

Full Length Research Paper

Biodiversity of *Drosophila* in three different altitudes of Brahmagiri Wildlife Sanctuary, Western Ghats

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Post monsoon studies were conducted to analyze the altitudinal variation in a population of *Drosophila* (Diptera: *Drosophilidae*) in Brahmagiri Wildlife Sanctuary belonging to the Western Ghats of Coorg district, Karnataka State, India. A total of 4636 *Drosophila* flies belonging to 8 species of 3 subgenera were collected at altitudes of 800, 900 and 1000 m. The subgenus *Sophophora* was predominant with 5 different species, subgenus *Drosophila* with 2 different species and the subgenus *Scaptodrosophila* was least represented with only a single species. The population density varied in the above three altitudes and highest density was found at 800 m, then the density reduced at 900 m (380 flies) and once again the density increased at 1000 m. This shows that *Drosophila* community is affected by elevation. The diversity of the *Drosophila* community was also assessed by applying the Simpson and Berger-Parker indices. At 800 m, the Simpson Index was low at 0.37 and the Berger-Parker index was high at 0.47, 900 m. The distributional pattern of a species or related group of species was uneven in space and time. *Drosophila kikkawai*, *Drosophila takahashii*, *Drosophila immigrans* and *Drosophila nigra* were found in all the three altitudes suggesting that these species are dominant in this region.

Key words: *Drosophila*, Brahmagiri Wildlife Sanctuary, *Drosophila kikkawai*, *Drosophila takahashii*, *Drosophila immigrans*, *Drosophila nigra*.

INTRODUCTION

Since the times of Morgan, the species of *Drosophila* genus forms a very good model organism in all aspects of biological research and by far it forms a better model over bacteria, nematode worm, zebra fish and house mouse. The family *Drosophilidae* has 3500 described species in various ecosystems throughout the world (Bachli 1998), of which most Genera are concentrated in the tropical regions. The pattern of eco-distribution, biodiversity, Guruprasad et al. (2010) clinal and altitudinal variations (Guruprasad and Hegde, 2006) have been well studied using *Drosophila*. When compared with other

parts of the world, the *Drosophila* taxonomic studies in India are poorly concentrated as it involves the hardships during work and lack of opportunities in the field. But recently, very few attempts have been made to collect *Drosophila* from few parts of India Guruprasad et al., (2011). Brahmagiri Wildlife Sanctuary in the Western Ghats of Coorg district is one of such place where collection studies of *Drosophila* has not been made. This sanctuary derives its name from the highest point, the Brahmagiri peak. The sanctuary has a varying altitude up to 1527 m. The average rainfall in the region is 2500 to

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Table 1. Biodiversity of *Drosophila* at three different altitudes of Brahmagiri Wildlife Sanctuary during post monsoon season (October to December 2012).

S/N	Species	800 m	900 m	1000 m	Total number
Subgenus <i>Sophophora</i>					
1	<i>D. ananassae</i>	304	3		307
2	<i>D. bipectinata</i>	81		11	92
3	<i>D. kikkawai</i>	368	60	609	1037
4	<i>D. malarkotliana</i>	372			372
5	<i>D. takahashi</i>	133	177	458	768
	Total	1258	240	1078	2576
Subgenus <i>Drosophila</i>					
6	<i>D. immigrans</i>	113	28	89	230
7	<i>D. nasuta</i>	1067	91		1158
	Total	1180	119	89	1388
Subgenus <i>Scaptodrosophila</i>					
8	<i>D. nigra</i>	481	21	170	672
	Total	481	21	170	672
	Grand total	2919	380	1337	4636
	Simpson index	0.79	0.69	0.66	
	Shannon-Wiener index	1.79	1.38	1.21	
	Berger – Parker index	0.37	0.47	0.46	
	Mean temperature in °C	18.33	19	19.66	

to October). The forests are mainly evergreen and semi evergreen in nature, shola vegetation is dominant in higher altitudes of the sanctuary. Further in the lower regions of the sanctuary, deciduous forests are seen, which are an abode for rich faunal diversity of *Drosophilidae*. Therefore, the present study has been undertaken in this sanctuary to understand the biodiversity of *Drosophila* in relation to microhabitat variations.

MATERIALS AND METHODS

Using sweeping and bottle trapping method, *Drosophila* collections were made during post monsoon period (October to December 2012) in the Brahmagiri Wildlife Sanctuary in the Western Ghats of Coorg district to account for the biodiversity of *Drosophila* fauna. The collections were made in three different altitudes (800, 900 and 1000 m) of Brahmagiri Wildlife Sanctuary.

In net sweeping methods, various rotting fruits, such as, *Vitis vinifera* (grape), *Musca paradisca* (banana), *Solanum lycopersicum* (tomato), *Manilkara zapota* (sapodilla), *Citrus sinensis* (orange), *Malus domestica* (apple), *Carica papaya* (papaya), *Citrus aurantium* (lime) and *Ananas comosus* (pineapple), were mixed and spread under shaded areas to attract flies. After a day of spreading, the flies were collected by sweeping using fine net. The flies were then transferred to the bottles containing wheat cream-agar medium and brought to laboratory for identification. Bottle trapping method was also followed for collection, in this technique, culturing bottles containing smashed banana sprayed with live yeast were tied to twigs of bushes under shaded areas. The following day, bottles with attracted flies were collected by plugging the bottles and later transferring to culture bottles containing wheat

cream-agar medium and brought to the laboratory for identification. The collected males were identified using taxonomical markers such as body pigmentation, sex comb and genital plate. Since there are no such taxonomical markers in females of *Drosophila* species, therefore the collected females were subjected to isofemale lines. The male flies obtained from the progenies of isofemale lines were used for species identification. Uniformity was maintained in using the techniques and in the number of baits used in the collection sites.

The sanctuary is rich in floral diversity. Vegetation at the collected sites included *Acacia catechu*, *Albizia amara*, *Alstonia species*, *Artocarpus*, *Bauhinia species*, *Bombax*, *Caryota*, *Calophyllum*, *Carea*, *Cinnamomum species*, *Clementis trifolia*, *Coffea arabica*, *Eucalyptus grndis*, *Ficus bengalensis*, *Garcinis gummi-gutta*, *Gymnima sylvestres*, *Hibiscus malva*, *Lantana camera*, *Litsea species*, *Mesua*, *Pongamia glabra*, *Vitex negundo*, *Holorrhina* and *Strobilanthes* which are the main vegetation growing in the sanctuary.

The abundance, richness and diversity relationship of flies collected were assessed by Simpson (D), Shannon-Wiener (H) and Berger-Parker (1/d) indices (Mateus et al., 2006). The Simpson index (D) that measures the probability that two individuals are randomly selected from a sample that belong to the same species, was calculated using the formula:

$$D = \sum n(n-1) / N(N-1)$$

where, n = the total number of organisms of a particular species and N = the total number of organisms of all population.

Shannon-Wiener measures the value of species as a function of their frequency in the community and was calculated using the formula:

$$H' = - \sum p_i \ln p_i$$

p_i = the proportion of individuals belonging to the i th species in the

dataset of interest.

Berger- Parker index (1/d) which shows the relative abundance was calculated using the formula:

$$1/d = N/N_{\text{Max}}$$

Where, N = number of individuals of all species and Nmax = number of individuals in the most common species.

RESULTS AND DISCUSSION

The number of flies at three different altitudes of Brahmagiri Wildlife Sanctuary collected during the post monsoon season is shown in Table 1. At 800 m, the number of flies collected was the highest with 2919 flies which comprised of 8 different species. At 900 m, a total of 380 flies belonging to 6 different species were recorded. But at 1000 m, a total of 1337 flies of only 5 different species were collected. *Drosophila kikkawai*, *Drosophila takahashii*, *Drosophila immigrans* and *Drosophila nigra* species were seen as common species in all altitudes.

The collection data of *Drosophila* at different altitudes of Brahmagiri Wildlife Sanctuary shows that highest *Drosophila* density is in the lowest altitude of 800 m, after which it drastically falls at 900 m. Following this, at 1000 m once again the *Drosophila* density increased to 1337 flies. This shows that *Drosophila* community is affected by elevation. Studies by Guruprasad et al. (2011) in Chamundi hill and Wakahama (1962) have also reported the influence of elevation on the distribution of *Drosophila* flies. They have found that density of *Drosophila* decreased with increase in elevation. Greater density of *Drosophila* flies in the lowest altitude found in the present study could be due to the increased floral diversity. The sanctuary is rich in, *Manilkara zapota*, *Citrus sinensis*, *Musca paradisca*, *Garcinis gummi-gutta*, *Cinnamomum* species, *Hibiscus malva* and at this altitude most of the *Coffea arabica* and *Coffea robusta* estates are found. This floral diversity is seen decreasing with increasing altitude.

The value of Simpson, Shannon-Weiner and Berger-Parker indices that indicate the abundance, richness and diversity of *Drosophila* flies in different altitudes of the hill are shown in Table 1. At the lowest altitude of 800 m, Simpson = 0.79; Shannon-Weiner = 1.79 and Berger-Parker = 0.37; at 900 m Simpson = 0.69; Shannon-weiner = 1.38 and Berger-Parker = 0.47. At the higher altitude of 1000 m, Simpson = 0.79; Shannon-weiner = 1.79 and Berger-Parker = 0.37

In the Simpson index (D), 0 represents infinite diversity and 1, no diversity, that is, the greater the value of D, the lower the diversity but the reverse is true in the case of Berger-Parker and Shannon-Wiener indices (Ludwig and Reynold, 1988; Mateus et al., 2006). Applying these indices to understand the measures of biodiversity of flies at different altitudes demonstrates that the lower altitude of 800 m has a higher value (D) and lower value of 1/d

indicating more biodiversity as compared to the higher altitude of 900 and 1000 m (Table 1).

The density or richness of species also depends on the number of biotic and abiotic factors encountered in the seasons. A change in relative frequency of different species from season to season due to changes in natural environment was reported by Guruprasad et al. (2010). Dobzhansky and Pavan (1950) showed that rainfall appears to have a greater influence on the abundance of *Drosophila* than temperature. For building larger communities of *Drosophila*, monsoon is a suitable season and population density declines from the middle of post monsoon due to the prevalence of cold and dry weather (Guruprasad et al., 2011). So, the observed lower densities of *Drosophila* in the present study can be attributed to the post monsoon climatic conditions. In addition, climatic variables such as humidity, rainfall, temperature and incidence of sun light among others, are determining factors in the occurrence of *Drosophila* species. These studies suggest that the changes in the natural environment caused by the alteration of seasons would result in the change in relative frequency of different species from season to season.

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