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STUDIES ON THE OCCURRENCE AND SEASONAL ABUNDANCE OF AQUATIC COLEOPTERA IN RELATION TO SOME PHYSICOCHEMICAL PARAMETERS OF WATER OF GHARANA WETLAND RESERVE JAMMU (J AND K)

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ABSTRACT
The present study was aimed to record the occurrence and abundance of aquatic beetles (Order: Coleoptera) and physicochemical factors of water of Gharana wet land. Specimens were collected from September, 2008 to August, 2009 with pond net. A total of 11 aquatic beetle species belonging to 03 families viz. Hydrophilidae, Dytiscidae and Staphylinidae were collected. Out of these 03 families the most abundant family was Dytiscidae (56%) followed by Hydrophilidae (40%) and Staphylinidae (4%). Physicochemical parameters like water and air temperature, pH, dissolved oxygen (DO) and free carbondioxide (FCO_2) were also measured.

INTRODUCTION

Aquatic insects constitute an important part of the aquatic ecosystems. These are involved in nutrients recycling and form an important component of natural food web in aquatic ecosystem. Some are of medical importance as they help in the biological control of mosquitoes and a number of aquatic insects are used as food for fishes and as pollution indicators. It is estimated that about 3% of total insects are aquatic spending at least a part of their life cycles in water and these comprise about 25,000 to 30,000 species (Cheng, 1976).

Coleopterans (commonly called beetles) is a diverse order with over 5,000 aquatic species and constitute an important part of macro-zoo-benthos of fresh water habitats (Thakur, 2003). They are minute to large in size, herbivorous, predacious or scavenger insects with biting and chewing type of mouth parts. Adults have the mesothoracic wings modified as rigid elytra. About 10 families are exclusively aquatic as larvae and adult (Thakur, 2003). An additional few are predominantly as aquatic as larvae and terrestrial as adults or vice-versa and several more have sporadic aquatic representation. Limited number of studies has been carried out on general entomofauna of wetlands of J&K which includes the work of Salaria (1992); Sharma *et al*., (1996); Choudhary (1980); Thakur (2003); Singh (2004); Ayri (2007); Saini (2009). The present paper deals with occurrence, seasonality of aquatic Coleopterans in relation to physicochemical parameters.

MATERIALS AND METHODS

Study Area

The present study carried out in Gharana wet land Reserve of Jammu, J&K. It is one of the important wet land reserves of Jammu region. It situated at Indo-Pak International border in Ranbir Singh Pura Sector, Jammu and is about 35Km South of Jammu city. The wet land is located at 70º7′ NL and 32º34′ E L. Insects were collected at monthly intervals from September, 2008 to August, 2009. The collection were made with the help of circular net with a long handle of area 314 cm^2 with a mesh size of 1mm and a kitchen sieve of area 1256 cm2 with a mesh size of 1mm by randomly netting different areas of wet land. Insects thus collected were preserved in 70% alcohol and dry preservation by pinning and carding the specimens. The preserved specimens in the collection were later get identified at Entomology Laboratory, IARI, New Delhi.

Physico-chemical Characteristics of Water

Physico-chemical parameters of study sites include Water and Air temperature, pH, DO and FCO_2. Water temperature is measured by using hand mercury thermometer, pH was measured by using pH meter, DO was determined by sodium azide modification of Winkler's Method (APHA, 1985) and FCO_2 was estimated by using Tetrimetric method (APHA, 1985).

Statiscical analysis

Total counts of each aquatic Coleoptera captured in wetland

Table 1: Aquatic beetles found during study and their distribution

Family	Name of species	Distribution
Hydrophilidae	*Sternolophus rufipus Fab.*	S.E Asia, Japan and Andaman Islands (Vazirani, 1973)
	Regimbartia sp.	Australia, Srilanka, Thailand, China, South- East Asia (including Japan), India(Vazirani, 1973)
	Berosus sp.	China, Malaysia, Srilanka, Thailand, Mexico, Portugal (Fonseca et al., 1999)
	Halochares sp.	Russia, Turkey, Argentina, India :Karnataka (Vijay Kumar and Ramesh, 2003)
Dytiscidae	*Laccophilus parvulus Aube*	Ceylon,Burma,Thailand, West Pakistan, Singapore, China, India: Pondicherry, Rajasthan, Gujrat,Andra Pradesh, Assam, Bihar,Goa,MadhyaPradesh,Maharashtra, Chennai and Orissa (Vazirani, 1968)
	Bidessus sp.	Ceylon,Britain, Southern England,Scotland, South Ireland, North Africa, Central Europe, Turkey, Spain (Valladares et al., 1994), India:Bihar, Calcutta, Orissa and Maharashtra
	Canthydrus sp.	Burma, Ceylon, Pakistan, Belgium, Congo and Nepal, India:W.B., U.P., Rajasthan, Punjab, Orissa, Kerala, Bihar, Gujrat, Maharashtra, Assam and Andra Pradesh (Vazirani, 1977)
	Dytiscus sp.	Nova Scotia, Canada, U.S.A., North Asia, Britain (Lyneborg, 1976), India: Banglore
	Cybister sp.	Europe, Transcaucasus, Central Asia, Mediterrinean region, Finland, Lativia (Kalnins, 1999)
	Hypophorus sp.	Iran, Central Europe (Shidokht,1978)
Staphylinidae	*Paederus* sp.	North America, Portugal, Britain, East Malaysia, Berlin

were divided by the number of sweeps taken in wetland. This yielded a mean number of specimens per sweep (ie abundance based on a catch per unit effort). Karl Pearson's correlation coefficient (r) was performed to determine the association between insects abundance and physicochemical variables of wetland.

RESULTS AND DISCUSSION

A total of 11 aquatic beetle species belonging to 03 families viz. Hydrophilidae, Dytiscidae and Staphylinidae were collected during the study period are listed in Table 1and Fig.2.

A total of 502 individuals were collected from the study station during the period of study which were further categorised into 11 species of aquatic beetles belonging to three families viz. Hydrophilidae, Dytiscidae and Staphylinidae(Table 1). Minimum numbers of beetles (07 individuals) were collected during September 2008 and maximum numbers (144 individuals) were collected during the month of February 2009 (Fig. 1A). Though earlier observations of Malhotra *et al.,* (1990) reported the peak of aquatic organisms in August while the trough appeared in January and February in Lake Mansar, Jammu. Also observations regarding insect abundance both in quality (26 sps. of insects) during colder months and quantity during summer seasons in pond water were observed by Kaushik *et al., (*1990) at Gwalior (M.P.). *Canthydrus* sp. was present in maximum number (130) and *Cybister* sp. present in least number (03) (Table 2). Percentage contribution of Family Dysticidae was maximum 56 % with 06 species, family Hydrophilidae contributed 40 % with 04 species and the least contributed family was Staphylinidae 9.1 per cent with 01 species (Fig. 1Band 1C). Similar observations regarding the preponderance of Dytiscidae over Hydrophilidae was

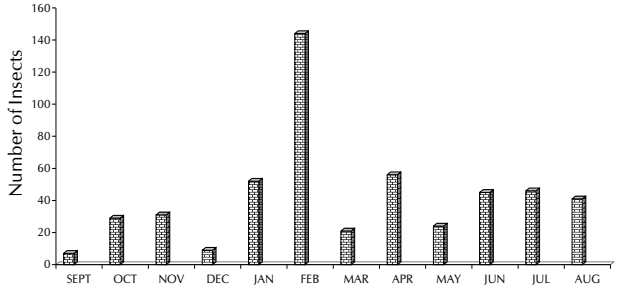


Figure 1A: Monthly variation in abundance of Aquatic Coleoptera in Gharana Wetland

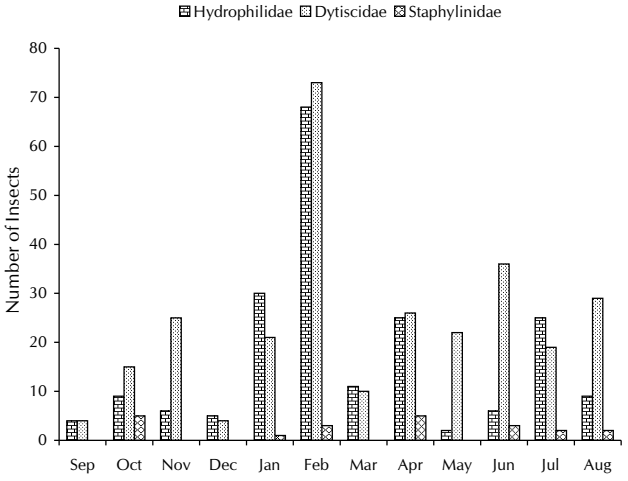


Figure 1B: Annual incidence of three families of order Coleoptera in Gharana wetland

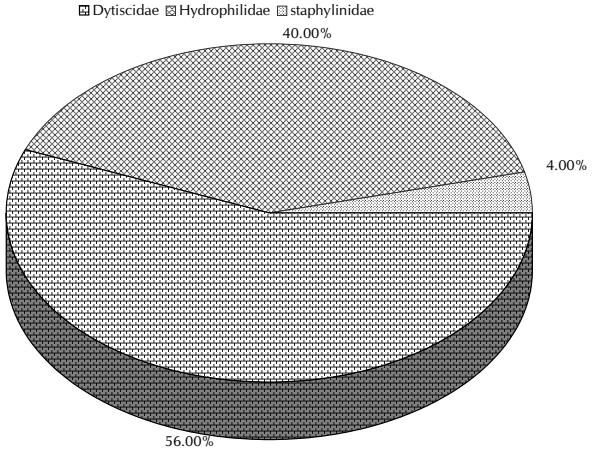


Figure 1C: Relative abundance of families of order Coleoptera in Gharana wetland

Table 2: Annual incidence of various species of beetles in Gharana Wetland during September 2008 to August 2009

Family	Species	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Total	R.A (%age)
Hydrophilidae	*Sternolophus rufipus*	1	-	-	-	-	10	5	5	-	-	5	1	27	5.37
	Regimbartia sp.	2	1				3	6	10	2	5	10	-	39	7.76
	Berosus sp.	-	5	1	-	20	20	-	-	-	1	10	-	57	11.3
	Halochares sp.	-	3	5	5	10	35	-	10	-	-	-	8	76	15.1
Dytiscidae	*Laccophilus parvulus*	2	5	10	4	-	20	10	10	-	-	6	9	76	15.1
	Bidessus sp.	-	-	15	-	-	25	-	-	-	3	5	-	48	9.56
	Canthydrus sp.	-	10	-	-	10	20	-	15	20	30	8	17	130	25.8
	Cybister sp.	-	-	-	-	-	-	-	-	-	-	-	3	3	0.59
	Dytiscus sp.	-	-	-	-	1	3	-	-	-	-	-	-	4	0.79
	Hypophorus sp.	2	-	-	-	10	5	-	1	2	3	-	-	21	4.18
Staphylinidae	*Paederus* sp	-	5	-	-	1	3	-	5	-	3	2	2	21	4.18
Total		7	29	31	9	52	144	21	56	24	45	46	41	502	

observed by Jana *et al.,* (2009) who worked on diversity and community structure of aquatic insects in a pond in Midnapore town, West Bengal, India. They recorded 20 species of aquatic insects from a weed infested pond belonging to three orders Odonata, Hemiptera and Coleoptera. The preponderance of Dytiscidae over Hydrophilidae and Staphylinidae indicates the ecological condition of wet land. Dytiscidae generally inhabits bottom macrophytes and are predacious in nature. On the contrary, Hydrophilidae are water scavenger beetles and generally occur in shallower regions of wet land with abundant macrophytes and feed mainly on detritus, algae and decaying vegetative matter (Khan and Ghosh, 2001, Jana *et al.,* 2009).

Physico-chemical characteristics

Patterns of seasonal fluctuation of physicochemical parameters have been presented in Fig.1D. It reveals that the highest water temperature 36°C was recorded in the month of July and lowest 13°C was recorded in the month of December. Water temperature affects the number of aquatic insects since each species requires a specific range of water temperature to live in because of their different respiratory rate and metabolism. For dissolved oxygen the highest value 8.0 mg/L was recorded in the month of November and lowest 2.3 mg/L was recorded

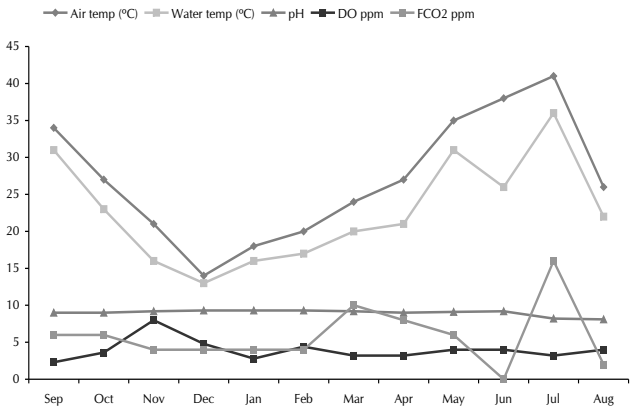
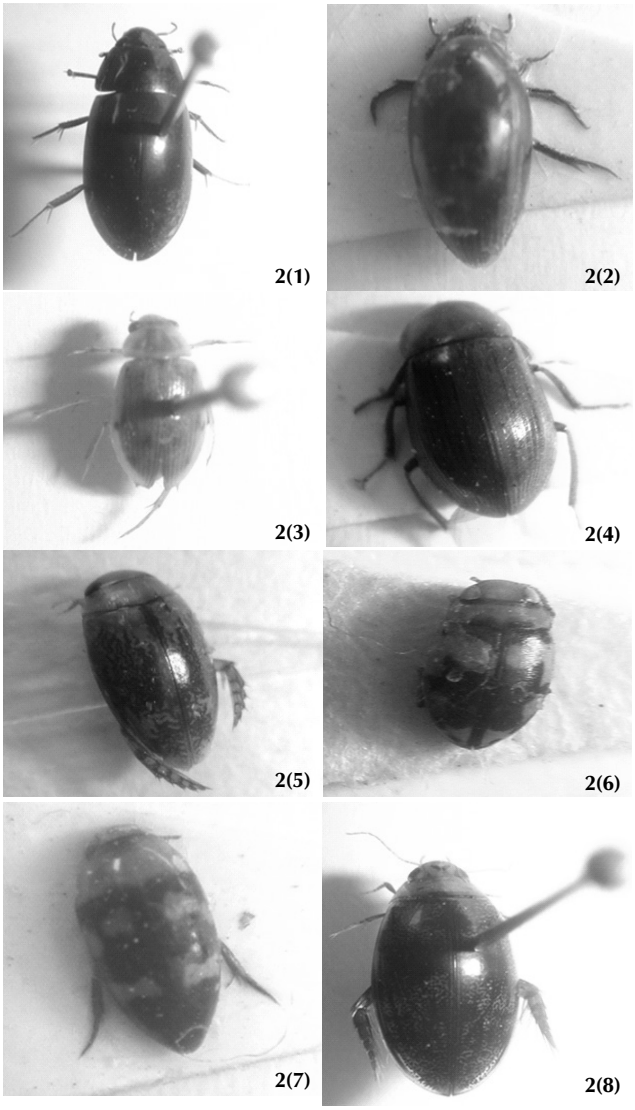


Figure 1D: Monthly variations in physico chemical parameters of Gharana wet land from Sept, 2008 to Aug, 2009




2(9)


2(10)


2(11)

Figure 2: 1. *Sternolophus rufipus*; 2. *Regimbartia* sp.; 3. *Berosus* sp.; 4. *Halochares* sp.; 5. *Laccophilus parvulus*; 6. *Bidessus* sp.; 7. *Canthydrus* sp.; 8. *Dytiscus* sp.; 9. *Cybister* sp.; 10. *Hypophorus* sp.; 11. *Paederus* sp.

in the month of September. Higher values in dissolved oxygen recorded during winter season may be due to low temperature which further increases the gas retention capacity of water as described by Bisht (1993) and also decrease in decomposition of organic matter as also suggested by Singh (2004). Reduction in DO in summer may be due to high temperature resulting in low gas retention capacity of water and increase in decomposition of organic matter as also stated by Saha (1987). Also reduction in DO in summer may be due to higher respiratory activity of aquatic organisms consuming more DO from aquatic system which may be due to higher metabolic rate at high temperature during this period (Sharma, 2002). Decline in DO concentration in the month of September may be due to phytoplankton bloom at this time of year. This is in accordance with observations of Singh (1988). Dissolved oxygen is most important for the survival of aquatic insects. This is the factor that due to which the number of insects collected less during the month of September. Some beetles such as *Laccophilus parvulus* and *Hypophorus* sp. (Dysticidae), *Sternolophus rufipus* and *Regimbartia* sp. (Hydrophilidae) are present in low Dissolved oxygen content water indicating the hardy nature of these beetles. Similar findings regarding the hardy nature of Coleopterans was observed by Ayri (2007). Lowest value of Free carbon dioxide (FCO_2) was recorded for the month of August which was 2.0 mg/L whereas the highest FCO_2 was recorded in the month of July and was 16mg/L. Higher concentration of FCO_2 during summer may be due to greater influence of high atmospheric temperature, on the decomposition process in shallow water resulting into liberation of large amount of FCO_2 and lower values of pH particularly in these months. The higher values of FCO_2 in summer and autumn season have also been reported by Qadri and Shah (1984). FCO_2 attained its lower values in winter season which related to the low temperature resulting into decreased rate of decomposition (Goldman and Horne, 1983), higher DO concentration in winter and high pH. Low conc. of FCO_2 in winter and higher in summer is in contradiction to the findings of Singh (1988), Sharma (2002) and Singh (2004). pH recorded shows its range from 8.1 to 9.3 throughout the year indicating the alkaline nature of wet land, Low values of pH was found to be 8.1 in the month of August and highest 9.3 in the month of December, January and February. Comparatively lower values of pH in summer is due to presence of FCO_2 and absence of carbonate and inflow of rain water during monsoon. Decline in pH during monsoon has also been reported by Adebisi (1981) and Bagde and Varma (1985). On the other hand comparatively higher value of pH during winter season may be due to lower values of FCO_2 during winter. Sharma (1999) also reported higher values of pH in winter season.

Table 3: Karl Pearson Correlation Coefficient (r) (significant at 5% level) between insects abundance and some physicochemical parameters

Parameter	Correlation coefficient (r)
Air temperature	-0.13526
Water temperature	-0.21557
pH	0.085531
Dissolved oxygen	0.094676
Free carbondioxide	-0.10196

Relationship between insects abundance and physicochemical parameters

The data on statistical correlation calculated between insects abundance and physicochemical parameters are presented in Table 3. An inverse correlation was found between insects abundance and air temperature (r= -0.135), water temperature (r= -0.215) and free carbondioxide (r = -0.101). However, a positive correlation was found between insects abundance and pH (r = 0.085) and dissolved oxygen (r = 0.094).

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