

FLORA AND FAUNA

2015 Vol. 21 No. 2 PP 219-224

ISSN 0971 - 6920

## BIOTIC AND ABIOTIC COMPONENTS ASSOCIATED WITH FRESHWATER SNAILS AT GULARGHATI IN DOON VALLEY, UTTARAKHAND

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**Received** : 7.8.15; **Accepted** : 10.10.15

### ABSTRACT

The present work was carried out for the occurrence of aquatic flora and fauna associated with freshwater snails. Monthly zooplankton and phytoplankton samples were obtained from selected sampling sites at Gularghati in Doon valley. In gastropods, 7 species of freshwater snails, viz., *Lymnaea acuminata*, *Thiara tuberculata*, *Melanoides crebra*, *Thiara scabra*, *Indoplanorbis exustus*, *Physa acuta* and *Gyraulus convexiusculus* were collected. Abundance of biotic community showed maximum in the winter season and the site reservoir contributed maximum. Both phyto and zooplankton showed positive correlation with conductivity and negative correlation with other selected parameters. On the other hand snails exhibited negative correlation with potassium and hardness.

Figure : 01

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KEY WORDS : Biotic/abiotic components, Doon Valley, Fresh water snails, Gularghati.

### Introduction

Water quality assessment involves analysis of physico-chemical, biological and microbiological parameters and it reflects on abiotic and biotic status of the ecosystem<sup>12,17,19</sup>. Planktonic communities are influenced by the prevailing physico-chemical parameters, which determine their abundance, occurrence and seasonal variations<sup>27</sup>. Ecologically, zooplanktons are the most important biotic components influencing all the functional aspects of an aquatic ecosystem<sup>9,20,24,29</sup>. The distribution of zooplankton community depends on complex factors such as, change of

climatic conditions, physical and chemical parameters and vegetation cover<sup>22,26</sup>. Most of the species of planktonic organisms are cosmopolitan in distribution<sup>18</sup>. The zooplankton plays an integral role and serves as bioindicators and it is a well-suited tool for understanding water pollution status<sup>9,20</sup>. Studies on planktonic relation to certain physico-chemical factors of water were conducted from Uttarakhand in the past<sup>6,11,14,16</sup>.

Aquatic snails play an important role in freshwater ecosystem and some of them transmit serious diseases to human, animals and fish. Abiotic factors of aquatic system play significant

**ACKNOWLEDGEMENTS** : The financial assistance rendered by the Uttarakhand State Council of Science and Technology (U-COST) is gratefully acknowledged. The authors are thankful to Dr. D.K. Gupta, Associate Professor, Botany Dept for his help in identifying some specimens of planktonic community and to the Principal, D.A.V. (P.G) College, Dehradun (Uttarakhand) for providing laboratory facilities.

TABLE-1: The biotic community at Gularghati in Doon valley during 2013-2014.

(I)	Planktons	Species
A)	Bacillariophyceae	<i>Actinella, Ceratium, Diatoma, Fragilaria, Gomphonema, Navicula, Nitzshia.</i>
B)	Chlorophyceae	<i>Chara, Chlorella, Chlorococcum, Cladophora, Microspora, Oedogonium, Spirogyra, Ulothrix.</i>
C)	Crustacean	<i>Bosmina, Cyclops, Daphnia.</i>
D)	Cynophyceae	<i>Anabena, Chroococcus, Nostoc, Oscillatoria.</i>
E)	Protozoa	<i>Amoeba, Ciliate, Euglena, Paramecium, Volvox, Vorticella.</i>
F)	Rotifera	<i>Brachinous, Philodina, Trichocera.</i>
(II)	Mollusca (Gastropods)	<i>Lymnaea acuminata, Thiara (M) tuberculata, Melanoides crebra, Thiara (T) scabra, Indoplanorbis exustus, Physa acuta and Gyraulus convexiusculus</i>

role in altering the snail population/infection rate as well as fecundity of snail<sup>13</sup>. Studies have been conducted on aquatic flora and fauna associated with the freshwater snail *Lymnaea acuminata* in Kham river at Aurangabad<sup>21</sup>. Further in the past, studies have been made on the factors determining population density and size distribution of a freshwater snail in streams<sup>8</sup>. The pH, maximum temperature and stream discharge were the dominant factors affecting the community structure in a number of English streams<sup>31</sup>.

As the snails breeding habitats are ponds, tanks, lakes, riverbeds and rice fields, the role of co-existing biotic community is a must in their survival. The present study is an attempt to investigate the physico-chemical parameters and composition of phyto/zooplankton community with the snail's abundance at Gularghati in Doon valley (Uttarakhand).

#### Study area

The investigation was performed at 5 selected sites at Gularghati in the vicinity of Doon valley, which is about 16 km away from the central point. It is situated at the latitude 30°11'N and longitude 78°08'E on the bank of river Song which is the main source of this locality. The area is densely occupied by vegetation while the animals like cows, buffaloes, goats, etc. visit the area frequently for grazing and drinking riverine water.

### Materials and Methods

**A) Collection of samples :** Monthly zooplankton and

phytoplankton samples were obtained from snail's sampling site "Gularghati" from different sampling stations, Site-1, Site-2, Site-3, Site-4 and Site-5 during May 2013 to June 2014. Concurrently, water samples were taken for estimating selected physico-chemical variables (temperature, pH, conductivity salinity, K<sup>+</sup>, and TDS) measured by field devices. For zooplankton / phytoplankton samples, 40 liters of water was filtered using plankton net of 50  $\mu$ m mesh size. The concentrated plankton samples were preserved immediately with the help of 4% formalin. Snails were collected by dip nets and also by hand.

#### B) Identification of the snail's samples:

Identification of snail's species was done with the help of standard keys and catalogues like **Handbook of freshwater mollusks**<sup>30</sup> and **Handbook on Indian Freshwater Molluscs**<sup>25</sup>.

**C) Biological analysis:** Planktons were studied under microscope and identified<sup>2, 3</sup>. Quantitative analysis was made using a plankton-counting cell (Sedgwick rafter).

**D) Physico-chemical analysis:** Temperature (air and surface water) was recorded on the spot using centigrade thermometer and pH meter respectively. However, chemical analysis of sample was done according to standard methods<sup>5</sup>.

### Results

A total of 6 groups of planktons viz., Chlorophyceae, Bacillariophyceae, Cynophyceae,

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Protozoa, Rotifera and Crustacean were collected from the selected five habitats [Site-1(reservoir); Site-2 (drains); Site-3 (canal); Site-4 (pond) and Site-5 (rice field)] at Gularghati during the study period. The abundance of phytoplankton was found more than zooplankton. Among the planktons recorded, 3 groups were shared by phytoplanktons (Chlorophyceae, Bacillariophyceae and Cynophyceae) and the remaining 3 were zooplanktons (Protozoa, Rotifera and Crustacean). In gastropods, 7 species of freshwater snails viz., *Lymnaea acuminata*, *Thiara (M) tuberculata*, *Melanoides crebra*, *Thiara (M) scabra*, *Indoplanorbis exustus*, *Physa acuta* and *Gyraulus convexiusculus* were collected (Table-1).

While studying the habitat/site wise biotic community abundance, the reservoir contributed highest followed by rice field, drains, canal and pond in succession. Maximum phytoplankton and zooplankton abundance was found at Site-1 and Site-5. However, snail abundance was maximum at Site-1 followed by Site-2, Site-4 and Site-3. In season wise abundance, winter shared highest number of phytoplankton in most of the habitats except pond while least during summer months. Zooplanktons shared maximum abundance in winter season followed by post monsoon season and minimum in monsoon season. In case of snail species, the reservoir shared maximum abundance during monsoon but the other sites showed maximum during winter season (Fig.-1).

Pearson correlation r-values have been calculated between physico-chemical variables and plankton population and shown in Table-2. Both

phytoplankton and zooplankton showed negative correlation with most of the parameters except conductivity. While snails showed positive relation with most of the parameters and negative was showed by potassium and hardness.

### Discussion

The results of present study showed maximum abundance of planktons during the winter months in most of the selected sites, thus supports the findings of earlier workers<sup>14,15,16</sup>. They stated that the planktons were maximum in the month of winter probably due to low temperature, high content of DO, low velocity, more transparency of water and other suitable conditions which are necessary for the growth of planktonic diversity. In this regard, high values of plankton were reported during January to March<sup>6</sup>.

In a study on biotic and abiotic factors influencing the distribution of the *Huachuca Springsnail (Pyrgulopsis thompsoni)* it was pointed out that many factors affect the distribution of *Huachuca springsnail*, but there was a specific relationships between springsnail abundance and the abundance of co-occurring snails (*Physa* sp.) and caddis fly larvae (*Helicopsyche* sp., Trichoptera), as well as a suite of abiotic factors (total dissolved solids, pH, distance from spring source, spring channel, water temperature and dissolved oxygen)<sup>34</sup>.

Dissolved oxygen is one of the major components, which is required for the metabolic activity of snails<sup>33</sup>. Dissolved oxygen concentration in water decreases with increase in temperature<sup>28</sup>.

**TABLE-2: Pearson Correlation between biotic community and physico-chemical parameters of habitats at Gularghati in Doon valley during 2013-2014.**

Parameters	Phytoplankton	Zooplankton	Total Snails
Temp	-0.74	-0.36	0.22
pH	-0.37	-0.33	0.19
Cond.	0.15	0.31	0.68
K <sup>+</sup>	-0.15	-0.38	-0.4
F <sup>-</sup>	-0.17	-0.62	-0.85
TDS	-0.38	-0.34	0.4
Sal	0.02	0.02	0.15

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When the CO combines with water it forms carbonic acids and releases hydrogen ions, pH of water is one of the important factors that directly or indirectly influence the metabolic activities and thereby the growth and abundance of freshwater mollusks<sup>1,13</sup>. In general, the aquatic organisms are affected by pH because most of their metabolic activities are pH dependent.

It is generally assumed that the aquatic vegetation offers a favorable habitat to the snails<sup>10</sup>. Snail could live and reproduce without aquatic vegetation<sup>1,32</sup>. Although the soft parts of microphytes and the periphyton growing on them are the favorable food source<sup>1</sup>. In a study on resource

limitation, competition and the influence of life history in a freshwater snail community, increased densities of snails were found after an increase in resource level<sup>23</sup>. Though there is a bit similarity between the findings of present study and with regard to occurrence of *Lymnaea acuminata* but the difference exists if the co-existing biotic community is taken into consideration<sup>21</sup>.

Conclusively, the present findings could be utilized by future researchers and ecologists as supplementary in public and veterinary health sciences, water quality assessment and riverine management.

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