Diversity of Aquatic Insects in Karamana River, Southern Western Ghats, India

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Abstract: The River Karamana, a west flowing perennial drainage originates from the hills of Agasthyarkoodam, part of Southern Western Ghats. The present study will contribute towards the knowledge of the assessment of population and species diversity of aquatic insects of the River. Monthly sampling of aquatic insects was conducted at seven stations of the river during May 2014 to Oct. 2014. A total of 47 genera belong to 7 orders and 28 families were identified. Among them, the order Hemiptera (46%) was the most dominant, followed by the order Coleoptera (22%). Statistical analysis was done by appropriate statistical tools. The study shows many parts of the river started to deteriorate hence the complete absence or less abundance of sensitive/pollution intolerant species are less in the study. Therefore immediate attention and proper maintenance of the river is to be suggested.

Keywords: Aquatic insect, Diversity, River Karamana, Southern western Ghats, Kerala

1. Introduction

Insects are the most species-rich and have successfully invaded virtually all aquatic habitats. They often exhibit high diversity (Anne, E.H. et al., 2010). Aquatic insects are significant in many ways such as processing organic matter and transporting energy along stream channels etc. (Hynes, 1970, Malmqvist, 2002). According to Lewis and Gripenberg (2008), aquatic insects are present in some quantity in almost every type of habitat and many are habitat specialists so that they often make good indicators. Because of their differential responses to stimuli in their aquatic habitat and determining the quality of that environment aquatic insects are used for monitoring the health of aquatic environments (Merritt R.W; K.W. Cummins and M.B. Berg 2008). Some of these insects may be beneficial to human being, and some of them are quite harmful to us (Ahmed, 1983). At the larval stage, they constitute the principal nutritive fauna of fish (Minshal 2003; Tachet el al., 2003).


Very few studies on aquatic insects in Kerala have been reported so far. Due to limited knowledge of the taxonomy and distribution of aquatic insects in the country, most of the studies have been confined to supra-specific taxonomic levels.

Karamana is one of the major rivers flowing through Thiruvananthapuram district, Kerala. This is a small falls mountainous river draining the Western Ghats. The present study will contribute towards the knowledge of the assessment of population and species diversity of aquatic insects of Karamana River.

2. Materials and Methods

Study Area

The River Karamana originates from Agasthyarkoodam hills, the southern tip of the Western Ghats and flows through the Thiruvananthapuram, the capital city of the State Kerala. The river flows 68km westward and meanders their way to the Arabian Sea at Thiruvallam. Seven stations were selected for the present study during May 2014 to October 2014 period. They were Aruvikkara (Station 1- 8°44’, 76°95’), Irumba (Station 2-8°46’76°97’), Vellaikadavu (Station 3-8° 47’, 76°98’), Thrikkannapuram (Station 4-8°47’, 77°00’), Parayilkadavu (Station 5-8°53’, 77°01’), Maruthoorkadavu (Station 6-8°56’, 77°00’) and Thiruvallam (Station 7-7°57’, 77°02’). The samplings were done between 6.30 am and 11.30 am on every month. The study is aimed at compiling the first inventory of the aquatic insect diversity of Karamana River of Kerala.

Methodology

Aquatic insects were collected monthly from different stations of the river by the nylon pond net method (Subramanian KA, Sivaramakrishnan KG, 2007). The insects were sorted, counted and identified by using standard keys (Thirumalai, 1999, 2002; Jessup et al., 2003; Bahl and Basu, 2004; Neiser, 2004; Epler, 2006; Gupta and Chaturvedi, 2008; Webb and Mccafferty, 2008). For identification, only two or three specimens were used and the rests were returned to the sites after counting.

Data Analysis

By using statistical tools, data were analysed. Prior to this Normality tests were done by PAST 3.12. The Shannon-Weiner index and Simpson dominance index were
determined for each station to analyse the species diversity and component of dominance respectively. Buzas and Gibson's evenness(eH/S) index was used to calculate relative abundance of each insect order for each station.

3. Results and Discussion

Insect Fauna: The present study recorded 833 individuals which were belonged to7 orders of aquatic insects (Odonata, Hemiptera, Coleoptera, Ephemeroptera, Diptera, Trichoptera, Megaloptera), 28families (Coenagrionidae, Libellulidae, Gomphidae of order Odonata;Nepidae, Pleidae, Belostomatidae, Naucoridae, Gerridae, Notonectidae,Veliidae, Mesoveliidae, Microveliidae, Helotrephidaeof the orderHemiptera;Elmidae, Hydrophilidae, Dytiscidae, Limnichidae of order Coleoptera;Leptoceridae of order Trichoptera; Chironomidae and Sciamyzidae of orderDiptera; Caenidae,Baetidae, Ephemerellidae, Heptageniidae, Leptopylebiidae of order Ephemeroptera; Corylladidae of order Megaloptera), 47 genera and 49 species. They were represented by 12 species of order Odonata (14), 19 species of order Hemiptera (36%), 7 species of order Coleoptera (14%), 2 species of order Trichoptera (7%), 2 species of order Diptera (7%), 5 species of order Ephemeroptera (18%), and 1 species of order Megaloptera (4%)(Fig.1).Here, order Hemiptera was the most dominant in the River Karamana. Takhelmayum and Gupta (2011) reported similar abundance of hemiptera in Loktak Lake, Manipur. However Abhijna et.al.,(2013) in Vellayani Lake, Kerala and Sharma and Rai(1991) in Bhagalpur, Bihar found insects of Coleoptera to be the most common. In the present study, Coleoptera was the second dominant order. Family–level distribution : FamilyLibellulidae (Order: Odonata) were more species rich (4 species) and that of Notonectidae (Order Hemiptera) was the most individualized (231 insects) family accounting for 27.73% of the total individuals recorded in the study. The families Coenagrionidae (54 members), Gomphidae (31 members), Nepidae (50 members),Gerridae (12 members) and Hydrophilidae (58 members) were recorded by 3 species each. Families Pleidae (14 members), Belostomatidae (5 members),Naucoridae (28 members), Notonectidae (231 members), Helotrephidae (7 individuals) and Dytiscidae (23 members) were recorded by 2 species each. The rest of the families Veliidae (1 members), Mesoveliidae (6 members), Microveliidae (1 member), Elmidae (24members), Limnichidae (73 members), Leptoceridae (7 members), Chironomidae (43members), Sciamyzidae (1 member), Caenidae (14 members), Baetidae (22 members), Ephemerellidae (3 members), Heptageniidae(6 members), Leptopylebiidae (6 members) andCorylladidae (5members) were recorded by 1 species each.Family level distribution was shown in Table 1.

**Table 1:** Family-wise distribution of aquatic insects showing number of species in Karamana River during the study period

<table>
<thead>
<tr>
<th>Order / Family</th>
<th>Genus</th>
<th>No.of individuals of Genus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odonata</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Coenagrionida**

1. Cerion 3 39
2. Ischnura 9
3. Ceragion 6

**Libellulida**

4. Namophya 4 1
5. Hydrobasileus 9
6. Crocothemis 17
7. Urothemis 25

**Gomphidae**

8. Melligomphus 3 3
9. Helogomphus 4
10. Paragomphus 24

**Cordulidae**

11. Somatochloria 2 16
12. Epitheca 5

**Hemiptera**

13. Ranatra 3 37
14. Cercotmetus 11
15. Laccotrephes 2

**Nepidae**

16. Paraplea 2 2
17. Neoplea 12

**Pleidae**

18. Belostoma 2 13
19. Sphero dema 2

**Belostomatidae**

20. Thurelins 2 26
21. Naucoris 2

**Gerridae**

22. Gerris 3 4
23. Rhagadotarsus 2
24. Halobates 6

**Notonectidae**

25. Micronecta haliploides 2 108
26. Micronecta Sp. 120

**Veliidae**

27. Microvelia 1 1

**Helotrephidae**

28. Nanotrephes 2 3
29. Helotrephes 4

**Mesoveliidae**

30. Mesovelia 1 16

**Microveliidae**

31. Microvelia 1 11

**Coleoptera**

32. Stenelmis 1 24

**Hydrophilidae**

33. Helochares 3 1
34. Amphioips 13
35. Allocotocerus 53

**Dytiscidae**

36. Cybister 2 14
37. Hydropropus 1

**Limnichidae**

38. Limnichus 1 73

**Trichoptera**

39. Polycentropus 1 4

**Leptoceridae**

40. Leptocerus 1 10

**Diptera**

41. Chironomus 1 43

**Sciomyzidae**

42. Sepedon 1 1

**Ephemeroptera**

43. Caenis 1 14

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The Station-wise abundance of aquatic insects in River Karamana showed that maximum abundance (364) was recorded in station 1 and minimum (36) in station 7. This reveals that the more human intervention adversely affect the abundance and diversity of aquatic insect. Major Disturbance in Station 7 was at its highest with people fetching water. The work done by Kyerematen and Gordon (2012) affirms this for their studies in three river systems in Ghana. Ephemeroptera were present in all stations throughout the study period and recorded high abundance in Station 1. This revealed that Station 1 is a pollution-free site hence the insect is a pollution-intolerant (J.V.Ward, 1992).

### Diversity and Species Richness

Shannon index is a sensitive indicator of pollution. The result of Diversity indices analysis showed that, all the stations show a good diversity (>1) of insects except station 4. This is clearly perceived that the station 4 is under degradation of habitat structure. Station 6 recorded the maximum diversity (Shannon index H) of 1.5 and the Simpson index was 0.75 and minimum dominance (D) of 0.24 for the entire sampling period. Minimum diversity of 0.86 and highest dominance of 0.56 were seen in station 4. The Evenness of distribution of aquatic insects in the stations of river ranged from 0.47 to 0.83 in the stations 4 and 7 respectively.

### Figure 1: Pie- diagram showing the Composition of aquatic insects Orders during a period of six months

### Table 2: Diversity indices of aquatic insects in Karamana River during the study period

<table>
<thead>
<tr>
<th>Station</th>
<th>Taxa_S</th>
<th>Individuals</th>
<th>Dominance_D</th>
<th>Simpson_1-D</th>
<th>Shannon_H</th>
<th>Evenness_e^H/S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station 1</td>
<td>6</td>
<td>364</td>
<td>0.321</td>
<td>0.679</td>
<td>1.338</td>
<td>0.6353</td>
</tr>
<tr>
<td>Station 2</td>
<td>4</td>
<td>74</td>
<td>0.3338</td>
<td>0.5892</td>
<td>1.2</td>
<td>0.8298</td>
</tr>
<tr>
<td>Station 3</td>
<td>6</td>
<td>118</td>
<td>0.4108</td>
<td>0.4333</td>
<td>1.094</td>
<td>0.4978</td>
</tr>
<tr>
<td>Station 4</td>
<td>5</td>
<td>116</td>
<td>0.5667</td>
<td>0.671</td>
<td>0.8659</td>
<td>0.4754</td>
</tr>
<tr>
<td>Station 5</td>
<td>5</td>
<td>57</td>
<td>0.329</td>
<td>0.7561</td>
<td>1.391</td>
<td>0.6697</td>
</tr>
<tr>
<td>Station 6</td>
<td>6</td>
<td>68</td>
<td>0.2439</td>
<td>0.7407</td>
<td>1.538</td>
<td>0.776</td>
</tr>
<tr>
<td>Station 7</td>
<td>5</td>
<td>36</td>
<td>0.2593</td>
<td>0.7407</td>
<td>1.431</td>
<td>0.8366</td>
</tr>
</tbody>
</table>

### Figure 2: Population Dynamic of Aquatic Insect (Order) in Karamana River from May 2014 to November 2014

Figure 2 shows that the population of insect orders fluctuated throughout study period. A decreasing trend of insect abundance was seen from May to November 2014. The highest population was recorded in November 2014. Subsequently, the least population was recorded in September 2014 except the order Odonata.

### 4. Conclusion and Recommendations

The result of the present work revealed that there are 8330 individuals of aquatic insects sampled in seven stations from May 2014 to Dec 2014. They belonged to 7 orders and 26 families, 44 genera and 45 species. Among them, the order Hemiptera (46%) was the most dominant, followed by the order Coleoptera (22%). Dominance of hemipteran and...
coleopteran insects suggested that the River is relatively less polluted. The abundance of the aquatic insect recorded as the highest number during November 2014 in Karamana River. Station 1 is rich in vegetation and unpolluted. So the Dytiscidae population was higher than any other stations during the study period. The Station-wise abundance of aquatic insects in River Karamana showed that maximum abundance (364) was recorded in station 1 and minimum (36) in station 7. This reveals that the more human intervention adversely affect the abundance and diversity of aquatic insect.

Many aquatic insects are very sensitive to changes in levels of pollutants in the water and are therefore used as indicators of the ecological well-being of these river systems (Kyerematen and Gordon, 2012). Therefore they should be preserved. Hence they play a significant role in maintaining the health of the ecosystems by being part of the food chain, cleaning up the system as scavengers and contributing immensely to decomposition of dead organic matter, their preservation. Hence they play a significant role in maintaining the health of the ecosystems by being part of the food chain , preserved. Therefore they should be intervened adversely affect the abundance and diversity of sensitive/ intolerant species are less in the study. Therefore 4 is less diverse site. Many of the part of the river started to deteriorate hence the complete absence or less abundance of aquatic insect.

5. Acknowledgements

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