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A study on water quality index and diversity of aquatic insects at Lingambudhi lake, Mysore, Karnataka.

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Abstract

Aquatic insect's community fluctuation can give quick information as they interact with water quality changed due to physical and chemical environment these insects are commonly used as indicators for an integrated assessment of water quality. The present study on water quality index and diversity of aquatic insects on Lingambudhi lake, Lake is a perennial a typical village lake in the rural surrounding of the city of Mysuru seasons of winter summer, monsoon and a post-monsoon period physico-chemical parameters were analysed by using standard methods. The obtained data of water, Lingambudhi lake has a WQI of 127 indicating poor quality of water, the lake was highly polluted, low dissolved oxygen, relatively high phosphate, nitrogen , hardness and richness of chemicals, which may be the result of water inputs and extracellular products liberated by the death and decay of algal blooms are common in water bodies. The diversity of aquatic insects in lake has observed three orders Hemiptera, Diptera, Odonata which includes seven different families with eight different species of insects. The aquatic Hemipteran are highly important group of insects. The negative correlation of Pleidae, Geridae and Notonectidae with WQI and less abundance represents they are sensitive to pollution. This study indicates that Hemiptera could be a highly promising choice for further study as aquatic habitat indicator organisms for a variety of water characteristics.

key words : Water Quality Index · Hemiptera · algal blooms pollution · Aquatic insects.

INTRODUCTION

The habitat of aquatic life, is importance for surface water quality assessment, freshwater makes up only about 0.3% of world total water body and contains about 100000 species (8%) out of 1.3 million scientifically described species (Merritt and Cummins, 1996). Freshwater aquatic insects inhabit in lakes associated with various types of substrates such as mineral, sediments, macrophytes and algae, these components are essential elements in lentic and lotic trophic webs, participating in the energy flow and nutrient cycling. They are also important food resources for fish and some insectivorous birds. Aquatic insects are extremely important in ecological systems for many reasons and are the primary bio-indicators of freshwater bodies such as lakes, ponds, wetland, streams and rivers (Merritt *et al*, 2008). The distribution of aquatic organisms is the result of interactions among their ecological role, the physical conditions that characterize the habitat, and food availability, thus, the community structure of aquatic insects depends on a number of factors, such as water quality, water flow, organic matter availability, oxygen concentration, aquatic insects are often used as indicator of water quality. The presence or absence of certain families of aquatic insects can indicate whether a particular water body is healthy or polluted (Arimoro *et al.*, 2010*).*

Anthropogenic activities releases from domestic sewage, run-off from agricultural lands, laundering into streams and mining activities. Most water bodies have consequently been subjected to increasing pollution loads, affecting greatly their quality and health status. Which undoubtedly alters the physicochemical properties of water. variations in these water properties greatly influence the distribution patterns of aquatic insects in the water are highly sensitive to pollution while others are somewhat tolerant or completely tolerant to pollution and environmental disturbances (Hepp *et al*,. 2013*).* The present attempt was made to know aquatic insect diversity and water quality index on Lingambudhi lake.

MATERIALS AND METHODS

Study area

Lingambudhi Lake is located 7km from the city of Mysore district, geographically located at 12˚ 16' 20" North and 76˚31' East at the south west Mysuru city. Altitude of 730m above mean sea level, it is a perennial freshwater lake situated in the basin of the River Cauvery. It has 217 acres of catchment area, the southern side of the lake was surrounded by agricultural field and the remaining sides have forest area with rich fauna and flora, lake has a variety of habitats which including the adjacent paddy fields and Scrub forest. Some important species of flora are: Sesbania spp, Acacia spp, Pongamia pinnata, Mangifera indica, Ziziphus spp. Grass vegetation is more around the lake. (Fig.1.3)

Sampling sites

Sampling of the aquatic insects was done at two different sites of the lake.

Site-1: The sampling site was targeted at the North side of the lake, no human activities are found in this area, it is nearer to the sewage entry point from Ramakrishna nagar.

Site-2: This site is situated on the way parallel to road which including the adjacent paddy fields, the site water was covered with algae and no human activities were found. (Fig. 1.3)

Collection of the water samples and aquatic insects

Water samples were collected every week for one year from seasons of winter summer, monsoon and a post-monsoon period from two sampling sites. Surface water samples were collected (between 6:30 am to 7:30 am) the insects were collected using cone shaped net with a mesh size of 1mm. The area of the net is $8m^{3.}$ It holds approximately 8L of water, insects were collected by sweeping the net for a distance of 2 meters. One single sweep collects insects found in 32L of water. The trapped insects are transferred to the plastic jar, net was properly checked for insects clinging to the mesh. The cringed insects were picked with the help of forceps. Samples from two different sites are collected in alternative weeks. Collected sample was preserved by adding 4% formalin.

Determination of Physico – Chemical Parameters

Surface water samples were also collected in a five-liter polythene plastic can, from the two different sampling sites (Between 6:30 am - 7:30 am) every week from seasons of winter summer, monsoon and a post-monsoon period , Water temperature and pH were measured on site, using a mercury thermometer and Hanna H198107 pH meter, respectively. Further analysis of various physic-chemical parameters such as dissolved oxygen, electrical conductivity, total dissolved solids, turbidity, free corbon dioxide, hardness, calcium, phosphate, chloride, nitrate, sulphate, total anions strong acids (TASA), total suspended solids(TSS) were carried out in the laboratory as per standard methods followed in APHA, 1997. The mean values of the measured parameters for each were compared with BIS, WHO and ICMR standards and pollution status was determined using water quality index (WQI) method. Correlation was examined using Pearson's correlation co-efficient. Values of Pearson's correlation co-efficient, calculated after $\log_{10}$ transformation using SPSS and were generally used to help interpret the results.

Determination of abundance of aquatic insect group

In the laboratory abundance diversity was calculated for organisms/L of water, for measuring the Total abundance of insects in each group, the counting was carried out by determining the abundance of insects in each group and the total abundance of all the insects groups, Put together was calculated by using the following formula.

n/32L = org/L

Where - n = total count of aquatic insects

32 L Amount of water passes through the net for 2 meter sweeping.

Area of the cone shaped net =1/3∏r2h

Where, r – radius of the cone shaped net. H – height of the cone shaped net.

Area of the net = 8m3. 1m3 holds 1L of water, then the net having a surface area of 8m3 of 50cm length holds 8 L of water. Sweeping 2M i.e., 200cm covers 32 liters of Water.

Water quality index computation

Water Quality Index (WQI):National Sanitation Foundation Water Quality Index (NSFWQI)

The water quality index was calculated using the weighted arithmetic index method. The quality rating scale for each parameter Qi was calculated by using this expression.

Quality rating, Qi = 100[(Vn-Vi)/(Vs-Vi)]

Where, Vn – actual amount of nth parameter.

Vi - The ideal value of the parameter.

Vi = 0.

Except for pH and DO – Vi = 7.0 for pH

Vi = 14.6 mg/L for DO.

Vs: recommended WHO standard of corresponding parameter.

Relative weight (Wi) was calculated by a value inversely proportional to the recommended standard (Si) of the corresponding parameter.

Wi = 1/si

WQI are discussed for a specific and intended use of water, in this study the WQI for human consumption is considered and permissible WQI for the drinking water is taken as 100. The overall WQI was calculated by using equation:

WQI =(∑(qi)wi)/(∑wi)

RESULT AND DISCUSSION:

The mean values of selected physico chemical parameters of water quality and abundance, diversity of Hemiptera, Odonata and Diptera at Lingambudhi lake, of the study were presented in Table 2.

Air temperature : The mean air temperature recorded was 22˚C and it ranged from minimum of 18˚C to a maximum of 26˚C . Less monthly variation (CV=14%) in the air temperature was noticed during the study period. The air temperature gradually increases from spring contineously for 11 weeks, then decreases gradually to last sampling at mid of summer. Thus, the maximum (25˚C) air

Water temperature : Surface water temperature (at a depth of 10cm) was measured with the help of hand hold mercury in thermometer in the field, soon after the collection. Similarly air temperature was also recorded by holding the thermometer above the sampling sites. The mean water temperature recorded was 24˚C and it ranged from minimum of 20˚C to a maximum of 28˚C. Showed less monthly variation (CV=123%) in the water temperature was recorded during the study period. The water temperature was almost similar in study period from seasons of winter summer, monsoon and a post-monsoon period Maximum (28˚C) is noticed in the month of Early summer**.** Further, it was noticed that the water temperature was generally higher than the air temperature throughout the study period. The water temperature shows positive correlation with lab pH and negative correlation with calcium.

pH : The mean pH recorded was 10 and it ranged from minimum of 8.8 to a maximum of 9.4 less weekly variation (CV=10%) in pH was noticed during the study period. The pH gradually increases from the beginning to the end of the study period i.e. from Spring to Summer**.** The pH shows positive correlation with conductivity, TDS, Nitrate, TASA and TSS and one negative correlation with Calcium.

Dissolved Oxygen : The mean DO concentration recorded was 3 mg/L and it ranged from minimum of 0.8 mg/L to a maximum of 5 mg/L. Weekly variation of (CV=33%) in the DO concentration was noticed during the study period. DO increased in last three weeks of study period, 5 mg/L in the mid of summer because of moderate rainfall that increases the water level in the lake. The DO shows positive correlation with TDS and Conductivity and negative correlation with Chloride.

Carbon dioxide : Carbon dioxide in water is produced by the breakdown of organic materials and the respiratory activity of aquatic plants and animals. In the present investigation CO_2 was completely absent during the study period.

Conductivity : The mean conductivity recorded was 1542 µS cm^{-1} and it ranged from minimum of 884 µS cm^{-1} to a maximum of 2700 µS cm^{-1}. Weekly variation (CV=31%) in conductivity was noticed during the study period from seasons of winter summer, monsoon and a post-monsoon period suddenly decreased to 1650 µS cm^{-1} in last monsoon period2600 µS cm^{-1}, because of increased water level in lake due to rainfall. The Conductivity shows positive correlation with TASA and TDS, negative correlation with Calcium and Hardness as the concentration of ions increases the conductivity of water is also increases hence conductivity shows positive correlation with TASA and TDS.

Total dissolved solids : The mean TDS recorded was 987 mg/L and it ranged from minimum of 566 mg/L to a maximum of 1736 mg/L. weekly variation (CV=31%) in TDS was noticed during the study period. The conductivity gradually increases from 566 mg/L to 1736 mg/L, from the first week to the last week of study period. The TDS was more in the month of May 2015 and it shows negative correlation with Calcium and Hardness, positive correlation with TASA.

Turbidity : The mean turbidity recorded was 35 NTU and it ranged from minimum of 21 NTU to a maximum of 53 NTU. Weekly variation (CV=29%) in turbidity was noticed during the study period. The turbidity did not shows consistence it varies in every seasons of study period. Turbidity of water did not shows any type of correlation with other Physico-Chemical parameters.

Hardness : The mean hardness concentration recorded was 316 mg/L and it ranged from minimum of 202 mg/L to a maximum of 470 mg/L. Weekly variation (CV=26%) was noticed, during the study period. The Hardness shows maximum value of 470 mg/L in the first month of study period, gradually decreases. The hardness shows positive correlation with Calcium and negative correlation with Sulphate, TASA and TSS.

Calcium : The mean calcium recorded was 58 mg/L and it ranged from minimum of 44 mg/L to maximum of 88 mg/L. Weekly variation of (CV=22%) was recorded during the study period Calcium concentration gradually decreased from 88 mg/L in the first season of study period to 42 mg/L with a standard derivation of ± 13 mg/L. Calcium concentration shows negative correlation with TSS.

Phosphate : The mean phosphate concentration recorded was 0.38 mg/L and it was ranged from minimum of 0.2 mg/L to a maximum of 0.6 mg/L. More monthly variation (CV=40%) in phosphate concentration was noticed

during the study period. The phosphate concentration was almost similar throughout the study period with a standard deviation of ± 0.15. The grouped data revealed that, the phosphate concentration showed positive correlation with Chloride, TASA and TSS.

Chloride : The mean chloride concentration recorded was 107 mg/L and it ranged from minimum of 88 mg/L to a maximum of 128 mg/L. Very less monthly variation (CV=9%) in Chloride Concentration was noticed during study period. The concentration of chloride shows almost similar values in seasons of winter summer, monsoon and a post-monsoon period of study period with a deviation of ± 10. The Chloride concentration shows positive correlation with TASA and TSS.

Nitrate : The mean nitrate concentration recorded was 0.55 mg/L and it ranged from minimum of 0.2 mg/L to a maximum of 0.8 mg/L. Weekly variation (CV=31%) in nitrate concentration was noticed during study period. The concentration of nitrate was minimum in second (0.2 mg) and fifth week (0.2 mg), remaining 14 week shows almost similar values. 0.63 mg/L of Nitrate concentration was recorded in all four seasons of study period. The concentration of nitrate shows positive correlation with TSS.

Sulphate : The mean sulphate concentration recorded was 38 mg/L and it ranged from minimum of 15 mg/L to a maximum of 55 mg/L. weekly variation (CV=26%) in sulphate concentration was noticed. It shows almost smilar value throughout the study period, with a maximum deviation of ± 10, and the concentration of sulphate shows positive correlation with TASA.

TASA : The mean TASA concentration recorded was 146 mg/L and it ranged from minimum of 113 mg/L to a maximum of 163 mg/L, with a weekly variation of 9%, shows very less variation. The value of concentration depicts there is no gradual increase or decrease in concentration of TASA, it shows deviation of ± 13. The TASA Concentration showed positive correlation with TSS.

TSS : The mean TSS concentration recorded was 373 mg/L and it ranged from minimum of 90 mg/L to a maximum of 500 mg/L. Weekly variation of (CV=30%) in TSS Concentration was noticed during the study period of winter, summer, monsoon and a post-monsoon period. Very less concentration (90 mg/L) of TSS was recorded in third week of study period and high concentration more than 400 mg/L was recorded in eleven weeks of study period. The concentration of TSS shows high deviation value of ± 111 during the study and TSS concentration did not shows any type of correlation with other Physico-Chemical parameters.

Water Quality Index (WQI) : The mean value of WQI during the study period was 127, indicates poor water quality and it ranged from 93 to a maximum of 148 showing variation of 13%. The WQI showsdeviation of ± 17 to the mean value 127. The values recorded are more than 100 and less than 150, almost similar values recorded. WQI did not show any correlation with Physico-chemical parameter.

Abundance and diversity of aquatic insects.

Aquatic insects are a group of arthropods that spend part of their life cycle in water bodies, aquatic insects are one of the most common groups of organism used to assess the health status of aquatic ecosystems (Rosenberg

and Resh, 1993; Xu *et al.*,2014). Some aquatic insects respond to specific changes in water conditions and have become indicators of river health condition to aquatic ecologists. The presence and absence of some particular aquatic insects indicate the degree of pollution, through the specific causative physicochemical methods (Gupta and Paliwal 2010).

Hemiptera

The mean abundance of the aquatic Hemipterans were from the seasons of winter summer, monsoon and a post-monsoon period shows 2 org/L, they ranged from minimum abundance of 1 org/L to a maximum of 3 org/L. Weekly variations (CV=49%) in abundance of the Hempiterans were noticed during the study period (Table 2). The abundance of Hemiptera shows negative correlations with Calcium (Table 4) out of 16 parameters analyzed .In the order Hemiptera 5 families viZ Notonectidae, Corixidae, Gerridae, Pleidae and Veliidae were found during the study period out of this 5 families Corixidae are found more in number, it consists both Adult and Nymphs. Hemipteran includes 94% of Corixidae, 2% Notonectidae, 2% Veliidae, 1% Geridae and 1% of Pleidae. The family veliidae shows correlation with eight physico-chemical parameters negatively with Lab pH, conductivity, TDS, chloride TASA and positively with hardness, calcium and with total suspended solids. Corixidae shows negative correlation with hardness and calcium. Pleidae positively correlates with hardness of water. Geridae shows both positive and negative correlation with pH and nitrate respectively. Notonectidae negatively correlates with both pH and dissolved oxygen. Interestingly Pleidae, Geridae and Notonectidae shows negative correlation with water quality index (Table 5).

Diptera

The mean abundance of aquatic Dipterans was 0.14 org/L. It ranged minimum abundance of 0 org/L to a maximum of 1 org/L (It shows great variation of (CV = 107%) in abundance of the Dipterans were noticed during the study period (Table 4). The abundance of Dipterans was nil in every sampling. Dipterans show huge variation in their ocurance**.** The abundance of Dipteran did not show any type of correlation with Physico-chemical parameter.In the order Diptera, only one family Chironomidae was found during study period.

Odonata

The mean abundance of the aquatic odanates recorded was 0.03 org/L, ranged from minimum abundance of 0 to a maximum of 0.062 org/L. weekly variation (CV=67%) in the abundance of odonata were noticed during the study period. The abundance of odonates are very less when compare to Hemiptera and Diptera. The abundance of odonates did not show any correlation with physico-chemical parameters (Table 4).In the orderodonata only one family lectidae was found during study period.

In the present study Lingambudhi lake shows WQI of 127 an average value of study indicating poor water quality. Udayashankara (2013) and his team worked on Lingambudhi lake for the analysis of water quality and dynamic analysis of phytoplankton, they also found that the quality rating of Lingambudhi lake water was bad, they also recorded very less amount of dissolved oxygen. Due to more amount of algal growth in the lake and the water become greenish in colour. Panduranga murthy *et al* 2014. worked on lake of Mysore in which Lingambudhi lake,

applied Innovative Water Quality Index (Iwqi) unlike many other indexes, this index requires the analysis of only five water chemical parameters, they rated the quality of water was marginal or almost poor rating (Panduranga murthy *et al,* 2014). Lingambudhi lake, though with the poor water quality index has a very diverse and large aboundant aquatic insect groups, the dominating insect group was found to be order Hemiptera along with five different families.

Aquatic hemiptera hold an important place in the ecology of freshwater systems. They are important food for many organisms, including fish, amphibians, waterfowl and other animals (Clark, 1992 ; McCafferty, 1983). These insects generally hold an intermediate place in food chains, and apart from being eaten, are often important predators. Another important function of aquatic Hemipterans in ecosystem is to inhabit conditions that would be extremely stressful for other organisms. In lingambudhi lake abundance of Hemipterans are more compare to other insect groups Shows that the tolerance level of hemipterans are more, corixidae in particular, are some of the first colonizers of extreme environments because of their huge occurrence in lingambudhi lake. The same results were reported by Jansson in 1987 The corixidae have been present in finland waters heavily polluted by sewage and Wollmann in 2000 reported that these insects have been found in German mining lakes with a pH below 3. In the present study corixidae shows negative correlation with Hardness and Calcium. Ligambudhi lake water has hardness of 315mg/L, represents high level both in hardness and Calcium concentration, interestingly the abundance of corixidae is also more in the group hemiptera but statistically shows negative correlation with Hardness and Calcium. If the amount of Hardness of Calcium decreases it may further increases the abundance of Corixidae. The Notonectidae or backswimmers and Velidae are interesting groups of aquatic Hemipterans shows an abundance of 2% each in the order Hemiptera Backswimmers are aquatic insects with a boat shaped back and paddle like legs. Their hind legs are much longer than their middle and front legs, Backswimmers swim upside – down on their backs just under the surface of the water. They swim by moving their long hind legs like the oars of a boat. The abundance of backswimmers are very less and shows negative correlation with water quality index, indicating sensitivity to pollution. (Merritt *et al,.1996*) represents backswimmers are not pollution tolerant. The pleidae and Geridae are found very less, and shows negative correlation with water Quality index, indicating moderately intolerant to pollution. This study indicating that Hemiptera would be a highly promising choice for further study as an aquatic habitat indicator organism for a variety of water characterististics.

Chironomus larva are found during the study period, it is the only one individual found in the family Diptera. It shows 7% of abundance in total insect abundance in Lingambudhi lake. Chironomidae did not show any correlation with physico-chemical parameters. Chironomidae (Diptera) are a family of small flies. They are such a diverse and widespread family that they can subsist in most climates and widespread family that they can subset in most climates and a wide range of water qualities. This family has no relationship between physico-chemical parameters and less abundance shows sencitivety to pollution but some article reported as chironomidae are tolarent to pollution. During the sample collection, collecting net was swiped at surface water, the chironomidae are benthic, soil dwellars hence the abundance is very less compared to Hemiptera.

Odonata were found during the study period and shows very less abundance. Only 2% of odonata are found in the whole study. In the order odonata only Damesefly Nymphs are found. Its belongs to the sub order Zygoptera. Damesefly nymphs are easily recognized by their three long tail-like gills at the end of their slender body. Damesefly nymphs are predators that feed mostly on other water insects, while young larvae feed primarily on zooplankton, mature larvae feed on other macro invertebrates and sometimes even small fish (MDEP) Damselflies cope with low dissolved oxygen by climbing to the surface and absorbing oxygen from the air through their skin. In the present study damselflies did not show any correlation neither with physico-chemical parameters and nor with water Quality index. This indicates the richness and diverse group of aquatic insects in the study area, it reinforces to the fact that habitate quality is most suitable for insects to breed and multiply under the natural ecosystem. Further more lake environmental factors have directly or indirectly affected aquatic insects assemblegs, showing that aquatic insects were useful indicator of water quality in the lake, all sampling stations in this study shows moderately polluted by indication of diversity index.

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CONFLICT OF INTEREST

The author(s) declares no conflict of interest.

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Table 1.showing water quality rating as per weight arithmetic water quality index.

WQI value	Rating of water quality	Grading
0-25	Excellent water quality	A
26-50	Good water quality	B
51-75	Poor water quality	C
76-100	Very poor water quality	D
Above 100	Unsuitable for drinking purpose	E

Table 2 : The abundance of three groups of insects at Lingambudhi lake.

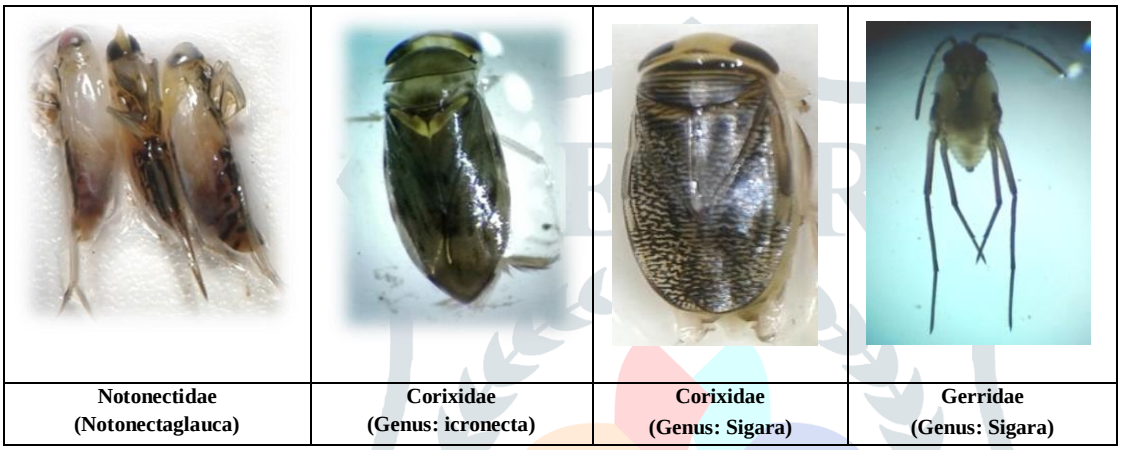
Aquatic insects(Org/L)	Mean ± S.D	Range	CV (%)
Hemiptera	1.88 ± 0.93	1 to 3	49
Diptera	0.14 ± 0.15	0 to 1	107
Odonata	0.03 ± 0.02	0 to 0.1	67
Total abundance	2.05 ± 1.00	1 to 3.8	49

Table 3: Drinking water standards recommending by different agencies.

PARAMETERS	STANDARDS	RECOMMENDED AGENCY	RELATIVE WEIGHT
pH	6.5-8.5	ICMR	0.1176
Conductivity mS/cm	300	ICMR/BIS	0.0033
Hardness mg/L	300	ICMR	0.0033

TSS mg/L	500	ICMR	0.002
Calcium mg/L	75	WHO	0.0133
Chloride mg/L	250	ICMR	0.004
Nitrate mg/L	45	ICMR	0.0222
Sulfate mg/L	150	ICMR	0.0066
DO mg/L	5	ICMR	0.2
TDS mg/L	500	ICMR	0.002

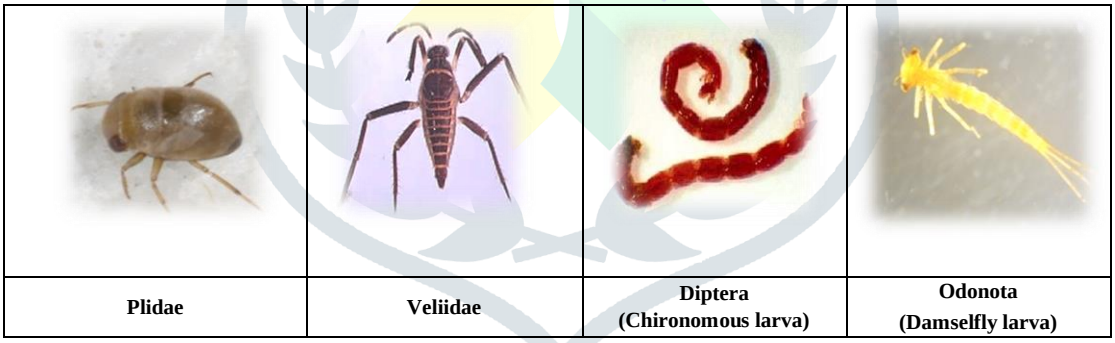
Fig 1.1:Hemipterans found in Lingambudhi lake, Mysuru.



Notonectidae (Notonectaglauca)	Corixidae (Genus: icronecta)	Corixidae (Genus: Sigara)	Gerridae (Genus: Sigara)

Fig. 1.2 Diptera and Odonota found in Lingambudhi lake, Mysuru.

Table



Plidae	Veliidae	Diptera (Chironomous larva)	Odonota (Damselfly larva)

4:Relationship between physicochemical parameters and insect groups at Lingambudhi Lake.

Environmental Variables	Hemiptera	Diptera	Odonata	Total abundance
AT	NS	NS	NS	NS
WT	NS	NS	NS	NS
Lab pH	NS	NS	NS	NS
DO	NS	NS	NS	NS
COND	NS	NS	NS	NS
TDS	NS	NS	NS	NS
TURB	NS	NS	NS	NS
HARD	NS	NS	NS	NS
Ca	**-0.021***	NS	NS	**-0.023***
PO_4	NS	NS	NS	NS

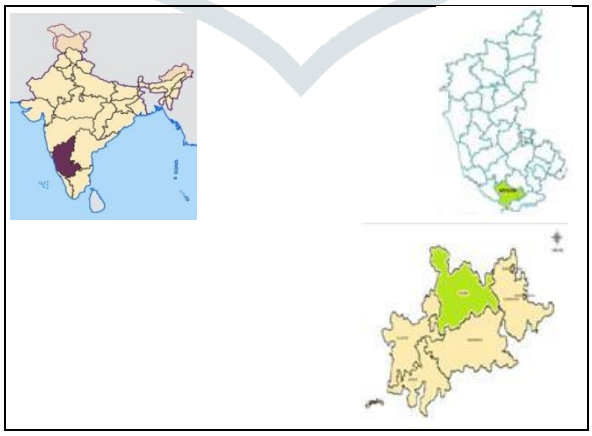
Cl_2	NS	NS	NS	NS
NO_3	NS	NS	NS	NS
SO_4	NS	NS	NS	NS
TASA	NS	NS	NS	NS
TSS	NS	NS	NS	NS
WQI	NS	NS	NS	NS

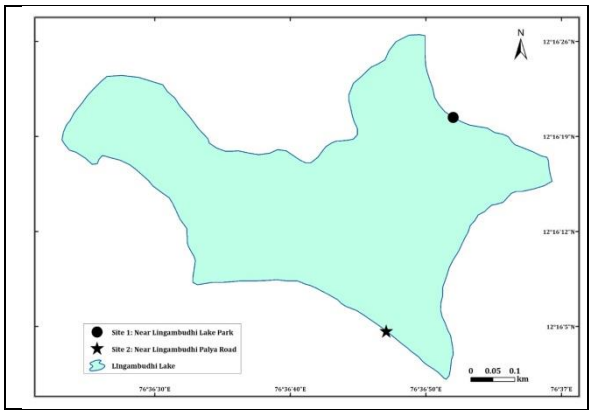
Table 5: Relationship between physicochemical parameters and Hemipteran families at Lingambudhi Lake.

Environmental Variable	Veliidae	Pleidae	Geridae	Corixidae	Notonectidae
AT	NS	NS	NS	NS	NS
WT	NS	NS	NS	NS	NS
Lab pH	**-0.024***	NS	**0.018***	NS	**-0.045***
DO	NS	NS	NS	NS	**-0.035***
COND	**-0.036***	NS	NS	NS	NS
TDS	**-0.036***	NS	NS	NS	NS
TURB	NS	NS	NS	NS	NS
HARD	**0.019***	**0.011***	NS	**-0.040***	NS
Ca	**0.028***	NS	NS	**-0.022***	NS
PO_4	NS	NS	NS	NS	NS
Cl_2	**-0.021***	NS	NS	NS	NS
NO_3	NS	NS	**-0.040***	NS	NS
SO_4	NS	NS	NS	NS	NS
TASA	**-0.001****	NS	NS	NS	NS
TSS	**0.000****	NS	NS	NS	NS
WQI	NS	**-0.020***	**-0.029***	NS	**-0.015***

Values are Pearson correlation coefficient, 2-tailed test was applied after log $_{10}$ transformation of all variables using SPSS software .**Correlation is significant at the 0.01 level (2-tailed).* Correlation is significant at the 0.05 level (2-tailed). N=13. This aquatic insects group did not show any correlation . AT= Air Temperature, WT=Water Temperature, COND= Conductivity, TURB= Turbidity, HARD= Hardness, Ca= Calcium, PO_4= Phosphate, Cl_2=Chloride, NO_2= Nitrate, SO_4= Sulphate, TASA= Total Anion in Strong Acids, TSS= Total suspended Solids.

Fig. 1.3 : Map showing the sampling sites along in Mysore district and Lingambuddhi lake.




N
12°16'26"N
12°16'19"N
12°16'12"N
12°16'5"N
Site 1: Near Lingambudhi Lake Park
Site 2: Near Lingambudhi Palya Road
Lingambudhi Lake
0 0.05 0.1
km
76°36'30"E
76°36'40"E
76°36'50"E
76°37'E