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Research Article

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Diversified distribution of malacoauna from Hiranyakeshi river- A contemporary study

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ABSTRACT

Molluscan species were collected from selected sites of Hiranyakeshi river. A total nine taxa were recorded from all sampling sites during the study period from Feb. 2012- Jan. 2013. For molluscs, gastropod and bivalve recorded species viz; Parreysia corrugata, Pyrresia favidens, Lamillidens marginalis, Lamillidens corrianus, Corbicula regularis, Bellamya bengalensis, Tarebia lineata, Melanoidus tuberculata and Indoplanorbis exustus.Data showed the dominance of Parreysia corrugata, Lamillidens marginalis, and Lamillidens corrianus speciesand less number of Indoplanorbis exustus.

Key words: *Mollusca, Gastropoda, Bivalvia, River Hiranyakeshi.*

INTRODUCTION

Mollusca occur in various habitats and are divided into freshwater, marine and terrestrial forms. The fresh water molluscs play a significant role in aquatic ecosystems and some of them are edible. All aquatic ecosystems around the globe are generally colonized by the inclusion of phylum Mollusca. Molluscs, a group of most diverse and dominant fauna in water bodies and perform a key role maintained functioning of aquatic ecosystem. Molluscans are of great significance because they form the food of fishes and their productivity play an important link in the food chain. There are a variety of causes that contribute to the vulnerability of freshwater mussels, both in terms of abundance and diversity[4,10,11,31].

Molluscans communities are good indicators for the localized conditions, which reflect the water quality. Molluscs are bioindicators of freshwater pollution[16]. Molluscans species become prime model as biomonitoring agents, because of its sedentary and sessile life style, along with benefit of quick assessment of biological resources to obtain the population indices. The freshwater ecosystems in India highlight a rich diversity of molluscs, representing 212 species belonging to 21 families. Of these, 164 species were recorded from rivers and streams[35]. The presence of thriving population of molluscans indicates the land is not acidic; hardly some of the molluscs survive beyond pH 5[6]. Biological monitoring of rivers using macroinvertebrate is accepted as useful tool for the assessment of water quality[18,29].

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However, most studies have investigated streams and relatively small rivers and there is vital need to obtain biological information on the large rivers many of which became burdon due to population growth and urbanization within the area[25].

Subba Rao and Dey[34] and Garg *et al*[15].,documented a correlation between the molluscan diversity with physiochemical parameter with effect of water from Ramasagar reservoir from located in north way site of Dhatia city, Madhya Pradesh. Piola and Johnston[26] focused on the influence of pollution on the native diversity of invertebrates of new southwales, Australia. Prabhakar and Roy[27] studied the taxonomic diversity of shell. Verma and Saksena[39] studied the sewage pollution impact on water quality and micro zoobenthic fauna from Kalpi river, Gwalior, Madhya Pradesh.

There are many causes for the decline in freshwater mussel biodiversity[10,11,31]. Dudgeon *et al*[11]., described five major factors for the loss of freshwater biodiversity, which indicated over-exploitation, pollution, flow modification, exotic species invasion and habitat degradation. Another major reason for extinction of freshwater mussels is the high degree of endemism. This aspect is typical for freshwater habitats, where species often have a small effective population size, narrow ecological amplitude and a limited biogeographic range[32]. Consequently, the threat situation can be motivated when habitats are changed, degraded or heavily modified, especially in species with low dispersal ability, such as mussels under unionidae family[7]

Differences in growth and shell size of mussels attributed under the combined effect of many intrinsic and extrinsic factors, including population density, size, age, gonad development, nature of the substratum, temperature, food availability, environmental stress such as pollution, parasitism, pathogens, etc[13]. Invertebrate communities changes with response to habitat alteration and physico-chemical factors. Considering the Senario, present investigation has been undertaken to study diversity indices of molluscan fauna, from Hiranyakeshi river with respect to contamination of water.

MATERIALS AND METHODS

Study area

For the present molluscan diversity study, freshwater aquatic bodies from Gadhinglaj Tahsil, District Kolhapur, State Maharashtra had been selected. Hiranyakeshi river is the major lotic system which arises at Amboli in Sindhudurg district. For the study we selected four sites of Hiranyakeshi river, Mahagoan site (N 16°9’54” E 74°19’58”), Harali site (N 16°9’54” E 74°19’58”), Nilgi site (N 16° 14’ 16” E 74° 25’ 41”) and Nangnur site (N 16°14’3” E 74° 29’46”) (Plate No. 1).

Collection of species

Molluscan species were collected by simple hand picking method from selected sites.

Collection method

Quantitative analysis of Molluscan fauna was carried out by stratified random quadrate sampling method from selected sites as per standard method of Christon and Harris[8].

Fixation and preservation

After collection animals were cleaned and preserved in 70% alcohol.

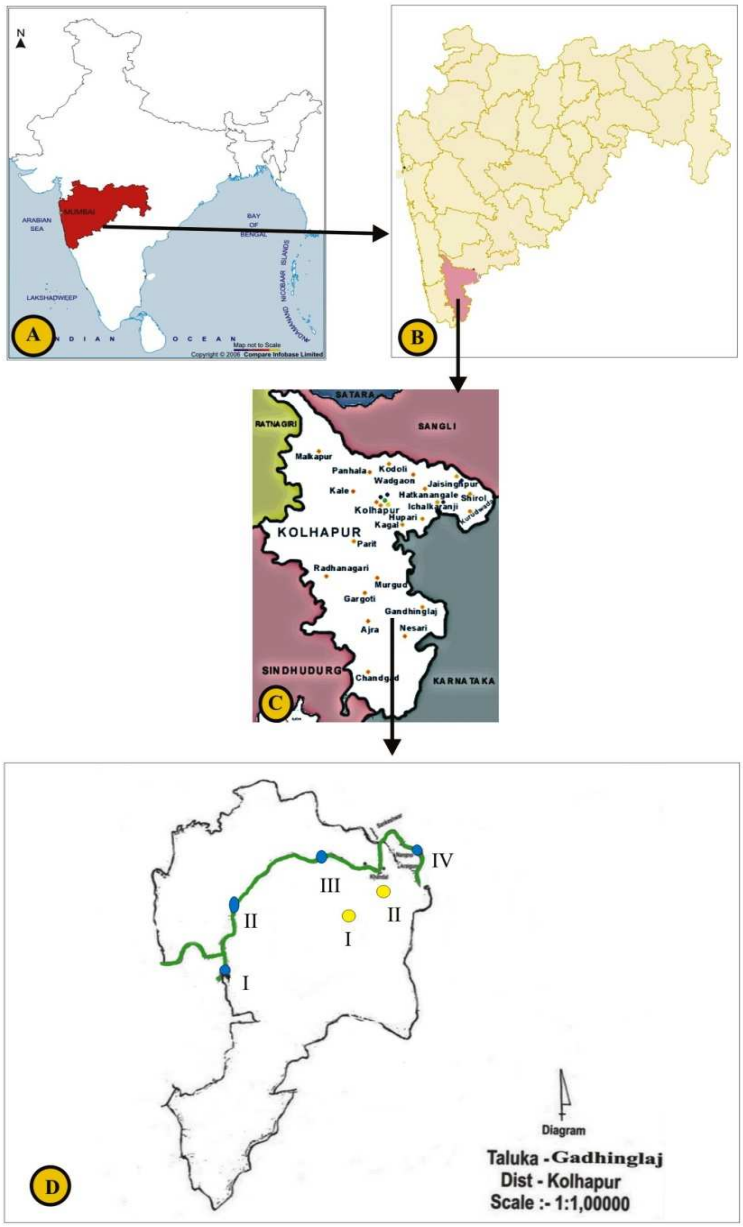
Identification

Identification of species was carried out by using standard literature of ZSI (Zoological Survey of India) and available identification keys (Krishnaram and Dey, 2007).

Statistical analysis

Statistical analysis of quantified data was carried out by calculating Shannon Weaver Index, (1963), Simpson Index[30], (1949) and Species Evenness Method, (Pielu, 1969) to interpret species richness and species abundance.

Plate No. 1



Graphical view of Hiranyakeshi river, Gadhinglaj, Kolhapur, Maharashtra representing study sites.

A: Map of India showing location of Maharashtra.

B: Map of Maharashtra showing location of Kolhapur District.

C: Map of Kolhapur district showing Tahsil location.

D: I- Mahagoan site of Hiranyakeshi river.

II- Harali site of Hiranyakeshi river.

III- Nilgi site of Hiranyakeshi river.

IV- Nangnur site of Hiranyakeshi river

RESULTS

Total of nine taxa were recorded from selected sampling sites during the period of Feb. 2012- Jan. 2013 (Table No. 1, 2). The phylum mollusca covers two classes, *viz.*, Gastropoda and Bivalvia (Table No. 3). Gastropod includes by two orders *viz.*, Mesogastropoda and Basommatophora; three families (Viviparidae, Tharidaeand Planorbidae) and four species. Site wise percentage population documented in Fig. No. 1.1- 1.4.

Class bivalvia also had one orders *viz.*, Trigoinoida; one families (Uninoidae); four genera and five species.

The species observed under class Gastropoda, order Mesogastropoda were, *Bellamya bengalensis, Tarebia lineata, Melanoidus tuberculata* showed in Plate No. 4.

The order with Basommatophora only single species was observed *Indoplanorbis exustus* Plate No. 3.

The molluscans community with class Bivalvia order Trigoinoida five species were observed *Parreysia corrugata, Pyrresia favidens, Lamillidens marginalis, Lamillidens corrianus* and *Corbicula regularis* Plate No. 2 and Plate No. 3.

The maximum diversity of molluscans was found in summer season while minimum in rainy season.Among the class Gastropod species the percentage composition of *Bellamya bengalensis* (Family- Viviparidae), was high at all sampling sites with abundance of 18%. *Tarebia lineata* (Family- Viviparidae) was also noted with higher dominance 12% after *Bellamya bengalensis.* All other molluscans species- *Melanoidus tuberculata* (Family- Tharidae) with 4%. *Indoplanorbis exustus* also with 4% Fig. No. 1.6.

Among class Bivalvia (Family- Uninoidae) *Parreysia corrugata* was noted as dominant species throughout the sampling sites with 22%, *Pyrresia favidens* with 16%, *Lamillidens marginalis* with 11%, *Corbicula regularis* with 7% and *Lamillidens corrianus* with 6% Fig. No. 1.6.

Faunal diversity of site I to site IV was noted with average Simpson Index[30] as 0.854, 0.853, 0.793 and 0.794 with evenness of 0.939, 0.915, 0.906 and 0.923 (Fig. No.1.8) As per Shannon Index, species abundance at site I- 2.032, site II- 2.00, site III- 1.625 and site IV- 1.66 (Fig. No. 1.9), while species evenness representing its average diversity and uniform distribution (Fig. No. 1.10).

Thus site I presenting richest molluscans diversity, with abundance and distribution (27%) andPhysico-chemical parameters were also positively co-related for growth and development of total malacofaunal assemblage. Sampling site III was observed with minimum percentage composition (23%) (Fig.1.5). Within these species *Parreysia corrugata* found maximum percentage (22%), while minimum *Malanoidus tuberculata* and *Endoplanorbis exustus* (4 %) depicted in Fig. No. 1.6. The annual percentage contribution of malacofauna to the total molluscans species was higher in the class Bivalvia (57%) and Gastropoda with 43% (Fig. No. 1.7).

Table No. 1: Molluscan species occurred at study localities

S. No.	Name of Class	Name of species	Site I	Site II	Site III	Site IV
1	Bivalveia	*Parreysia corrugata*	+++	+++	+++	+++
2		*Parreysia favidens*	+++	+++	++	+++
3		*Lamillidens marginalis*	+++	+ +	++	+++
4		*Lamillidens corrianus*	++	+ +	++	++
5		*Corbicula. regularis*	++	+ +	++	+++
6	Gastropoda	*Bellamya bengalensis*	+++	+++	+++	+++
7		*Tarebia lineata*	+++	+ +	++	+++
8		*Melanoidus tuberculata*	+++	+ +	++	+++
9		*Indoplanorbis exustus*	++	++	+	+

+++: Abundant population, ++: Moderate population. + : Low population.

Table No. 2: Species distribution from study localities

Study sites	Molluscans	
	Bivalve	Gastropods
I	5	4
II	5	4
III	4	4
IV	4	3

Table No. 3: Molluscan species occurred at study localities

S.No.	Phylum	Class	Order	Family	Species
1	Mollusca	Bivalveia	Trigoinoida	Uninoidae	*Pyrresia corugata*
2	Mollusca	Bivalveia	Trigoinoida	Uninoidae	*Pyrresia favidens*
3	Mollusca	Bivalveia	Trigoinoida	Uninoidae	*Lamillidens marginalis*
4	Mollusca	Bivalveia	Trigoinoida	Uninoidae	*Lamillidens corrianus*
5	Mollusca	Bivalveia	Trigoinoida	Uninoidae	*Corbicula regularis*
6	Mollusca	Gastropoda	Architaenioglossa	Viviparidae,	*Bellamya bengalensis*
7	Mollusca	Gastropoda	Sorbeoconcha	Thiaridae	*Tarebia lineata*
8	Mollusca	Gastropoda	Sorbeoconcha	Tharidae	*Melanoides tuberculata*
9	Mollusca	Gastropoda	Hygrophila	Planorbidae	*Indoplanorbis exustus*

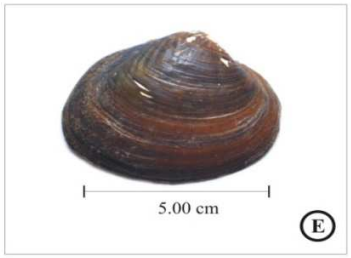
Plate No. 2

A: *Lamillidens marginalis*- Dorsal view

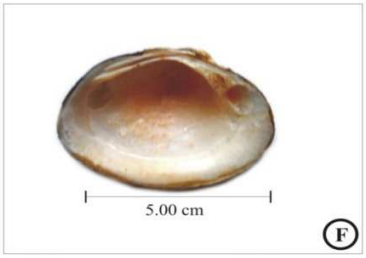
B: *Lamillidens marginalis*- Ventral view

C: *Corbicula regularis*- Dorsal view

D: *Corbicula regularis*- Ventral view

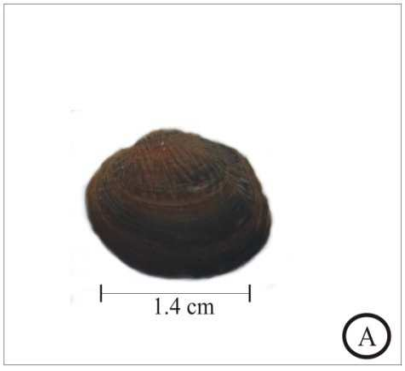


E: *Parreysia corrugata*- Dorsal view

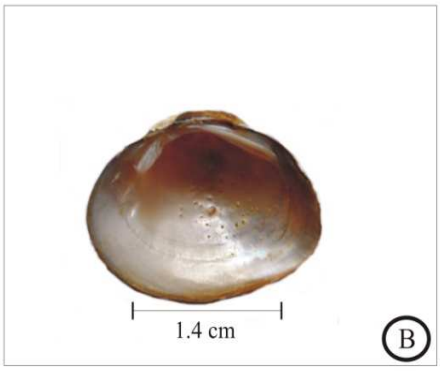


F: *Parreysia corrugata*- Ventral view

Plate No. 3

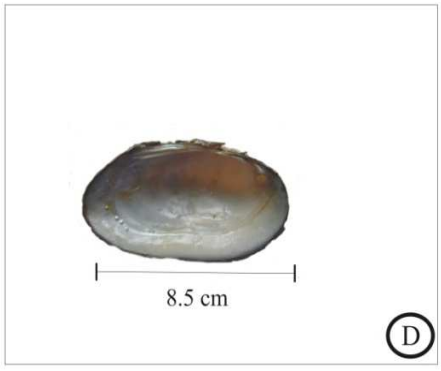


A: *Parreysia favidens*- Dorsal view

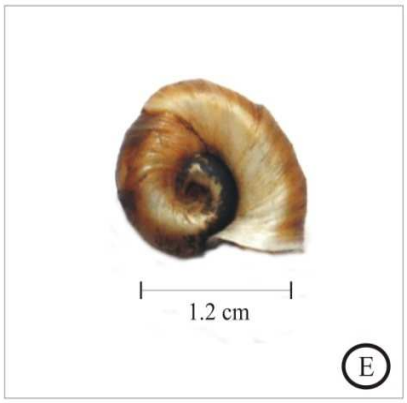


B: *Parreysia favidens*- Ventral view

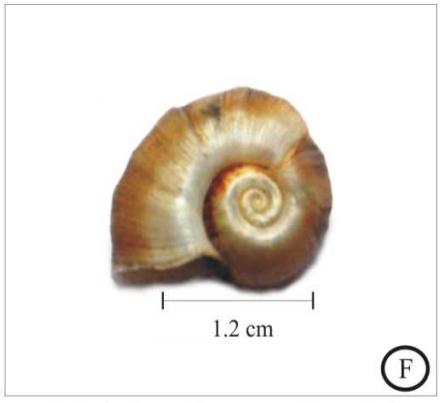
C: *Lamellidens corrianus*- Dorsal view



D: *Lamellidens corrianus*- Ventral view

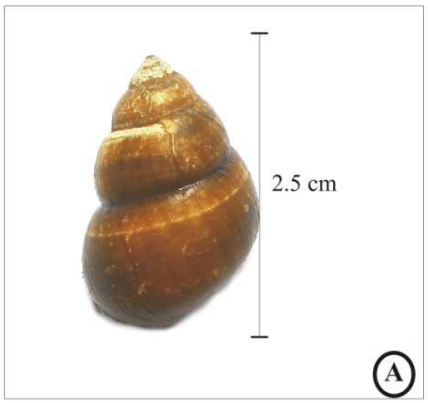


E: *Indoplanorbis exustus*- Dorsal view

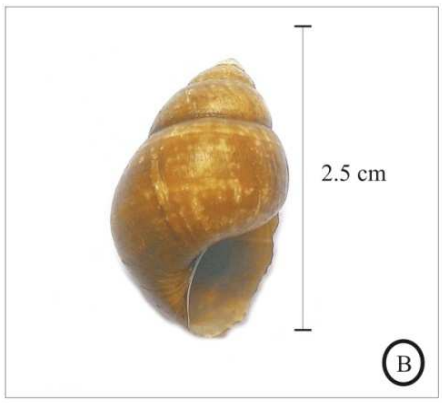


F: *Indoplanorbis exustus*- Ventral view

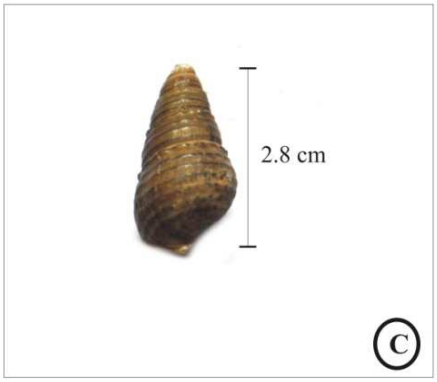
Plate No. 4



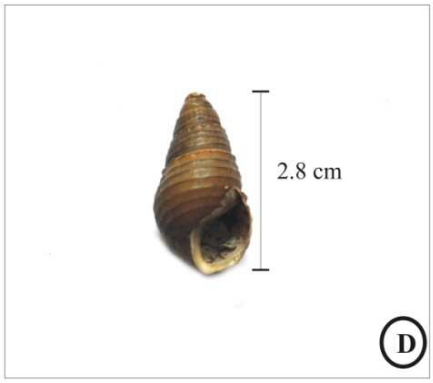
A: *Bellamya bengalensis*- Dorsal view



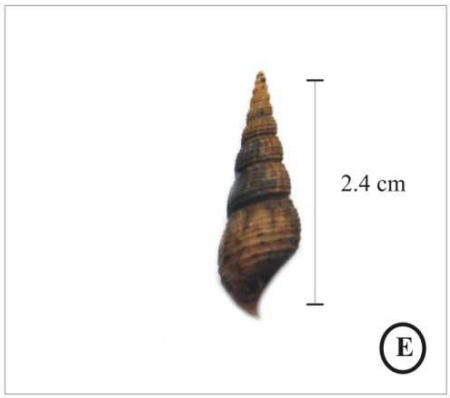
B: *Bellamya bengalensis*- Ventral view



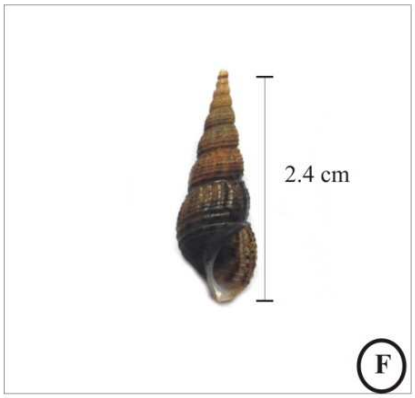
C: *Tarebia lineata*- Dorsal view



D: *Tarebia lineata*- Ventral view



E: *Melanoides tuberculata*- Dorsal view



F: *Melanoides tuberculata*- Ventral view

Fig. No. 1.1: Graphical representation of molluscans diversity from site I

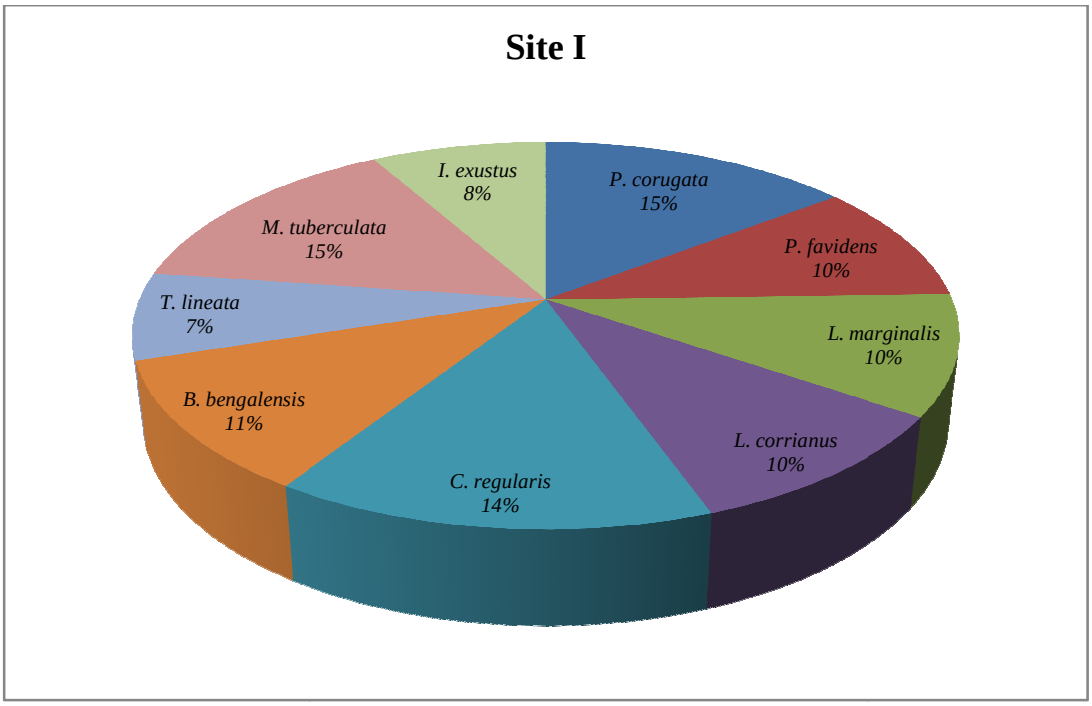


Fig. No. 1.2: Graphical representation of molluscans diversity from site II

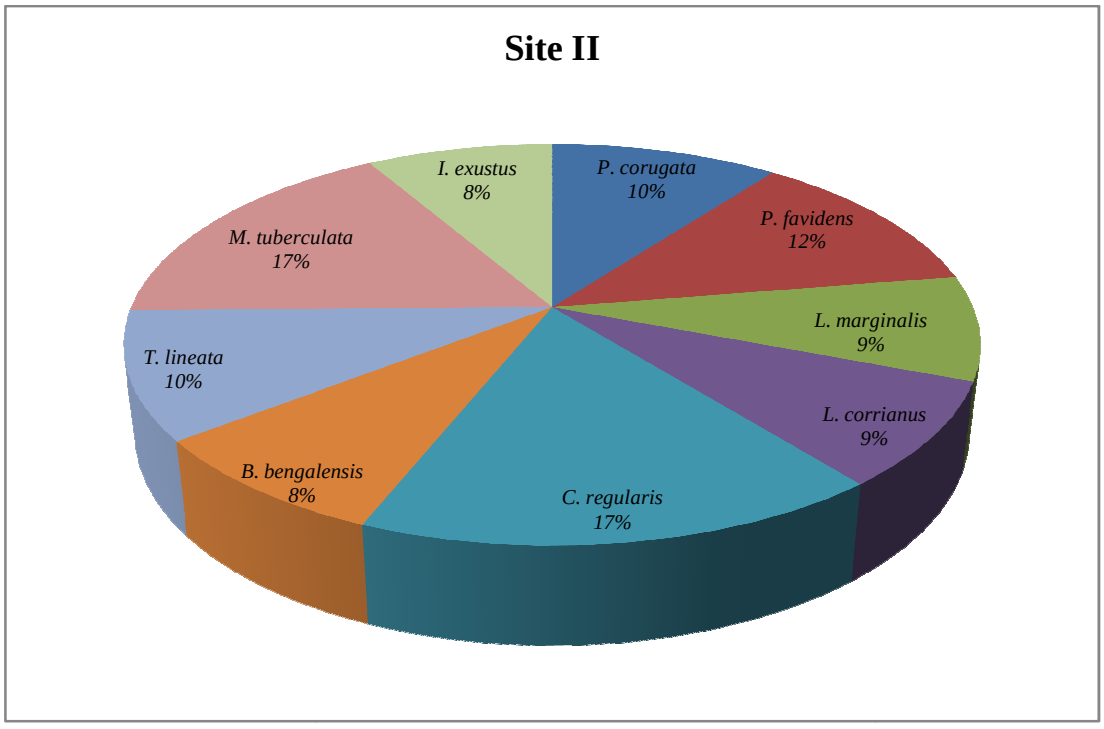


Fig. No. 1.3: Graphical representation of molluscans diversity from site III

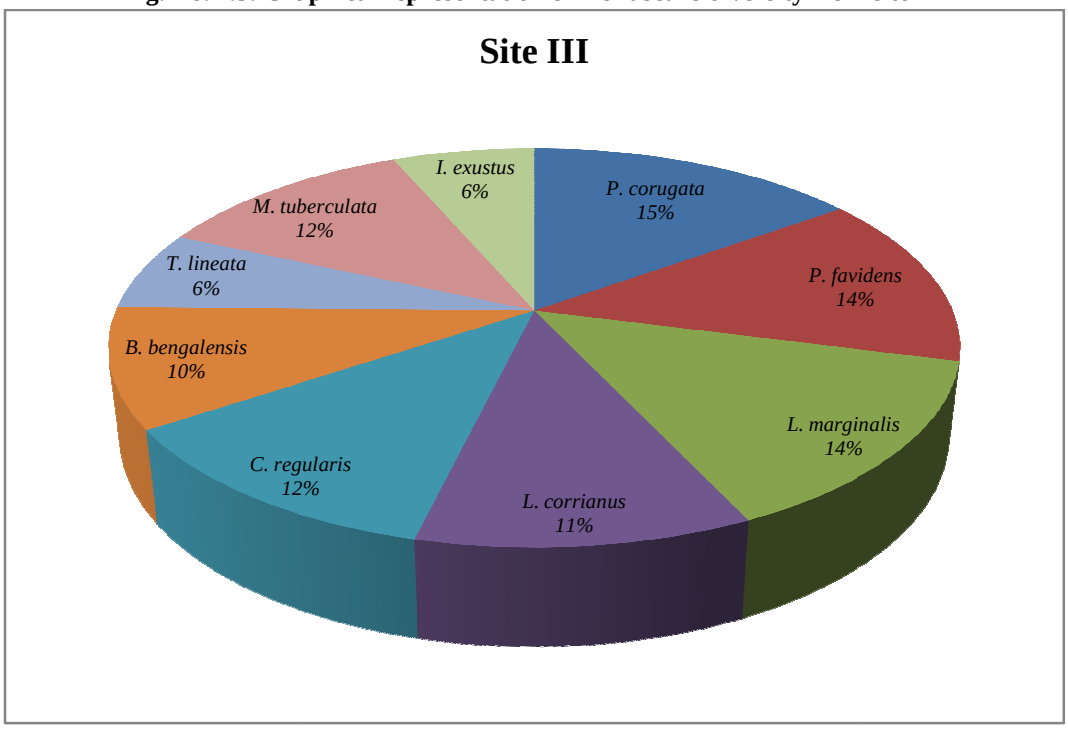


Fig. No. 1.4: Graphical representation of molluscans diversity from site IV

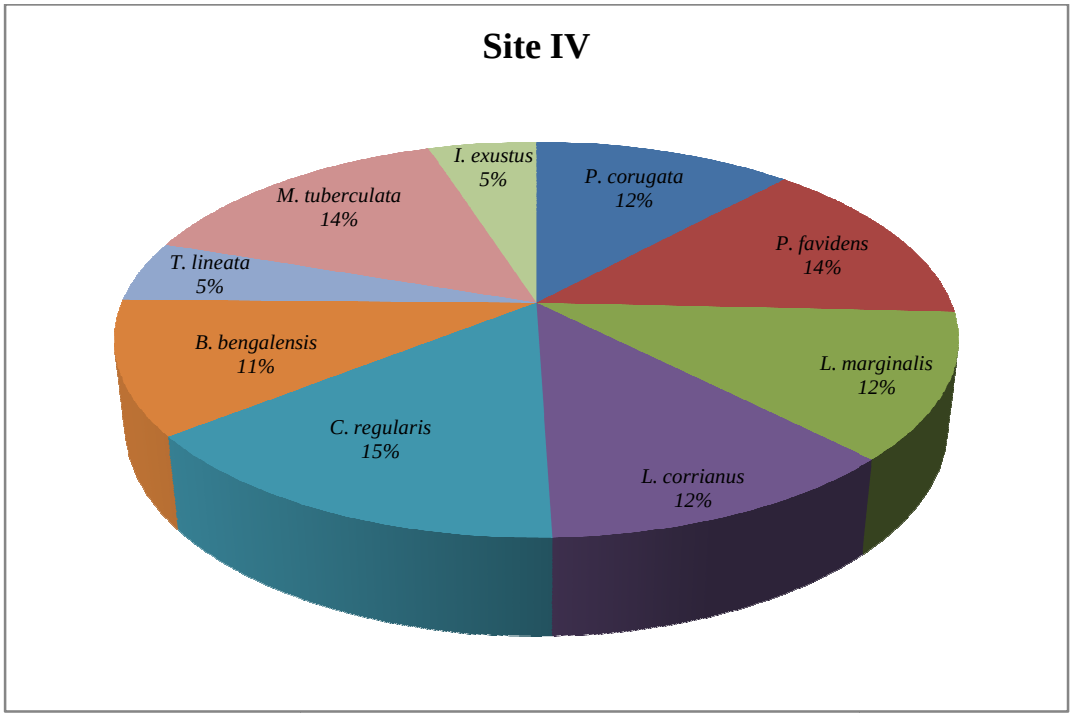


Fig. No. 1.5: Malacofaunal assemblage from study sites

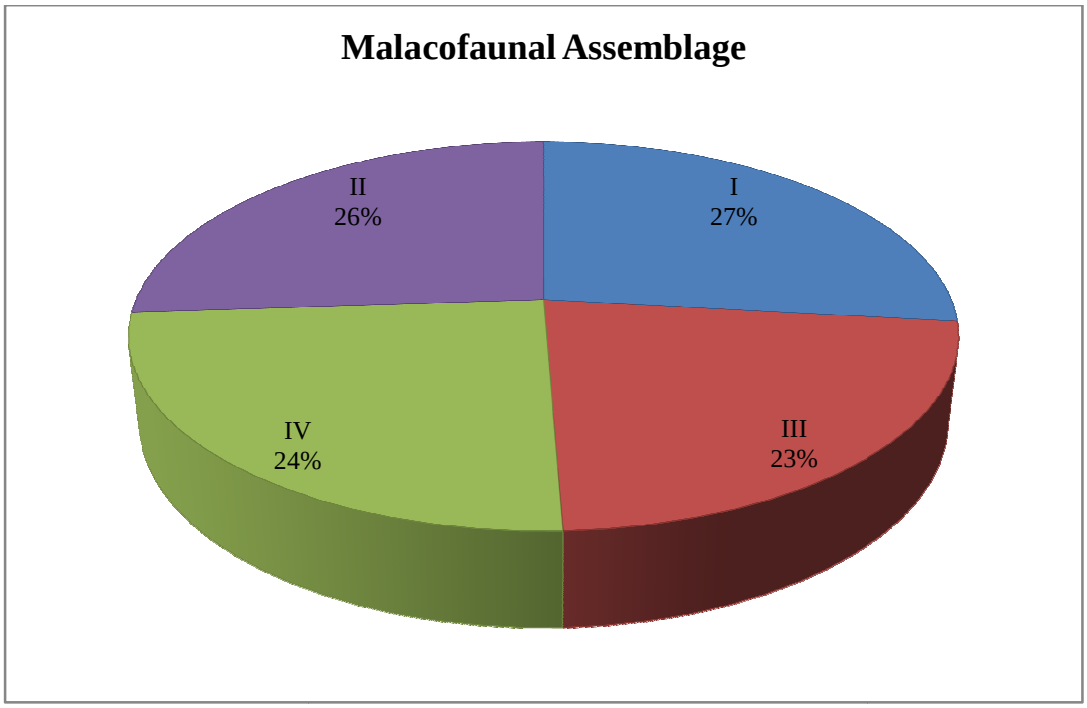


Fig. No. 1.6: Total count of observed species

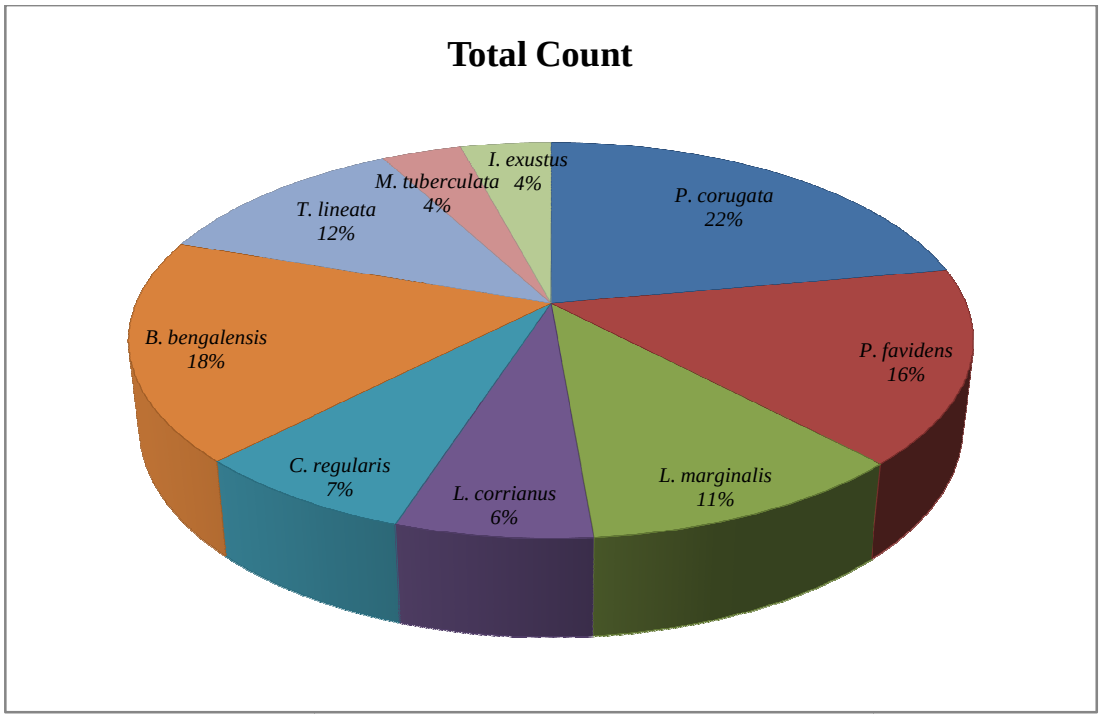


Fig. No. 1.7: Total Malacofaunal percentage at all study sites

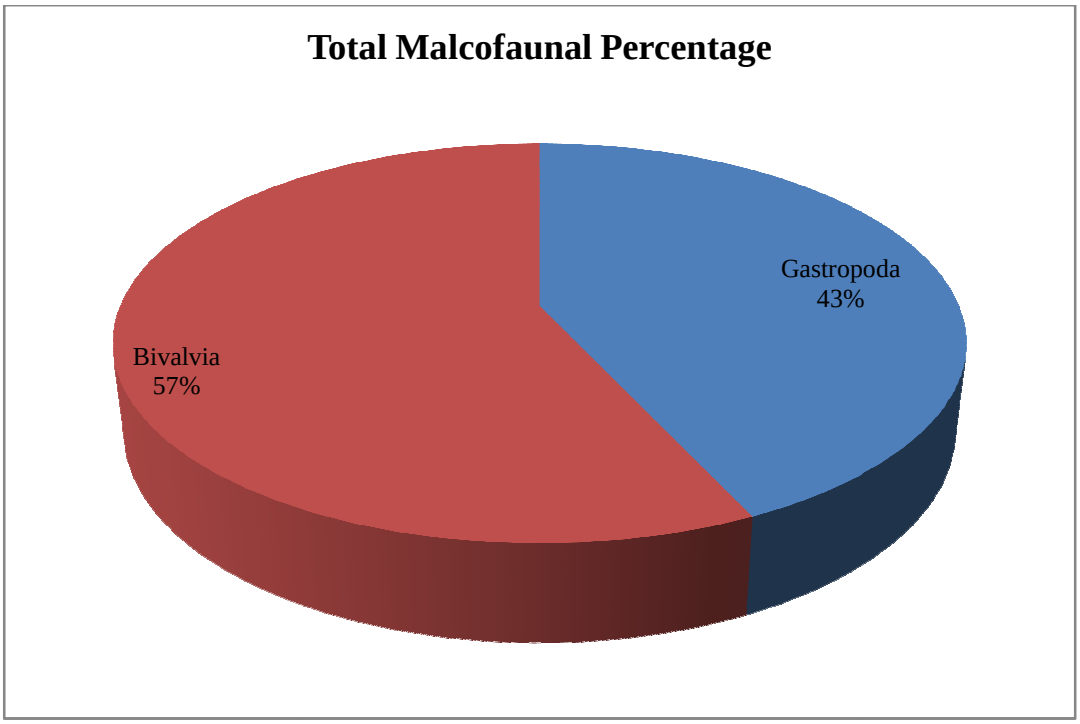


Fig No. 1.8: Estimated Simpson index[30] during assessment period

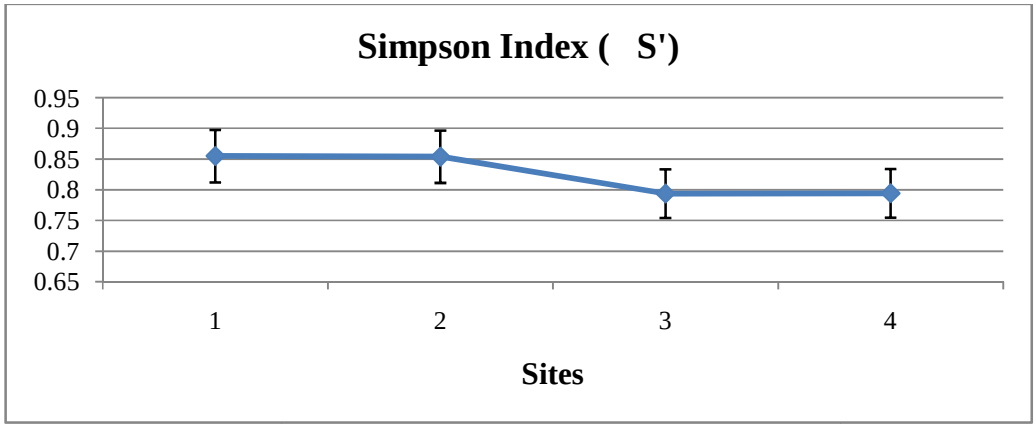


Fig No. 1.9: Estimated Shannon index during assessment period

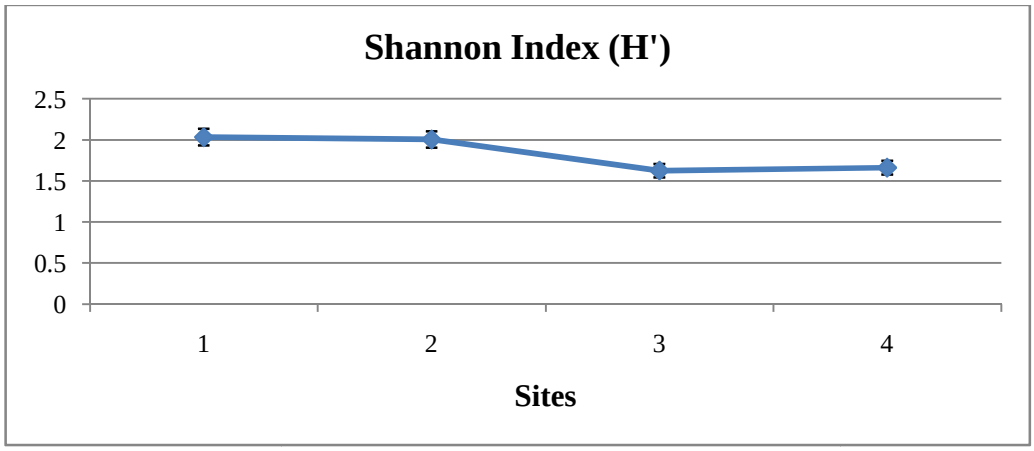
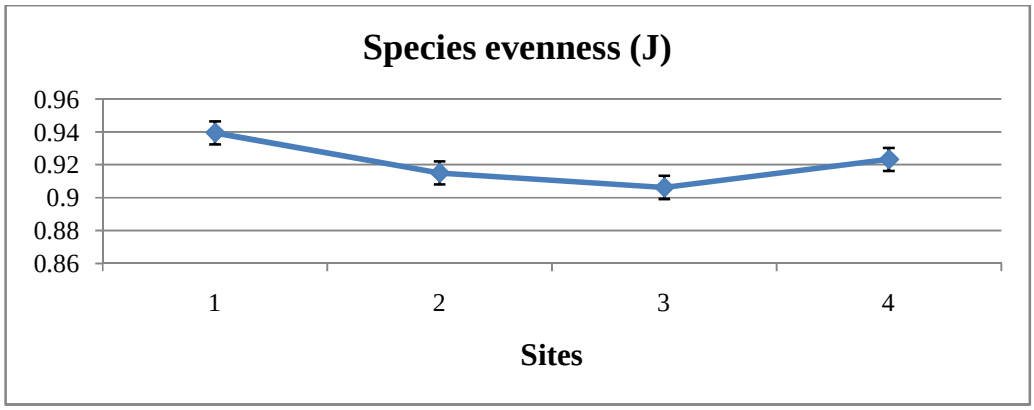


Fig No. 1.10: Estimated Species evenness during assessment period



DISCUSSION

Freshwater molluscan species found on every continent and in all aquatic habitats[33]. Morphological assessment of molluscs became fundamental part of biological research and found suitable technique in the identification of species[1]. Water quality has major influence over invertebrate population, composition and distribution[3,14,19]. Freshwater molluscs play a massive role in nature and help in assessment of ecological status of the water bodies. Freshwater mussels of the family Unionidae are the most diverse group of freshwater bivalve molluscs worldwide[5].

Bivalve species can be found all around the world in varied of environmental conditions from the poles to the tropics[9,17,38]. Over such a range, differences in environmental conditions such as in water temperature, salinity, food availability and water current occur. Water temperature found important factor influencing various physiological processes in bivalves. Therefore, higher water temperatures in the Dutch Wadden Sea showed effect on population dynamics of mussels might be expected. It was found that high water temperatures enhance predation pressure on larvae and post-larvae[2].

The availability of maximum molluscs during summer months could be related to two important ecological phenomenons which includes, maximum abundance of decomposers settled organic matter and macrophytes on the bottom of water body. Increased water temperature, activating the process of decomposition of these organic sediments[22].

We found that, population density of molluscan gets decreased in the period of post monsoon season. Oliver[23], explained that it may be due to the sudden inflow of water from the catchment area or water inlet or outlet system. The maximum diversity of molluscans was found in summer season. One of the most important factor which seems to determine the habitat and activities of molluscs is the amount of dissolved salts especially calcium carbonate in water, which is essential material for shell formation[20].

Molluscans were considered as most diverse and dominant benthic fauna both from lentic and lotic region which are mainly represented by the two major classes namely Gastropods and Pelecypods[21]. Patil and Talmale[24]has documented the checklist of the land and freshwater molluscan of Maharashtra state, where they reported 142 species of molluscan of all forms belonging to 42 genera including 23 families. Prabhakar and Roy[27]have observed 18 Gastropod species and 7 Pelecypod species from north Bihar region of India. Dutta and Malhotra[12] while studing the seasonal variation in macro benthic fauna of Gadigarh stream from Jammu observed that the predominance of molluscan fauna in the fishpond due to higher Calcium concentration. Verma and Saksena[39] observed 11 species of the molluscans from Kalpi (Marar) river from Ramaua reservoir, Gwalior Madhya Pradesh. Rajan and Murugan[28]recorded diversity of molluscan fauna from Shivakshi Tamilnadu where they observed 4 species of molluscan at less polluted site and 2 species of molluscan at high polluted site and 5 species noticed at unpolluted site of Arjuna river. In present investigation also 9 species of molluscan were observed at the different study site. The diversity of molluscs at four localities at Hiranyakeshi river vary significantly. In present study 57% gastropod species and 43% bivalve species were recorded from selected sites of river Hiranyakeshi. There

was a considerable difference within the study localities. High species diversity was found at site I it was due to the presence of maximum number of species and also due to positively co-related physicochemical parameters for growth and development as compared to other three sites. Molluscans were considered to be affected by environmental factors like physico-chemical parameters[15]. The physico-chemical parameters has showed alterations in their normal range which has affected over the population and growth of species as a indicator of pollution. So, conservation of molluscans diversity found essential to protect the freshwater biota by restricting anthropogenic activities and richening the tank by providing proper channelized flow contents containing more algal biomass, decayed plant material etc. which is a good source of food for molluscs. The bivalves such as oysters, mussels and clams serve the nutritional needs of the coastal population and good source of minerals, protein and glycogen and are easily digestible compared to other animal foods[37]. Molluscs are extremely important communities of many ecological communities and proved immensely beneficial both economically and medicinally[40]. They proved as a source of food, jewellery, tools and even pets. Fresh water molluscs play significant role in public and veterinary health[36].

CONCLUSION

The freshwater molluscs play a massive role in nature and help in assessment of ecological status of the water bodies. The diversity of molluscs at four localities of Hiranyakeshi river found varied significantly. During the study period 43% of gastropod species and 57% of bivalve species were recorded. Because of less contamination of water at site I maximum molluscan population was recorded, whereas due to mixing of domestic and industrial discharge site III showed depleted rate of population. The present study revealed that recorded all molluscan faunain the category of indigenous species with valuable biodiversity potancy which need to be conserve in relation to maintain the ecological balance and their sustaince in the nature.

The study infocus the interrelationship between the varied seasonal parameters with biodiversity contest. Finding of the present work shall be utilized by future researchers and ecologists as supplimentory information in the ecotoxicology, water quality assessment and river management studies.

Acknowledgement

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