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Study of species Richness, Abundance, Seasonal variations, various Biological and Diversity Indices of Malacofauna around Parola city district-Jalgaon(MS) India.

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Abstract: Freshwater Molluscan distribution and diversity status of Parola region, district Jalgaon, were studied during June 2015 to May 2016. The samples were collected at every month from three sites. Total 14 species were recorded throughout the year, out of which 11 species were Gastropods and 3 species were Pelecypods; which belongs to 5 orders, 9 families and 11 genera. The average numbers of animals were indicated per season: i.e. monsoon, winter and summer. Maximum species were recorded in winter season at all these three sites. Molluscan diversity were calculated by the various diversity indices such as Shannon-Wiener diversity index (H), Simpson's Dominance index (D), Simpson's index of diversity (I-D), Simpson's Evenness(E) and Pielou's Evenness index (J).

Keywords: Molluscan Richness, Abundance, Diversity, Seasonal Variations, Biological Indices

INTRODUCTION

Molluscs are extremely important communities among other ecological communities. They constitute the second largest invertebrate and most successful group next only to insects, Abbott [1] Bouchet [2]. Their sizes are very diverse from tiny snails, clams, and abalone to largest invertebrate, squid, cuttlefish and octopus. Their range is from 1 mm to more than 15 meter. Population density of may be exceeds to about 40,000 per meter square. It has been here for over 500 million years. With reference to molluscan diversity all over the world, maximum number of species occur in the marine ecosystem (31463) followed by terrestrial ecosystem (24503) and fresh water ecosystem (8765).

Out of these freshwater, 248 species (56 genera) were reported from India and adjacent countries. These includes, 171 are Gastropods [3].

Basically all Molluscs are aquatic but they move on the land and still dependent on a moist ground, in an excess of cold or hot and dry climate they enter in the state of hibernation and aestivation for about 2 to 3 years without any arousal. The Phylum Mollusca are classified into seven classes *viz.* Aplacophora, Polyplacophora, Monoplacophora, Gastropoda, Scaphopoda, Pelecypoda, and Cephalopoda. Gastropoda is the largest class more than 80,000 species are recorded throughout the world [4].

They prove beneficial to man by both way economically and medicinally 5]. Like all animals, the molluscs are not considered by men to be either useful or destructive. Gastropod plays an important role in balancing the nature. The shells were used in Unani and Ayurvedic medicine system for meditation, in the production of humus, in the control of fungi, algae, lichens and also as predators and parasites; but, in nature the molluscs are hunted and eaten by predators [6].

In scientific studies, molluscs prove key role in study of drug action on heart, hormones, enzymes and antitoxins-especially in relation to immunological hematology. These are suitable bio-indicators for some radio-active and chemical pollution in the coastal areas of water bodies. The snails and slugs are important to study because of the damage they do in agriculture, horticulture and forestry. Furthermore, they are of importance in medical and veterinary practice, since they serve as intermediate host for certain parasitic worms of man and domestic animals *viz.* Schistosome parasites [6-8].

MATERIALS AND METHODS

Study area

Parola, (district-Jalgaon, Maharashtra state, India) is the town from East Khandesh zone, situated on the National high way number 6th (NH-6), about 37 km from Dhule and 55 km away from Jalgaon. The average rainfall ranges from 77 cm 80 cm. The 1252 hectares of land area includes major rivers passing from Parola city is the Bori and other tributaries. The average altitudes of dam are 856 feet from sea level. The average minimum temperature 10 - 12 ^{0}C and maximum temperature was 42 -45 ^{0}C of the year. The Longitudinal and the latitudes of Parola are 20.8822 ^{0}N 75.1253 ^{0}E respectively.

Fig-1: Map Showing Study area, Parola, Dist-Jalgaon (MS) India.

Fig-2: Map Showing Study Site I, II and III around Parola city.

Bori River Dam (Site -I)

Dam is 20 km away from Parola. It is an earthen dam and its height above lowest foundation is 66 feet and the length is about 3 km. The volume content is 5535 km^3 and gross storage capacity is 50000.00 km^3.

Bhokarbari Lake (Site -II)

Lake is near the village Bhokarbai, about 5.5 km away from Parola, The main supply of water to this pond is Bori river dam through the water canal via Mhaswa Lake. The height of the lake from foundation is about 20 feet and the length is about 1 km. The volume content and gross storage capacity is not recorded officially.

Kankraj Lake (Site -III)

Lake is the natural site, about 11 km away from Parola; the water accumulation depends on rain and very small tributary coming from Shevage budruk and nearby hills. The height of the lake from foundation is 10 to 15 feet and the length is about 1 km. The volume content and gross storage capacity is not recorded.

Site I is located towards South of Parola and the Site II and III are located towards north side of Parola city. Site I and II has perennial water reservoir and site III sometimes becomes completely dry in summer.

Sampling and preservation:

The Molluscan species were collected by hand picking method for the big specimens and for the smallest one, a sieve for soil samples were used. All specimens were brought to the laboratory and preserved in 4 % formalin. Identification was done on the basis of Preston [9] Rao [10] and Tonapi [11]. The unidentified molluscan shells are identified and classified up to the generic and species level by Zoological survey of India, Pune, Maharashtra State, India. Data were collected at every month, pooled seasonally *viz.* monsoon, winter and summer from June 2015 to May 2016.

Data analysis

Quantitative and qualitative estimation of molluscan fauna were carried out using quadrate method [12, 13]. At least four quadrat (1 X 1m) were sampled from each site and the averages of these were considered as density and species richness per m^2 for that area.

Formulae for indices

Shannon-Weiner Index [14]: H= -∑Pi (Ln Pi), Simpson's Dominance Index [15]: D = ∑ n(n-1)/N(N-1), Simpson's Index of diversity: D_1 = 1-D, Simpson's reciprocal Index: D_2 = 1/D, Simpson's Evenness: E = D_2/S and Pielou's evenness Index [16]: J = H/Ln*S were used for calculation. Where, S = Number of species, N = Total number of individual of all species, Pi = A/T where A is number of each species in the sample, T = Total number of individual of all species in the sample and n = Total number of individuals of particular species.

RESULTS AND DISCUSSION

Total 2160 samples were collected during June 2015 to May 2016 from three sites *Viz.* Site-I (Tamaswadi), site-II (Bhokarbari) and site-III (Kankraj). We observed total 13 different species of molluca belonging to 2 groups: Gastropods and pelecypods. The population of these animals was recorded throughout year and it represented by 13 species, belonging to 5 orders, 8 families and 10 genera, showen in Table-1. In Gastropods order Basommatophora was found to be dominant by 2 families, *viz.* Planorbidae, Lymnaeidae, followed by Mesogastropoda by 2 families: Thiaridae, Viviparidae, Stylommatophora by 2 families *viz.* Cerastuidae and Achatinidae and Soleolifera having single families Veronicellidae. In pelecypods single order Unionoida shows 2 families *viz.* Unionidae and Amblemidae.

In gastropods the *Viviparous bengaliensis* was found to be dominant (43.33%) followed by *Thiara lineata* (24.72%) *Thiara tuberculata (*8.84%*) Indoplanorbis exustus* (5.09%) *Leviculis alte alte* (2.59%) *Rachis punctatus* (2.77%) *Lymnea tuberculata* (2.22*) Lymnea accuminata* (2.54%), *Gyraulus Convexiusculus* (0.97) and *Acatina fulica fulica* (0.87%). In Pelecypods *Lamiledence marginalis* was found to be dominant (1.48%) showed dominancy followed by *Parresiya cylendrica* (1.38%) *Parresia corrugata* (1.25%). Ahirrao and Patole [17], recorded 10 Gastropod species, belonged to 4 orders, 7 families and 8 genera and the dominant order was found to be Basmatophora. Patil *et al.*, [18] reported 13 molluscan species, belonged to 4 orders, 10 families and 12 genera, from Nakana lake, near Dhule (MS) city.

Table-1: Check list of mollusca recorded at Parola (MS) India, during June 2015 to May 2016 from Site-I, II and III.

Class	Order	Super Family	Family	Sr. No.	Species (Scientific Name)
GASTROPODA	Mesogastropoda	Cerithioidea	Thiaridae	**1**	*Tarebia lineata* (Benson)
				2	*Melanoides tuberculata* (Mueller)
		Viviparoidea	Viviparidae	**3**	*Viviparous bengaliensis* (L)
	Basommatophora	Planorboidea	Planorbidae	**4**	*Indoplanorbis exustus* (Deshyes)
				5	*Gyraulus Convexiusculus* (Hutton)
		Lymnaeoidea	Lymnaeidae	**6**	*Lymnea accuminata* (Gray)
				7	*Lymnea luteola* (Lamarck)
	Stylommatophora	Achatinoidea	Achatinidae	**8**	*Acatina fulica fulica* (Ferussac)
	Soleolifera	Veronicelloidea	Veronicellidae	**9**	*Leviculis alte alte* (Ferussac)
				10	*Rachis puncalus* (Anton)
BIVALVIa	Unionoida	Unionoidea	Unionidae	**11**	*Lemellidens marginalis* (Lamarck)
			Amblemidae	**12**	*Parreysia cyindrica* (Annandale and Prasad)
				13	*Parreysia corrugate* (Mueller)

SEASONAL VARIATIONS

From the present investigation it has been found that the site-I has 12 species in summer, and 13 species in monsoon and winter, While at site-II, 11species at summer and monsoon but in winter 13 species were recorded and the sit-III shows 8 species at summer, 12 in monsoon and 13 at winter. The total density of gastropods ranged between 1 to 136 org/$m^2$and pelecepods ranged between 1 to 17 org/m^2. About gastropods at site -I ranges between 2 to 115 org/m^2 in summer, 1 to 85 in monsoon 2 to 123 in winter; site II has ranges between 1 to 133 org/m^2 in summer, 1 to 78 in monsoon 2 to 115 in winter and site –III has ranges between 2 to 94 org/m^2 in summer, 2 to 75 in monsoon 2 to 136 in winter and about pelecepods at site -I ranges between 2 to 17 org/m^2 in summer, 2 to 8 in monsoon 2 to 6 in winter. Here site-I found to be dominant about gastropods as well as pelecepods, shown in fig-2, 3 & 4.

It has been recorded that highest population of molluscs was found in winter at all sites. Particularly

the *Thiara lineata* was found to be dominant in the January. Flores and Zaffaralla [19] also cited Thiaridae as the most persistent and abundant micro-invertibratefamily, while the *Leviculus alte alte* was found in September. The least recorded species Acatina *fulica fulica* found at site-I in winter season but at site-II and III recorded in summer season. Sharma *et al*., [20]; Hussein *et al*., [21] shows peak population of *M. Tuberculata* reported during October. Thiaridae is the most abundant from the mollusca. Contreras –Arquieta [22] reported that members of Thiaridae are quick colonizers, tolerant to habitat diversity and variability due to a very strong and sturdy thick shell.

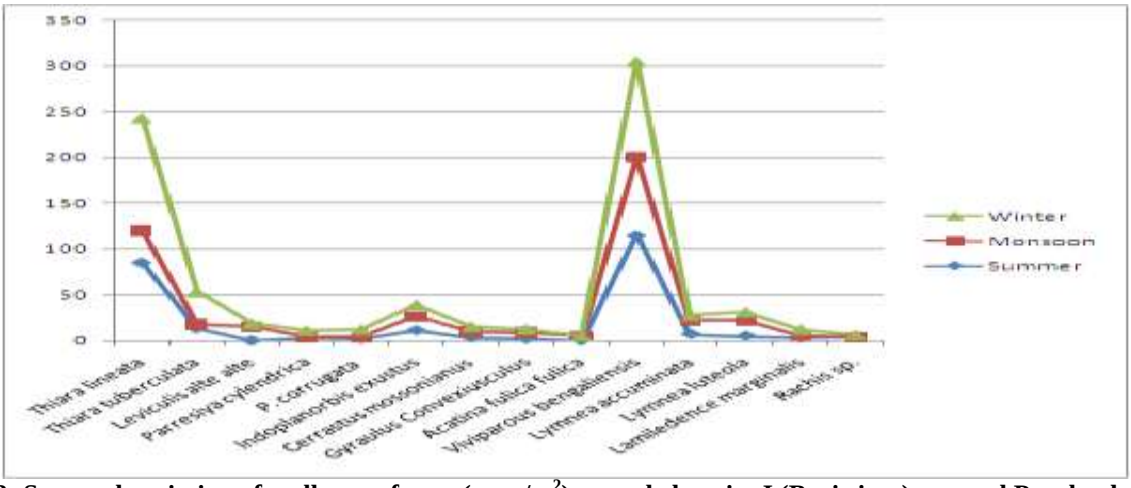

Fig-3: Seasonal variation of molluscan founa (org. /m^2) recorded at site-I (Bori river), around Parola, during 2015-16.

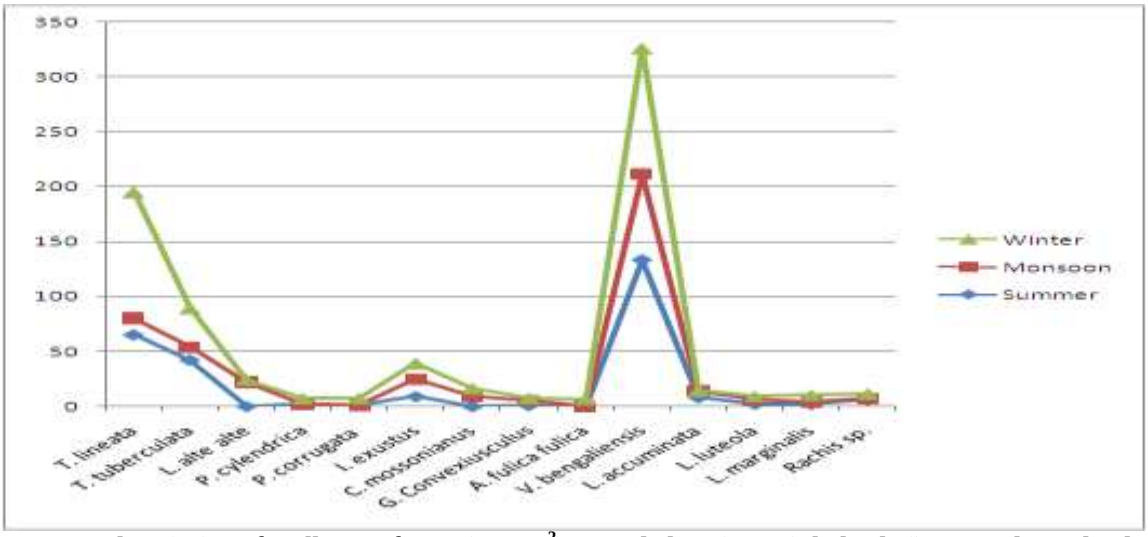

Fig-4: Seasonal variation of molluscan founa (org./m^2) recorded at site-II (Bhokarbai), around Parola, during 2015-16.

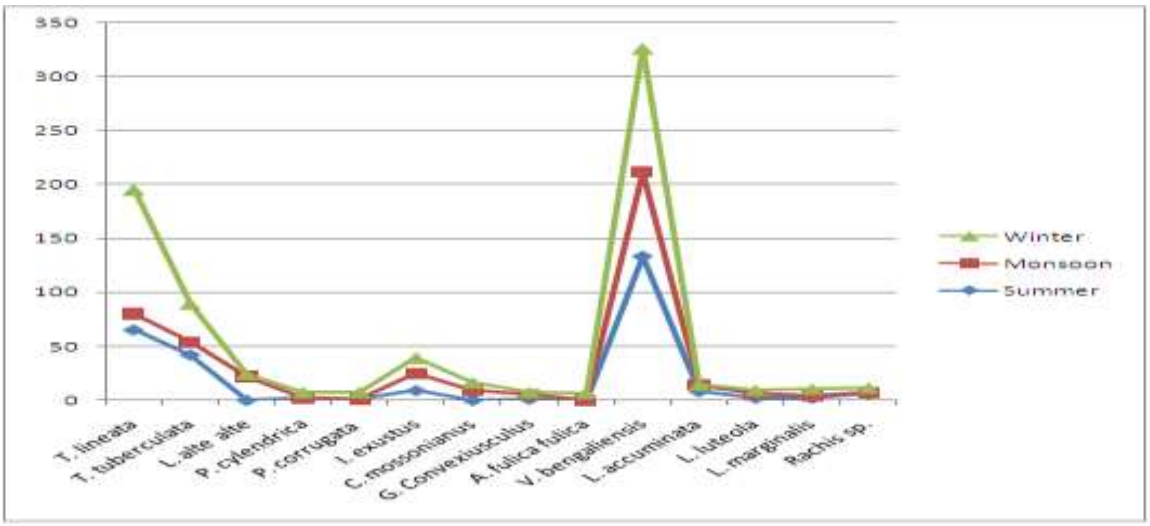

Fig-5: Seasonal variation of molluscan founa (org./m^2) recorded at site-III (Kankaraj), around Parola, during 2015-16.

Biological Indices

Stability of ecosystem harbors abundance of mollusc. Molluscan diversity is calculated by some diversity indices i.e. Richness, Dominance and Evenness values are shown in Table no. 2, all sites shows variations.

Table-2: Molluscan species richness, abundance and different biological indices recorded during June 2015 to May 2016.

Sr. No.	Index	(S)	(N)	(H)	(D)	(1-D)	(1/D)	(J)
Tamaswadi Site-I	Summer	12	253	38.8285	0.3232	0.6768	3.094	15.6566
	Monsoon	13	211	19.3763	0.2112	0.7888	4.7348	7.5688
	Winter	13	325	45.0996	0.2615	0.7385	3.8284	17.6170
Bhokarbari Site -II	Summer	11	271	47.8011	0.3225	0.6775	3.1107	20.0004
	Monsoon	11	169	18.1428	0.2528	0.7472	3.9556	7.5911
	Winter	13	320	44.9379	0.272	0.728	3.6764	17.5538
Kankraj Site-III	Summer	8	179	39.6353	0.3335	0.6665	2.9985	19.1474
	Monsoon	12	153	14.7954	0.2671	0.7329	3.7439	5.9658
	Winter	13	279	35.1474	0.2864	0.7136	3.4916	13.7294

(S)=Species Richness, (N)= Species abundance, (H)=Shannon-Weiner Index, (D)= Simpson's Dominance Index (1-D) =Simpson's Index of Diversity, (1/D)=Simpson's reciprocal Index, (J)= Pielou's Evenness.

During one year study period all three sites shows quite large fluctuations. All 3 sites shows Shannon – Weiner Index (H) varied from minimum in winter at site-III i.e. 14.7954 and maximum at site-II in summer and it is about 47.8011. Simpson's Dominance Index (D) was fluctuated in between 0.2112 and 0.3232 at site-I, 0.2528 and 0.3225 at site -II and at site-III 0.2671 to 0.3335. Values of Simpson's Index of Diversity (D_1) was at site -I is found to be varied *i.e.* 0.6768 in summer, 0.7888 in monsoon and 0.7385 in winter at site-II was 0.6775in summer, 0.7472in monsoon and 0.728 in winter and at site-III was 0.6665 in summer, 0.7329 in monsoon and 0.7136 in winter. Simpson's reciprocal Index (I/D) was highest at monsoon 4.7348, 3.9556 and 3.7439 while least at 3.094, 3.1107 and 2.9985 at site-I, II and III respectively. Pielou's evenness Index (J) ranges in between minimum at 5.9658 to 19.1474 at site-III, moderate at 7.5688 to 17.6170 at site-I while maximum at 7.5911 to 20.0004 at site-II

Present study resembled with records made by few workers from different freshwater ecosystems [23, 24, 18].

CONCLUSION

The study revealed that species richness, abundance, density and diversity of molluscans depend upon:

- Rich ecosystem,
- All recorded molluscan species are indigenous.
- There found a considerable difference within the study localities.
- In post-monsoon and pre-winter the abundance record has been found in almost all species, when the availability of ample water and moisture.
- Species to species breeding potential, sturdyness, susceptibility, vigor, are most important factors for their natality and mortality.

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REFERENCES

1. Scheier, M. F., Matthews, K. A., Owens, J. F., Magovern, G. J., Lefebvre, R. C., Abbott, R. A., & Carver, C. S. (1989). Dispositional optimism and recovery from coronary artery bypass surgery: the beneficial effects on physical and psychological well-being. *Journal of personality and social psychology*, *57*(6), 1024.
2. Gallant, D. J., Bouchet, B., Buleon, A., & Perez, S. (1992). Physical characteristics of starch granules and susceptibility to enzymatic degradation. *Eur. J. Clin. Nutr*, *46*(Suppl 2), S3-S16.
3. Rao, Y. P., Murthy, N. L. N., & Kishore, S. DNA-Based Molecular Analysis By Using Of Mollusc Shells: With Reference To Bellamya bengalensis. *Cell*, *91*, 9951201976.
4. Hyman, L. H. (1967). The invertebrates Vol.6. Mollusca, 1, *McGraw Hill*, New York.
5. Wosu, S. N., Hosur, M. V., Jeelani, S., Vaidya, U. K., & Ajit, D. K. (2003). Survivability of affordable aircraft composite structures. *Air Force Final Report*, *1*.
6. Ahirrao, K. D. (2003). Effects of sevin on some ecophysiological aspects of a Melanoid snail, *Melania scabra. Ph. D. Thesis* submitted to Dr. BAMU, Aurangabad.
7. Ahirrao, K. D. (2011). Paradox LC_{50} due to Physico-chemical parameters in a fresh water snail, *Thiara lineata. International Indian Streams of Res. journals Laxmi Publications* 1(1):01-06.
8. Ahirrao, K. D., & Khedkar, G. D. (2012). Variations in LC_{50} of some pesticides due to physic-chemical parameters and impact of sevin on neurosecretory cells of a fresh water snail, *Thiara lineata*, *International Journal of Research in Biology, Ficus Publishers*1:050-056.
9. Prestone, H. B. (1915). The fauna of British India including Ceylon and Burma. Mollusca (Freshwater Gastropoda and Pelecypoda) Taylor and Francis, Landon, pp i-xi+ 244.
10. Rao, S. N. V. (1989). Freshwater Mollusca of India. In. Rao K.S. (ED.): Recent advances in freshwater Biology. New Delhi. Anmol Publication, 2: 187-202.
11. Tonapi, G. T. (1980). Freshwater animals of India. An Ecological Approach, Oxford and IBH publishing co., New Delhi *Oxford & IBH. Publ. Co.* pp 341.
12. Michael, P. (1984). Ecological methods for field and laboratory investigations; Tata McGraw – Hill Publishing Company Limited, New Delhi.
13. Subba Rao, N. V. (1989). Handbook: Freshwater molluscs of India, *Zoological Survey of India*, Calcutta.
14. Shannon, C. E., & Wiener, W. (1949). The Mathematical theory of communication, University of Illinois Press, Urbana, PP.125.
15. Simpson, E. H. (1949). Measurement of diversity, *Nature, Lond.* 163 (4148)-688.
16. Pielou, E. C. (1975). Ecological diversity. *Wiley*, New York,165 p.
17. Ahirrao, K. D., & Patole, S. S. (2016). Diversity of Gastropods in the Bori river dam, at Tamaswadi, Tal-Parola, District Jalgoan(MS), India, *International Golden Research Thoughts, Laxmi Publications* 6(6):001-004.
18. Patil, M. U., Patole, S. S., Bhoi, S. S., & Ahirrao, K. D. (2016). Malacofaunal distribution, abundance and diversity of the Nakana Lake, Dhule (MS)India. *International Journal of Research in Biology, Ficus Publishers* 6(2):1977-1983.
19. Flores, M. J. L., & Zaffaralla, M. T. (2012). Macro-invertebrate composition, diversity and richness in relation to the water quality status of Mananga River, Cebu, Philippines, *Philippines Sci. Late* 5(2): 103-113.
20. Sharma, K. K., CHOWDHARY, S., & SHARMA, A. (2010). Malacofuana diversity of river chenab fed stream (gho-manhasan). *The Bioscan*, *6*(2), 267-269.
21. Hussein, M. A., Obuid-Allah, A. H., Mahmoud A. A., & Fangary, H. M. (2011). Population dynamics of fresh water snails (Mollusca:Gastrapoda) at Qena Governorate, *Upper Egypt. Acad. J. Biol. Sci.*, 3(1):11-22.
22. Contreras-Arquieta, A. (1998). New records of the snail Melanoides tuberculata (Müller, 1774) (Gastropoda: Thiaridae) in the Cuatro Cienegas Basin, and its distribution in the state of Coahuila, México. *The Southwestern Naturalist*, 283-286.
23. Mohan, D., Elumalai, V., Subbulakshmi, G., Jaylakshami, S., & Sriniwasan, M. (2013). Biodiversity of cultivable molluscan resources from Pulicat Lake, Southeast coast of India, *Arthropods* 2(2): 53-65.
24. Dolikar, A. V., Mohite, A. S., & Charde, P. N. (2014). Correlation of molluscan diversity with physico-chemical characteristic of water of Gorewada reservoir, Nagpur, India. *Int. Jour. of Life Sciences*, Special issue, *A-2*.197-202.