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Composition and Trophic Categorization of Aquatic Insects and Bio-monitoring Potential of Selected Hill Streams of Western Ghats, India

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ABSTRACT

Composition and trophic categorization of aquatic insects for biomonitoring of three hill streams/rivers of Western Ghats was investigated during August 2011 to January 2012. A total of 1461 individuals of aquatic insects belonging to 6 orders, 29 family and 36 genera of aquatic insects were collected in 3 stations in first order streams for 6 months in Alagar hills, Sothupparai and Manjalar river of Western Ghats. Diversity values of aquatic insects of three streams/rivers of Western Ghats were calculated. Further the insects were categorized into shredders, scrapers and detrivore-herbivore assessed on their feeding behavior which indicates the dominance of collectors in all the three streams. The water quality was also assessed as per BMWP scoring system, which revealed that all the streams are in good health and suitable for potable.

Key Words: BMWP Scoring System; Diversity; Pollution Indicator; EPR Complex; Southern India

INTRODUCTION

A large number of major and minor rivers flow through the Western Ghats, which is an assemblage of a series of broken hills spreading over the states Orissa, Andhra Pradesh, Telungana and Tamil Nadu in India. Several investigations on the aquatic insects of streams of Western Ghats have already been reported (Sivaramakrishnan et al. 1990, Subramanian, et al. 2005, Anbalagan, et al. 2004, Dinakaran and Anbalagan 2007, Selvakumar et al. 2012, Kubendran et al. 2013, 2014 2015 2016a,b 2017a,b, Rathinakumar et al. 2014a,b). But last few years no investigations have so far been made to study the fauna of Alagar hills, Sothupparai and Manjalar rivers of Western Ghats.

Benthic macroinvertebrates have been widely used as biological indicators of river health because they play an important role in food webs (Balcombe et al. 2005), and they are known to be sensitive to changes in their environment and habitat characteristics (Rosenberg and Resh 1993). The vast majority of the investigation on aquatic bioindicators has however focused mainly on water quality (Thirion et al. 1995) in particular the impact of organic pollution. For example, in African countries, stream assessment using macroinvertebrates mainly considered the degrading impact of organic pollution on urban rivers (Ndaruga et al. 2004). However, non-urbanized catchments in Western Ghats in India, for example, mountainous regions and many rural areas are not or only slightly polluted (Rathinakumar et al. 2014a,b).

The influence of human on streams and rivers used for recreational purposes such as personal hygiene has caused habitat impairment in several areas of Tamilnadu.

Direction of resulting impacts on streams depends on the use of biomonitoring combined with physical and chemical characterization (Dudgeon 1994). The biological approach for assessing streams and rivers with the use of benthic macroinvertebrates, especially aquatic insects as very good indicators of pollution (Dudgeon 1999). Among fresh water inhabitants aquatic insects occupy prominent place like their terrestrial counter part. Almost all microhabitats of stream ecosystem are occupied by immature stages of aquatic insects. Trophic adaptation found among aquatic insects for feeding groups provides a useful mean for describing morpho-behavioral mechanisms of food acquisition.

Comprehensive information on the physic-chemical and biological parameters aid in developing conservation strategies for the riverine ecosystem of trophical biodiversity hot spots such as Western Ghats in India. Hence the present study carried out to evaluate the structure, diversity and functional trophic group composition of aquatic insects and to analyse the water quality using aquatic insects as bioindicator tools in the selected streams of Western Ghats.

STUDY AREA

The present study deals with documentation of the diversity of aquatic insects of selected streams of Western Ghats.

Alagar Hills Stream

It is one of the reserve forests of Western Ghats (10º14'180''N and 77º 58'567''E) are 22km northeast of Madurai, Tamil Nadu. There are two springs Garuda-thirtham (350m), a seasonal one and another one the perennial Nuburagangai (425m). The monthly mean temperature is 27.5ºC. The maximum temperature reaches up to 41ºC during the daytime of summer in the month of April-May and night temperature is 29ºC. In the winter season (December) the day temperature is 29ºC and night temperature is 22ºC. The rainfall system is unpredictable. This area comes under dissymmetric rainfall regime with the bulk of the rains during the retreating northeast monsoon in the month of October-November. Some rain is also received during the southwest monsoon in the month of June-August (Dinakaran et al. 2009).

Sothupparai River

Sothuparai Dam is located at (10.07ºN 77.33ºE) 9km from Periyakulam on the foot of Kodaikanal hills or the Western Ghats of Palni range; helps enrich the entire area of Periyakulam and beyond by run as a perennial river Varaganathi. The catchment of the dam is a combine of rain and small streams of Kodaikanal hills and the release of water from Berijam Lake. It has an average elevation of 925 feet. It is one of the most fertile places in the state of Tamil Nadu.

Manjalar River

This river originates from Palni hills of Kodaikanal (10.13ºN 77.35º E) and runs towards east and joins the Vaigai River. There are nine anicuts and nine tanks in this sub-basin. It receives an annual rainfall of 775mm.

METHODS

Sampling Rationale

The physico-chemical and aquatic insect sampling was carried out in three different streams/rivers of Alagar hills, Sothupparai and Manjalar Rivers. During each sampling, three replicates were collected, pooled and considered as a single collection. The mean values are provided for physico-chemical parameters.

Stream Characteristics

The characteristics like stream order, nature of eco-region, substrate and organic composition were evaluated quantitatively by visual observation following the method developed by Nagendran (2002).

Substrate Index

Substrates were classified by using the following criteria: <0.5 mm for mud/silt, 0.5-2 mm for sand, 2-64 mm for gravel, 65-256 mm for cobbles, and >256 mm for boulders (Jowett et al. 1991). For statistical analysis, substrate composition was converted to a substrate index as explained below, following (Suren 1996):

Substrate Index =
(0.07x % boulder) + (0.06 x % cobble) + (0.05x % gravel) + (0.04x % sand) + (0.03x % mud/ silt)

Chemical Analysis

Sampling and analytical procedures followed the

methods of American Public Health Association (APHA 2005). Total Dissolved Solid (TDS), Conductivity, Free Carbon di Oxide, alkalinity, Salinity and Dissolved Oxygen (DO) were analyzed by using Water Analyzer Kit (Systronics Make, Model No. 371). pH of Water was determined with the help of digital pH meter (Elico, India).

Aquatic Insect Sampling

The larvae of aquatic insect species were collected by kick net (mesh size, 0.5 to1.0 mm) sampling (Balasubramanian et al. 1992). The duration of each kick net operation was 2 minutes. The substratum viz., bed rocks, boulders and cobbles was vigorously disturbed strictly restricted to one m^2 area. All specimens from the net surface were carefully collected without any morphological damage using fine forceps or brush and preserved in 85% Ethyl alcohol immediately. Sampling was performed on for six month from August 2011 to January 2012. The collected samples were brought to laboratory and identified upto genus and species level by using published taxonomical literature pertaining to the Western Ghats, India (Sivaramakrishnan et al. 2009, Selvakumar et al. 2012, Kubendran et al. 2014 2015).

Diversity Indices

The following diversity indices were calculatd from the BMWP scores, which were obtained for 60 study sites. They are Shannon-Weiner index, Simpson index, Berger-Parker Dominance index and Evenness, by using PAST software.

Functional Feeding Groups

Classification of aquatic insects into functional feeding groups follows Merritt and Cummins (1984). Information is supplemented with relevant data from ready-made given in Merritt and Cummins (1984). Trophic categorization was based on the general category of functional feeding groups of aquatic insects.

Calculation of BMWP scores

BMWP score is also known as TSS (Total Site Score). Families of aquatic insects were tabulated separately for each station. Each family was ascribed the suitable score (10-1) depending on its sensitivity to pollution as prescribed by BMWP score system. Scores of indicator families were just added to arrive at BMWP or TSS (Armitage et al. 1983).

Derivation of Average Score per Taxon (ASPT)

ASPT value was obtained from TSS by dividing it with the total number of families recorded as follows.

RESULTS AND DISCUSSION

Physico-chemical parameters and Total Site Score (TSS) and Average Score Per Taxon (ASPT) as per BMWP score system for all the four sampling sites such as Alagar Hills, Sothupparai and Manjalar were listed in Table 1. Physico-chemical profile of south Indian streams/rivers has received scanty scientific attention. Various studies on the streams of Western Ghats of this region have concentrated only on the taxonomy and physiology of aquatic insects (Balaubramanian et al. 1992, Sivaramakrishnan. et al. 1995). In the present study, maximum depth was noticed in Sothupparai and the stream/river width did not differ significantly and ranged from 2.5 m to 2.6 m.

The stream of investigation carried comparatively less water during post monsoon season of the study. In Himalayan streams, Rawt (1988) have reported similar results. Joshi (1994) has reported that water level falls during the dry months of the Kumaon Himalayan streams, Uttar Pradesh. A few investigations on streams have demonstrated the importance of water current to the distribution and life of aquatic insects (Minshall 1984). The water current, in the present study ranged between 6.16 - 12.1 m/sec. Seasonal variation in water current has been reported in streams of Palani hills by Sivaramakrishnan and Venkataraman (1990) and in Kurangani stream by Balasubramanian et al. 1992, Rathinakumar et al. 2014.

Investigation of water temperature revealed a maximum of 29°C water temperature in Sothupparai and minimum of 20.5°C in Manjalar, whereas maximum of 32°C air temperature was recorded in Sothupparai and minimum of 26.6°C in Manjalar stream/river. Water temperature ranges from 12 to 20 °C in streams at different altitudes of Palani hills (Sivaramakrishnan and Venkata-raman 1990). In general, both seasonal pattern and magnitude varies geographically.

The pH of all the streams is acidic and is ranges between pH 5- 7. But Sivaramakrishnan et al. (1990) and Joshi and Tyagi (1997) have reported different trend in

Table 1. Physio-chemical characteristics, Total Site Score (TSS) and Average Score per Taxon (ASPT) as per BMWP score system for selected streams/rivers of southern Western Ghats during August 2011-January 2012.

S.N.	Physico-chemical Characteristics	Site I	Site II	Site III
1.	Stream Order	I	I	I
2.	Altitude (m.a.s.l)	~ 350	~ 359	~300
3.	Eco-region	Dry dedious forest	Mono-culture	Poly-culture
4.	Canopy cover	Partially covered	Partially covered	open
5.	Odor of the water	-	-	-
6.	Water colour	Colourless	Colourless	Slightly brown
7.	**Substrate (%)**			
	a. Bed Rock	-	-	-
	b. Boulders	30	20	30
	c. Cobbles	20	15	10
	d. Pebbles	15	10	10
	e. Gravel	10	15	15
	f. Sand	20	20	25
	g. Silt	5	10	10
8.	**Organic deposition**			
	a. Coarse particulate Organic matter (CPOM)	Presence	Presence	Presence
	b. Fine particulate Organic matter (FPOM)	Presence	Presence	Presence
9.	Width (m)	3.5 ± 0.47	1.76 ± 0.25	1.63 ± 0.84
10.	Depth (cm)	7.7 ± 0.26	8.0 ± 1.0	4.0 ± 1.0
11.	Air temperature (ºC)	7.0 ± 1.0	11.1 ± 0.76	11.3 ± 1.52
12.	Water temperature (º C)	8.3 ± 1.52	7.0 ± 1.0	11.1 ± 0.76
13.	Water current (sec/m)	5.0 ± 1.0	14 ± 2.0	7.0 ± 1.0
14.	pH	5.5 ± 0.15	5.5 ± 0.158	5.0 ± 0.1
15.	Dissolved oxygen (mg L^{-1})	11.4 ± 0.21	10 ± 0.1	11.2 ± 0.1
16.	Free carbondioxide (ppm)	3.0 ± 1.0	3.0 ± 1.0	2.0 ± 1.0
17.	Total alkalinity (TA)	85 ± 1.0	31.6 ± 7.6	30 ± 5.0
18.	Chlorinity	0.21 ± 0.01	0.10 ± 0.05	0.21 ± 0.01
19.	Salinity	0.41 ± 0.01	0.39 ± 4.5	0.41 ± 0.01
20.	Total solids (g L^{-1})	0.5 ± 0.1	2.0 ± 1.0	5.0 ± 1.0
21.	Total dissolved solids (g L^{-1})	0.25 ± 0.05	0.8 ± 0.1	0.63 ± 0.39
22.	Total suspended solids (g L^{-1})	0.36 ± 0.15	0.25 ± 0.05	0.36 ± 0.15
23.	Chlorides (mg L^{-1})	26.8 ± 1.70	7.2 ± 0.75	15.1 ± 1.06
24.	Inorganic Phosphates	0.6 ± 0.1	2.0 ± 1.0	0.4 ± 0.1
25.	Nitrate	1.45 ± 0.04	0.76 ± 0.04	0.76 ± 0.04
26.	Nitrite	0.63 ± 0.25	0.25 ± 0.04	0.25 ± 0.04
27.	TSS	96	79	89
28.	ASPT	4.0	5.2	5.0

a stream of Cardamom Hills, Western Ghats and Chirapani stream in Kumaon Himalayas. Dissolved Oxygen (DO) concentration ranges 6.23-6.8 mg L^{-1}. Wide variation in DO concentration was reported for several south Indian streams in relation to season, stream orders etc. Sivaramakrishnan et al. (1995) have studied DO concentration in tributaries of Kaveri River with different stream orders indicated a range between 4- 8 mg L^{-1} of DO. A similar result also obtained by Joshi and Tyagi (1997) in Chirapani stream, which is also supported the free CO_2 levels in the present study.

Total alkalinity was highest (47.3 mg L^{-1}) in Alagar hills and lowest (17.5 mg L^{-1}) in Sothupparai stream. High total alkalinity in Chirapani stream and Kaveri River was reported by Joshi and Tyagi (1997). Studies on aquatic insects are very much limited when compared with other animal group of both lentic as well as lotic ecosystems (Gopal and Zutshi 1998). Species diversity

Table 3. Order, family and genera of aquatic insects collected in the selected streams/rivers of Western Ghats, India during August 2011-January 2012.

Order	Family	Genera	Site I	Site II	Site III
Ephemeroptera	Baetidae	*Baetis sp.*	108 ± 0.47	135 ± 0.47	125 ± 0.47
	Heptageniidae	*Epeorus sp.*	12 ± 0.12	14 ± 0.47	11 ± 0.12
	Caenidae	*Caenis sp.*	12 ± 0.12	14 ± 2.42	11 ± 1.14
	Leptophlebiidae	*Choroterpes sp.*	37 ± 0.47	34 ± 1.34	18 ± 2.47
		Travella sp.	1 ± 0.47	7 ± 0.12	6 ± 0.47
	Ephemeridae	*Ephemera sp.*	1 ± 0.37	0	0
Odonata	Coenagrionidae	*Coenagrion sp.*	1 ± 0.12	11 ± 0.12	11 ± 2.23
Hemiptera	Gerridae	*Gerris sp.*	20 ± 0.47	19 ± 0.47	24 ± 0.47
	Velidae	*Rhagovelia sp.*	1 ± 0.37	3 ± 0.47	1 ± 0.12
	Neucoridae	*Gryphocricos sp.*	1 ± 0.12	3 ± 1.86	1 ± 0.12
	Saldidae	*Saldula sp.*	1 ± 0.12	2 ± 0.37	3 ± 0.12
Trichoptera	Philopotamidae	*Wormaldia sp.*	11 ± 0.47	0	0
	Polycentropodidae	*Polycentropus sp.*	10 ± 0.47	19 ± 0.47	15 ± 0.47
		Cyrenellus sp.	1 ± 0.12	3 ± 0.47	2 ± 0.12
	Hydropsychidae	*Hydropsyche sp.*	72 ± 29.7	76 ± 0.47	158 ± 0.47
		Homoplectra sp.	55± 36.51	44 ± 0.47	81 ± 0.47
		Potamiya sp.	66± 68.29	6 ± 0.47	4 ± 0.37
	Rhyacopilidae	*Rhyacopila sp.*	2±0.37	0	0
	Lepidostomatidae	*Leptostoma sp.*	4 ± 6.98	4 ± 0.47	6 ± 0.37
Coleoptera	Gyrinidae	*Gyrinus sp.*	11 ± 22.73	2 ± 0.12	2 ± 4.84
	Hydrophilidae	*Tropisternus sp.*	1 ± 0.37	5 ± 0.12	2 ± 0.12
	Dyophidae	*Dyops sp.*	1 ± 1.11	1 ± 0.12	1 ± 0.12
	Stephinidae	*Bledius sp.*	4± 0.47	2 ± 0.37	1 ± 0.12
	Hydrophilidae	*Hydromorpha sp.*	10 ± 0.47	5 ± 0.12	3 ± 0.47
	Psephinidae	*Acneus sp.*	2 ± 0.12	2 ± 0.12	2 ± 0.76
		Psephines sp.	5 ± 0.47	5 ± 8.9	3 ± 0.47
	Elmidae	*Narpus sp.*	1 ± 0.12	3 ± 1.86	1 ± 0.12
Diptera	Tipulidae	*Tipula sp.*	3± 0.47	2 ± 0.37	1 ± 1.86
		Pedicia sp.	2 ± 1.59	4 ± 2.42	2 ± 0.12
	Culicidae	*Anopheles sp.*	2 ± 0.37	1 ± 2.21	1 ± 0.12
	Simulidae	*Simulium sp.*	1 ± 1.11	10 ± 5.40	16 ± 15.56
	Chironomidae	*Chironomous sp.*	11 ± 1.11	14 ± 0.47	12 ± 0.47
	Stratiomydae	*Stratiomys sp.*	1 ± 0.37	1 ± 0.37	1 ± 0.37
	Ptychopteridae	*Ptychoptera sp.*	1 ± 0.37	3 ± 0.37	4 ± 0.47`
	Tabanidae	*Leucodebanus sp.*	4 ± 0.37	5 ± 0.47	3 ± 0.47

pattern in selected streams of Western Ghats have been well studied (Nagendran 2004, Subramanian and Sivaramakrishnan 2005, Sivaramakrishnan et al. 1990, Rathinakumar et al. 2014).

A total of 1461 individuals of aquatic insects belonging to 29 family and 36 genera of aquatic insects were collected in 3 stations in first order streams for 6 months in Alagar hills, Sothupparai and Manjalar river of Western Ghats (Table 2). Indian Trichoptera includes five families and the present study also reviews the dominance of Trichoptera. More than 500 species of Caddisflies distributed over 9 families are known from nine states of India including Karnataka, Kerala and Tamil Nadu. The selected streams recorded a maximum of five families in both Sothupparai as well as Manjalar. Burton and Sivaramakrishnan (1993) have reported 4 families from Silent Valley. Indian Ephemeroptera include 13 families and the present study also recorded the dominance of Ephemeroptera (Sivaramakrishnan and Venkatraman 1990). However, only seven families were

recorded in the present study. Considerable information on the diversity of Hemiptera in Western Ghats is available, for instance, 8 families from 89 localities Western Ghats (Subramanian and Sivaramakrishnan 2005), 7 families in Southern Western Ghats (Nagendran 2004) and 5 families in Cekerek stream Turkey (Duran and Suicmez 2007). However, 4 families were recorded in the present study

The order Coleoptera is represented maximum of 6 families in Alagar hill stream followed by Manjalar and Sothupparai stream/river. It is represented by 10 families in Western Ghats (Subramanian and Sivaramakrishnan 2005). In the present study order Diptera represented by 7 families. It is represented by 5 families in Western Ghats (Subramanian and Sivaramakrishnan 2005). The order Odonata is represented by 1 family in the present study. However, Nagendran and Smija (2005) have recorded 2 families in the hill streams of Western Ghats, Theni and more representation of Odonata was observed by Nagendran et al. (2002).

In India 34 genera of Hemiptera belonging to 12 families were recorded (Srivastava 1991) of which 17 genera occur in Western Ghats (Subramanian and Sivaramakrishnan 2005). The present study found 4 genera, *Gerris, Rhagoveila, Gryhocricos* and *Saldula*. We recorded 8 genera of Coleoptera which are represented by 16 genera in the Western Ghats (Subramanian and Sivaramakrishnan 2005).

Burton and Sivaramakrishnan (1993) and Sivaramakrishnan et al. (2000) have reported only one genus Simulium of the order Diptera whereas 5 genera was recorded from the streams of Western Ghats in the present study. As a whole, the generic diversity is more in the streams/rivers of Western Ghats.

Diversity index ranges from 0.867 to 0.386 (mean = 0.689) for Alagar hills stream and 0.865 to 0.620 (mean = 0.738) for Sothupparai and 0.841 to 0.629 (mean = 0.653) for Manjalar stream/river (Figure 1). Diversity was higher in Sothupparai than in Alagar hills and Manjalar in terms of Shannon Diversity index. It was also observed by Dinakaran and Anbalagan, (2007) in Monkey falls.

Diversity index ranges between 0.822-0.410 (mean = 0.715) for Alagar hills stream and 0.842-0.701 (mean = 0.768) for Sothupparai stream and 0.836-0.626 (mean = 0.753) for Manjalar stream/river. Diversity was found higher in Sothupparai when compare to Alagar hills and Manjalar in terms of Simpson diversity index.

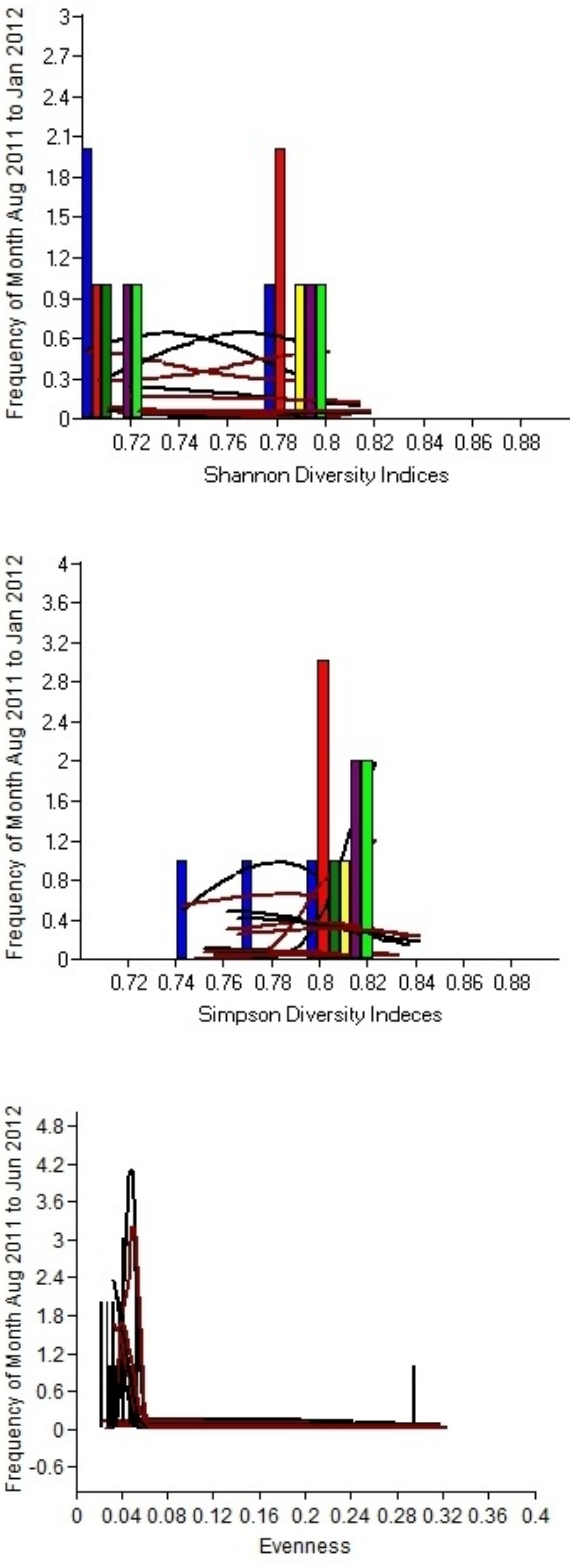

Figure 1. Shannon Diversity, Simpson Diversity and Evenness Indices for the aquatic insects collected from the streams/rivers of southern Western Ghats during August 2011to January 2012.

Sorenson similarity index for the present study reveals that similarity between Alagar hills stream and Manjalar stream is 1.93 and Sothupparai stream and stream 3 is 1.86 and Manjalar stream and Alagar hills stream is 1.72 and also revealed that higher similarity between Alagar hills stream and Manjalar stream/river (Table 3).

Table 3. The Sorenson Similarity Index (SSI) between the selected streams/rivers of Western Ghats, India during August 2011-January 2012.

Streams/river	Site I	Site II	Site III	SSI
Stream/river 1 and 2 (Alagar hills and Sothupparai river)	27	19	10	0.43
Stream/river 2 and 3 (Sothupparai river and Manjalar river)	19	19	13	0.68
Stream/river 3 and 1 (Manjalar river and Alagar hills)	19	27	15	0.65

Hynes (1975) already proposed that every stream is likely to be individual; moreover, each substrate type exhibits a very distinct community, and faunal similarity. The individuality of streams as well as of substrate types, however, has been challenged by anthropogenic impacts. It not only eliminates the lateral habitats but also leads to a homogenization of aquatic communities. In addition, embankment construction has led to an artificial channel reducing the availability of littoral refugia that lessen the impact of both natural (e.g. unpredictable patterns of discharge) and anthropogenic (bathing) disturbances on the biota (Townsend 1989. Townsend and Riley 1999).

Studies on trophic categorization of aquatic insects in South Indian streams were meager. The aquatic insects collected in the selected streams of Western Ghats were grouped on the basis of the table given by Merritt and Cummins (1984) and Dudgeon (1984). This is because according to Dudgeon (1984) gut content analysis is necessary only when published information on feeding habit of a given genera was inadequate. Percentage of trophic categories of aquatic insects in selected streams of Western Ghats. In the present study, Collectors dominate at all the sites among stream communities such as *Baetis, Ephemera, Choroterpes, Hydropsyche* and *Hydromorpha*. Sivaramakrishnan et al. (2000) have also reported the dominance of collectors in 17 locations of Southern Western Ghats.

The BMWP score system was designed to give a broad indication of the pollution condition of rivers throughout UK and Armitage et al. (1993) examined the performance of the BMWP score using samples in 41 rivers in England and Wales. In India, BMWP-ASPT score system was recommended as best for evaluating water quality in streams of Shillong (Gupta 1994) and the South Indian River Kaveri (Sivaramakrishnan et al. 1996). An extensive study on 31 streams of Southern Western Ghats located in Karnataka, Kerala and Tamilnadu also supports the use of BMWP-ASPT score system (Nagendran 2004 2007, Nagendran et al 2002). Our study revealed that the Total Site Score was highest in the Alagar hill stream, suggesting its pristine nature since it was least exposed to anthropogenic impact when compared to Sothupparai stream (Table 4).

Table 4. BMWP scores for families of insects in the three streams of southern Western Ghats, India

Family	Site I	Site II	Site III
Baetidae	8	8	8
Leptophlebidae	10	10	10
Heptageniidae	10	10	10
Caenidae	7	7	7
Ephemeridae	10	0	0
Coenagrionidae	8	8	8
Gerridae	5	5	5
Velidae	5	5	5
Neucoridae	5	5	5
Saldidae	5	5	5
Philopotamidae	5	0	0
Polycentropodidae	5	5	5
Hydropsychidae	6	6	6
Rhyacopilidae	5	5	5
Lepidostomatidae	5	0	0
Gyrinidae	5	5	5
Hydrophilidae	5	5	5
Dyophidae	5	5	5
Stephinidae	5	5	5
Hydrophilidae	5	5	5
Psephinidae	5	5	5
Elmidae	5	5	5
Tipulidae	2	2	2
Culicidae	2	2	2
Simulidae	2	2	2
Chironomidae	2	2	2
Stratiomydae	2	2	2
Ptychopteridae	2	2	2
Tabanidae	2	2	2
Total	148	128	128

But the ASPT was similar in all the streams except the Alagar hill stream. It might be due to physico-chemical features in particular, stream characteristics rather than with anthropogenic impact. Thus, the selected streams suffered from organic pollution that reduced the abundance but not diversity.

CONCLUSIONS

Composition and trophic categorization of aquatic insects and biomonitoring were investigated during August 2011 to January 2012 at Alagar hills, Sothuparai and Manjalar river/streams of selected Western Ghats. A total of 1461 individuals of aquatic insects belonging to 6 orders, 29 family and 36 genera of aquatic insects were collected in all stations in first order streams for 6 months. Diversity values of aquatic insects of three streams/rivers of Western Ghats were calculated. Further the insects were categorized into shredders, scrapers and detritivore-herbivore assessed on their feeding behavior which indicates the dominance of collectors in all the three streams. The water quality was also assessed as per BMWP scoring system, which revealed that all the streams are in good health and suitable for potable.

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