

Malacofauna of Village Tanks and Minor Seasonal Water Bodies from Upper Deccan Plateau Ahmednagar Maharashtra

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ABSTRACT

Aim/Background: Tank irrigation is common in India and includes artificial water reservoirs such as village tanks, bandharas, and percolation tanks. The malacofauna of village tanks has been poorly documented. The present investigation is an attempt to make known the malacofauna of village tanks and minor water bodies from the upper part of Deccan Plateau Maharashtra.

Materials and Methods: The mollusc specimens were collected from village tanks, and other minor seasonal water bodies from the 23 different localities within the study area. The specimens were preserved and subsequently identified by expert taxonomists at ZSI, WRS, and Pune. **Results:** The present study reports 19 mollusc species representing 7 families, and 12 genera. This includes 12 gastropods and 7 bivalves. The snail *R. acuminata* is found to be the most commonly distributed (78.3%) species in the study area. Data on species richness (S) shows that the Ghod River showed the highest value of 17 for species richness. Similarly, the Shannon-Weiner Species Diversity Index (H) is highest for the Ghod River. The value of H ranges between 0 to 2.86 for the water bodies studied. The species evenness (J) values range between 0 to 0.99. **Conclusion:** The study area harbours a number of economically important mollusc taxa. Many of the molluscs from the study area are of medical and veterinary importance. Some of them are used as food in the northeastern states of India. The snail *A. carinata*, a native species from the Australian continent, is reported from the study area for the first time.

Keywords: Diversity, Malacofauna, Village tanks.

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INTRODUCTION

Tank irrigation is common in India, and about one-third of the irrigated area in south Indian states is contributed by the tank irrigation system,^[1] with around 120,000 small tanks, irrigating about 4.12 million ha of land.^[2] The upper part of the deccan plateau forms much of the part of the state of Maharashtra. Almost every village in the Deccan plateau region of Maharashtra has village tanks, bandharas or other such smaller

water bodies including seasonal streams. Most of these minor water bodies are seasonal and become dry during summer. The fauna inhabiting such water bodies must be able to withstand periods of drought by having some special adaptations. The state of Maharashtra has a large number of minor irrigation works, which include mainly the *Percolation tanks*, the *Village tanks* and the *Bandharas* or *Dharans*.^[3] The minor irrigation works include artificial water reservoirs with a Culturable Command Area (CCA) of less than 2,000 ha. The village tanks are water reservoirs constructed on a small stream to provide sufficient storage to the villagers for drinking supply, washing and watering the cattle. The percolation tanks are similar to the village tanks, but they are mainly constructed for recharge of groundwater. The tanks are usually smaller than 100 m × 100 m in area; however,

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they may be as small as 30m × 30m. The *bandhara* is an artificial weir across a small stream to raise the water level on the upstream side.^[3]

The freshwater malacofauna of India is poorly investigated and the present record lists only about 217 species of freshwater molluscs.^[4,5] The freshwater molluscs of Maharashtra include about 60 species under 10 families and 19 genera.^[5,6] The Nagar tahsil within the Ahmednagar district is part of the upper Godavari basin and almost every village in the study area has a village tank or other smaller seasonal water bodies. Most of these minor water bodies are seasonal and become dry during summer. Seasonal water bodies experience extended periods of drought every year. The aquatic fauna of such water bodies must be adapted for uncertainties of the availability of water. The malacofauna of Maharashtra has been poorly studied, however, some significant contributions to the malacofauna of the Maharashtra state were made by some devoted researchers from the Zoological Survey of India and other institutes.^[6-9] These studies are solely based on some sporadic investigations on a few selected water bodies of Maharashtra. A large number of major and minor inland water bodies within Maharashtra have not been studied yet with respect to the diversity of malacofauna. There is no published record on the diversity of malacofauna in minor water bodies, especially the village tanks. In light of this, the present research work was proposed and executed successfully. This work provides the first picture of the malacofauna of village tanks and other minor irrigation works from the study area.

MATERIALS AND METHODS

Study area

In the present investigation, 23 freshwater bodies located within and around the Nagar tahsil, Ahmednagar district, Maharashtra, India were surveyed to study the diversity of the malacofauna. The freshwater bodies surveyed are listed (Table 1) with the GPS coordinates of sampling sites. The GPS coordinates were recorded with the Garmin GPS unit: eTrex 30 and the study area map was prepared with ESRI ArcGIS 10.3 (Figure 1).

Collection and identification

Malacofaunal surveys were executed by employing standard methodology.^[10,11] The mollusc specimens were collected using the aquatic net or directly by handpicking. The collected specimens were preserved in 70% ethanol. Specimen bottles were labelled with the date of collection, locality, and the name of the

collector. The snail and bivalve specimens were sent to the Zoological Survey of India (ZSI), Western Regional Station, Akurdi, Pune for ultimate identification where the fourth author identified them as expert taxonomists. Identification was mainly based on shell morphology. The classification and nomenclature of taxa are based on recently published updates in mollusc systematics.^[12]

Statistical analysis

Distribution (%), Species richness (S), Relative species abundance, The Shannon's Diversity Index (H), and Species evenness (J) were calculated using MS-Excel.

RESULTS

Diversity and distribution

The present study reports a total of 19 mollusks representing 2 classes, 7 families, and 12 genera. This includes 12 gastropods from 5 families and 9 genera. The bivalves recorded include 7 species from 2 families and 3 genera (Table 2 and Figure 2).

The gastropod species recorded represent 5 families such as Lymnaeidae (2 species), Planorbidae (3), Physidae (1 species) Thiaridae (4 species), and Viviparidae (2 species). The bivalves of the study area represent two families: Unionidae (5 species) and Corbiculidae (2 species). Except for the Mula dam, all the water bodies surveyed include small seasonal water reservoirs such as village tanks, bandharas, seasonal rivers, natural streams, and garden tanks.

The snail *R. acuminata* is found to be the most commonly distributed (78.3%) species in the study area (Table 2). Other commonly distributed species include *I. exustus* (57.5%), *M. tuberculata* (47.8%), *G. convexiusculus* (39.1%), *T. lineata* (26.1%), and *T. scabra* (21.7%).

The snail *A. carinata* was recorded only from one site and it is least common among all snails. The bivalve molluscs were recorded only from 4 of the 23 water bodies. The bivalves are benthic and usually occur in sandy and muddy beds of rivers, canals and dams from the study area.

Data on species richness (S) shows that the Ghod River showed the highest value of 17 for species richness, followed by the Mula dam (11), the Mula water-supply reservoir (11), and Mula canal (8). Similarly, the Shannon-Weiner Species Diversity Index (H) is highest for Ghod river (Table 3; Figure 3). The value of H ranges between 0 to 2.86 for the water bodies studied. The species evenness (J) values range between 0 to 0.99 (Table 3). For the entire study area put together, the species richness is 19, the Shannon-Weiner index is 2.59 and the Species evenness is 0.88.

Table 1: List of water bodies with GPS coordinates.

Sl. No.	Name of water body	Administrative Address	GPS coordinates of sampling sites
1	Narayan-Doh village tank	At: Narayan -Doh village, Taluka: Nagar, Dist: Ahmednagar.	N 19°02.343' E 074°49.212'
2	Sarola-baddhi village tank	At: Sarola-Baddhi village, Taluka: Nagar, Dist: Ahmednagar.	N 19°04.722' E 074°49.999'
3	Kapurwadi village tank	At: Kapurwadi village, Taluka: Nagar, Dist: Ahmednagar.	N 19°06.663' E 074°47.364'
4	Aagadgaon village tank	At: Aagadgaon village, Taluka: Nagar, Dist: Ahmednagar.	N 19°08.743' E 074°51.326'
5	Baradari village tank (Vivekanand lake)	Baradari village, Taluka: Nagar, Dist: Ahmednagar	N 19°06.936' E 074°51.048'
6	Pargaon village tank	At: Pargaon village, Taluka: Nagar, Dist: Ahmednagar	N 19°05.068' E 074°53.331'
7	Bhatudi village tank	At: Bhatudi (Pargaon) village, Taluka: Nagar, Dist: Nagar	N 19°03.484' E 074°53.916'
8	Walki village tank	At: Walki village, Taluka: Nagar, Dist: Ahmednagar	N 18°57.667' E 074°43.341'
9	Pimpalgaon-Malvi village tank	At: Pimpalgaon-Malvi village, Taluka: Nagar, Dist: Ahmednagar	N 19°12.118' E 074°45.689'
10	Village tank at Mulanagar village	At Mulanagar village, Taluka: Rahuri, Dist: Ahmednagar	N 19°20.029' E 074°38.001'
11	Ghod river,	Near Shirur town, Taluka: Parner, Dist: Ahmednagar.	N 18°49.883' E 074°23.506'
12	Sina river	At: Shiradhon village, Taluka: Nagar, Dist: Ahmednagar	N 18°59.204' E 074°47.785'
13	Dev river	At: Nandgaon village, Taluka: Nagar, Dist: Ahmednagar	N 19°16.576' E 074°39.660'
14	Mula dam	At Mulanagar village, Taluka: Rahuri, Dist: Ahmednagar	N 19°19.941' E 074°36.574'
15	Water-supply reservoir, at Mulanagar village	At: Mulanagar, Near MPKV, Taluka: Rahuri, Dist: Ahmednagar.	N 19°20.393' E 074°38.374'
16	Mula canal	At: Mulanagar village, Taluka: Rahuri, Dist: Ahmednagar.	N 19°20.295' E 074°38.676'
17	Mulanagar water stream	At: Mulanagar village, Taluka: Rahuri, Dist: Ahmednagar	N 19°20.403' E 074°38.321'
18	Shiradhon Water stream,	At: Shiradhon Village, Taluka: Nagar, Dist: Ahmednagar	N 19°00.528' E 074°46.757'
19	Bandhara at Shahapur village	At: Shahapur Village, Taluka: Nagar, Dist: Ahmednagar	N 19°05.230' E 074°49.233'
20	Bandhara at Mehekari village	At: Mehekari village, Taluka: Nagar, Dist: Ahmednagar	N 19°05.259' E 074°52.231'
21	Ahmednagar fort ditch.	At: Ahmednagar fort, Ahmednagar city.	N 19°05.567' E 074°45.271'
22	Garden cement tank-I	Military campus area, Near Ahmednagar fort, Ahmednagar city.	N 19°05.514' E 074°45.478'
23	Garden cement tank-II	Ahmednagar college campus, Ahmednagar city.	N 19°05.438' E 074°44.781'

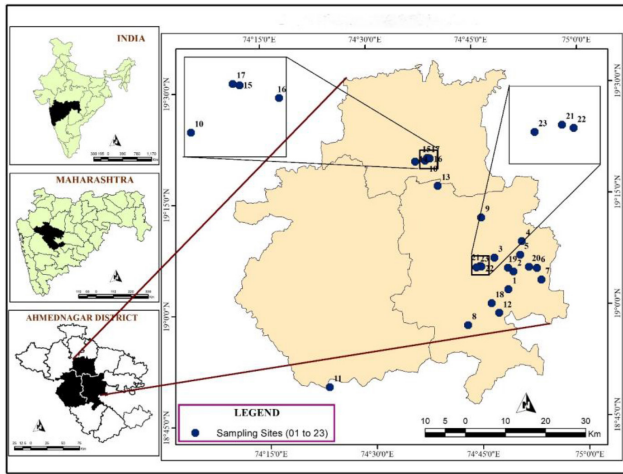


Figure 1: Study area map with location of sampling sites.
Note: Numbers '1 to 23' refer to Serial numbers for water bodies mentioned in Table 1.

The analysis of results obtained shows that the gastropods are common in village tanks. The bivalve molluscs were not recorded from any of the village tanks studied. This may be due to the fact that the village tanks are seasonal and usually remain dry in summer.

New Locality record for snail *A. carinata*

This study reports a new locality for the snail *A. carinata* (Jr. synonym: *Bulinus indicus*). The snail *A. carinata* is native to the Australian region and found in many parts of the World.

Medical importance

The schistosomiasis disease is one of the most common parasitic diseases in the World. and a number of gastropods recorded from the study area are concerned with the transmission of schistosomiasis. The trematode

Table 2: Malacofauna of the study area with their distribution and relative abundance.

Gastropoda	*Sitewise Distribution	Distribution (%)	Relative abundance
Family: Lymnaeidae			
<i>Radix acuminata</i> (Lamarck, 1822)	1, 2, 3, 4, 5, 6, 8, 9, 11, 13, 14, 15, 16, 19, 20, 21, 22, 23.	78.3%	0.189
<i>Radix luteola</i> (Lamarck, 1822)	4, 7, 10.	13%	0.016
Family: Planorbidae			
<i>Gyraulus convexiusculus</i> (Hutton, 1849)	1, 2, 4, 6, 11, 13, 14, 15, 16.	39.1%	0.061
<i>Amerianna carinata</i> (H. Adams, 1861). [Jr. Synonym <i>Bulinus indicus</i> Subba Rao, 1994].	16.	04.0%	0.004
<i>Indoplanorbis exustus</i> (Deshayes, 1834)	1, 2, 3, 6, 7, 8, 9, 10, 11, 15, 16, 18, 22.	56.5%	0.118
Family: Physidae			
<i>Physella acuta</i> (Draparnaud, 1805)	11, 15, 16, 23.	17.4%	0.043
Family: Viviparidae			
<i>Filopaludina bengalensis</i> (Lamarck, 1822)	11, 15, 16.	13.0%	0.059
<i>Idiopoma dissimilis</i> (Mueller, 1774)	11, 14, 15, 16.	17.4%	0.059
Family: Thiaridae			
<i>Tarebia lineata</i> (Gray, 1828)	11,12, 15, 16, 17, 18,	26.1%	0.073
<i>Tarebia granifera</i> (Lamarck, 1822)	11, 15, 16, 17.	17.4%	0.021
<i>Melanoides tuberculata</i> (Mueller, 1774)	11, 12, 13, 14, 15, 16, 17, 18, 21, 22, 23.	47.8%	0.116
<i>Thiara scabra</i> (Mueller, 1774)	11, 13, 17, 18, 21.	21.7%	0.025
BIVALVIA			
Family: Unionidae			
<i>Lamellidens corrianus</i> (Lea, 1834)	11, 15.	08.6%	0.043
<i>Lamellidens consobrinus</i> (Lea, 1834)	11.	04.0%	0.006
<i>Parreysia caerulea</i> (Lea, 1831)	11, 17.	08.6%	0.020
<i>Parreysia corrugata</i> (Mueller, 1774)	11, 17.	08.6%	0.038
<i>Parreysia cylindrica</i> Annandale and Prashad, 1919.	11.	04.0%	0.006
Family: Corbiculidae			
<i>Corbicula striatella</i> Deshayes, 1854	11, 15, 16, 17.	17.4%	0.082
<i>Corbicula peninsularis</i> Prashad, 1928	11, 17.	08.6%	0.015

*Note: The numbers represent sites as follows: 1: Narayan-Doh village tank, 2: Sarola-Baddhi village tank, 3: Kapurwadi village tank, 4: Aagadgaon village tank, 5: Baradari village tank, 6: Pargaon village tank, 7: Bhatudi village tank, 8: Walki village tank, 9: Pimpalgaon-Malvi village tank, 10: Mulanagar village tank, 11: Ghod river, 12: Sina river, 13: Bandhara at Mehekari village, 14: Dev river, 15: Mula dam, 16: Mula water-supply reservoir, 17: Mula canal, 18: Mulanagar village water stream, 19: Shiradon village water stream, 20: Bandhara at Shahapur village, 21: Water ditch Ahmednagar fort, 22: Garden cement tank-I, Military camp area, 23: Garden cement tank-II, Ahmednagar college campus (Figure 1).



Figure 2: Some of the mollusc species recorded from study area.

A: *R. acuminata*, B: *R. luteola*, C: *I. exustus*, D: *G. convexiusculus*, E: *A. carinata*, F: *P. acuta*, G: *F. bengalensis*, H: *I. dissimilis*, I: *T. lineata*, J: *T. granifera*, K: *M. tuberculata*, L: *T. scabra*, M: *L. corrianus*, N: *P. corrugate*, O: *P. cylindrica*, P: *C. striatella*.

Table 3: Ecological parameters: S, H, and J for mollusc diversity of study area.			
*Site/Water Body	S (Species richness)	H (Shannon-Weiner Species Diversity Index)	J (Species evenness)
1: Narayan-Doh village tank	3	0.89	0.81
2: Sarola-Baddhi village tank	3	0.97	0.89
3: Kapurwadi village tank	2	0.65	0.94
4: Aagadgaon village tank	3	1.10	0.99
5: Baradari village tank	1	0.00	0.00
6: Pargaon village tank	3	1.03	0.94
7: Bhatudi village tank,	2	0.64	0.92
8: Walki village tank	2	0.64	0.92
9: Pimpalgaon-Malvi village tank	2	0.68	0.98
10: Mulanagar village tank	2	2.70	0.97
11: Ghod River	17	2.86	0.95
12: Sina River	2	0.69	0.99
13: Bandhara at Mehekari village	2	0.69	0.99

continued...

Table 3: Cont'd.			
*Site/Water Body	S (Species richness)	H (Shannon-Weiner Species Diversity Index)	J (Species evenness)
14: Dev River,	4	1.37	0.98
15: Mula dam	11	2.32	0.97
16: Mula water-supply reservoir	11	2.25	0.94
17: Mula canal	8	1.93	0.93
18: Mulanagar village water stream	3	1.08	0.98
19: Shiradon village water stream	1	0.00	0.00
20: Bandhara at Shahapur village	1	0.00	0.00
21: Water ditch Ahmednagar fort	3	1.06	0.96
22: Garden cement tank-I, Military camp area	3	1.09	0.98
23: Garden cement tank-II, Ahmednagar college campus	3	1.04	0.94

Note: For all sites in entire study area put together, the species richness is 19, Shannon-Weiner index is 2.59 and Species evenness is 0.88

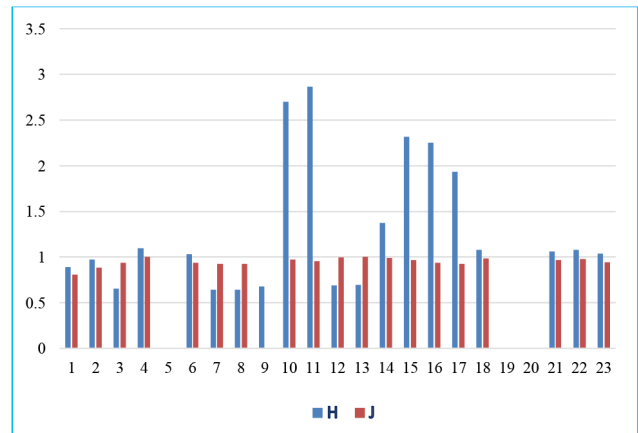


Figure 3: Shannon-Weiner index (H) and Species evenness (J) for water bodies 1-23.

parasites use snails as intermediate hosts. The freshwater snails recorded from the study area such as *R. acuminata*, *R. luteola*, *I. exustus*, *G. convexiusculus*, *M. tuberculata*, *T. scabra* and *T. granifera* are well-established intermediate hosts of parasitic trematodes of humans and cattle. The four molluscs: *F. bengalensis*, *I. dissimilis*, *L. corrianus* and *P. caerulea* from the study area, have been used as food in some of the Indian states.^[4]

Significance of the study

The findings of this work will help to update the data on the faunal resources of India. The information on the diversity, distribution and medical importance of malacofauna can be useful in the studies related to the

management, taxonomy, distribution, and conservation of malacofauna. The results obtained will also be helpful in formulating strategies for the control and management of medically important vector snails.

DISCUSSION

The present investigation recorded 19 mollusc species which includes 12 gastropod and 7 bivalve taxa. The mollusc fauna recorded represents major freshwater families of the freshwater Mollusca. It represents 7 families and 12 genera. The bivalve family Unionidae is the most diverse family in the study area with 5 species followed by the gastropod family Thiaridae with 4 species. The snail *R. acuminata* is the most abundant snail in the study area with a relative abundance value of 0.189. This snail is one of the most commonly distributed freshwater snails in India as reported earlier.^[4,6-10] The highest number of mollusc taxa are recorded from the Ghod River which has a species richness value is 17. This is the first-ever comprehensive record on the malacofauna of village tanks, percolation tanks, bandharas, and other smaller minor seasonal water bodies from the study area. The literature on the molluscs fauna of the state shows that the studies dealing with freshwater malacofauna of the state of Maharashtra are mainly devoted to larger water bodies such as dams, rivers and lakes.^[6-10] The village tanks and other minor irrigation works have remained largely neglected with regard to their faunal resources. There are some recent sporadic publications on malacofauna of some localities within the state but none of them is concerned with minor irrigation works and other seasonal water bodies.^[13,14]

This study reports a new locality for the snail *A. carinata* (Jr. synonym: *Bulinus indicus*), which was earlier reported for the first time in India from the Pune district of Maharashtra.^[15,16] The schistosomiasis disease affects about 229 million people worldwide^[17] There are many reports on human schistosomiasis and cercarial dermatitis from different regions of India, including Maharashtra.^[18-23] The freshwater snails recorded from the study area such as *R. acuminata*, *R. luteola*, *I. excustus*, *G. convexiusculus*, *M. tuberculata*, *T. scabra* and *T. granifera* have been reported to serve as vectors for trematode parasites of medical and veterinary importance.^[19,22,24] The study highlights the current status of faunal diversity because mollusc fauna of freshwater bodies is under threat due to habitat loss, environmental pollution and global environmental pollution.^[25-28] Some of the mollusc taxa from the study area have been reported to be used as food in the North-Eastern states of India.^[4]

Further studies are required to uncover the malacofaunal diversity of the study area which has a rich network of rivers, dams, canals and seasonal streams. We hope that the present investigation will stimulate the interests of malacologists so that further studies will be undertaken on different aspects of mollusc diversity, ecology, their medical importance, and management.

CONCLUSION

The present study reports a total of 19 molluscs representing 2 classes, 7 families, and 12 genera. This includes 12 gastropods from 5 families and 9 genera. The bivalves recorded include 7 species from 2 families and 3 genera. The snail *R. acuminata* was found to be the most commonly distributed species in the study area. Other commonly distributed species include *I. excustus*, *M. tuberculata*, *G. convexiusculus*, *T. lineata*, and *T. scabra*. Data on species richness (S) shows that the Ghod River showed the highest value of 17 for species richness, followed by Mula dam, Mula water-supply reservoir, and Mula canal. Similarly, the Shannon-Weiner Species Diversity Index (H) is highest for Ghod river. The value of the biodiversity index "H" ranges between 0 to 2.86 for water bodies studied. The species evenness (J) values range between 0 to 0.99. The freshwater snails recorded from the study area (*R. acuminata*, *R. luteola*, *I. excustus*, *G. convexiusculus*, *M. tuberculata*, *T. scabra* and *T. granifera*) serve as intermediate hosts for parasitic trematode of medical and veterinary importance. The four mollusc species from the study area, have been used as food in some of the Indian states. This study reports a new locality for the snail *A. carinata*, which was earlier reported for the first time in India from the Pune district of Maharashtra.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

BCUD: Board of College and University Development; **ESRI:** Environmental Systems Research Institute; **GOMID:** Government of Maharashtra, Irrigation Department; **GPS:** The Global Positioning System; **Jr.:** Junior; **MPKV:** Mahatma Phule Krishi Vidyapith; **WRC:** Western Regional Centre; **ZSI:** Zoological Survey of India.

SUMMARY

The present study includes a survey of the malacofauna of village tanks and minor seasonal water bodies from the Deccan Plateau. Altogether, 23 water bodies were surveyed for malacofauna. It reports a total of 19 mollusc species which includes 12 gastropods and 7 bivalves. The mollusc fauna represents 7 families and 12 genera. The Ghod River had the highest species richness among all water bodies studied. The gastropod *R. acuminata* is the most commonly distributed species in the study area. The H value ranges between 0 to 2.86 for all the water bodies surveyed from the study area. The species evenness (J) values range between 0 to 0.99. Some of the gastropods from the study area are of medical and veterinary importance, and few are edible. This study is the first attempt to report the malacofauna of the village tanks from Ahmednagar Maharashtra.

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