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Aquatic insects of a tropical rain forest stream in Western Ghats, India

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ABSTRACT: In the studies on diversity, abundance and distribution of aquatic insects in Kallar stream and its tributaries in Western Ghats, collected on a monthly basis from five different sites revealed a total of 13,510 individuals belonging to 9 orders, 61 families and 125 genera. Trichoptera was the most dominant order with maximum number of individuals. It was followed by Ephemeroptera, Odonata, Hemiptera, Plecoptera, Coleoptera, Diptera, Megaloptera and Lepidoptera. Shannon-Weiner, Simpson dominance and Margalef's richness indices were found to be highest in site 5 and lowest in site 3. The most pollution sensitive aquatic insects are high in the main Kallar stream (site 5) compared to the tributaries. In the tributaries many anthropogenic activities are taking place and these factors have direct and indirect impact on the diversity of aquatic insects. So this may be the reason for the low abundance of the pollution sensitive taxa in the tributaries compared to the main Kallar stream.

KEYWORDS: Aquatic insects, Western Ghats, biodiversity indices

INTRODUCTION

Insects are the integral part of any ecosystem and their variety, number, size, life history, food habits, power of adaptation, high rate of reproduction and various modes of locomotion are some of the reasons for the success of this group in influencing the structure and function of terrestrial and aquatic ecosystem (Sundari and Santhi, 2008). Aquatic insects are a group of arthropods that live or spend part of their life cycle in water bodies (Pennak, 1978). More than one million insect species have been described so far, that is over 50% of all known organisms (Segers and Martens, 2005). About 4500 species of insects of the world are known to inhabit diverse fresh water ecosystems (Balaram, 2005). They involved in nutrient cycling and form an important component of natural food web in aquatic ecosystem. These insects are used to monitor the biological integrity of stream ecosystem in various studies (Rosenberg and Resh, 1993). Most importantly aquatic insects are good indicators of water quality since they have various environmental disturbances tolerant levels (Arimoro and Ikomi, 2007). Several orders of insects, especially Ephemeroptera, Plecoptera and Trichoptera (EPT) require high quality water for their existence. Aquatic insects show different modes of existence or habits which include skaters (adapted for life on water surface), swimmers (adapted for fish like swimming), clingers (adapted for attachment to substrate surfaces), sprawlers (inhabiting the surface of floating leaves of vascular plants or fine sediments in depositional habitats), climbers (living

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and moving upward on vascular plants or detrital debris) and burrowers (inhabiting fine sediment) (Morse *et al.,* 1994). In relation to functional feeding groups, invertebrates can be classified as: collectors (gatherers or filterers), shredders, scrapers, and predators (Cummins and Klug, 1979; Merritt and Cummins, 1996).

In spite of some studies carried out on the aquatic insects in various streams of Western Ghats (Sivaramakrishnan and Job, 1981; Sivaramakrishnan *et al.,* 1996, 2000; Anbalagan *et al.,* 2004; Subramanian and Sivaramakrishnan, 2005; Subramanian *et al.,* 2005; Anbalagan and Dinakaran, 2006; Dinakaran and Anbalagan, 2007 a, b, 2008; Dinakaran *et al.,* 2009; Selvakumar *et al.,* 2012), there has not been any attempt to document their diversity in the Kallar stream and its tributaries before. Kallar stream is a typical rain forest stream located in the Southern tip of Western Ghats. ‘Kallar’ literally means stony river. The present study was carried out to determine the diversity, abundance and distribution of aquatic insects in the Kallar stream and its tributaries.

MATERIALS AND METHODS

Study area

The study stream Kallar is a perennial river located near Ponmudi in Thiruvananthapuram district, Kerala, which forms the upper course of Vamanapuram River, part of Neyyar Wildlife Sanctuary. It originates from Chemmunji Mottai, a mountain peak in the Western Ghats at an elevation of 1860 m above MSL. In this study five collection sites were selected, they are Darpha-Kalungu (S1- 8°40’42se N, 77°04’02se E), Pottanchira (S2-8°41’31se N, 77°03’09se E), Kaliyikkal (S3-8°40’16se N, 77°06’04se E), Meenmutti (S4-8°42’36se N, 77°07’41se E) and main Kallar (S5-8°43’42se N, 77°07’37se E). From these the first four sites are the tributaries of Kallar stream and the fifth one is the main stream. The sites are chosen based on their location relative to habitat availability, land use pattern and human intervention. At each sampling locality, a stretch of 100 m area was chosen for collection of samples.

Field and laboratory methods

Samplings were done on monthly basis from January 2013 to December 2013. Aquatic insects were collected by using kick net (1m² area, mesh size 200 µm) and D-frame net (mesh size 50 µm). The samples were placed in white trays for sorting and screening. The sorted invertebrates were collected without any damage using fine forceps and they were preserved in 70 % alcohol. In the laboratory, the immature insects were sorted, identified and counted under a stereoscopic microscope (Labomed CX Rlll). The collected samples were identified at genus level using published keys (McCafferty and Provonsha, 1981; Morse *et al.,* 1984; Yule and Sen, 2004; Subramanian and Sivaramakrishnan, 2007). All the taxa encountered during the study were assigned a habit (mode of existence) and functional feeding categories with the help of published references (Cummins and Klug, 1979; Merrit and Cummins, 1984; Resh and Rosenberg, 1984; Pringle *et al.,* 1988).

Statistical analysis

One-way ANOVA was performed to study the changes in the insect abundance and diversity across sites (SPSS, 2006). The biodiversity indices like Margalef’s richness index, Shannon-Weiner diversity index and Simpson dominance index values were calculated using the software PAST (2005).

RESULTS

A total of 13,510 individuals belonging to 9 orders, 61 families and 125 genera were collected and identified (Table 1). Trichoptera were the most abundant order with the highest number of individual. In Trichoptera the abundant family was Hydropsychidae with seven different genera and the most abundant genus was *Hydropsyche sp.* and the least abundant genus was *Diplectrona sp.* The least abundant families are Psychomyidae and Xiphocentropodidae. In the order Ephemeroptera numerically the most abundant family was Leptophlebidae with four different genera. Among these the most abundant genus was *Thraulodes*

Table I. Abundance of the aquatic insects in the Kallar stream and its tributaries during January 2013 to December 2013

Order	Family	Genus	Site 1	Site 2	Site 3	Site 4	Site 5	Grand Total
EPHEMER OPTERA	**Leptophlebiidae**	*Leptophlebia sp.*	112	144	26	112	42	436
		Thraulodes sp.	166	170	109	76	134	655
		Choroterpes sp.	8	1	12	1	9	31
		Hebrophlebiodes sp.	118	110	27	97	31	383
	Ephemeridae	*Ephemera sp.*	12	13	7	8	15	55
	Potamanthidae	*Potamanthus*	1	0	0	0	4	5
		Rhoenanthus sp.	1	0	0	0	0	1
	Ephemerellidae	*Ephemerella sp.*	1	2	0	2	4	9
	Tricorythidae	*Neurocaenis sp.*	0	0	0	0	1	1
	Caenidae	*Caenis sp.*	117	85	51	15	17	285
	Heptageniidae	*Heptagenia sp.*	4	4	1	117	165	291
		Epeorus sp.	0	1	2	51	184	238
		Thalerosphyrus sp.	2	2	0	130	224	358
	Baetidae	*Baetis sp.*	111	72	59	73	49	364
		Cloeon sp.	16	27	9	7	13	72
Total			669	631	303	689	892	3184
Mean ±SE			44.6± 3.35[b]	42.07± 5.64[b]	20.2± 5.00[a]	45.93± 4.10[b]	59.47± 4.57[b]	212.27± 6.58
PLECOPTERA	**Perlidae**	*Neoperla sp.*	91	117	23	239	393	863
		Tetropina sp.	1	0	0	2	0	3
		Perlesta sp.	1	2	5	21	80	109
Total			93	119	28	262	473	975
Mean ±SE			31± 1.93[a]	39.67± 1.81[a]	9.33± 0.6[a]	87.33± 3.12[b]	157.67± 5.01[c]	325± 6.93
TRICHOPTERA	**Hydropsychidae**	*Arctopsyche sp.*	64	85	64	114	114	441
		Parapsyche sp.	20	16	28	26	74	164
		Diplectrona sp.	2	1	2	0	11	16
		Ceratopsyche sp.	1	0	2	14	2	19
		Cheumatopsyche sp.	30	73	34	62	105	304
		Hydropsyche sp.	219	422	263	428	550	1882
		Potamyia sp.	1	1	4	4	9	19
	Polycentropodidae	*Polycentropus sp.*	1	7	2	39	58	107
		Nyctiophylax sp.	0	1	0	1	5	7
	Psychomyeidae	*Psychomyia sp.*	0	0	0	0	2	2
		Tinodes sp.	0	1	0	0	0	1
	Xiphocentropodidae	*Xiphocentron sp.*	0	1	0	0	2	3
	Calamoceratidae	*Anisocentropus sp.*	2	1	1	1	4	9
	Odontoceridae	*Psilotreta sp.*	1	1	1	2	5	10
	Philopotamidae	*Dolophilodes sp.*	0	1	2	49	74	126
	Stenopsychidae	*Stenopsyche sp.*	0	0	0	8	20	28
	Brachycenridae	*Brachycentrus sp.*	2	2	2	12	12	30
	Lepidostomatidae	*Goerodes sp.*	0	0	0	3	13	16
		Neoseverinla sp.	1	0	0	0	5	6
Total			344	613	405	763	1065	3190
Mean±SE			18.11± 5.87[a]	32.26± 4.29[ab]	21.32± 5.76[a]	40.16± 5.44[b]	56.05± 4.25[c]	167.89± 5.41
ODONATA	**Gomphidae**	*Lamelligomphus sp.*	48	288	60	79	193	668
		Leptogomphus sp.	23	105	20	55	77	280

		Gomphidia sp.	3	6	14	1	4	28
		Paragomphus sp.	52	56	36	16	10	170
		Sleboldius sp.	5	11	6	0	25	47
		Heliogomphus sp.	7	9	7	12	8	43
		Labrogomphus sp.	7	3	1	0	1	12
		Ophiogomphus sp.	4	1	1	0	8	14
		Sinictinogomphus sp.	0	2	2	0	2	6
		Sinogomphus sp.	3	2	2	0	0	7
		Gastrogompus sp.	4	2	1	0	0	7
		Stylogomphus sp.	0	0	3	0	4	7
	Cordullidae	*Cordulia sp.*	6	5	20	1	0	32
		Epitheca sp.	21	3	59	4	3	90
		Somatochlora sp.	0	0	1	1	0	2
	Libellulidae	*Libellula sp.*	36	10	48	7	7	108
		Nannophya sp.	27	1	35	5	0	68
		Acisoma sp.	12	2	22	3	2	41
		Brachythermis sp.	14	0	28	1	0	43
		Deielia sp.	4	1	9	0	0	14
		Trithemis sp.	13	0	10	0	0	23
		Diplacodes sp.	23	2	22	2	0	49
	Macromidae	*Macromia sp.*	4	15	24	7	2	52
	Coenagrionidae	*Coenagrion sp.*	7	11	14	3	4	39
	Platycnemididae	*Platycnemis sp.*	17	0	27	2	7	53
		Copera sp.	7	2	35	5	7	56
	Platystictidae	*Drepanosticta sp.*	7	11	14	3	26	61
	Protoneuridae	*Prodasineura sp.*	44	11	21	5	6	87
	Lestidae	*Indolestes sp.*	6	2	6	1	5	20
		Lestes sp.	1	1	1	1	1	5
	Chlorolestidae	*Sinolestes sp.*	14	17	44	28	46	149
		Megalestes sp.	17	12	19	13	17	78
	Calopterygidae	*Calopteryx sp.*	123	56	28	19	8	234
		Neurobasis sp.	8	13	28	15	1	65
		Matrona sp.	3	1	0	1	1	6
	Chlorocyphidae	*Libellago sp.*	0	4	4	0	2	10
		Rhinocypta sp.	3	0	7	6	8	24
	Euphaidae	*Bayadera sp.*	29	41	69	35	98	272
		Anisopleura sp.	15	15	25	9	46	110
Total			617	721	773	340	629	3080
Mean±SE			15.82± 4.47[b]	18.49± 4.34[b]	19.82± 5.52[b]	8.72± 2.93[a]	16.13± 3.5[b]	78.97± 2.97
HEMIPTERA	**Aphelocheridae**	*Aphelocherius sp.*	3	2	2	41	8	56
	Nepidae	*Ranatra sp.*	5	5	2	1	0	13
		Nepa sp.	1	1	0	0	0	2
		Laccotrephes sp.	2	1	1	1	0	5
	Belostomatidae	*Lethocerus sp.*	97	1	8	0	2	108
		Diplonychus sp.	33	1	3	0	1	38
	Naucoridae	*Naucoris sp.*	100	25	200	51	21	397
		Ctenepocoris sp.	141	65	207	85	63	561
		Heleocoris sp.	11	6	11	13	8	49
	Notonectidia	*Notonecta sp.*	2	1	0	0	0	3
	Pleidae	*Paraplea sp.*	1	2	0	2	3	8
	Vellidae	*Rhagovelia sp.*	24	58	14	23	1	120
		Angilia sp.	3	4	0	12	0	19

	Gerridae	*Rhagadotarsus sp.*	26	40	56	43	10	175
		Gerris sp.	3	3	2	0	0	8
	Hydrometridae	*Hydrometra sp.*	2	0	0	0	0	2
Total			454	215	506	272	117	1564
Mean±SE			28.38± 3.69[a]	13.44± 2.13[ab]	31.63± 191[a]	17± 2.59[b]	7.31± 2.62[a]	97.75± 2.51
COLEOPTERA	**Hydroscaphidae**	*Hydroscapha sp.*	2	4	3	1	0	10
	Dytiscidae	*Dytiscus sp.*	25	6	7	7	4	49
		Laccophilus sp.	131	48	40	21	3	243
		Copelatus sp.	0	1	0	1	0	2
		Cybister sp.	1	1	2	0	0	4
	Gyrinidae	*Dinectus sp.*	5	15	1	7	3	31
	Amphizoidae	*Amphizoa sp.*	0	7	3	1	5	16
	Hydraenidae	*Limnebius sp.*	28	45	15	25	4	117
	Elmidae	*Stenelmis sp.*	5	22	5	26	37	95
		Potamophilus sp.	0	0	0	0	5	5
	Dryopidae	*Elmomorphus sp.*	1	3	3	15	16	38
	Hydrophilidae	*Helochares sp.*	14	1	33	15	2	65
		Hydrophilus sp.	0	1	0	0	0	1
		Berosus sp.	0	1	0	0	0	1
		Tropisternus sp.	0	2	2	8	7	19
		Amphiops sp.	1	1	3	2	1	8
	Psephinidae	*Mataeopsephus sp.*	3	3	15	73	115	209
		Eubrianax sp.	0	0	2	13	23	38
	Sperchidae	*Spercheus sp.*	1	0	4	0	0	5
	Scritidae	*Cyphon sp.*	0	0	2	0	0	2
Total			217	161	140	215	225	958
Mean±SE			10.85± 1.98[ab]	8.05± 2.13[ab]	7.00± 1.91[a]	10.75± 2.59[ab]	11.25± 2.62[b]	47.9± 2.51
MEGALOPTERA	**Corydalidae**	*Protothermes sp.*	0	0	1	2	2	5
		Neochauliodes sp.	2	1	2	39	51	95
Total			2	1	3	41	53	100
Mean±SE			1±0.08[a]	0.05± 0.06[a]	1.5± 0.127[a]	20.5± 0.65[b]	26.5± 0.39[b]	50±0.35
LEPIDOPTERA	**Pyralidae**	*Ostrinia sp.*	3	1	1	6	8	19
Total			3	1	1	6	8	19
Mean±SE			3±0[ab]	1±0[a]	1±0[a]	6±0[bc]	8±0[c]	19±0
DIPTERA	**Tipulidae**	*Tipula sp.*	5	1	0	3	7	16
		Hexatrona sp.	17	21	9	46	48	141
	Ceratopogonidae	*Dasyheleina sp.*	7	14	0	1	0	22
		Bezzia sp.	1	0	15	13	12	41
	Chironomidae	*Chironomus sp.*	2	3	11	3	4	23
	Simulidae	*Simulium sp.*	4	8	21	12	6	51
	Tabanidae	*Tabanus sp.*	8	2	14	9	0	33
	Athericidae	*Atherix sp.*	3	3	4	77	10	97
		Atrichops sp.	1	1	1	0	1	4
	Ephydridae	*Ephydra sp.*	2	2	1	2	5	12
Total			50	55	76	166	93	440
Mean±SE			5±0.50[a]	5.5± 0.58[a]	7.6± 1.193[a]	16.6± 1.86[b]	9.3± 0.71[a]	44±1.21
Grand Total			2449	2517	2235	2754	3555	13510

Note: a,b,c are the homogenous groups between sites by Duncans multiple comparison range test

Table 2. Biological indices of aquatic insects

Indices	Site 1	Site 2	Site 3	Site 4	Site 5	Total
Shannon Weiner Diversity Index	3.20	3.16	2.98	3.26	3.27	3.82
Simpson Dominance Index	0.93	0.93	0.92	0.94	0.94	0.96
Margalef's Richness Index	8.11	8.21	7.24	8.44	8.90	13.04

sp. The least abundant family among Ephemeroptera was Tricorythidae with only one genus *Tricorythus sp.* and it was present only in site 5. In the order Plecoptera only one family was obtained, Perlidae. Among Perlidae most abundant genus was *Neoperla sp.* and least abundant was *Tetropina sp.* Numerically, the third abundant order was Odonata. From this the most abundant family was Gomphidae with twelve different genera and the least abundant family was Lestidae. In the order Hemiptera the most abundant family was Naucoridae with three different genera and the least dominant family was Hydrometridae and this family was present only in site 1. From the order Coleoptera the most abundant family was Dytiscidae with four different genera and the least abundant family was Scritidae and it was present only in site 3. Megaloptera and Lepidoptera are the least abundant orders and were represented with only one family each. In Diptera the most abundant family was Tipulidae and is found to be maximum in site 5 and minimum in site 3. The least abundant family was Ephydridae.

Organization of functional feeding groups and habit categorizations

The major feeding groups are collector- gatherers, collector- filters, predators, scrapers and shredders. The proportion of each functional feeding category is presented in fig.1. In all sites predators were the most dominant functional feeding groups and shredders are the least abundant feeding group.

The main habit categories are clingers, sprawlers, swimmers, skaters, climbers and burrowers. The proportional abundance of habit categories of aquatic insects were represented in fig.2. Clingers were dominant habit at all the sites and skaters were the least dominant habit categorization.

Biological indices

The biological indices of aquatic insects at five sites were represented in table 2. Shannon-Weiner diversity index for five sites were ranged from 2.98 to 3.27 and the maximum value was reported from site 5 and the minimum from site 3. Shannon-Weiner diversity of the entire stream was 3.82. The Simpson dominance index value fluctuated from 0.92 to 0.94 and the highest value was reported in sites 4 and 5 and the lowest value was in site 3. The overall value was 0.96. The Margalef's richness index showed comparatively low value in site 3 (7.24) and high in site 5 (8.90) and 13.04 was the value of the entire stream. The statistical analysis of the diversity indices of the five sites reveled that Shannon Weiner diversity indices shows 1% significant variation between sites while Margalef's richness indices shows 5% significant variation. Simpson Dominance indices don't show significant variation.

DISCUSSION

Aquatic biodiversity is one of the most essential characteristics of aquatic ecosystem for maintaining its stability (Vinson and Hawkins, 1998; Sharma *et al.,* 2004). Biodiversity loss in freshwater ecosystems is an increasing phenomenon, mainly due to human activities (Abell, 2002). Aquatic habitats particularly free flowing tropical Asian streams with acceptable water quality and substrate conditions harbour diverse macro invertebrate

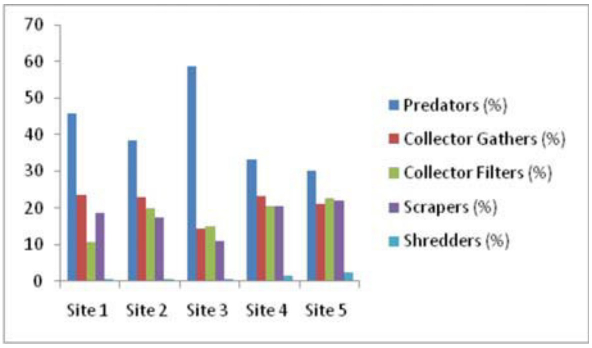

Fig. 1: Proportional abundance of functional feeding groups

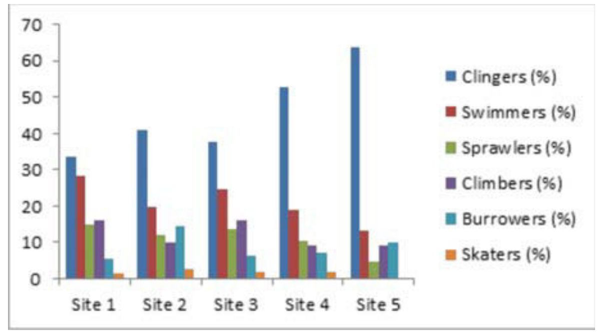

Fig. 2: Proportional abundance of habit categories of insects

communities in which there are a reasonably balanced distribution of species among the total number of individuals present.

In our study, 9 orders comprising 61 families, 125 genera and 13,510 individuals of aquatic insects were collected and identified. Trichoptera was numerically the most abundant order in our study. The results support the findings of Sivaramakrishnan *et al*. (2000). They reported that Trichoptera was the most popular order of aquatic insects in the streams of Western Ghats. According to Dinakaran and Anbalagan (2008) *Hydropsyche sp.* (Hydropsychidae) was the most widely distributed genus in the Western Ghats. In our study also Hydropsyche was the most abundant genus in all the collection sites. Ephemeroptera is one of the intolerant groups of insects which are considered as an indicator of water quality because of its presence in both the polluted and unpolluted reaches of the aquatic body. The genera *Baetis sp*. and *Caenis sp*. from earlier studies have been reported to be tolerant to organic pollution (Menetrey *et al.,* 2008; Abhijna *et al.,* 2012). The genus *Thalerosphyrus sp.* belonging to the Heptagenidae family was found to be intolerant to pollution (Abhijna *et al.,* 2012). In our study *Thalerosphyrus sp.* was abundant in site 5 and absent in site 3. This is because of the poor water quality of site 3 compared to that of other sites.

The order Plecoptera is one of the most pollution sensitive aquatic insect orders. In our study only one family (Perlidae) of Plecoptera were obtained and the same results were obtained by other studies in the streams of Western Ghats region (Anbalagan *et al.,* 2004; Dinakaran and Anbalagan, 2007; Balachandran *et al*., 2012 and Rathinakumar *et al*., 2014). According to Fore *et al.* (1996) and Maxted *et al.* (2000) the order Plecoptera is considered highly sensitive to environmental degradation. In our study maximum number of Plecoptera was reported in site 5 and minimum number was in the site 3, this result clearly indicates the condition of water body. In our study 13 families and 39 genera of Odonates were obtained and it is the 3rd abundant order. Odonata population can be indicative of the richness of other invertebrates and macrophytes (Bried and Ervin, 2005). The sub order Anisoptera (dragonflies) were abundant than that of Zygoptera (damselflies) in all the selected sites in Kallar during the study period. Same result was obtained in other studies from the Western Ghats such as Anbalagan *et al.* (2004) and Balachandran *et al.* (2012).This might be due to their high dispersal ability (Corbet, 1999, Lawler, 2001; Kadoya *et al.,* 2004) and their adaptability to wide range of habitats (Suhling *et al.,* 2004, 2005). Zygoptera would be more affected by environmental characteristics and space than Anisoptera, for being more habitat dependent (Corbet, 1999) and having less dispersal ability (Weir, 1974). The presence of Coleopteran in an aquatic system along with other less tolerant species such as Ephemeroptera, Plecoptera, Trichoptera and Odonata have been observed to reflect clean water conditions (Miserendino and Pizzolon, 2003; Adakole and Annune, 2003). Dytiscidae family generally inhabits leaf of bottom macrophytes of the clean fresh water and is predaceous in nature. Hydrophylidae family in the contrary, are water scavenger beetles and generally occur in shallower regions of the wetland with abundant macrophytes particularly emergent ones and feed mainly on detritus algae and decaying vegetative matter (Khan and Ghosh, 2001). Chironomidae are widely considered tolerant to organic pollution. Stuijfzand *et al.* (2000) claim the success of this group is better attributed to utilizing organic food sources, rather than tolerance to pollution. Still, it is known that some genera are intolerant to organic pollution (Raunio *et al.,* 2007). According to Yule (2004) Chironomidae is probably the most diverse and abundant group of all stream macroinvertibrates. The standing and slow flowing streams and muddy or sandy areas, with fine sediment particles are known to support higher diversity and abundance of Chironomidae (Yule, 2004). The dominant group in Kallar was predators, and collectors and shredders were the least dominant groups. Collector filters comprised most of the functional feeding group in distribution and can be explained by the most abundant taxa which could be due to their great capacity of wide distribution (Morse *et al.,* 1984). The proportion of collector gatherers highlighted the presence of considerable amount of fine particulate organic matter in the study area (Lemly and Hilderbrand, 2000). The preponderance of collectors in tropical streams may be due to the fact that leaves are decomposed to detritus particles by the microbial community in matter of days leaving little for shredder to feed (Burton and Sivaramakrishnan, 1993). The results of the study showed that the Shannon-Weiner diversity index values ranged from 2.98 (site 3) to 3.27 (site 5). Sharma *et al. (*2008) studied the diversity of aquatic insects in Chandrabhaga River and they reported that the value of Shannon Weiner diversity index ranged from 2.54 to 3.86 and the present results are also in this range. The Simpson dominance index values ranged from 0.92 (site 3) to 0.94 (site 4 and site 5). According to Thakur *et al*. (2013), the lower values indicate comparatively less evenly distributed communities in those sites. Margalef's richness index values shows variation between sites. The highest value of 8.90 was reported in site 5 and the lowest value of 7.24 in site 3. Kocatas (1992) reported that the fall in the value of Margalef's index shows a rise in the level of pollution. The abundance and diversity of aquatic insects in the Kallar stream and its tributaries were found to be highest in site 5 followed by site 4, site 2, site1 and site 3 respectively. In addition to that the most pollution sensitive organisms are highest in site 5 and lowest in site 3 and this clearly indicates the quality of the water body. In the tributaries many anthropogenic activities are taking place and these factors have direct and indirect impact on the diversity of aquatic insects. The conservation and management of the stream is very important for proper functioning of the ecosystem. The present data can be used for monitoring and upkeep of streams of Western Ghats.

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