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Research Article

ABUNDANCE OF HYDRADEPHAGAN BEETLES FROM THE LAKES OF KANCHEEPURAM DISTRICT, TAMIL NADU, INDIA

G. Senthil Kumar[1]*, P. Kalaimagal[2], J., IssaqueMadani[2] and J. Sugumaran[3]

[1]PG and Research Department of Zoology, Thiru Kolanjiappar Government Arts College, Vriddhachalam-606 001, Tamil Nadu, India

[2] PG and Research Department of Zoology, The New College, Chennai-600 014, Tamil Nadu, India

[3]PG and Research Department of Zoology, Khadir Mohideen College, Adirampattinam-614701, Tamil Nadu, India

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ABSTRACT

Abundance of Hydradephagan beetles in relation to site vegetation variability was studied from hundred water bodies of Kancheepuram district, Tamil Nadu, India. Protected sites with reduced slope, reduced wave exposure and increased vegetation affects the lake littoral invertebrates. The exposed sites without vegetation probably offer an excellent hunting ground for the various predators, because of this fact; some of the species are totally absent in the exposed ponds. The results are treated with Spearmen's rank correlations.

Keywords: Hydradephaga, beetles, Site vegetation, Abundance, Kancheepuram.

INTRODUCTION

Water beetles form an important component of food web in a freshwater ecosystem which is economically important as some of them form natural food for aquatic vertebrates and others as predators on other insects. Many ecologists working towards the development of a broad theory of community organization tried to understand the causes for the pattern of species diversity (Hutchison, 1959). Boughey (1968) is of the view of that in tropical areas seasonal fluctuations in aquatic animal population tend to be correlated with seasonal variation in rainfall, whereas in temperate and arctic areas they can be correlated with prevailing temperature. The factors like wave action, wind velocity and scarcity of emergent vegetation presumably discourage the colonization of aquatic beetles. The abundance of macrophytic vegetation provides necessary shelter, shade and substrate for colonization of aquatic beetles in the rainy and post-rainy season (Fernando, 1968). This view was also supported by Tonapi and Ozarkar (1969) who studied aquatic beetles of Poona, India. Galewski (1971) reported that the physical and structural variables are seemingly more important than chemical variables in the habitat selection of dytiscid beetles.

Fischer *et al.* (2000) described the seasonal variation of the insect community of the rain pools and analyzed the relationship between the observed biotic pattern and some physical and meteorological variables and found that the maximum of taxonomic richness was observed at the end of summer, in coincidence with maximum rainfalls and temperature and minimum richness were recorded during the spring drought. Lundkvist *et al.* (2001) observed that the diving beetles depend on the number of wetland types represented in a landscape. Baptista *et al.* (2001) reported the diversity and habitat preference of macro-invertebrates in Macae River and found highest richness and diversity during the dry season. Abundance, diversity and seasonal succession of dytiscid and noterid beetles in two marshes of Eastern Poplain river were studied by Bosi (2001) in which competition and predation of hemipterans and odonate larvae on dytiscid larval stages were suggested as factors in determining water beetle communities. Cagnolo *et al.* (2002) studied the abundance, richness, diversity and biomass of the insect assemblages which show minimum values in the most intensely grazed habitat which also differs from other sites in terms of insect families and coleopteran composition.

*Corresponding Author: Dr. G. Senthil Kumar, Assistant Professor and Head, Dept. of Zoology, Thiru Kolanjiappar Government Arts College, Vriddhachalam-606 001, Tamil Nadu, India, Email: k.senthil28oct@yahoo.com, Mobile: +91 95782 48188.

Adephagan beetles are one of the most successful groups of insects, distinguished by their adaptive nature in diverse ecological and geographical ranges. Literature pertaining to the relationship between the water parameters, availability of food, seasonal variation, competition or predation, aquatic vegetation and migration of dytiscid beetles in freshwater bodies is rather very scanty. Considering this fact, abundance was studied to document which species occur in the various ponds of Kancheepuram region and in order to characterize the regional species pool of the beetle faunas of protected and exposed sites.

MATERIALS AND METHODS

Hydradephagan beetles were collected from one hundred ponds and lakes located in Kancheepuram district, Tamilnad. The D-frame net (300 mm x 400 mm x 330 mm) with a nylon mesh size of 0.5 mm was used for collections; bottle traps (Hilsenhoff, 1991) were used and kick samples were also made to collect the large sized beetles. Kancheepuram district, Tamilnadu, India (covers an area of 4447.21 sq. km. spread over 1252 villages). The district lies in between 12º, 10′ and 13º 15′ N and 79º 15′ and 80º 2′ E. Temperature ranges from 36.6ºC to 21.1ºC; the average annual rain fall in most of the places of the district is around 1200 millimeters. One hundred ponds were selected to represent broad ranges. Kancheepuram and its surroundings include a number of water bodies such as swamps, ponds and lakes.

RESULTS

Fourty five species of Adephagan beetles were represented from both exposed and protected ponds (Table-1) at different places of Kancheepuram district, India. Five to 100 specimens belonging to 26 species were collected from both exposed and protected sites, of which seven species *Hydrovatus sinister, H. confertus, Dineutus spinosus, D. indicus, Orectochilus producutus, Haliplus arrowi* and *H. variegates* did not occur in exposed sites. These species are found in less than 10 sites in protected sites. Most species occur from protected sites more frequently than those from exposed sites.

Mean abundance of more than 10 is expressed in the case of *Rhantaticus congestus, Sandracottus dejeani, Hyphydrus renardi, Clypeodytes pederzanii, Yola consanguinea, Hydroglyphus pradhani* and *Dineutus indicus* in exposed sites. *Haliplus variegates* shows a mean abundance of 32 in the protected site, while it is completely absent in exposed sites. 12 species of adephagans show a mean abundance of more than 10 in the protected sites. All the sites under investigation contain the adephagan beetles. Regional distribution expressed as occurrence at number of sites was positively correlated with the mean abundance in exposed site, negatively correlated in protected sites at number of sites with mean abundance of species (Spearman's Rank Correlation in exposed sites it is r_s= 0.437, p< 0.01; in protected sites it is r_s=-0.174, p< 0.01; Table-1).

There is a positive relationship in protected sites and negative relationship in exposed sites between the number of individuals and number of species (Spearman's Rank Correlation in exposed site r_s= -0.112 p<0.01; in protected site r_s=0.127, p<0.01). The most diverse sample includes 16 species which is the highest number of species per lake recorded, the largest sample *Dineutus unidentatus* is of 150 individuals. Samples from protected sites included significantly more individuals and species than from exposed sites (Fig.1). There is negative relationship in exposed sites and positive relationship in protected sites between the mean body length and mean abundance (Spearman's Rank Correlation in exposed site r_s = -0.1, p<0.01; in protected sites r_s = 0.11).

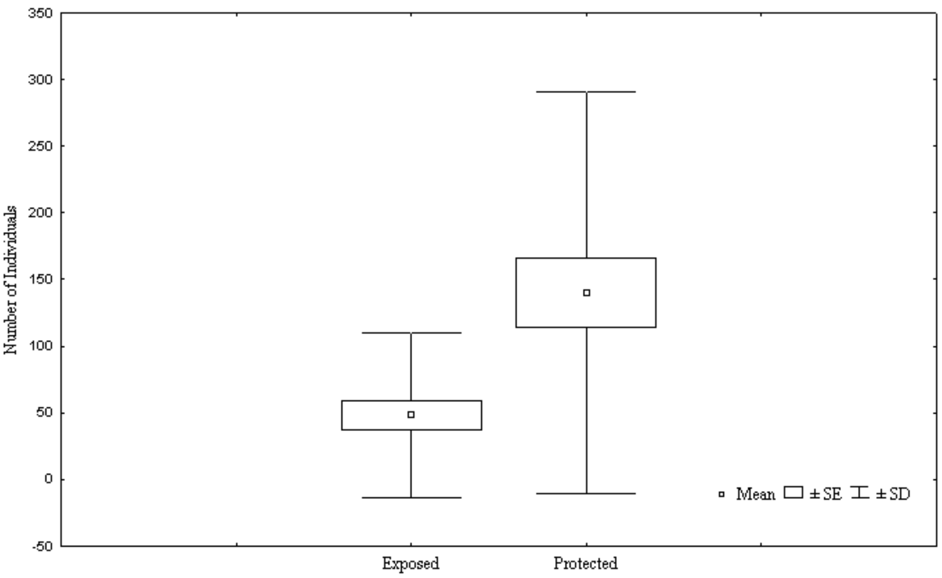

Figure 1. Mean number of Hydradephagan beetles collected from hundred freshwater bodies of Kancheepuram district.

Table 1. Hydradephagan beetles collected from hundred water-bodies of Kancheepuram district.

Species	Body Length		Exposed sites			Protected sites		
	$\bar{x}$ (MM)	± SD (MM)	Individuals	Abundance	Frequency	Individuals	Abundance	Frequency
Eretes griseus	13.58	0.72	58	6.44	9	39	13.0	3
Hydaticus vittatus	14.2	0.63	26	8.67	3	61	8.71	7
H. fabricii	10.4	0.52	21	3.5	6	135	7.10	19
H. chennaiensis n. sp.	10.41	0.39	18	4.5	4	61	4.69	13
Rhantaticus congestus	8.63	0.86	34	11.33	3	128	8.0	16
Sandracottus dejeani	14.0	0.78	18	18.0	1	34	8.5	4
Cybister convexus	25.8	2.20	7	3.5	2	15	3.0	5
C. tripunctatus	26.4	1.78	10	5.0	2	41	3.42	12
C. confusus	38.1	1.59	5	1.67	3	19	2.71	7
Copelatus feae	5.8	0.21	22	5.5	4	101	6.31	16
Hyphydrus flavicans	4.2	0.16	66	8.25	8	208	10.4	20
H. renardi	4.0	0.23	72	10.28	7	165	9.70	17
Hydrovatus acuminatus	2.8	0.18	76	8.44	9	405	9.88	41
H. rufescens	3.47	0.23	9	4.5	2	112	12.44	9
H. sinister	2.58	0.08	0	0	0	5	1.67	3
H. subtilis	2.65	0.16	72	8.0	9	330	8.68	38
H. confertus	2.42	0.18	0	0	0	7	3.5	2
*H. vazirani*in.sp.	2.66	0.18	3	3.0	1	2	2.0	1
Clypeodytes bufo	2.1	0.08	11	5.5	2	40	3.33	12
C. pederzanii n.sp.	1.64	0.10	21	10.5	2	66	13.2	5
Yola consanguinea	1.87	0.09	12	12.0	1	73	14.6	5
Hydroglyphus pradhani	2.18	0.15	38	12.67	3	43	3.31	13
H. flammulatus	2.36	0.13	251	9.30	27	537	9.42	57
*H. milleri*n.sp.	2.03	0.05	15	3.75	4	38	4.75	8
H. inconstans	1.9	0.09	58	5.8	10	160	7.27	22
H. pendjabensis	1.76	0.11	66	7.33	9	106	5.89	18
Herophydrus musicus	3.08	0.14	12	6.0	2	158	14.36	11
Peschetius quadricostatus	3.59	0.07	2	2.0	1	44	11.0	4
Laccophilus anticatus	3.75	0.18	34	6.8	5	115	5.75	20
L. sharpi	3.94	0.12	177	7.08	25	386	6.65	58
L. parvulus	3.32	0.09	195	7.5	26	468	7.8	60
L. flexuosus	3.94	0.50	165	8.68	19	455	8.42	54
L. inefficiens	3.63	0.39	23	4.6	5	76	6.91	11
Neohydrocoptus bivittis	2.99	0.12	18	3.0	6	87	3.22	27
N. subvittulus	1.99	0.14	57	4.75	12	192	5.33	36
Canthydrus laetabilis	2.85	0.16	104	5.47	19	141	4.03	35
C. luctuosus	3.17	0.24	77	4.28	18	160	4.0	40
C. morsbachi	3.41	0.15	15	2.5	6	66	3.47	19
Dineutus spinosus	9.22	0.20	0	0	0	20	10.0	2
D. unidentatus	7.92	0.44	62	12.4	5	227	22.7	10
D. indicus	13.27	0.57	0	0	0	34	17.0	2
Gyrinus convexiusculus	5.32	0.29	8	8	1	106	11.78	9
Orectochilus productus	6.63	0.39	0	0	0	72	12.0	6
Haliplus arrowi	3.6	0.25	0	0	0	38	6.33	6
H. variegatus	3.2	0.16	0	0	0	32	32.0	1

DISCUSSION

Various environmental factors associated with protected sites for example reduced slope, reduced wave exposure and increased plant biomass affect lake littoral invertebrate biomass positively, according to Rasmussen (1988). The data provides an insight into the hydradephagan beetle abundance in exposed and protected sites in 100 water bodies of Kancheepuram district. The abundance of seven species which include *Hydrovatus sinister*, *H. confertus*, *Dineutusspinosus*, *D. indicus*, *Orectochilus producutus*, *Haliplus arrowi* and *H. variegatus* in exposed sites indicates that these species are confined to sites rich in vegetation because they depend on the plants to hide from their predators and the plants provide resting site. Bendell and McNical (1995) have shown that the diets of ducklings of four insectivorous waterfowl species, in small Ontario lakes, varied with lake acidity and fish predator.

The exposed sites probably offer an excellent hunting ground for the various predators. Probably because of this fact some of the species are totally absent in the exposed ponds. Many of the species were found to be more abundant in protected ponds rather than exposed sites.

The amount of littoral zoo benthos in lakes is known to be correlated with both physical and chemical factors as reported by Cyr and Downing (1988), generally biomass increases with the amount of macrophyte vegetation and negatively correlated with the slope degree of wind exposure at shores. Zoobenthic biomass may differ depending on different plant species Hanson (1990). According to Okland (1990) the amount of macrophyte vegetation is an important factor controlling species abundance and richness of snails in Norwegian lakes. The increase in abundance of species of aquatic adephagans in the present study also suggests that the increase in biomass of plant may perhaps have an influence on the abundance of more than 10 as observed in the case of *Rhantaticus congestus, Sandracottus dejeani, Hyphydrusrenardi, Clypeodytes pederzanii, Yolacons anguinea, Hydroglyphus pradhani* and *Dineutus indicus*may possibly be due to the absence of fishes and other predators. *Haliplus variegates* shows a mean abundance of 32 in the protected sites while it is zero in exposed sites. This shows the possible total dependence of *H. variegates* for feeding and for its various life stages on plants. Seeger (1971) is although opinion that the species composition of haliplid beetles differs between lakes with respect to trophic position, amount of benthic algae and oxygen conditions. In exposed water bodies these factors may be less and hence the species abundance is reduced in exposed ponds. The optimal development appears to occur in areas of shallow open water and dense marginal vegetation as suggested by Nilsson (1984).

CONCLUSION

The present analysis also indicates that the shallow protected areas of ponds provide rich vegetation and food substances for beetles and for their prey. The aquatic beetles are generally predatory in adult as well as larval stages. Interestingly they seem to prefer mosquito larvae which are vectors of a number of human diseases.

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