International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 12-11-2021, Accepted: 26-11-2021, Published: 13-12-2021
Volume 6, Issue 6, 2021, Page No. 225-229

Insect fauna and water chemistry in relation to trace metals in the sediment samples of Bathi lake, Davangere, Karnataka: A case study

Nagaraja B[1*], Thirumala S[2]

[1] Assistant Professor, Department of Chemistry, SJM Science, Commerce and Arts College, Chandravalli, Chitradurga, Karnataka, India

[2] Assistant Professor, Department of Environmental Science, Government First Grade College & P.G. Center, Near Anubav Mantapa, Davanagere, Karnataka, India

Abstract
Bathi lake in Davangere was studied for insect composition and Physico-chemical as well as trace metal parameters at five sites, for a period of six months from April to September 2019. A total of 11 species of aquatic insects belonging to 04 orders and 07 families were recorded. Among orders, Hemiptera consists of 08 species followed by Trochoptera, Ephemeroptera and Araneae with 01 species each respectively. Human activities, agricultural runoff and discharging of waste water creates threat to the biota of the lake by altering the water quality. Different parameters studied were pH, electrical conductivity, nitrogen, phosphorus, zinc, copper, iron and manganese levels. The results obtained from the current study indicated that the water pH of Bathi Lake was alkaline in nature, EC, nitrogen and phosphorus contents were in moderate concentrations. Manganese and iron levels of sediment sample in Bathi lake shows maximum level of pollution and ecological balance is disturbed. One-way ANOVA and Tukey HSD test were calculated to know the significant difference between the samples.

Keywords: pH, Electrical conductivity, nitrogen, phosphorus, trace metals, insect fauna

Introduction

Globally about 45,000 species of insects inhabit in diverse fresh water ecosystem (Balaram, 2005) [3]. Aquatic insect are involved in nutrient recycling and form an important element of natural food web. Some are them play a role in biological control of mosquitoes and a many aquatic insects are used as a food for fishes and acts as pollution indicators. They are primary bio- indicator of freshwater bodies such as lentic and lotic habitat due to their different environmental disturbances tolerant levels (Arimoro and Ikomi, 2008; Mirgane Amol Prabhakar and Kumbhar Arvind Choodamani, 2018) [2, 10].

Soil erosion is that the main worldwide reason for diffuse pollution, as a result of the impacts of the abundance residue streaming into the world's water approach. The silt themselves approach as contaminations, even as being transporters for various pollutants, for instance, connected chemical molecule or trace metals. The impact of distended silt stacks on aquatic environments will be fatal. Silt will cowl the delivery spawning beds of fish, by occupying within the house between rock on the stream bed (Vidya and Suresh, 2016) [17].

Water is the mainly fundamental natural resources in the globe for living organisms. Water can be found on oceans, rivers, reservoirs, streams and lakes etc. Such water may be contaminated by discharging domestic waste, industrial water, agricultural activities, surface-runoff and erosion etc. They may pollute the water bodies and become unfit for human consumption and adversely affects the natural surroundings (Padmini and Aravinda, 2016) [11].

Sediment contamination is an inevitable natural issue that undermines aquatic biological systems round the world. Once discharged into surface waters, various toxic and persistent contaminants become adsorbate to residue and might get united into aquatic food networks. As such, impure silt will have harmful and bio mixture impacts on aquatic life contaminants in biological systems.

Trace metals are extraordinarily unsafe poisons as a result of their bioaccumulation and harmfulness that lawfully impacts the biological procedures. The problem of resistless metal toxicity could stay as a heritage of mass mechanical development sure enough ages and is possibly getting to rise more in future. In such approach, the buildup of past and also the gift files of generous metal fixation is an activity of fantastic criticality. resistless metal sullying may be a quickly making issue for our surface water resources. As of currently it's going to not be the most effective sullying issue, nevertheless primarily keeping things in check for it to go away or to light itself will not facilitate. we should always deem the problems follow metals build, thus we have a tendency to generally, in our own one in every of a sort very little ways that, will boost the arrangements. Clean water is our movement into a perfect future. we want to exhort individuals regarding however follow metal contamination gets into our condition in order that they will be increasingly responsive to the risks of those poisons. (Thirumala *et al.*, 2019) [14].

The main aim of the current study is to grasp the insects fauna, physico-chemical and trace metal concentration within the sediment of Bathi lake, Davangere district, Karnataka.

Materials and Methods

Study area

Bathi lake of Davangere district is located at 14°28'27" N latitude and 75°52′13″ E longitude. It lies at 598 mt above MSL in Davanagere Taluk in Karnataka. This lake is

adjacent to Harihara- Davanagere state highway. This wetland provides water for fishing aquaculture activities and irrigation to the near by agricultural lands of Doddabathi village. This lake is approximately 7 km away from Davanagere town and Harihar taluk respectively. The lake has used for recreational activities and this lake inhabit many resident and only some migratory birds.

Fig 1: A view of Bathi Lake

Methodology

In this study lake sediment samples has been collected during April to September 2019 and analysed as per standard methods prescribed by APHA (2012) [1] and Trivedy and Goel (1984) [16]. For trace metal analysis the samples were collected in good quality polypropylene bottles, each with 2 liter capacity, properly labelled and estimated for trace metals by Atomic Absorption Spectrophotometer (AAS).

A cleaned Ekman grab sampler was used to collect the lake sediments. To prevent contamination, of the sediment, it was scoped and transfer to pre-cleaned polythene bags and then freezed. The sediments was dried, powdered and passed through 63 µm sieve. 1gm powder was digested using 10 ml of Aqua Regia for 30 minutes at 60ºC using aluminium block. The solutions were diluted in 50 ml flasks, together with reagent blanks. Sediment extracts were analysed for trace metals using an atomic absorption spectrophotometer with appropriate standards and several blanks prepared similar to the samples (APHA. 2012) [1]. One-way ANOVA was calculated by using statskingdom soft ware.

Results and Discussion

In this study, a total of 11 species of aquatic insects belonging to 04 orders and 07 families were recorded (Table 1, Figure 2e, Figure 3). Among orders, Hemiptera consists of 08 species followed by Trochoptera, Ephemeroptera and Araneae with 01 species each respectively.

Table 1: Occurrence of insects in Bathi lake of Davangere district

Class	Order	Family	Scientific name
Insecta	Hemiptera	Notonectidae	*Notonecta maculata*
Insecta	Hemiptera	Corixidae	*Corixa sp.*
Insecta	Hemiptera	Corixidae	*Hesperocorixa sp.*
Insecta	Hemiptera	Belostomatidae	*Lethocerus sp.*
Insecta	Hemiptera	Gerridae	*Gerris sp.*
Insecta	Hemiptera	Gerridae	*Cyprus sp.*
Insecta	Hemiptera	Nepidae	*Nepa cinerea*
Insecta	Hemiptera	Nepidae	*Ranatra sp.*
Insecta	Trichoptera	Notonectidae	*Caddis fly larvae*
Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena sp.*
Arachnidae	Araneae	Dictynidae	*Argyroneta aquatica*

The orders Hemiptera, Odonata, Coleoptera and Ephemeroptera are the bio- indicators of water quality and they are the bio- control agents. Similar explanation were reported by Majumder *et al*., (2013) [9] reported 31 species from fresh water lake of Tripura having 23 genera, 15 families and 4 orders and they opined that Hemiptera and Odonata orders were dominant. However, Choudhary and Gupta (2015) [4] have studied the aquatic insect fauna of Deepor beel in Assam and they reported 31 species belonging to 18 families of 5 orders and noticed that Hemiptrea was the dominant order with 17 species and 8 families. Mirgane Amol Prabhakar and Kumbhar Arvind Choodamani (2018) [10] paper deals with aquatic insect diversity of Katphal Lake Tal. Sangola, Dist. Solapur, India. They reported a total of 20 species of aquatic insects belonging to 20 genera and 15 families distributed over 5 orders; Hemiptera was dominant order with 7 species and Ephemeroptera least with 2 species.

Deepa and Rao (2005) [6] have recorded 8 hemipteran insects from Pocharam lake of Andhra Pradesh.While, Similarly, Das and Gupta (2012) [5] have also reported 14 species of hemiptera from a temple pond in Cachar district, Assam.

The pH of the sediment ranged between 7.1 (S1) in the months of April and 8.2(S5) in the month of June. Electrical conductivity fluctuated from 0.2 µmhos/cm (S4) in the months of March and 0.7 µmhos/cm (S3) in the month of July. While, nitrogen substance varied from 14.1 ppm (S2, March) and 30.02 ppm (S5, March). Phosphorus levels ranged between 0.32 ppm (S1, March) and 1.7 ppm (S3, April) (Figure 2a-2b).

The heavy metals like Iron content ranged from 7.74ppm (S2, March) to 20.2 ppm (S1,May).On the other hand, zinc content varied from 0.2 ppm (S3-April) to 8.4 ppm (S5,March). Nevertheless, Manganese fluctuated from 10.0 ppm (S2, May) to 33.6 ppm (S3-April). Nonetheless, copper content deviated from 0.3 ppm (S2-July) to 8.9 ppm (S5-April) (Figures 2c-2d). Table 2-3 shows the One-way ANOVA and Tukey HSD test data for physico-chemical and trace metals in sediment samples of Bathi lake.

Most of the water parameters and trace elements are also used to estimate the level of pollution in a region (Thomas *et al*,, 1984; Emmanual *et al*., 1994; Sarika *et al*, 2008; Jayaram *et al*.,2016; Padmini and Aravinda,2016; Vidya and Suresh, 2016; Thirumala *et al*., 2019; Ravikumar *et al*., 2020) [15, 7, 13, 8, 11, 17, 14, 12]. The study area is dominated by anthropogenic activities. The generated wastes are

sometimes disposed in nearby place by surface run off. The fluctuated water and sediment concentration in a samples is clearly indicates its part of anthropogenic, sewage and industrial activity in a surrounding area, due to this activity wastes were leached from soil or carried through water leads to contamination of lake.

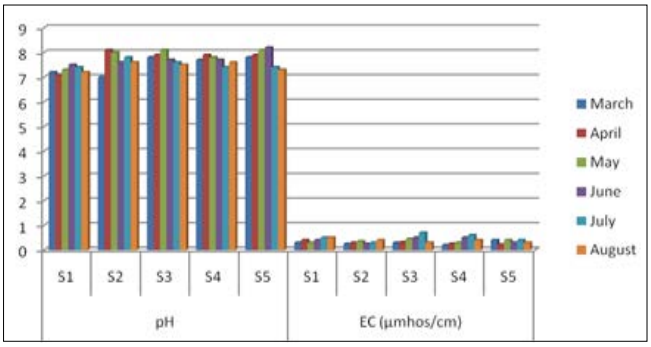

Fig 2a: pH and EC levels in the sediment of Bathi lake

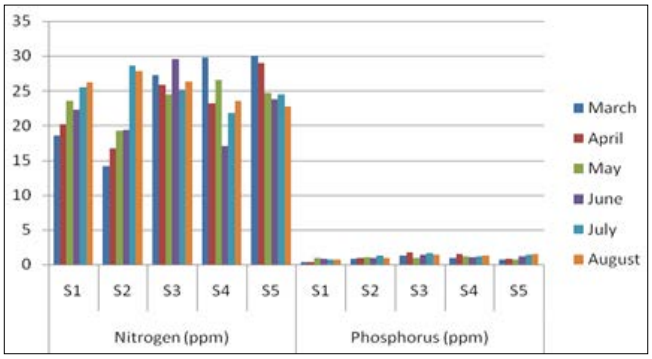

Fig 2b: Phosphorus and Nitrogen levels in the sediments of Bathi lake

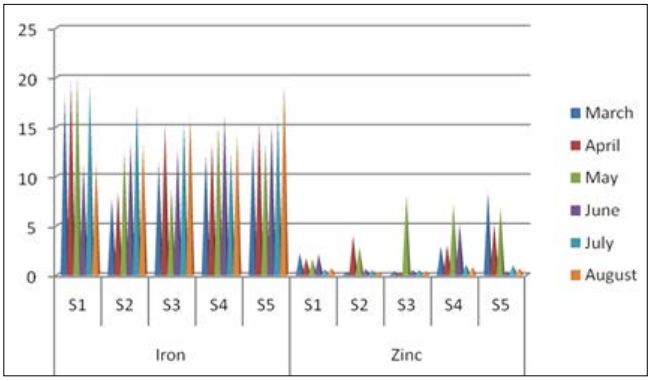

Fig 2c: Iron and Zinc levels in the sediments of Bathi lake

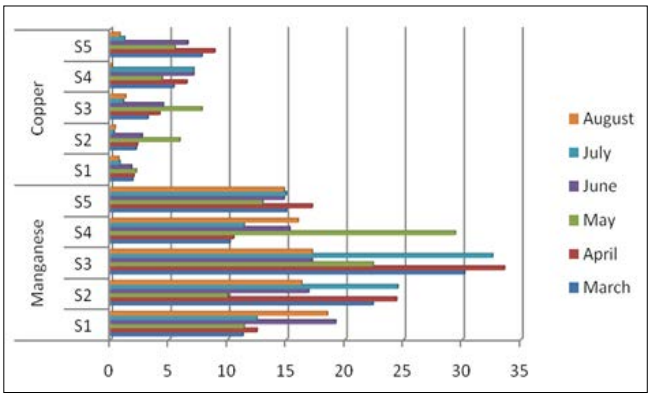

Fig 2d: Manganese and Copper levels in the sediments of Bathi lake

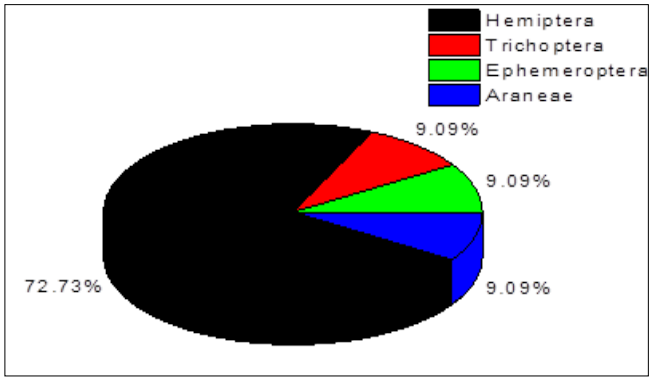

Fig 2e: Percentage occurrence of insect orders in Bathi lake, Davangere district

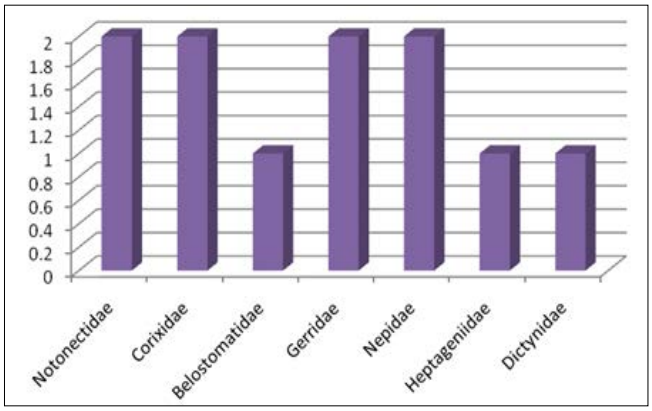

Fig 3: Number of insects in each families of Bathi lake, Davangere district

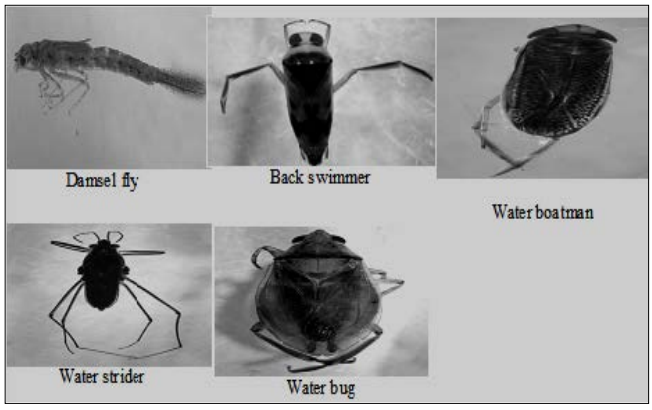

Fig 4: Aquatic insects of bathi lake, Davangere district

One Way ANOVA and Tukey HSD test

Table 2: One Way ANOVA data for physico-chemical and trace metals

Source	DF	Sum of Square	Mean Square	F Statistic
Groups (between groups)	4	11618.09169	2904.522922	53.210163
Error (within groups)	295	16102.83105	54.585868	
Total	299	27720.92274	92.712116	

Since p-value<α, H_0 is rejected. Some of the groups' averages consider to be not equal. In other words, the difference between the averages of some groups is big enough to be statistically significant-value equals zero (p (x ≤ F) = 1.000000). This means that the chance of type1 error (rejecting a correct H_0) is small: 0.000 (0.0%).
The smaller the p-value the stronger it support H_1 The test

statistic F equals 53.210163, is not in the 95% critical value accepted range: (-∞: 2.4022) The observed effect size f is large (0.85). That indicates that the magnitude of the difference between the averages is large. The η^2 equals 0.42. It means that the group explains 41.9% of the variance from the average (similar to R^2 in the linear regression).

Tukey HSD test

The means of the following pairs are significantly different: x1-x2, x1-x3, x1-x4, x1-x5, x2-x3, x2-x4, x2-x5, x3-x4, x3-x5.The test priori power is strong: 0.9486

The population's variances consider to be not equal. (p-value = 0.00). Levene's test power consider to be strong (0.95).The groups' size consider similar. (The ratio between the bigger group and the smaller group is 1.00).The ANOVA test consider to be robust to the homogeneity of variances assumption when the groups' sizes are similar.

Table 3: Tukey HSD values for physico-chemical and trace metals in the sediment samples of Bathi lake, Davangere

Pair	Difference	Q	Lower CI	Upper CI	p-value
x1-x2	4.891333	5.128174	1.188976	8.593690	0.00310281
x1-x3	13.491000	14.144241	9.788643	17.193357	1.26909e-10
x1-x4	4.499834	4.717718	0.797477	8.202191	0.00845296
x1-x5	6.872334	7.205096	3.169977	10.574691	0.00000617306
x2-x3	18.382333	19.272415	14.679976	22.084690	1.26860e-10
x2-x4	9.391167	9.845892	5.688810	13.093524	3.44741e-10
x2-x5	11.763667	12.333270	8.061310	15.466024	1.26909e-10
x3-x4	8.991166	9.426523	5.288809	12.693523	1.42034e-9
x3-x5	6.618666	6.939145	2.916309	10.321023	0.0000151129
x4-x5	2.372500	2.487378	-1.329857	6.074857	0.399761

Group	x2	x3	x4	N_2 & Phosphorus (x5)
pH & Cu (X1)	4.89	13.49	4.50	6.87
EC & phosphorus(X2)	0.0	18.38	9.39	11.76
N_2 & Fe (X3)	18.38	0.0	8.99	6.62
Mn & Zn (X4)	9.39	8.99	0.0	2.37

Conclusion

Few physico-chemical and trace metal parameters in the studied lake showed temporal and spatial variations throughout the study. Bathi lake receives maximum pollution load from the surroundings areas and the sediment is highly contaminated and if the similar condition continues for longer time and the Bathi lake may become eutrophic. The levels of the manganese and iron was found to be varying from 10 ppm to 33.6 ppm and 7.74 ppm to 20.2 ppm due to fluctuation of pollutant load entering into the water body. The lake is polluted due to entry of domestic wastewater into lake and also the agricultural activities around the lake. This is due to the discharge of the domestic wastewater into the lake. The impurities present in domestic wastewater is entering and contaminating with the impurities present in the Bathi lake. This concludes that the lake water is unsuitable for human consumption and hence it cannot be used without any proper treatment.

References

1. APHA. American Public Health Association Standard Methods for examination of water and waste water specifications. Washington D.C., 6. 22nd edition, 2012.
2. Arimoro FO, Ikomi RB. Ecological integrity of upper Warri River, Niger Delta using aquatic insects as bioindicators. Ecological Indicators,2008:395:1-7.
3. Balaram P. Insect of tropical streams. Curr. Sci., 2005:89:914.
4. Choudhury D, Gupta S. Aquatic insect community of Deepor beel (Ramsar site), Assam, India. Journal of Entomology and Zoology Studies. E-ISSN: 2320-7078 P-ISSN: 2349-6800,2015:3(1):182-192.
5. Das K, Gupta S. Seasonal variation of Hemiptera community of a temple pond of Cachar District, Assam, Northeastern India. Journal of Threatened Taxa,2012:4:3050-3058.
6. Deepa J, Rao CA. Aquatic Hemiptera of Pochram Lake, Andhra Pradesh, Print Journal,2005:1822(12):2937-39.
7. Emmanuel I, Adeyeye. Determination of trace heavy metals in illisha Africana fish and in associated water and soil sediments from some fish ponds. Int. jour. of Envi. Stu.,1994:45:231-238.
8. Jayaram GN, Chandrashekarappa KN, Anantha Murthy KS. Heavy metal distribution in sediments around Kallur Mandli and Sagar road Industrial estate Shimoga, Karnataka, India. International Journal For Innovative Research In Multidisciplinary Field Volume,2016:2(10):360-365.
9. Majumder J, Rajib K Das Prasanta Majumder, D Ghosh BK Agarwala. Aquatic insect fauna and diversity in urban fresh water Lakes of Tripura, Northest India. Middle-East journal of Scientific Research,2013:13(1):25-32.
10. Mirgane Amol Prabhakar, Kumbhar Arvind Choodamani. Aquatic insect diversity of fresh water body at Katphal lake, tal- Sangola, dist Solapur (M.S.) India. Paripex - indian journal of research,2018:7(5):26-27.
11. Padmini VN, Aravinda HB. Domestic wastewater effecting on physico-chemical properties of Bathi lake, Davangere City, Karnataka. International Journal of Research in Engineering and Technology,2016:05(08):146-149.
12. Ravikumar R, Purushothama R, Kiran BR. Physico-chemical and trace metalprofile of purle tank, shivamogga District, Karnataka. Journal of Xidian University,2020:14(5):2295-2301.
13. Sarika PR, Chandramohankumar N. geochemistry of heavy metals in the surficial sediments of mangroves of the south west coast of India; Jour. Che. Eco, 2008:24(6):437–447.

14. Thirumala S, Shashi shekar TR, Kiran BR. Trace metal levels in the sediment and water of river Bhadra, Karnataka, India. Int J Pharma Bio Sci. 2019:10(3):(B)144-150.
15. Thomas M, Petit D, Lamberts L. Pond sediments as historical record of heavy metals fallout; laboratory of analytical chemistry and mass spectrometry, faculties universities notre- dame de la paix, rue de bruxelles, 61, b-5000 Namur, Belgium; water, air, and soil pollution,1984:23:51-59.
16. Trivedy RK, Goel PK. Chemical and biological methods for water pollution studies. Environmental publication, Karad, India, 1984.
17. Vidya BR, Suresh S. Sediment quality assessment of Bathi lake, Davanagere city: A Case Study. International Journal of Innovative Research in Advanced Engineering,2016:10(3):1-7.