International Journal of Global Science Research
Vol. 11, Issue. 2, October 2024, pp. 2381-2387
Available Online at www.ijgsr.com

ISSN: 2348-8344 (Online)
DOI: https://doi.org/10.26540/ijgsr.v11.i2.2024.274

Research Paper

Preliminary report on the occurrence of molluscs in the selected rice field ecosystem in Jabalpur district with the report on the occurrence of exotic invasive snail *Physella acuta* (Draparnaud, 1805)

Pallabi Priyadarsini*, Sandeep Kushwaha and Akhil Nair
Zoological Survey of India, Central Zone Regional Centre, 168-169, Scheme No-5, Vijay Nagar, Jabalpur, Madhya Pradesh, India
*Corresponding author Email: pallabi_priyadarsini@yahoo.com

Received: 06/09/2024
Revised: 12/09/2024
Accepted: 21/09/2024

Abstract: Rice field ecosystem provides favorable conditions for the development of freshwater snails. Molluscs have been reported as crop pests throughout every inhabited continent in the world. The diversity of Rice field ecosystem of 2 selected farms have been studied in every monsoon season of consecutive 3 years from 2022 to 2024 in Jabalpur , Madhya Pradesh, India. The study was carried out in different ecological niches of rice field ecosystem. A total of 17 species of Freshwater and terrestrial Molluscs belonging to 13 families were recorded during the study period. Of these the occurance of exotic invasive snail *Physella acuta* (Draparnaud, 1805) was also recorded for the first time from the state. *Indoplanorbis exustus* (Deshayes, 1833) was the most common species found in the study site followed by *Radix rufescence* (Gray, 1822). In the present study exotic invasive land snail *Achantina fulica* (Bowdich, 1822) and pestiferous land snail *Macrochlamys indica* (Godwin-Austin, 1883) were also reported to be occur. Present study aims to be beneficial for the understanding of the mollusks biodiversity in the irrigated rice field ecosystem and further intense study in this regard will be beneficial for the controlling the harmful effects of Molluscs on the crop and the ecosystem.

Keywords: Molluscs, Gastropod, Bivalve, Rice field ecosystem, Exotic invasive snail, *Physella acuta*, Jabalpur, Madhya Pradesh.

Introduction:

The need to produce sufficient food for people whilst also maintaining biodiversity and ecosystem integrity is one of the most pressing challenges in the 21st century. This challenge is exemplified in wetlands and deltas of Southeast Asia that have been transformed to intensify rice production and have subsequently lost the naturally present wild aquatic species that previously bolstered local food and nutrition security. In contrast, rice producing areas where

International Journal of Global Science Research
Vol. 11, Issue. 2, October 2024, pp. 2381-2387
Available Online at www.ijgsr.com

ISSN: 2348-8344 (Online)
DOI: https://doi.org/10.26540/ijgsr.v11.i2.2024.274

natural hydrologic flows and ecosystem processes are retained can sustain aquatic biodiversity and fisheries. (Freed, et al, 2020). Rice fields have been in existence since the beginning of organized agriculture. Since then a rich biodiversity has become associated with rice fields. (Jayanthi P, 2006).

In numbers of living animal species, though far behind the Arthropoda, Mollusca is the second biggest phylum. However, a great majority of Mollusca species are marine and only about 11% belong to freshwater represented by a fraction fewer than two classes Gastropoda and Bivalvia (Nicol, 1969). Many snails are herbivorous, eating plants or rasping algae from surfaces. Land snails are among the pestiferous snails as these are known to cause damage to horticultural and plantation crops in India (Jayashankar et al., 2015; Zala et al., 2018).

The advancing invasion of several limnic and terrestrial mollusks species, mainly natives and exotics gastropods, and the damage that these animals can cause to the irrigated rice systems and other agricultural productions, besides interest for veterinary, medical, and sanitation applications (public health problems), makes it more and more important to focus on pest management. (A. Ignacio Agudo-Padrón, 2008).

The Indian freshwater molluscs fauna represented by Class Gastropoda and class Bivalvia harbour a rich diversity in India, which comprising 217 species of freshwater molluscs (150-Gastropods, 67-Bivalves) are distributed across the country including Islands (Mukhopadhyay *et al*., 2017). The work on the Malcofaunal diversity of Central India was significantly contributed by Agarwal *et al* (1976, 1977a,b,c,; Patil and Talmale (2011) have reported 72 species belonging to 38 genera, under 24 families of freshwater and land mollusca from Madhya Pradesh including Chattisgarh. Mukhopadhyay, 2007 have also reported 24 species of fresh water and land molluscs in the Malcofauna study of Jabalpur. The work reported herein was undertaken to study the Malcofaunal diversity in rice field ecosystem of selected sites of Jabalpur city. A total of 17 species of Freshwater and terrestrial Molluscs belonging to 13 families were recorded during the study period. Of these the occurance of exotic invasive snail *Physella acuta* (Draparnaud, 1805) was also recorded for the first time from the state. *Indoplanorbis exustus* (Deshayes, 1833) was the most common species found in the study site followed by *Radix rufescence* (Gray, 1822). In the present study exotic invasive land snail *Achantina fulica* (Bowdich, 1822) and pestiferous land snail *Macrochlamys indica* Godwin-Austin, 1883 were also reported to be occurring in the present study.

Materials and Methods:

Study Area:

Irrigated rice field at Rengwa village, outskirt of Jabalpur (23°11’29.7” N 79° 54’52.5” E) was selected for the Molluscan survey (fig.1). A drain called Omti Nala passed by side of the study site. (fig.2) the paddy field tends to be flooded at the time of heavy rain by flooding of nearby drain Omti nala during monsoon season.

Snail Survey:

A preliminary survey in the selected paddy field was carried out during the Kharif season 2022, 2023 and 2024. The survey was performed every month to the selected rice field ecosystem and microhabitats such as cultivated fields, grass muddy areas near the cultivation sites, residential hut inside the farm during the rainy seasons. Specimens were

International Journal of Global Science Research
Vol. 11, Issue. 2, October 2024, pp. 2381-2387
Available Online at www.ijgsr.com

ISSN: 2348-8344 (Online)
DOI: https://doi.org/10.26540/ijgsr.v11.i2.2024.274

collected by hand picking method from selected sites during the study period. At each site, all snails were placed in a single, labelled container and transported to the laboratory where they were sorted, washed and sun dried. Collected Molluscan washed properly and sun dried.

Snail identification was based on morphological criteria based on the Taxonomic key based on Subba Rao (1989), Ramakrishna and Dey (2007), Tripathy and Mukhopadhayay (2015) and Mitra, et. al., (2005). Identified species are sorted and stored in dry condition with cotton in suitable containers, labelled and preserved in National Zoological Collection at Central Zone Regional Centre, Zoological Survey of India, Jabalpur.

Statistical analysis:

Statistical analysis of quantified data was carried out by calculating various indexes as Shannon-Weaver Index, Simpson Index and Evenness Index to interoperate species richness, species abundance. All the variables are statistically analyzed.

Figure 1. Selected Rice field for study

Figure 2.Omti nala Near the study site

Result and Discussion:

The Present study revealed the occurrence of 17 species of Freshwater and terrestrial Molluscs belonging to 17 genera and 13 families were recorded during the study period. The exotic invasive snail *Physella acuta* (Draparnaud, 1805) was also reported from the sytudy site (Fig.3), recorded for the first time from the state. *Indoplanorbis exustus* (Deshayes, 1833) was the most common species found in the study site followed by *Radix rufescence* (Gray,1822). In the present study exotic invasive land snail *Achantina fulica* (Bowdich, 1822) (Fig.4) and pestiferous land snail *Macrochlamys indica* Godwin-Austin, 1883, (Fig.5) and most destructive invasive molluscan pest of agricultural crop *Laevicaulis alte* (Ferussac, 1822) (Fig.6) were also reported to be occur in the rice field ecosystem. The complete list of collected molluscan species along with their taxonomic classification is depicted in Table .1.

International Journal of Global Science Research
Vol. 11, Issue. 2, October 2024, pp. 2381-2387
Available Online at www.ijgsr.com

ISSN: 2348-8344 (Online)
DOI: https://doi.org/10.26540/ijgsr.v11.i2.2024.274

Table 1. List of Molluscan species with taxonomical classification

Sr. No	Phylum	Class	Order	Family	Species
1.	Mollusca	Gastropoda	Hygrophila	Physidae	*Physella acuta* (Draparnaud, 1805)
2.	Mollusca	Gastropoda	Hygrophila	Lymnaeidae	*Radix rufescence* (Gray,1822)
3	Mollusca	Gastropoda	Hygrophila	Lymnaeidae	*Racesina luteola* (Lamark,1822)
4.	Mollusca	Gastropoda	Hygrophila	Bullinidae	*Indoplanorbis exustus* (Deshayes,1834)
5	Mollusca	Gastropoda	Hygrophila	Planorbidae	*Gyraulus convexiusculus* (Hutton,1849)
6	Mollusca	Gastropoda	Caenogastropoda	Thiaridae	*Tarebia lineate*(Gray,1828)
7	Mollusca	Gastropoda	Caenogastropoda	Thiaridae	*Mienioplotia scabra* (Mueller,1774)
8	Mollusca	Gastropoda	Caenogastropoda	Thiaridae	*Melanoides tuberculata* (Mueller,1774)
9	Mollusca	Gastropoda	Littorinimorpha	Bithynidae	*Bithynia (Digoniostoma) pulchella* (Benson,1836)
10	Mollusca	Gastropoda	Architaenioglossa	Viviparidae	*Filopaludina bengalensis* (Lamark,1822)
11	Mollusca	Gastropoda	Architaenioglossa	Viviparidae	*Idiopoma dissimilis*(Mueller,1774)
12	Mollusca	Gastropoda	Architaenioglossa	Ampullaridae	*Pila globosa* (Swainson,1822)
13	Mollusca	Gastropoda	Stylommatophora	Ariphantidae	*Macrochlamys indica* Godwin-Austin, 1883
14	Mollusca	Gastropoda	Stylommatophora	Achatinidae	*Achantina fulica* (Bowdich, 1822)
15	Mollusca	Gastropoda	Systellommatophora	Veronicellidae	*Laevicaulis alte* (Ferussac, 1822)
16	Mollusca	Bivalvia	Unionida	Unionidae	*Parreysia corrugate* (Mueller,1774)
17	Mollusca	Bivalve	Veneroida	Corbiculidae	*Corbicula striatella* Deshayes,1834

Freshwater and Land snail recorded in the selected paddy field ecosystem comprises of 12 species of Freshwater Gastropods (85%), 3 species of Land Molluscs (10%) and 2 species of Bivalve (5%). The gastropods were represented by 8 families, from which Prosobranch were represented by 4 families Ampullaridae, Viviparidae, Thiaridae and Bithynidae and

Pulmonates with 4 families Bullinidae, Physidae, Planorbidae and Lymnaeidae. *Indoplanorbis exustus* of family Bullinidae found abundantly followed by *Radix rufescence* (Lymnaeidae). Among terrestrial snails the diversity of pestiferous land snail *Macrochlamys indica* Godwin-Austin, 1883 found to be more in comparison to the

International Journal of Global Science Research
Vol. 11, Issue. 2, October 2024, pp. 2381-2387
***Available Online* at www.ijgsr.com**

ISSN: 2348-8344 (Online)
DOI: https://doi.org/10.26540/ijgsr.v11.i2.2024.274

terrestrial snail *Achantina fulica* (Bowdich, 1822) and slug *Laevicaulis alte* (Ferussac, 1822). Class Bivalve represented by only 2 species and having less diversity in comparison to class Gastropoda. Among the mollusks studied the occurrence of exotic invasive snail *Physella acuta* (Draparnaud, 1805) was also recorded for the first time from the state.

Figure 3. *Physella acuta* (Draparnaud, 1805)

Figure 4.*Achantina fulica* (Bowdich, 1822)

Figure 5. *Macrochlamys indica* Godwin-Austin, 1883

Figure 6. *Laevicaulis alte* (Ferussac, 1822)

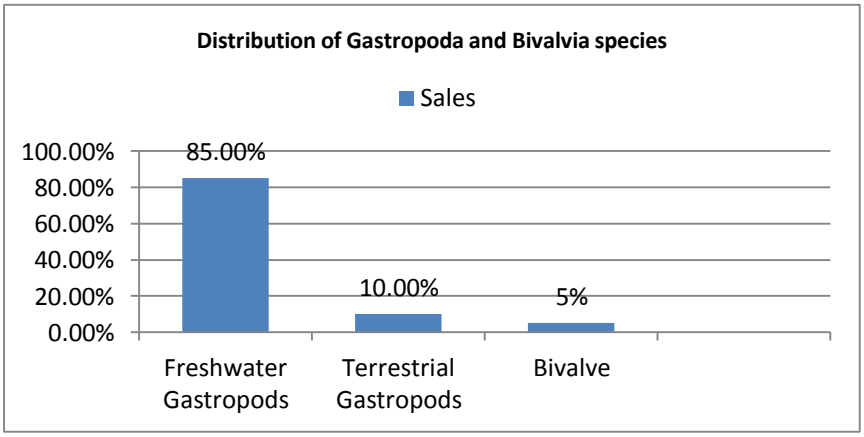

Chart: chart showing Distribution percentage of Freshwater Gastropods, Terrestrial Gastropods and Bivalvia molluscs specimen studied from the Paddy field ecosystem.

Malcological diversity in the selected rice field ecosystem was note Shannon diversity index at 2.13.Evenness shown at the site is 0.753. based on species

ISSN: 2348-8344 (Online)
DOI: https://doi.org/10.26540/ijgsr.v11.i2.2024.274

richness the no. of species is 17 and the no. of Individual in the collection sample is 111. The average population size was measured as 6.53 , Simpson' s index noted as 0.2, Simpson diversity index for the sample is 0.8 and Simpson reciprocal index calculated to be 5.08 for the samples collected from the study site.

Summary:

The present study reveals 17 species of Freshwater and Land mollusc belonging to 17 genera, 13 families, 8 orders and 2 classes. Given data is based on the collection of Molluscs sample from the Rice field ecosystem of Jabalpur, Furthermore studies of mollusks will help to access the exact biodiversity of the mollusks in the irrigated rice field ecosystem and further intense study in this regard will be beneficial to understand the ecology and controlling the harmful effects of Molluscs on the crop and the ecosystem.

Acknowledgement:

The authors are highly grateful to Director, Zoological Survey of India, Kolkata for providing facilities and encouragement. Sincere thanks are due to Officer-in-Charge, Zoological Survey of India, CZRC, Jabalpur for guidance and constant encouragement.

References:

Freed, S. Kura, Y. Sean, V. M, Samonn, P. Cohen, M. Kim, S. Thay and Chhy, S. (2020) Rice field fisheries: Wild aquatic species diversity, food provision services and contribution to inland fisheries: Fisheries Research 229.

Jayanthi P. Edirisinghe'" and Channa N.B. Bambaradeniya (2006) Rice fields : an ecosystem rich in biodiversity: j. Natn.Sci.Foundation Sri Lanka 4 2006 34(2), 57-59

Nicol, D. (1969) The number of living species of molluscs. Systematic Zoology. 18 (2), 251–254.

Jayashankar, M., Reddy, M .S. and Ramakrishna, S. (2015) Incidence of the common garden snail, Macrochlamys indica Benson, 1832 (Gastropoda: Ariophantidae) in Bangalore region, The Bioscan, **10**(3), 1003-1006.

Zala, M. B., Sipai, S. A., Bharpoda, T. M. and Patel, B.N. (2018) Molluscan pests and their management: A review, AGRES - An International E. J., **7**(2), 126-132.

A. Ignacio Agudo-Padrón and jaime vargas de oliveira (2008) mollusk fauna occurrence in irrigated rice fields of the southern brazil: a preliminary general report : ellipsaria-the newsletter of freshwater mollusks conservation society, vol. 10 (1).

Mukhopadhyay, M., Tripathy B. and Ghosh, A. (2017) Mollusca. In: Current status of freshwater Faunal Diversity in India: 501-526 (Published by the Director, Zool. Surv. India, Kolkata).

Mukhopadhyay, M. (2007) Malcofauna of Jabalpur. In: Rec. zool. Surv. India: 107(Part-1), 1-18, 2007.

Agarwal, H. P. (1976). New records of freshwater gastropods from Madhya Pradesh,India. Newsl. Zool. Surv. India, 2(5), 191-192.

Agarwal, H. P. (1977a). Fauna of Pench National Park, M.P. Mollusca.Newsl. Zool. Surv. India, 3(1), 33-36.

Agarwal, H. P. (1977b) New records of freshwater Pelecypods from M. P. India.Newsl. Zool. Surv. India, 3(4), 139-141.

Agarwal, H. P. (1977c) A report on molluscs from Madhav National Park, Shivpuri, M. P. Newsl. Zool. Surv. India, 3(5), 284-286.

Patil, S. G. and Talmale, S. S. (2011) Land and Freshwater Mollusca in: Fauna of

Madhya Pradesh (including Chhattisgarh), State Fauna Series, 15(Part-3), 1-30.

Subba Rao, N. V.(1989) Handbook Freshwater Molluscs of India: Zoological Survey of India, Calcutta: 289 pp.

Ramakrishna and Dey, Anirudha.(2007) Handbook on Indian Freshwater Molluscs: Zoological Survey of India, Kolkata, 399pp.

Tripathy, B and Mukhopadhyay, M. (2015) Fresh water Molluscs of India: An Insight of into their Diversity , Distribution and Conservation: Aquatic Ecosystem: Biodiversity, Ecology and Conservation., 163-195.

Mitra, S. C. , Dey, A and Ramakrishna, (2004) Pictorial Handbook- Indian Land Snails (Selected Species): 1-344(Published by the Director, Zool. Surv. India, Kolkata).