I. exustus</i>

neighboring Pune district (Tonapi and Mulherkar, 1963; Tonapi, 1971; Surya Rao et al., 2002) and Aurangabad district (Nagabhushnam and Kulkarni, 1973; Patil and Ramakrishna, 2005). The bivalves recorded from the study area have also

been reported from water bodies of neighboring districts such as Pune, Aurangabad and Nashik (Surya Rao et al., 2002; Patil and Ramakrishna, 2005, Shinde, 2016; Pande et al., 2020) and seems to be widely distributed in other parts of the state.

Some of the mollusk species reported from the study area such as *F. bengalensis*, *I. dissimilis*, *L. corrianus* and *P. corrugata* are edible mollusks and used as food in many north-eastern states of India (Subba Rao and Dey, 1986; Ramakrishna and Dey, 2007). Many of the gastropods recorded to serve as vectors for trematodes that cause schistosomiasis and are of medical importance (Kali, 2015). The snail *R. acuminata* and *I. exustus* reported in the present study are widely distributed in India (Ramakrishna and Dey, 2007) and are used as model experimental animals in a variety of fundamental research (Pande et al., 2009, 2010; Singh et al., 2013).

The work on the malacofauna of the Maharashtra state was embarked by distinguished malacologists such as Annandale, Prasad, and Hora (Patil and Ramakrishna, 2005). There is no recent published record on the freshwater mollusks of Maharashtra (Patil and Talmale, 2005). The literature on the diversity, distribution, and conservation status of malacofauna of the state is limited and scattered. A total of 53 species of mollusks were reported from Pune district alone (Tonapi and Mulherkar, 1963; Tonapi, 1971, 1980). In one more study, about 11 mollusk species were reported from Ujani Wetland in Pune district (Surya Rao et al., 2002). A total of 27 mollusk species were recorded from the Nathsagar dam from Aurangabad district (Patil and Ramakrishna, 2005). However, the mollusk fauna of other districts of Maharashtra has not been studied in detail. In light of this background, the present investigation is the first exclusive report on freshwater mollusk fauna from the study area. The results obtained will enrich the faunal data of Maharashtra state and India. The information on the diversity, distribution, and medical importance of malacofauna can be useful in taxonomy, distribution, conservation of malacofauna. It will also be helpful in formulating strategies for the control and management of medically important vector snails.

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