

## RESEARCH ARTICLE

# Physico-chemical and aquatic insects diversity of pond ecosystem in Karwar, India

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## ABSTRACT

This study was aimed to study the diversity of aquatic insects and physicochemical factors of water in pond of Karwar, India. The aquatic insects were collected using insects net from the study area during June 2009 to May 2010. 15 species belonging to 6 orders were found, with the highest number of aquatic insects from the order *Hemiptera*. The most abundant order was *Coleoptera* which were very commonly found during the study period. Physicochemical values of water, air temperature, pH, DO, CO<sub>2</sub>, TA, Cl<sub>2</sub>, PO<sub>4</sub> and NH<sub>4</sub> were measured.

**Key words:** Aquatic insects, Physico-chemical parameters, diversity, *Hemiptera*.

## INTRODUCTION

All over the world about 45000 species of insects are known to inhabit diverse freshwater ecosystem (Balaram, 2005). These are involved in nutrient recycling and form an important component of natural food web in aquatic ecosystem. These also serve as reliable indicators of ecological characteristics of water. Insects with their abundance and diversity dominate fresh water ecosystem. However, the aquatic insect fauna of this part in India is rather poorly documented. Limited numbers of studies have been carried out on the ecological aspects of aquatic entomofauna. Some recent works are those by Sharma and Rai (1991), Sivaramakrishnan *et al.* (1995; 1996.) Thirumalai (1999), Anbalagan *et al.* (2004), Subramanian and Sivaramakrishnan (2005), Anbalagan and Dinakaran (2006), Dinakaran and Anbalagan (2007).

The Ponds, Lakes and other stagnant water are homes of 2 great groups of aquatic insects i.e. the surface hunters and divers. The Surface hunters are the common water striders, water skaters and beetles which rarely, if ever dive below. They walk and run with great speed on water surface. Most surface hunters are gregarious and show a decided preference for open water particularly some shady tree on the shore.

The divers in our ponds, lakes and tanks includes many divers' insects Among them both the aquatic larvae of typically aerial adult like mayfly, stone fly, dragon fly, caddis fly and mosquitoes and as well as numerous other which are aquatic throughout their life cycle, like water boatmen, Nepha (water scorpion), bugs etc., information is also available on aquatic fauna studied by Tonapi (1959) Information is also on aquatic coleopterary Puna studied by Tana and Ozarkar (1969). Information is also available in lentic ecosystem to mention few aquatic insects of pond carried by Vijaykumar and Ramesha (2002). In the aforementioned context the present study was carried out with the objective to identify the commonly occurring insect fauna and workout their abundance in and around the Karwar area.

## MATERIALS AND METHODS

### Study Area

For the collection and study of fresh water insects found in pond of Karwar area. Karwar is on the coastal Karnataka, It has a unique geographical condition, Karnataka coast commonly called as "Malabar" extends 320 km and width ranges from 8 to 25 km towards the inland areas. Uttar Kannada district, lies between 74°9' to 75°10' east longitudes and 13°55' to 15°31' north latitude and extends over an area of 10,327sq. km. The study was under taken in the Karwar area situated between latitudes 13°31' and 13°55' N and 75°04'E, it is broad ere by the towering heights of the Western Ghats Mountains towards the east & Arabian sea.

### Method

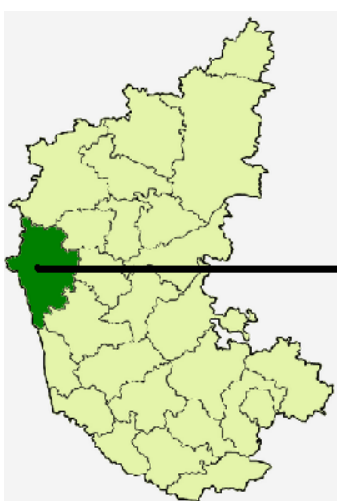
Monthly samplings are made in the study site from June 2009 to May 2010 over a period of 12 months. By using aquatic insects net, during early and afternoon hours and physico-chemical were recorded (APHA, 1985). Collected samples were fixed in 70% alcohol in specimen bottles for further study. These collected specimens were brought to the Laboratory for identification with the help of literatures of aquatic insects of India by Tonapi (1980) and fresh water fauna of Dharwad area given by Gouder and Patil. (1985).

## RESULTS AND DISCUSSION

The physico-chemical parameters of Karwar area are summarized in Table-1. Many aquatic organisms are sensitive to changes in water temperature. Temperature is an important water quality parameter and is relatively easy to measure. Water bodies will naturally show changes in temperature seasonally and daily (Pankow, 1991). In the present investigation the minimum water temperature recorded during June (19.1 C) and maximum was recorded in the month of May (27.3C). The difference in water temperature may depend on the climate and the environment sampling station as well as time, wind, water mixing and amount of sun light. Water temperature affects the numbers of aquatic insects since each species requires in a specific range of water temperature to live in because of different respiratory rate and metabolism (Devi, 2013).



INDIA



KARNATAKA



KARWAR

Map : Location map of the study area

Table 1: Monthly variation in Physico-Chemical Parameters in Pond of Karwar area.

Parameters	Month/Year											
	June 2009	July 2009	Aug 2009	Sept 2009	Oct 2009	Nov 2009	Dec 2009	Jan 2010	Feb 2010	March 2010	April 2010	May 2010
Atms. Temp °C	24.6	28.9	24.3	26.8	28.5	28.7	28.9	28.5	30.7	31.7	32.0	33.5
Water Temp °C	19.9	23.3	23.9	20.2	21.8	23.5	24.5	23.7	24.7	24.6	25.8	27.3
pH	8.5	9.0	8.3	8.4	7.9	8.7	8.0	8.1	8.0	8.1	8.1	8.2
DO mg/l	5.2	4.8	4.4	3.9	3.5	4.0	4.1	4.9	6.8	4.5	4.1	4.0
CO <sub>2</sub> mg/l	+	0.6	6.6	8.6	+	+	1.1	1.1	+	1.1	2.2	1.1
TA mg/l	125	140	117	165	160	185	155	160	175	135	120	125
Cl <sub>2</sub> mg/l	34.60	63.90	62.48	59.64	58.22	48.28	58.22	48.28	35.60	34.60	48.28	34.60
PO <sub>4</sub> -P mg/l	0.13	0.14	0.14	0.15	0.16	0.17	0.11	0.12	0.14	0.12	0.11	0.12
NH <sub>4</sub> -N mg/l	0.26	0.66	0.61	0.61	0.27	0.66	0.65	0.59	0.69	0.67	0.38	0.30

Table 2. Correlation coefficient between the various Physico Chemical Parameters in Pond of Karwar area.

Parameters	Atm. Temp °C	Water Temp °C	pH	DO mg/l	CO <sub>2</sub> mg/l	TA mg/l	Cl <sub>2</sub> mg/l	PO <sub>4</sub> -P mg/l
Atm. Temp °C	-							
Water Temp °C	0.7745**	-						
pH	-0.3078	-0.2931	-					
DO mg/l	0.3509	0.2583	-0.3457	-				
CO <sub>2</sub> mg/l	-0.4006	-0.2488	0.0520	-0.3552	-			
TA mg/l	0.0124	-0.2371	-0.0116	0.2276	-0.1672	-		
Cl <sub>2</sub> mg/l	-0.4422*	-0.2764	0.2515	-0.6643	0.4698	0.0991	-	
PO <sub>4</sub> -P mg/l	-0.3757	-0.4962	0.3806	-0.2515	0.0872	0.5731	0.3001	-
NH <sub>4</sub> -N mg/l	-0.0308	0.1028	0.2108	0.1406	0.2046	0.4457	0.2535	0.0997

Table 3: Aquatic Insects collected at the ponds of Karwar area.

Sr. No.	Order	Species	Abundance
1	<i>Hemiptera</i>	<i>Gerris remigis</i> (Image 2)	+
		<i>Notonecta irrorata</i> uhler, 1879 (Image 3)	+
		<i>Belostoma species</i> (Image 4)	++
		<i>Corisella species</i> (Image 5)	+
		<i>Notonecta glauca</i> (Image 6)	+
		<i>Ranatra elongata</i> (Image 7)	+++
2	<i>Ephemeroptera</i>	<i>Rhithrogena germanica</i> (Image 8)	++
3	<i>Trichoptera</i>	<i>Caddisflies</i> (Image 9)	+++
4	<i>Plecoptera</i>	<i>Pteronarcys species</i> (Image 10)	+
5	<i>Amphipoda</i>	<i>Epimeria costa, 1851</i> (Image 11)	+
6	<i>Coleoptera</i>	<i>Predaceous Diving Beetles</i> (Image 12)	++
		<i>Water scavenger Beetles</i> (Image 13)	+++
		<i>Water-penny beetles</i> (Image 14)	++
		<i>Scirtes species</i> (Image 15)	+++
		<i>E. sticticu</i> (Image 16)	+





**Fig. 1 :** Habitat shots of pond of Karwar



**Fig. 2 :** *Gerris remigis* (Water Strider)



**Fig. 3:** *Notonecta irrorata uhler*



**Fig. 4:** *Belostoma species*



**Fig.5:** *Corisella species*



**Fig. 6:** *Notonecta glauca*



**Fig. 7:** *Ranatra elongate*



**Fig. 8:** *Rhithrogena germanica.*





Fig. 9: Caddisflies



Fig. 10: Pteronarcys species



Fig.11: Pteronarcys species



Fig. 12: Predaceous diving beetles



Fig. 13: Water scavenger Beetles



Fig. 14: Water-penny beetles



Fig. 15 : Scirtes Species



Fig. 16: E. sticticus

Ayyappan and Gupta (1981); Vijaykumar (1992) while working on the limnology of Ramasamundra tank and Jagath tank, Karnataka and many other workers have also observed similar trend in different water bodies. In the present study the pH concentration has been recorded from June 2009 to May 2010. pH values ranged from 8.0 to 9.0 and it is observed that the pH of Karwar area followed a specific seasonal trend from June to May. pH is important environment factors which affect the life process of animals inhabiting the water. The increase rate of decomposition of organic matters, influx of carbon dioxide, source of high water temperature, mixing of domestic sewage caused low PH value, Dubey *et al.* (2006).

Dissolved oxygen (DO) is essential to all forms of aquatic life including the organisms; in general, the concentration of dissolved oxygen will be the result of biological activity. Oxygen tends to be less soluble as temperature increases (Pankow, 1991). In the present investigation the dissolved oxygen in the Karwar area is 2.4 to 7.8 mg/l. The dissolved oxygen concentration recorded high during February 2010.

In the present investigations the free carbon dioxide values were considerably more in the month of August and September and less in the month of December and January (Table-1). In the present study total alkalinity values shows similar pattern of fluctuations though with minor differences in the study sites. The higher values of total alkalinity in the Karwar area reached up to 185 mg/CaCO<sub>3</sub> during November and February months. Two main sources of carbonate and bicarbonate are rain and soil including phosphate, borate and silicate, chloride concentration was minimum during March, April and June and maximum in July and August 2009 (Table 1).

During the present investigation the phosphate content was recorded minimum (0.11 mg/l) in the month of December 2009 and April 2010, maximum (0.17 mg/l) was observed in the month of November. Phosphate contaminated when the fertilizer used in nearby agricultural field and detergent that are widely used.

Ammonical nitrogen estimated in the present investigation remains much variable during the year but with an overall increasing during onset of the summer season (February, 0.66 mg/l).

Simple correlation coefficient analysis in Karwar area showed positive correlation of air and water

temperature were found to be highly significant at 1% level and atmospheric temperature was positively correlated with Cl<sub>2</sub> at 5% significant level.(Table 2).

In the present investigation total 15 species have been recorded belonging to 6 orders: belongs to the order *Heteroptera*, *Ephemeroptera*, *Trichoptera*, *Plecoptera*, *Amphipoda*, and *Coleoptera*. Order *Hemiptera* represents the highest number of species (6 species) followed by *Coleoptera* (5 species), and other orders such as *Ephemeroptera*, *Trichoptera*, *Plecoptera*, and *Amphipoda*, comprised one specie each (Table 3). Presence or absence of littoral vegetation and depth found to be important factors and that is affecting in the distribution of aquatic insects in the present studied water bodies.

The diversity of aquatic insects is also significantly high in comparison to some studies in lentic water bodies inhabiting insects of India. There is scare information available on the abundance and distribution of aquatic insects in lentic water bodies in Karnataka in general and Kawar in particular; therefore it is necessary to make continuous studies so that they can be accessible for scientists who are interested in finding proper management plans to protect aquatic resources. The study site representing the conditions between swamp and open water is a herbaceous natural water body is pre-dominated by the group of water hyacinth serves as a ideal habitat for the grouping and enriching of diverse species.

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