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Full Length Research Paper

Assessment of *Drosophila* diversity during monsoon season

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Two months survey was conducted to analyze the altitudinal variation in diversity of *Drosophila* in Chamundi hill of Mysore, Karnataka state, India. *Drosophila* flies belonging to 15 species were collected from 680, 780, 880 and 980 m altitudes. The species diversity according to the biodiversity indices was very high in 680 m compare to other higher altitudes.

Key words: *Drosophila,* Simpson, Berger-Parker indices.

INTRODUCTION

Drosophila is being extensively used in biological research, particularly for genetical, cellular, molecular, developmental and population studies. It has been used as model organism for research for almost a century. It has richly contributed to our understanding of pattern of inheritance, variation, mutation and speciation. Studies have also been made on the population genetics of different species of this genus. However, most of these studies have been carried out in the laboratory by many workers. Though early studies on *Drosophila* in India were mainly concerned with taxonomy, 1970 onwards studies on other field have also been initiated. Significant progress has been made in the field of cytogenetics, developmental genetics and molecular biology of *Drosophila*. The taxonomical and population genetical studies have progressed little due to lack of interest of people in it. Although many workers feel that the taxonomical work shall not be neglected, people show little interest because of the hardship during work and lack of opportunity in the field. To fill up this gap at least partially, we took this work for the study of *Drosophila* population and their species diversity in a given locality.

MATERIALS AND METHODS

To study the altitudinal variation of *Drosophila* and their distribution, the collection was done in the Chamundi hill during 2008-2009. Chamundi hill is a famous tourist spot with altitude 1100 m, 6 km from the Mysore city. Karnataka, India, The altitude of the hill from the foot (base) is 580 m, the temperature ranges from 17 to 35°C and relative humidity varies from 19 to 75%. The collections of flies were made during monsoon season (June and July once in 15 days of the months). For this method, flies were collected by using sweeping and bottle trapping method from the all altitude, such as 680, 780, 880 and 980m (base of the hill) lower altitude of Chamundi hill: 1) Bottle trapping method 2) Net sweeping method. In bottle trapping method, regular banana baits in quarter pint 250 ml milk bottles sprayed with yeast were tied to the twigs of tree at two and half feet above the ground in cool shaded areas that is covered by scrubs. Next day flies were attracted by the bait and thus the bottles were collected during early morning by plugging with cotton to the mouth of the bottles.

In net sweeping methods, rotting fruits are spread usually beneath shaded areas of the bushes of plantation, various fruits, such as *Musca paradisca* (banana), *Ananas comuses* (pineapple), *Vitas vanifera* (grape), *Artcarpus hetrophylles* (jack fruit), *Pyrus malus* (Apple) , *Carica papaya* (papaya), *Arthras* (guava) and *Citrous auranthium* (lime),are mixed and used for spreading. After one day of spreading, the flies are swept using fine net, this is done in all the altitude (680, 780, 880, 980 and 1100 m) height of the hill. The flies are transferred to the bottles containing wheat cream–agar medium and then brought to the laboratory isolated, sexed and identified according to the texas publication 1975 records, and then they were examined under the microscopy.

Vegatation at 680 m: The foot of the hill is surrounded by mango orchards along with trees such as *Acacia concinna, Acacia catechu, Anacardium occidentale, Bombax ceiba, Breynea restusa, Cassia spectabilis, Celastrus paniculata, Cipadessa baccifera, Clematis trifolia, Dalbergia paniculata*, *Dioscorea pentaphylla, Ficus religiosa*, *Ficus bengalensis, Glyrecidia* species, *Gymnima sylvestres, Hibiscus malva, Ichnocarpus frutescens, Lantana camera, Pongamia glabra, Phyllanthus* species, *Tamarindus*

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indica, *Thunbergia* species, *Tectona grandis, Sida retusa,* and many shrubs including cactus.

The vegetation both at 780 and 880 m was the same. Major plants found in these localities were *Albizzia amara, Andrographis serpellifolia, Argyria* species, *Bignonia* species, *Breynea restusa, Bridalia* species, *Cassia fistula, Cassine glauca*, *Eucalyptus grandis, Garcinia* species, *Lantana camera, Phyllanthus microphylla, Sida rhombifolia, Terminalia paniculata, Terminalia tomentosa*, *Vitex negundo, Zizipus oenoplea* and *Zizipus jujuba.*

The vegetation at the top of the hill (980 m) includes, *Acacia catechu, Anacardium occidentale, Autocarpus integrifolia, Jasminum species, Jatropa curcus*, *Lantana camera, Leus aspera, Mallotus philippensis, Murraya paniculata, T. indica* and *Zizipus jujuba.*

Analysis of species diversity of flies collected in monsoon was assessed by Simpson (D) and Berger-Parker (1/d) indices (Mateus et al., 2006). Shannon-Weiner index was also calculated, but the result was the same as Berger-Parkar index, hence not included here. Among these, Simpson index (D), which measures the probability that two individuals randomly selected from a sample that belong to the same species, was calculated using the formula:

$$D = \frac{\sum N(N-1)}{N(N-1)}$$

Where, n = the total number of organisms of a particular species, N = the total number of organisms of all population

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

$$1/D = \frac{N}{N_{MAX}}$$

Where, N= Number of individuals of all species; N_{max} = Number of individuals in the most common species

RESULTS AND DISCUSSION

Results of our experiments shows that as altitude increase, there was a decrease in the biodiversity (using biodiversity indices, such as Berger- parker and Simpson Index) of *Drosophila* (Guruprasad et al., 2009), Monsoon is the best season building large community, and in terms of population (number of flies), it is significant in different altitude. The community and biodiversity was big in lower altitude compare to higher. These results were due to micro and macro climatic conditions (Guruprasad and Hegde, 2007). Only 15 species were collected from all the altitude, which decreased compared to 20 species that were listed in our published data. About five species, such as *D. takahashii, D. suzukii, D. repleta, D. immigrans* and *D. buskii,* were not found in the collections that were found in earlier data during 2005-2006. A totally of 956 species were collected and belonged to 4 subgenera namely *Sophophora, Drosophila, Dorsilopha* and *Scaptodrosophila.* According to the biodiversity index, lower altitude showed higher biodiversity*. D. nasuta* and *D. malerkotilana* species are the common species found in the hill and it is regard as the common and abundant species in the hill. Another most important finding was that all species were not found in all altitude and *D. nasuta, D. neonasuta, D. malerkotliana, D. rajasekari, D. jambulina* and *D. bipectinata* were common abundant species found in all altitudes. The highest number and species of flies were found in the 680 m altitude. Further, our intention is not only to study the taxonomy of *Drosophila,* but also the relationship of ecology and phenotypic traits that is longevity (life span). From the aforementioned study, we realize the importance of *Drosophila* in two resources: its powerful genetic tools as a model system, and a natural ecology that provides substantial genetic variation across significant environmental heterogeneity. To know this heterogeneity, isofemale lines derived from low altitude have longer longevity compare to higher. This confirms the work of Trotta et al. (2006), where derived lines from temperate European populations, tropical Central American and African populations also show differences in mean life span, and mean life span under different thermal environments.

Cakir and Bozcuk (2000) showed that the differences in longevity have also been observed between inbred lines recently derived from natural populations near Ankara, Turkey. Longevity also varies significantly within populations (Schmidt and Paaby, 2008). This shows that the ecological factors play a role in the determination of longevity. Mueller et al. (2008) demonstrate a method for determining age specific survival and mortality in natural populations by marking individuals sampled from the wild at unknown age and subsequently constructing the life tables from recorded times -of-death. This technique has been used to describe the survival and death schedule of the medfly, *Ceratitis capitata*, and could be used for all the wild type of species found around us.

Drosophila populations have been surveyed in order to study the mechanisms of maintaining genetic variability of quantitative characters particularly morphological traits (Das et al., 1994; Garcia-vazquez et al., 1989; Sheldon and Milton, 1972). Morphological differences among natural populations are frequently attributed to natural selection, but the role of non-gentic modification by the environment has been neglected (Coyne and Beecham, 1987). According to the Carson and Stalker (1949), a population of one locality might adapt itself to the cyclic climatic changes associated with season, and undergo morphological change by a rapid type of natural selection, while Anderson (1973) is of the opinion that morphological change by a rapid type of natural variations may be simply a phenotypic response to environment, reflecting developmental plasticity or it may be partly or wholly genetic. In *Drosophila*, evidence on the adaptive nature of body size come from the observation of latitudinal clines and cyclic seasonal changes in several species (David and Bocquet, 1975) and from experiments with population cages (Anderson, 1966; Yadav and Singh, 2006), from all these aforementioned evidence my second objective were to analyse the variation in morphometric traits of *D. malerkotliana* at different localities. Altitudes of Chamundi hill is one of them (Guruprasad and Hegde, 2006). From this objective, we confirmed that as altitude increase, there was increase in morphometric traits, for example wing length, which is the index of body size (Hegde and Krishna, 1997). This is highly significant in case of male compare to female. This also shows that the male are more heterogeneous compare to female, female is too expose to more selection pressure than male. Thus, the present study implies that morphological variation of the species is inevitable consequence of the effects of environmental on it.

Earlier investigations have shown that these traits are expected to play important role in adaptations of flies to different environmental conditions (Griffith, et al., 2005). Anderson (1973) has shown that populations kept at different temperatures show divergence in wing length. There was clear association of body size with environmental temperature, with lower temperature favoring relatively larger size and higher temperature favoring smaller size. Tantawy (1964) has also shown that in addition to temperature, humidity also plays an important role in maintaining morphological differences. Tantawy (1964) compared 12 strains of *D. melanogaster* collected in Cameron at different altitudes. Their studies suggest that environmental variations correlated with altitude and play a direct role to bring about genetic variations. All these studies suggest that morphological variation in a given population is as a result of interplay of genotype and environment. Thus, the present study shows that morphometric variation is an inevitable consequence of the effects of environment. The length of wing and other parts of the body serve as indices of the body size, and in the present study, the author noticed the variability of these traits. These results, thus, suggest that the variability of body size is an inheritant property of the natural populations of *Drosophila* and in particular *D. ananassae*. Furthermore, the present studies contradict with the findings of Kitagawa et al. (1982) who have demonstrated lack of genetic divergence of morphometric traits of different populations of *D. nusuta* disturbed in a given area. On the other hand, Takanashi and Kitagawa (1977) have observed significant differences in the populations of the same species collected from different countries. Therefore, the author is of the opinion that the morphometric variability in the natural population does not only depend on the species or environment, but also on the response of the species in question to that environment.

From the point of future studies, one has to evaluate courtship behavior of *Drosophila* itself by aspirating the mating pair directly from nature or wild localities and evaluate the body size and morphometric traits. This can be continued frequently for not less than five year. Moreover, we can come across some question, such as, is there any increase in body size over years? From the results of the aforementioned question, one can predict it for many years and study the body size of *Drosophila*, which seems to be molded by the action of natural selection. In the present studies, it is noticed that the density of *Drosophila* at different altitudes of Chamundi hill decreased with increasing altitude. Thus the presence or absence of a species in an ecological niche, its richness or abundance in that area is an indicator of both biological and ecological diversity of that ecosystem. In addition to physical and biotic factors, the topography and season also affect the animal distribution. The list of plant species available at the collection sites indicates that the plant diversity also decreases with increasing altitude. Thus, the present study shows that the *Drosophila* community does not only depend on vegetation, but also on altitude.

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