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Research Paper

MORPHOMETRIC ANALYSIS OF FRESHWATER SNAILS ALONG WITH ASSOCIATED PLANKTONIC COMMUNITY AT DUDHLEE IN DOON VALLEY (UTTARAKHAND)

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Abstract

The present study was aimed to identify the freshwater snail fauna inhabiting water bodies of Doon valley. A total of 7 species of freshwater snails [*L.acuminata*, *T.tuberculata, M.crebra, T.scabra, I.exustus, P.acuta*and*G.convexiusculus*], belonging to 5 families at Dudhlee in the vicinity of Doon Valley during January 2015 – March 2015. Maximum abundance was recorded by *Gyraulusconvexiusculus* while minimum by *Physaacuta*. The shell of *L.acuminata* , *T.tuberculata* , *M.crebra* , *T.scabra*and *P. acuta* was conical while the shell of *Indoplanorbisexustus*and*Gyraulusconvexiusculus* was discoidal. The maximum Shell Height was of *T.tuberculata* while the minimum was of *G.convexiusculus*. The Shell Width of *I.exustus* was maximum while the minimum was of *P.acuta*. There was a rich biotic community found associated with *T.scabra* while it was least with *L.acuminata*.

Key words: Freshwater snails, morphometric measurements, Dudhlee, Doon Valley.

INTRODUCTION

Freshwater snails are diverse and occupy various aquatic environments including man-made ponds and ditches throughout the globe [1, 2]. Snails are among the few animals that provide a directly measurable connection to their individual lives, even after death, through their shells. Studies on morphology (i.e. size and shape) has been an important aspect in many biological fields, such as anatomy, ecology, systematic and phylogeny.

The biotic community in the streams and rivers is quite different from that in the ponds and lakes. Nevertheless planktonic communities are influenced by the prevailing physico-chemical parameters and thus determine their abundance, occurrence and seasonal variations [3]. Planktons respond quickly to environmental changes because of their short life cycle, hence, their species composition are more likely to indicate the quality of the water where they are found. The relative abundance of chlorophyll is indicative of productive water [4]. Diatomic species such as *Nitschia*, *Gyrosignma*and *Epithemia*are known to avoid acid water and very low concentration of calcium and magnesium [5]. According to the views of earlier workers [6, 7] the zooplankton plays an integral role and serves as bio indicators and thus acts as a well-suited tool for understanding water pollution status [8, 9]. The distribution of planktonic community depends on a complex of factors such as, change of climatic conditions, physical and chemical parameters and vegetation cover [10, 11].

As far as the morphometric analysis of fresh water snails is concerned, a little work has been performed in our country while a considerable work has been done from abroad [12-17]. Further from the Gharwal region no such studies have been conducted so far.

Some considerable work on faunal diversity and helminthic infection of snails of Uttaranchal (now Uttarakhand) region has been worked out in the past [18, 19, 20, 21, 22, 23, 24]. Earlier molluscan diversity of Asan river system in Doon Valley with special reference to vectors of trematode parasites was carried out in order to add more information in the existing knowledge [25]. As many as 18 species of molluscs comprising 13 species of gastropods, grouped under 5 different families *viz.,*Viviparidae, Lymnaeidae, Thiaridae, Planorbidae and Pilidae were collected. Among the gastropods, the Thiaroides were common and their numbers contributed 42% of the total collection of the snails. Studies were continued on the occurrence of recognized helminthic vector snails in different habitats in Dehradun Valley and seven species of snails [26]. Later on a study on the trematode cercarial infection in the snail *T. (M) tuberculata* at different aquatic habitats in Doon valley was performed [27]. Recently studies on seasonal fluctuation on the abundance of vector snails (*L.acuminata*, *T.tuberculata, I.exustus*and*G.convexiusculus*) under the impact of certain meteorological factors like temperature, RH and rainfall in district Dehradun was performed and a relationship was developed [28].

Keeping in view that almost no work is carried out on morphometric analysis of aquatic snails from Doon Valley as well as on associated biotic community with the snails, henceforth; the present study describes the shape, size and other characteristics of the shells of 07 species of freshwater snails along with associated biotic community at Dudhlee in Doon valley.

MATERIALS AND METHODS:

i) Study Site:

Monthly samples of freshwater snails were collected from different habitats viz. tanks, drains, canal, river bed, streams, ponds and rice fields of Doon Valley, in the vicinity of Dehradun city from January 2015 to March 2015.

ii) **Sampling and Identification of snails**: Snails were collected by passing a dip net (30 cm×40 cm) five times through the upper surface of sediment, water and vegetations on a depth of 20 cm (a column of water as parallel rectangles and its base is the rectangular net). The snails attached to the macrophytes were separated and all collected snails were kept in pre-labeled plastic containers. In the laboratory, the snails were counted and identified with the help of standard keys and catalogues like "**Handbook of freshwater molluscs"**[29] and **"Handbook on Indian Freshwater Molluscs''**[30].

iii) **Morphometric analysis of snails**:

The morphometric measurements of the shells were taken with the help of a digital Vernier caliper and measurements were taken in millimeters (mm). The height, diameter of the shell, umbilicus diameter, number of whorls, aperture size, height of spire and other morphometric parameters of shell were taken in consideration.

iv) Preservation of snails:

The snails were taken to the laboratory, washed with clean water to remove the debris and detail of fresh specimen was recorded. The specimens were put in 96% alcohol for 24 hours before removing the soft parts. The shells, if deeply covered with mineral deposit and algae, were cleaned by putting them in dilute solution of oxalic acid for few minutes, before being scrubbed with a soft brush and washed in order to reveal the sculpture of shell [31, 32]. The shells were dried at room temperature and preserved for future studies.

v) Sampling of associated biotic community:

Sampling of associated biotic community existed along with collected aquatic snails was performed using planktonic net. It was separated group wise and thereafter examined under binocular microscope. The identification of organisms was done on the characteristic features [33]. In case any confusion about identification; the authorities of Botanical Survey of India, Dehradun were consulted for confirmation of identification.

RESULTS:

The survey work during January 2015 – March 2015 revealed the occurrence of 7 species of freshwater snails, belonging to 5 families under class Gastropoda, at Dudhlee in the vicinity of Doon Valley. The snails like *L.acuminata* (Lamrack, 1822),*T.tuberculata*(Muller, 1774), *M.crebra* (Lea, 1850),*T.scabra*(Muller, 1774),*I.exustus* (Deshayes, 1834),*P.acuta* (Draparnaud, 1805)and *G.convexiusculus*(Hutton, 1849)were collected throughout the study period. There has been quite a large fluctuation in the abundance of Snail's. Maximum abundance was recorded by *G.convexiusculus* while minimum by*P.acuta*(Table 1)

Morphometric analysis of collected snails along with the shape of shell and associated biotic community has been mentioned in table 1. The shell of *L.acuminata*, *T. tuberculata, M.crebra*,*T.scabra*and *P.acuta* were conical while the shell of *I. exustus*and *G.convexiusculus*were discoidal. As far as the size range of snail is concerned, the minimum SH was of *T.tuberculata*while the minimum SH was of*G.convexiusculus.* The SW of collected snail exhibits the maximum for *I.exustus*and minimum for *P.acuta.* There was a rich biotic community found associated with *T.scabra*while it was least with *L.acuminata. I.exustus* was on the 2nd rank found associated with 9 different organisms.

Size distribution of collected snails in different range groups viz. 0 – 5 mm, 6 – 10 mm, 11 – 15 mm, 16 – 20 mm and 21 – 30 mm has been dipcted in figure 1.Maximum abundance was of *G.convexiusculus* followed by *T. scabra*, *T.tuberculata* and *P.acuta* in succession.

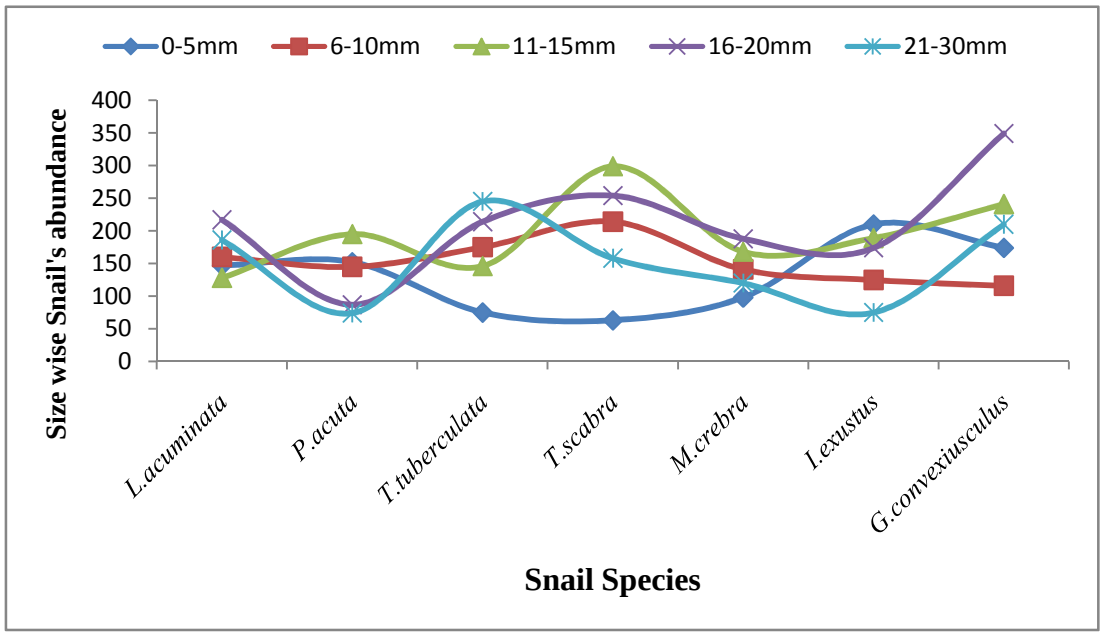

Fig. 1: Size distribution of collected snails at Dudhlee in Doon Valley during the study period (January 2015 - March 2015).

Table1: Details about the morphometric analysis of collected snails at Dudhlee in Doon Valley during the study period.

S.No.	Snails species	Size range		Shell of the shape	Associated biotic community
		SH	SW		
1.	***L. acuminata***	11.2-16.2	5.74-9.62	Conical	*Amoeba, Ciliate, Euglena, Spirogyra, Ulothrix, Daphnia.*
2.	***P. acuta***	6.1-10.2	4.60-5.71	Conical	*Anabena, Chroococcus, Nostoc, Bosmina, Cyclops, Amoeba, Daphnia.*
3.	***T. tuberculata***	13.2-28.2	7.75-8.52	Conical	*Diatoma, Fragilaria, Gomphonema, Navic Nitzshia, Oedogonium, Spirogyra, Ulothrix.*
4.	***T. scabra***	11.2-22.1	5.1-6.12	Conical	*Chara, Chlorella, Chlorococcum, Cladoph Microspora, Oedogonium, Spirogyra, Ulothrix, Amoeba, Ciliate, Euglena.*
5.	***M. crebra***	9.9-18.11	5.21-7.1	Conical	*Amoeba, Ciliate, Euglena, Spirogyra, Ulothrix, Paramecium, Volvox, Vorticella.*
6.	***I. exustus***	5.4-7.18	12.7-16.2	Discoidal	*Chlorococcum, Cladophora, Microspora, Oedogonium, Amoeba, Ciliate, Euglena, Paramecium, Vorticella.*
7.	***G. convexiusculus***	4.5-5.84	8.23-13.6	Discoidal	*Amoeba, Ciliate, Euglena, Paramecium, Diatoms, Fragilaria, Gomphonema, Navicula.*

Note: [SH-Shell height**; SW-**Shell width**]**

DISCUSSION

A number of workers have carried out their studies on various species of snails from different part of the country. The present findings resemble with the observation made by earlier workers on the occurrence of Malaco faunal diversity in water bodies of Doon Valley [24]. At Asan river 13 species of snails were recorded [25, 26] while in our present study only 7 species of snails were recorded. There is a major difference between the findings of present study andon snail fauna of Western Uttar Pradesh where the authors were recorded only 3 species of snails [34].

The present findings differ with [15] who provided information on population structure and shell morphometrics of the gastropod snail *Theodoxusmacri* and that too from Azraq Oasis, Jordon Further, there is a major difference with the findings carried out on the shape, size and other characteristics of the shells of 10 species of freshwater snails belonging to five families collected from some parts of the Pothwar region in Pakistan [16].

In our study, there was a rich biotic community found associated with *Thiara (M) scabra*while it was least with *Lymnaeaacuminata. Indoplanorbisexustus* was on the 2nd rank found associated with 9 different organisms. In this aspect, the present findings are in collaboration with results made on the role of aquatic flora and fauna associated with the freshwater snail *Lymnaeaacuminata* in Kham river at Aurangabad (M.S.) [35] and Kaveri river system [36]. The difference is in the species of snails as in present study the observations have been made on 07 species.

It can be speculated, therefore, that ecological conditions like size, depth of the water body, pH, temperature and dissolved oxygen of the water affect the snail population. Possible explanation in the uniqueness in the faunal diversity of snail is that the freshwater snails have been found plethora at those habitats where the water flow was slow to moderate and the substratum was having plenty of vegetation. At those places where the water flows fast, the snail's specimens were recorded less in number. This could be due to wash away of snails specimens along the water current.

Extrinsic factors due to environmental conditions can induce variations in the shell shape of snails. In addition, environmental changes without genetic change can create distinct non-genetic changes in shell morphology.
Large snails are older, on average, than small snails, within a given population [37]. This age variation translates into differential exposure to and duration of infection among snails of differing sizes because larger–older snails may have been exposed to more miracidia or may have been infected for a longer period and thus has patent, highly productive infections.

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REFERENCES

1. Watson, A. M., and Ormerod, S. J., 2004, The distribution of three uncommon freshwater gastropods in the drainage ditches of British grazing marshes. *Biological Conservation*, 118: 455-466.
2. Strong, E. E., Gargominy, O., Ponder, W. F., and Bouchet, P., 2008, Global diversity of gastropods (Gastropoda; Mollusca) in freshwater. *Hydrobiologia*, 595: 149-166.
3. Rothhaupt, K.O., 2000, Plankton population dynamics: Food web interactions and abiotic constraints. Freshwater Biol., 45: 105-109.
4. Jenkerson, C.G., and Hickman, M., 2007, Interrelationship among the epipelon, epiphyton and phytoplankton in an entrophic lake International Reve Dev. GesamtenHydrobiol. Hychrograp. 71(4): 557-579.
5. Mason, C.F., 1990, Biological Aspects of Fresh Water Pollution. 2nd Edn., In: Harrison, R.M. (Ed.), Pollutions: Causes, Effects and Control. Royal Society of Chemistry. London, 99-125.
6. Murugan, N., P., Murugavel and Koderkar, M.S., 1998, Freshwater cladocera; Indian Associ. of Aqua. Biologists (IAAB), Hyderabad. 47p
7. Dadhick, N., and Saxena, M.M., 1999, Zooplankton as indicators of trophical status of some desert waters near Bikaner. J. Environ. Pollut. 6, 251-254.
8. Ahmad, M.S., 1996, Ecological survey of some algal flora of polluted habitats of Darbhanga. J. Environ. Pollut, 3:147-151.
9. Contreras, J.J., Sarma, S.S.S., Merino-Ibarra, M., and Nandini, S., 2009, Seasonal changes in the rotifer (Rotifera) diversity from a tropical high altitude reservoir (Valle de Bravo, Mexico). J. Environ. Biol., 30, 191-195.
10. Rocha, O., Matsumura-Tundisi, T., Espindola, E.L.G., Roche, K.F. and Rietzler, A.C., 1999, Ecological theory applied to reservoir zooplankton, pp.457-476. In: Theoretical reservoir ecology and its application (Eds.: J.G. Tundisi and M.Straskraba). Internat, Inst. Ecol., Sao Carlos.
11. Neves, I.F., Recha, O., Roche, K.F., and Pinto, A.A., 2003, Zooplankton community structure of two marginal lakes of the river Cuiaba (Mato Grosso, Brazil) with analysis of Rotifera and Cladocera diversity. Braz. J. Biol., 63:1-20.
12. Todd, A. C., and Gary, D. S., 1990, Factors determining population density and size distribution of a freshwater snail in streams: effects of spatial scale. OIKOS 59: 359-367.
13. Chiu, Yuh-Wen., Hon-Cheng, C., Sin-Che, L., and Chaolun, A. C., 2002, Morphometric Analysis of Shell and Operculum Variations in the Viviparid Snail, *Cipangopaludinachinensis*(Mollusca: Gastropoda), in Taiwan. *Zoological Studies* 41(3): 321-331.
14. Graham, A. L., 2003, Effects of snail size and age on the prevalence and intensity of avian schistosome infection: relating laboratory to field studies. *J. Parasitol.,* 89(3):458-463.
15. Nekola, J. C., 2005, Geographic variation in richness and shell size of eastern North American land snail communities. *Records of the Western Australian Museum* Supplement No. 68: 39–51.

16. Elkarmi, A.Z., and Ismail, N.S., 2006, Population structure and shell morphometrics of gastropod Theodoxusmacri (Neritidae: Prosobranchia) from Azraq, Oasis, Jordon. Pak. J. Biol., Sci., 9(3): 549-552.

17. Afshan, K., Beg, M.A., Ahmad, I., Ahmad, M.M., and Qayyum, M., 2013, Freshwater Snail Fauna of Pothwar Region, Pakistan J. Zool., vol. 45 (1), pp. 227-233.

18. Srivastava, N., and Jauhari, R., 1990a, Influence of some abiotic factors on the occurrences of larval trematodes in *Lymnaea acuminate* (Lamarck) in Doon Valley. *Rivista di Parasitologiya.* 6(1):335-341.

19. Srivastava, N., and Jauhari, R., 1990b, Population fluctuation of the freshwater snail *Thiara (Melanoides) tuberculata* in Doon Valley in relation to certain factors. J. Zool. Soc. India, 41(1&2):63-67.

20. Pokhriyal, B.P., Mahesh, R.K., and Jauhari, R.K., 1997, Prevalence of trematode cercarial infection in the snail *Lymnaea (Pseudosuccinea) acuminata*Lamarck 1882 in different localities of Dehradun valley. *Bioved,* 8(1, 2):15-19.

21. Mitra, S.C., Dey, A., and Ramakrishna. 2003, Freshwater Mollusca fauna of Asan wetland. Wetland Ecosystem Zool. Surv. India, 5:19-22.

22. Rai, R., and Jauhari, R.K., 2009a, Bioecology of a Pulmonate snail,*Physaacuta*Draparnaud, 1805 (Mollusca:Gastropoda) in Doon-valley (Uttarakhand). IVthUttarakhand state sci. and Tech. Congress, 177-180.

23. Rai, R., and Jauhari, R.K., 2009b, New record of a pulmonate snail, *Physaacuta*Draparnaud, 1805 (Gastropoda: Physidae) from Doon-valley (Uttarakhand). Ann. For., 17(2):293-297.

24. Rai, R., and Jauhari, R.K., 2010, Malaco faunal diversity in water bodies of Doon Valley. Uttar Pradesh J. Zool., 30(1): 101-106.

25. Pokhriyal, B.P., Mahesh, R.K., and Jauhari, R.K., 1998a, Studies on the molluscan diversity of Asan river system in Doon valley with special to vectors of trematode parasites. J. Forestry, 21(2): 167-170.

26. Pokhriyal, B.P., Mahesh, R.K., and Jauhari, R.K., 1998b, Occurrence of recognized Helminthic vector snails in different habitats in Doon Valley. Him. J. Zool., 12:167-172.

27. Devi, P., 2011, Trematode cercariae infection in the snail, *Thiara(Melanoides) tuberculata*(Mueller, 1774) in different localities of Doon valley, India. Deccan Current Science, 4(I): 221-225.

28. Singh, S., Devi, N.P., and Jauhari, R.K., 2015, Seasonal Fluctuation on the Abundance of Vector Snails under the Impact of Certain Meteorological Factors in District Dehradun (Uttarakhand). Deccan Current Science, 11(1): 101 – 1.

29. Subba Rao, N.V., 1989, In: Freshwater molluscs of India, Hand Book Zoological Survey of India, Calcutta. XXIII+1-289KPP.

30. Ramakrishna and Dey, A., 2007, Handbook on Indian freshwater Molluscs, Zoological Survey of India, 1-399.

31. -Barth, G., 1962, Key to the identification of East and Central African freshwater snails of medical and veterinary importance. *Bull. Wld. Hlth. Org.,* 27: 135-150.

32. Thompson, F.G., 2004, The freshwater snails of Florida: a manual for identification. University of Florida Press, Gainesville, 32611-7800.

33. APHA 2005, Standard method for the examination of water and waste water. *Amer.Pub. Health Assoc, Washington*, 21st ed. D.C. 1325.

34. Sharma, B., Sharma, N., and Kumar, D., 2005, Biodiversity of freshwater snail fauna of western Uttar Pradesh. Uttar Pradesh J. Zool. 25(3):303-306.

35. Nagare, K.R., and Dummalod, C.B., 2012, Aquatic flora and fauna associated with the freshwater snail *Lymnaeaacuminata* in Kham river at Aurangabad (M.S.) International Multidisciplinary Res. J., 2(5):05-08.

36. Amanullah, B., and Hameed, S., 1996, Studies on the molluscan diversity in Kaveri river system with special reference to vector snail of trematode parasite. Current Sci., 71(6):473-475.

37. Minchella, D. J., Leathers, B. K., Brown, K. M., and Mcnair.J. N., 1985, Host and parasite counteradaptations: An example from afreshwater snail. The American Naturalist 126: 843–854.