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NUTRITIONAL PREFERENCE AND PATHOGENIC INVOLVEMENT OF THREE INDIAN SPECIES OF *DROSOPHILA*

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ABSTRACT

Based on the results of present study, it is evident that fungi may also serve as one of the important natural foods for many species of *Drosophila*. However, different species of fungi attract different species of *Drosophila* and in some cases the preference is very strong. This is probably responsible for the coexistence of the species in nature. Besides this, many species of *Drosophila* not only feed on various sorts of fungi but also act as mechanical vectors for them.

INTRODUCTION

The genus *Drosophila* is very large and worldwide in distribution. Out of the 2500 species representing 55 genera of the family Drosophilidae, about 1472 species belong to this genus alone (Wheeler, 1981). Unfortunately, our knowledge regarding their natural feeding sites has been very scanty and fragmentary and only known for a few species. Because collections are usually made either by exposing different fermenting fruits as bait or by net-sweeping over leaf-foliage, oozing sap, fallen flowers and decaying plant material. Nevertheless, the results of earlier exploratory studies on the food habits have revealed that fungi constitute an important natural food ingredient for most of the adults and larvae of *Drosophila* species, and a strong food preference has been noticed among them (Dobzhansky and Pavan, 1950; Carson, 1951; da Cunha *et al.*, 1951; Pavan, 1952; Dobzhansky and da Cunha; 1955; Shehata *et al.*, 1955; Carson *et al.*, 1956; Phaff *et al.*, 1956).

It is of course true that *Drosophilia* species are not injurious as other insect pests. But some are certainly known to cause a considerable damage both to leaves and fruits (Demerec, 1950). Besides, it has long been suspected that some of the *Drosophila* species also act as carriers for several pathogenic fungi and disease producing micro–organisms both of animals and plants. But, unfortunately no such studies have been undertaken with *Drosophila* species to date. In view of this situation attempts have been made for the first time to analyse nutritional preference among three sympatric and common species of *Drosophila* for naturally occurring fungi and their possible pathogenic involvement.

MATERIALS AND METHODS

Drosophila flies were collected in nature by net sweeping over wild vegetation and decaying plant material at Ayurvedic garden and Botanical garden of Banaras Hindu University campus. The fungi from freshly caught flies were extracted in two ways. For fungi adhering with their body surface, individual belonging to a single species were washed in sterilized distilled water. Whereas, fungi of the alimentary canal were extracted by taking out the gut content in sterilized distilled water.

While growing the fungi, a drop of fluid from the body wash as well as from the solution of gut content was inoculated separately on Czapek's–DOX yeast extract agar medium in an inoculation cum growth chamber and

then allowed to grow for about 7 days at 24± 1°C. After full growth, different species of fungi were identified.

OBSERVATIONS

The cultures established from the gut contents as well as from the body wash revealed that altogether 10 different species of fungi are associated with these three species of *Drosophila* (Table 1). Among these species, *D. ananassae* and *D. nasuta* both were found to carry only those very species of fungi which were also detected in their crop respectively. For instance, *D. ananassae* feeds and also carries on its body surface *Penicillium oxalicum*, *Aspergillus niger* and a species of genus *Candida*. Similarly, *D. nasuta* was found to carry and feed exclusively on single *Fusarium* species. Contrary to this, *D. malerkotliana* was found to feed largely on three species of fungi, one each of the genera *Geotrichum*, *Cephalosporium* *Penicillium frequentans* whereas it carries spores and hyphae of four altogether different species which have never been detected from its crop. They are *Aspergillus niger*, *A. lucheunsis*, *Mortriella subtilissima* and *Rhizopus nigricans*. These observations suggest that *D. ananassae* and *D. nasuta* visit only those fungi which they take as food, indicating their rigidness. Further, it also appears that these species are probably more expert in searching their food. On the other hand, *D. malerkotliana* had to visit several other species of fungi also in order to find its platable species. Of course it is never found to feed on all the species which it visits, indicating a very strong nutritional preference.

DISCUSSION

It is a known fact that no two species with identical ecological requirements can coexist indefinitely in the same environment. The two can be sympatric only provided that environment in which they inhabit is heterogeneous

Table 1

Species of fungi associated with different species of *Drosophila* observed during August–September 1982.

Sl. No.	Species of *Drosophila*	No. of flies examined	Fungi extracted from body surface	Fungi extracted from crops
1.	*D. ananassae*	22	1. *Penicillium oxalicum*	1. *Penicillium oxalicum*
			2. *Aspergillus niger*	2. *Aspergillus niger*
			3. *Candida* sp.	3. *Candida* sp.
2.	*D. malerkotliana*	21	1. *Aspergillus niger*	1. *Geotrichum* sp.
			2. *Aspergillus lucheunsis*	2. *Cephalosporium* sp.
			3. *Mortiella subtilissima*	3. *Penicillium frequentans*
			4. *Rhizopus nigricans*	—
3.	*D. nasuta*	19	1. *Fusarium* sp.	1. *Fusarium* sp.

(Gause, 1934). The results of the present study on nutritonal preference indicate that sympatric species of *Drosophila* largely depend on different species of fungi to which they use as food. And in some cases the preference is very strong. This is in accordance with Gause's principle which is responsible in large measures for the ecological separation of sympatric species in nature. For instance, *D. ananassae* feeds on *Penicillium oxalicum*, *Aspergillus niger* and a species of the genus *Candida*. Similarly, *D. malerkotliana* feeds on the three species one each of the genera *Geotrichun* and *Cephalosporium* and also on *Penicillium frequentans*. However, *D. nasuta* feeds exclusively only on single *Fusarium* species. Interestingly, no species of fungi is shared by these species of *Drosophila*.

Judging from the literature it is apparent that many species of fungi are pathogenic in nature. For instance, some species of the genus *Candida* are involved in serious skin disorders known as "Candidiasis". Infection of nail fold, caused by a species of the genus *Candida* is often considered to be an occupational hazard of house-wives, whose hands are frequently wet. During the present study it has been found that *D. ananassae* which is purely a domestic species also feeds on one of the species of this genus(probably some other also). It is therefore presumed that *D. ananassae*, always associated with human habitation, may have been a potential agent in spreading a few fungi of some pathogenic nature.

Similarly, species of the genus *Aspergillus*, *Cephalosporium* and *Fusarim* are also known for their pathogenicity. For instance, *Aspergillus* causes a lung disease of birds known as 'Aspergillosis.' Likewise, *Cephalosporium* and *Fusarium* are also known to be involved in some diseases of animals and plants.

Following the results of the present study one is inclined to infer that at least some of the species of *Drosophila* which are very common and wide spread may act as mechanical vectors for spreading these fungi both of pathogenic and non-pathogenic *nature*. However, this preliminary study on their pathogenic involvement is by no means complete, but does show that the genus has more than academic interest. We thus hope that the results of our further study in this field will uncover several facts of some common interest.

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REFERENCES

CARSON, H.L. 1951. *Evolution, 5 :* 91–96.

CARSON, H.L., KNAPP, E.P. and PHAFF, H.J. 1956. *Ecology, 37* : 538–544.

da CUNHA, A.B., DOBZHANSKY, Th. and SOKOLOFF, A. 1951. *Evolution, 5*: 97-101.

DEMEREC, M. 1950. Biology of *Drosophila*, John Wiley and Sons Inc., New york.

DOBZHANSKY, Th. and da CUNHA, A.B. 1955. *Ecology*, 36 : 34–39.

DOBZHANSKY, Th. and PAVAN, C. 1950. *Journal of Animal Ecology, 19* : 1–14.

Gause, G.F. 1934. The struggle for existance, Williams and Wilkins, Baltimore.

KANEKO, A. 1960. *J. Fac. Sci. Hokkaido Univ. Ser. IV. Zool. 14* : 493–498.

PAVAN, C. 1952. Tese fac. Filos. Cien. Letras Univers. Sao Paulo : 108.

PHAFF, H.J., MILLER, M.W., RECCA, J.A., SHIFRINE, M. and MRAK, E.M., 1956. *Ecology, 37* : 533–538.

SHEHATA, A.M., TABEY, El., MRAK, E.M. and PHAFF, H.J. 1955. *Mycologia, 47* : 799–811.

WHEELER, M.R. 1981. The Genetics and Biology of *Drosophila 3a*: 1-79.