Seasonal distribution of Drosophilids at Jnanabharathi Campus, Bangalore University, Bangalore, Karnataka, India.

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Abstract

Biodiversity is defined as the variety and abundances of species in different habitats. Drosophilids are regarded as potential indicators which are extremely necessary to achieve the conservation, and which are an effective group to test as potential indicators at different ecological gradients. In this the diversity and distribution of the Drosophilids have been affected enormously where human habitat is frequently sensed in Ghandhibhavan when compared to Madhuvana. Irrespective of vegetation, seasonal variation also has on impact on population density of *Drosophila*. This shows that climatic conditions existing in different seasons of the year may be a critical factor in population fluctions.

Introduction

Drosophila is the most abundant genus and comprises of 2240 species (around 64% of the total species). India with its vast array of vegetation and climates harbors a variety of *Drosophila* (Bächli, 1998). More than 3750 different species are now recognized belonging to the family Drosophilidae (Wheeler, 1981); about one-third (1048) of these species have been newly described since the publication of Wheeler's catalogue (Wheeler, 1986). The Indian subcontinent, with it subtropical climate and varied physiographic conditions, including variable altitudes and luxuriant flora, offers an adobe for the rich and wide distribution of *Drosophila* fauna. During recent years, considerable data have been accumulated regarding faunal composition of Drosophilid species as a result of extensive field collections in different ecological habitat by Ayala (1970).

Drosophila is being used for study of population fluctuations as they are highly sensitive to slight environmental modifications that are reflected in the size of natural populations, structure and ecology. It is known that temperature and rainfall affect viability, fertility, developmental time, and other factors that influence the rate of population growth and survival. *Drosophila* studies include intra-inter relationships, such as population density, population age, distribution, competition, and relationship between Drosophilids and their hosts and predators (Guruprasad *et al*., 2009). Drosophilid flies are good tools to improve the understanding of patterns and processes related to biodiversity, and the understanding of how human activities affect biodiversity at various temporal and spatial scales. Such tools permit the elaboration of more accurate and efficient conservation strategies, as well as the improvement of the projection about what might happen in the future. *Drosophila* has been used as a model in studies on bioindication (Parsons, 1991, 1995; Mata *et al*., 2008) and also biological invasions (Tidon *et al*., 2003).

Similarly, biotic factors like the kind of vegetation that form natural gradients and changes associated to latitude, for example, are also important (Powell, 1997). Therefore, the composition and structure of a Drosophilid assemblage depends on the habitat in which it was established. The better understanding of how different species are affected by current climates and why they sometimes respond differently to climate change is necessary for predicting future effects of climate change (Weatherhead, 2005).

In view of this an attempt has been made to understand the existing species diversity of *Drosophila* populations in nature at different localities, flies were particularly collected in two different localities, *i.e*., Madhuvana and Ghandhibhavana, at different seasons (summer, winter, rainy) in Jnanabharathi campus of Bangalore University, Bangalore, Karnataka, India during the year 2012-2013.

Materials and Methods

Drosophila flies were collected at Jnanabharathi campus in the month of October (2012), *i.e*. rainy season, January (2013) which falls in winter season, and in the month of April (2013) summer season at two different localities of Madhuvana and Gandhibhavana situated in Jnanabharathi campus, Bangalore University, respectively. The collections were made uniformly in the fourth week of each month for the assessment of fly's distribution pattern, during which the temperature recorded was 26°C-28°C (rainy), 28°C-31°C (winter), to 32°C-34°C (winter) and relative humidity varied from 19% to 65%. The method used to collect the flies was by net sweeping (Markow and O'Grady, 2006). The rotten mixed fruits were spread in the evening of the previous day. The fermented fruit was spread in each distant trap collection spot. Such bait as fermenting fruits retains its attractive odor for a long time. The collections were made early in the morning by sweeping in each trap at least three times and transferring to six quarter pint milk bottles filled with standard agar medium sprayed with yeast. The collected flies were brought to the laboratory, etherized, categorized, counted and species were identified under Olympus Stereozoom Microscope. The males were studied as such but the individual females, which could not be identified, were isolated and allowed to breed in separate vials containing standard laboratory food medium. The progeny obtained from such single gravid female were used for species identification.

Table 1. Number of *Drosophila* species collected from two different localities of Jnanabharathi campus.

Locality→	Madhuvana			Gandhibhavana		
Seasons→ Species↓	Summer	Rainy	Winter	Summer	Rainy	Winter
D. melanogaster	65	117	39	78	111	54
D. malerkotliana	68	78	32	44	56	21
D. simulans	47	45	21	33	21	10
D. rajashekari	56	45	37	41	45	37
D. bipectinata	38	65	34	31	71	34
D. nasuta	125	113	83	76	81	47
D. neonasuta	89	97	75	89	103	75
D. phorticella setiata	134	91	103	122	88	91
D. brundavensis	2	0	0	0	0	0

Results

Distribution of different species of *Drosophila* and their numbers were found, during collections along with temperature in Jnanabharathi campus, Bangalore, during 2012-2013. A total of 9 species (Madhuvana and Ghandhibhavana) were encountered in the collected site that belonged to 2 sub genera, namely, Sophophora and *Drosophila.* The collection of Drosophilid flies from two locations of Jnanabharathi campus at different seasons have yielded 3158 flies, out of which 1699 flies were collected from Madhuvana and 1469 from Ghandhibhavana during year 2012-2013. The data (Table 1) from the present survey have revealed 9 different species of *Drosophila* with no record of new species in different localities of Jnanabharathi campus. Of these *Drosophila phorticella setiata* was more abundant than the other eight species. *Drosophila brundavensis* was the least recorded.

However *Drosophila phorticella setiata* were found to be abundant in both the localities of the collected site, *i.e.*, Ghandhibhavana and as well as Madhuvana (Table 2). The commonly found 7 species in the assessments were *Drosophila melanogaster, Drosophila bipectinata, Drosophila simulans, Drosophila malerkotliana, Drosophila neonasuta, Drosophila nasuta, Drosophila phorticella setiata.* Of the 9 species

captured, *Drosophila brundavensis* was recorded only in Madhuvana. The most commonly found species with increasingly more in number next to *D* phorticella *setiata* were *D. melanogaster*, *D. malerkotliana,* and *D. simulans,* which means that these four species are more adapted to the prevailing environment (Figure 1). The sampling size varied with the season and temperature. The flies collected in rainy was abundant and winter was least, respectively, while in summer the collection was intermediate in number. Thus, the temperature has an impact on the development and distribution of the flies (Figures 1 and 2).

Table 2. Represents the Simpson-Weiner values for the species diversity.

	Madhuvana	Gandhibhavana
Taxa	9	8
Individuals	1699	1459
Simpson 1-D	0.858	0.852
Shannon-Weiner	2.017	1.983

As per Table 2, Simpson index value is 0.858 in Madhuvana and 0.852 in Ghandhibhavana, and Shannon Wiener values are 2.017 in Madhuvana and 1.983 in Ghandhibhavana. The Simpson values represent higher diversity, as "0" represents infinite diversity and "1" represents no diversity. However, it is vice versa in the case of Shannon Weiner-indices as the Weiner-indices more than "1" represents higher diversity (Ludwing and Reynold, 1998).

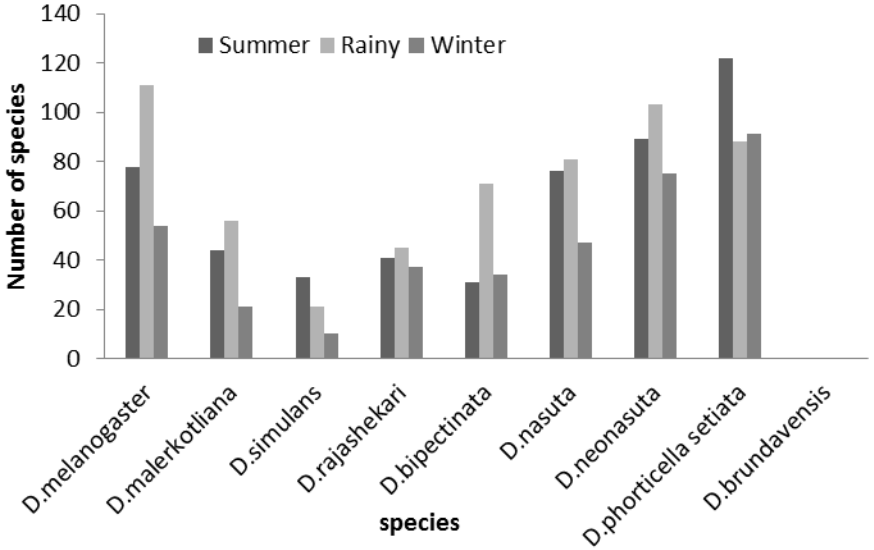

Figure 1 Top Left. Total number of flies collected at Madhuvana in different seasons.

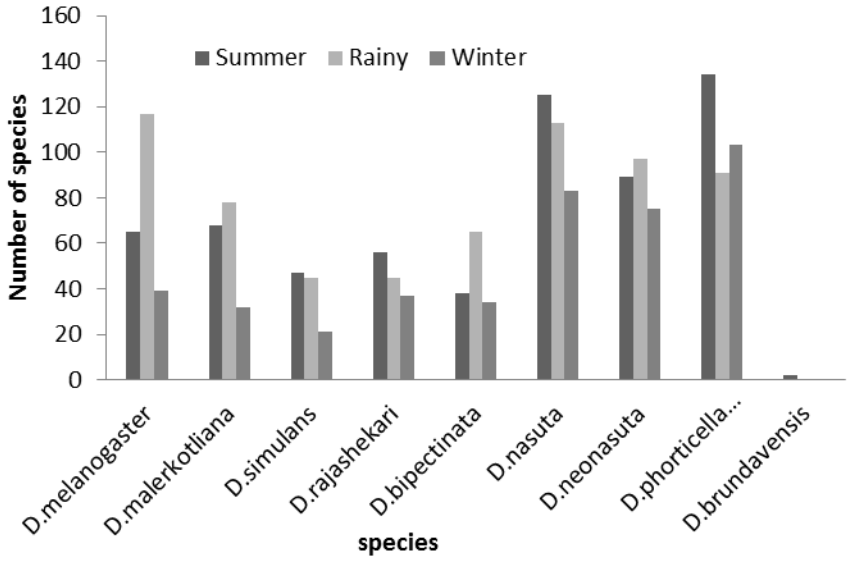

Figure 2 Bottom Left. Total number of flies collected at Gandhibhavana in different seasons.

Discussion

The changes in the natural environment caused by the alteration of seasons would result in the change in the relative frequency of different species from season to season. In tropical areas, especially in Brazil, changes in the environment are caused by the alteration between the dry and rainy seasons (Dobzhansky and Pavan, 1950). Species that are habitat specialists make up much of biodiversity, but the evolutionary factors that limit their distributions

have rarely been considered. Such species are likely to be constrained in their evolutionary responses to future climate changes (Kellermann *et al.*, 2009).

At first sight the flies collected from Madhuvana are increasingly higher in number, as it contains fruiting vegetation. But in Ghandhibhavana the number of flies collected was less as there is very little fruiting vegetation. But as far as the species diversity are connected the Madhuvana and Ghandhibhavana consists in a total of 9 species, which are common in both the collected localities of the present study. A better understanding of how different species are affected by current climates and why they sometimes respond differently to climate change is necessary for predicting future effects of climate change (Weatherhead, 2005).

Interestingly, it was also observed that the flies were recorded more in number during rainy season when compared to summer and winter. However, in winter season flies were least recorded. This ensures that the distribution of the flies is mainly effected in nature due to the variation in the temperature. The present study also implies that the climatic variables such as humidity, rainfall, and temperature are determining factors in the occurrence of Drosophilid species as suggested (Pavan, 1959). The diversity and distribution of the Drosophilids have been affected enormously where human habitat is frequently sensed in Gandhibhavana when compared to Madhuvana. Irrespective of vegetation, seasonal variations also have an impact on population density of Drosophilids. Thus assemblages of Drosophilids are less frequent in numbers at Gandhibhavana, which means that it is prone to be a disturbed gradient with human habitat than Madhuvana.

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Reduced male fertility of the Canton-S strain due to spermiogenic failure.

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Introduction

Male fertility is a quantitative trait composed of several components and appears to vary considerably among individuals; therefore, it is not a simple matter to quantitatively define the wild type. On the other hand, for a detailed analysis of the reproductive process, standard and marker strains with a normal phenotype are essential. Here, to test the adequacy of strains often used in the study of spermatogenesis, we studied the male fertility of eight strains of *Drosophila melanogaster*, finding a significantly reduced fertility of the Canton-S strain.