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Diversity and Distribution of Odonates in Alagar Hills of Southern India

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Abstract: Order Odonata includes important aquatic insect groups such as dragonflies and damselflies. They help to assess the ecosystem health and serve as pollution indicators. Studies of Odonata were conducted in Alagar hills of South India state of Tamil Nadu from August 2018 to January 2019. Odonate species abundance was high in October to November (7 to 8 species) and their abundance was low in the January and December (6 species.) Among all months, the abundance of libellulid species was comparatively high. Shannon index values were between 1.6094-1.9792 and it shows that these sites had critical position and they might have sensitive habitat status. The results of Simpson index complement with the results of Shannon index. Higher air and water temperature was in August and causes less diversity of organisms. DO was low in January (1.65) and it directly influences the abundance. This study interpreted that diversity of Odonates was directly and indirectly influenced by climatic change and anthropogenic impacts.

Keywords: Temperature, Diversity, Shannon index, Simpson index, DO

Dragonflies and damselflies are among the most attractive creatures on earth and occur in all types of freshwater and nearby habitats (Springate-Baginski et al 2009) from the largest lakes and rivers to tiny wetlands. Globally 5,952 species of Odonates are known and out-off these 474 species in 142 genera and 18 families have been recorded in India (Subramanian and Balu 2014). The Western Ghats are known to support a number of species of Odonata: 176 species have been recorded from the Western Ghats, including 68 species endemic to the region. Odonate larvae occupy a variety of running and standing freshwater environments such as rivers, lakes, ponds, wetlands and, to a lesser extent, phytotelmata, brackish waters and littoral areas of river. Vegetation provides adults with perching structures for thermoregulation, foraging, territory defense, mate attraction, copulation, nocturnal roosting and protection from adverse weather (Rouquette and Thompson 2007). The life history of Odonates is closely linked with water bodies as they use a wide range of flowing and stagnant water bodies. Even though most species of Odonates are highly specific to a habitat, some have adapted to urban areas and make use of man-made water bodies. Habitat specificity has an important bearing on the distribution and ecology of Odonates. The species of hill streams tend to be narrowly distributed when compared to pool breeders, which are wide spread. Diversity of tropical Odonates is partly explained by the high diversity of aquatic habitats in tropical forests (Orr 2006), especially in montane areas (Oppel 2005). The insect order Odonata is divided into

three suborders-damselflies (Zygoptera), dragonflies (Anisoptera), and primitive dragonflies (Anisozygoptera) (Mitra 2006). Recent studies on dragonfly ecology from Western Ghats indicate families like Bamboo tails, Reed tails, Glories, Torrent darts, Torrent Hawks and Club tails will be good indicators of health of riverine ecosystem.

MATERIAL AND METHODS

Study area: Collection of Odonata were conducted in Alagar hills of South India state of Tamil Nadu from August 2018 to January 2019. The reserve forest of Alagar hills is 20km north east of city and elevation reaches 830mts. The hill area occupies 6813 hectares. The sampling area were divided into three stations which were site 1 (77°50'E and 10°05'N), site 2 (77°90'E and 10°08'N), site 3 (78°20'E and 10°10'N). Three sites differ from one another by their forest vegetation and altitude. The sampling sites were selected based on the presence of microhabitats preferred by the Odonata and also specific hydrological characteristics such as current velocity and light intensity.

Sampling and collection of Odonates: The study was conducted twice at monthly interval during morning and evening in all habitats with the help of specially design sweep net.

Water samples collection: Water samples were collected in the three sites and water temperature, air temperature and dissolved oxygen were analyzed using APHA manual (APHA, 2005).

Identification of Odonates: Odonates were observed, captured, identified and released immediately at the spot of capture. The odonates which were difficult to identify in the field were collected as voucher specimens using a hand net. Identification was done by observing wing venation, color pattern, and genitalia described in standard taxonomic literature and field guide (Subramanian and Balu 2017).

Data analysis: This was done with the help of the PAST software to measure the Shannon, Simpson and Brillouin's indices (Hammer et al 2001).

RESULTS AND DISCUSSION

Adults were collected using line transect method resulted in the 87 odonate individuals of 8 species belonging to 2 families, of which 80 anisopterans (7 species, 1 family) and 7 zygopterans (one species and family each) were recorded (Table 3). Libellulidae (sub order anisoptera) was the major component of Odonates community in Alagar hills.

Biotic components: The percent of biotic components includes *Orthetrum sabina* (24), *Tramea limbata* (18), *Trithemis aurora* (16), *Diplacodes trivialis* (13), *Tramea lacerate* (8), *Orthetrum glaucum* (8), *Copera marginipes* (7) and *Brachythemis contaminata* (6) (Table 3).

From the study it was seen that the abundance was high during October to November (7-8 species) and was low in the January and December (6 species.) Among all months, the abundance of family libellulidae was comparatively high. The distribution and abundance of zygopteran species were most affected by reeds. However, anisopteran species were most affected by shade. The findings here in suggest that

open tracts of land, which only had few shady trees, are preferred only by zygopteran species of which 1 species were recorded therein, whereas they were not found in ponds or rivers. In this study Shannon index values were between 1.6094-1.9792 (Table 2) and it shows that these sites had critical position and they might have sensitive habitat status more especially in August and January, due to anthropogenic disturbances and climatic change which makes the pond water scarce of water and causes less diverse organisms. The Shannon index values are normally between 0.0-5.0 and results are generally 1.5-3.5 and it exceeds 4.5 very rarely (Kocatas 1992). The values above 3.0 indicate that the structure of habitat is stable/or balanced. The values under 1.5 indicate that ecosystem balance is broken or there is degradation in habitat structure. During the pre-monsoon period due to lack of rainfall the organisms were tough to survive without much stagnant water. Simpson index values are between 0.8444-0.9272 and the results are complements with the results of Shannon Index. The Brillouin's index value was highest in October 2018 (1.7524) and it was lowest in August 2018 (1.5047) because this index is strictly applicable only to entire populations rather than to finite samples (Table 2). The Brillouin Index also supports the Shannon and Simpson Indices. Water temperature directly affects both the nature of aquatic fauna and species diversity. It also affects organisms indirectly as a consequence of oxygen saturation levels. In the present investigation, the air and water temperature was recorded between 30-37°C and 20-26°C. Higher air and water temperature in August cause less diversity of organisms. The normal DO levels in the running

Table 1. Physico-chemical parameters of 3 sites in Alagar hills

Parameters		August	September	October	November	December	January
Air temperature (°C)	Site 1	37	37	36	34	32	34
	Site 2	35	35	35	32	30	33
	Site 3	35	35	35	32	30	33
Water temperature (°C)	Site 1	26	26	24	25	22	23
	Site 2	25	23	23	20	20	22
	Site 3	25	23	23	20	20	22
DO (mg/l)	Site 1	2.06	2.47	2.06	2.06	1.65	1.65
	Site 2	2.06	2.47	2.06	1.65	2.06	1.65
	Site 3	2.47	2.47	2.06	1.65	2.06	1.65

Table 2. Diversity indices of Alagar hills

Indices	August	September	October	November	December	January
Brillouin	1.5047	1.6854	1.7524	1.6656	1.5911	1.5104
Simpson	0.8538	0.8750	0.8888	0.9242	0.9272	0.8444
Shannon	1.7041	1.8239	1.8790	1.9792	1.8938	1.6094

Table 3. Taxonomic inventory of odonates in different months

Species	August	September	October	November	December	January	Species percentage (%)
Family Libellulidae- Group Anisoptera							
<i>Orthetrum Sabina</i>	4	4	4	3	2	4	24%
<i>Diplacodes trivialis</i>	4	3	2	1	1	0	13%
<i>Brachythemis contaminata</i>	1	1	0	1	1	2	6%
<i>Trithemis aurora</i>	4	2	3	1	2	1	16%
<i>Tamea limbata</i>	4	4	3	2	2	1	18%
<i>Tamea lacerate</i>	2	2	1	1	2	1	8%
<i>Orthetrum glaucum</i>	0	0	3	1	0	0	8%
Family Coenagrionidae - Group Zygoptera							
<i>Copera marginipes</i>	0	1	2	2	1	1	7%

water are 4.6 to 8.6 mg/l. In the present study the DO was low in January (1.65) (Table 1). DO plays a vital role in aquatic insect's life cycle. The lowest DO which might cause by contamination from community waste water, anthropogenic impacts and due to lack of rainfall and it directly influences the abundance of aquatic insects.

CONCLUSIONS

The results of this study give more knowledge about the diversity and distribution of Odonata in Alagar hills. From the results it reveals that Alagar hills supports family Libellulidae of Anisoptera compare to Coenagrionidae of Zygoptera and it indicates that more organic pollution were present because Libellulidae is more tolerant to pollution than Coenagrionidae. The main reason for the pollution is the regular visit by the pilgrims to the temple. In comparison with Western Ghats, low number of diversity works was done in Eastern Ghats and we lack knowledge about the diversity of odonates in that area and the anthropogenic impacts over the odonates. Hence this work suggests the taxonomists to pay more attention for the conservation of aquatic and terrestrial habitats in Eastern Ghats. Then only the most attractive creatures of the sites can be conserved and protected.

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