



A study on food preference of some species of genus *Drosophila* (Diptera: Drosophilidae) in natural and artificial conditions

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Abstract

Present study was conducted to ascertain food preference in some species of *Drosophila* in natural and artificial condition as well as to determine whether wild type drosophilid grow in artificial food medium or not. Different baits were used to ascertain the food preference. Only 3 species of genus *Drosophila* viz., *Drosophila suzukii*, *Drosophila immigrans* and *Drosophila busckii* were observed from different bait. Flies collected from their natural habitat were transferred to the yeast containing prepared food medium. After 15-20 days of observations, it was found that almost all flies survived in the yeast prepared food medium and within few days, they reproduced to produce offspring with less mortality. On the contrary, when flies were transferred to the yeast free artificial food medium, it was found that all flies had died.

Keywords: food preference, yeast, *Drosophila*, food medium, bait

1. Introduction

Insects are ancient and taxonomically varied group with worldwide distribution and have complex evolutionary history (Speight *et al.*, 2005; ^[14] Sahney *et al.*, 2010) ^[13]. They can tolerate the extreme temperature variations and thus they are adapted to almost every conceivable environment from the equator to the arctic and from sea level to the snowfield of highest mountains. The family drosophilidae is one such group of insects belonging to superfamily ephydroidea, order diptera (McAlpine, 1989) ^[11] composed of 4,460 species and 74 genera (<http://www.taxosdros.unizh.ch/>) ^[1]. Traditionally, the family drosophilidae is divided into two subfamilies, the drosophilinae and the steganinae (Throckmorton, 1962, ^[17] 1975; ^[18] Grimaldi, 1990) ^[7].

Food preferences and the choice of oviposition sites are critical factors for insects such as *Drosophila* and effect many aspects of their lives (Jenning and Seager, 1985) ^[9]. In drosophilids species, the diversity of feeding and breeding habits is astounding. The species may feed and breed exclusively on fruits, tree sap, leaves, stems, flowers, and mushrooms. Carson (1965) ^[3] listed a variety of organic material on which flies feed and breed. Among these, flowers and fruits were prominent. The most important finding was the selection of breeding site by drosophilid which was a major source of the carbohydrate necessary to support the growth. Today, many species still continue with this original feeding habit (Carson 1974) ^[4]. Several species preferred to feed and breed on living or fresh plant such as leaf miners (Frost, 1924⁵) and flower feeders (Pipkin *et al.*, 1966) ^[12]. Kimura (1976) ^[10] observed that some species of *Hirtodrosophila* were attracted towards fresh mushrooms. This suggested that species of *Drosophila* differ in their ability to utilize for food and may be differentiated with respect to their food preferences.

Yeast is considered as a major food source for the majority of species of saprophagous *Drosophila* (Diptera: Drosophilidae) in both adult and larval stages (Begon 1982)

^[2]. The yeast species may hereby differ in composition and quality, depending on both the yeast itself and the environment in which the yeast grows (Ganter, 2006) ^[6]. Various species of *Drosophila* exhibit a specific relation to particular yeast species or groups of yeast species, depending on substrate composition or the biogeographic distribution of the *Drosophila* species (Starmer *et al.*, 1990) ^[15]. In the present study an attempt is made to study the food preferences in some species of genus *Drosophila*.

2. Materials and methods

2.1. Study area

Samples for the present study were collected from Srinagar Garhwal, Uttarakhand. Sites are located at an elevation of 560m a.s.l. Here climate is somewhat sub-tropical in nature. In summer, maximum temperature reaches up to 45°C. May and June are the hottest period of the year. The maximum rainfall ranges from 60-70%, usually in month of August. The winter season starts from October and continues till the end of February.

2.2. Collection method

1. Trap-bait method

Bottles of 250 ml capacity containing fermented fruits viz., orange, apple, papaya, mango, grapes, banana and tomato were used for trap-bait method. Banana has the greatest reputation as *Drosophila* bait, but other seasonal fruits may also serve well. Bottles were hanged on the branches of bushes and trees in low lying shady and humid areas. Flies were removed from the bottle in the morning and evening by aspirator and transferred to fresh vials containing *Drosophila* food medium.

2.3. Identification

The collected flies were categorized and identified under margined stereo zoom microscope with the help of study of genital structure. For identification the detailed structures of male terminalia were dissected with the help of a needle.

After dissection, the male terminalia was cleaned by boiling it in 10% KOH up to 100°C for several minutes followed by keeping it in a droplet of glycerol and then observed under a light microscope. *Drosophila* flies were identified by employing several keys (Sturtevant 1927; [16] Throckmorton, 1962, [17] Gupta 2005) [8].

2.4. Preparation of *Drosophila* artificial food medium

Artificial food medium was prepared by the following method:

1. 9.0gm Agar-agar was boiled with 250 ml water.
2. 2.9.0gm dried yeast (in case of yeast food media), 26.5 gm. maize powder, 24.5gm brown sugar and 2gm nepagin was properly mixed with 250ml water and then it was added with boiled agar- agar solution.
3. 2.0ml propionic acid was added in the cooked food.
4. Prepared media was transferred in vials and bottles up to the 1/3 part.
5. Excess water was removed from the wall of filled vials and bottles.
6. After about one day it was prepared for *Drosophila* laboratory culture.
7. After transferring into the culture vials, flies were kept at a temperature of 25°C. Within few days, larvae, pupae and adult flies were developed.

3. Results & Discussion

Banana, tomato, orange and grapes were used as a bait to ascertain the food preference of drosophilids. Only 3 species of genus *Drosophila* viz., *Drosophila suzukii*, *Drosophila immigrans* and *Drosophila busckii* were observed from different bait. A total of 78 flies of *Drosophila suzukii* were collected from tomato bait with maximum number of flies were observed in the month of August while least number of flies was observed in the month of March. Similarly, 71 and 60 flies of *D. suzukii* were collected from orange and grapes bait respectively with maximum number of flies was observed in the month of August. No fly of *Drosophila suzukii* was observed in the bait of banana (Table 1.1). About 201, 40, 13 and 67 flies of *Drosophila immigrans* were collected from banana, tomato, orange and grapes bait respectively. The maximum numbers of *D. immigrans* flies were observed in the month of August in all baits. No fly of *Drosophila immigrans* was observed from orange bait in the month of March, April and June (Table 1.1). A total of 11, 139, 79 and 112 flies of *Drosophila busckii* were collected from banana, tomato, orange and grapes bait respectively. No fly of *Drosophila busckii* was observed from banana bait in the month of March, May and June (Table 1.1).

Citrus fruits like orange and tomato were preferred by the flies of *Drosophila suzukii* while they showed negligible

Preference on banana. In other cases, banana was highly preferred by *Drosophila immigrans* as compared to orange and tomato. *Drosophila busckii* mostly preferred tomato and grapes while banana was least preferred by these flies.

Three flies of *Drosophila suzukii* collected from their natural habitat were transferred to the yeast containing food medium and was observed for about 10-15days. A total of 26 flies emerged after breeding and these flies were transferred to another fresh food medium. Out of these 26 flies, 20 were survived while rest of 6 were died (Table 1.2). Three flies of *Drosophila immigrans* collected from their natural habitat were transferred to the yeast containing food medium and was observed for about 10-15 days. A total of 48 flies were emerged after breeding and these flies were transferred to another fresh food medium. Out of total, 35 flies were survived and rest of 13 flies died. Similarly, 6 flies of *Drosophila busckii* collected from their natural habitat were transferred to the yeast containing food medium. A total of 28 flies were emerged after breeding and these flies were transferred to another fresh food medium. Out of total, 20 flies were survived and rest of 8 flies died. Four adult flies of *Drosophila suzukii* were transferred to the yeast free prepared food medium and observed for some days. It was observed that all flies died in yeast free food media. Similar results were obtained with flies of *Drosophila immigrans* and *Drosophila busckii* (Table 1.3).

4. Tables and figures



Fig 1: Culture of flies in artificial food medium



Fig 2: Larvae and pupae developed in yeast artificial food medium

Table 1: Monthly variation in the number of *Drosophila* flies collected from different baits

S.no.	Species	Months	Baits				Total
			Banana	Tomato	Orange	Grapes	
1.	<i>Drosophila suzukii</i>	March	0	3	1	5	9
		April	0	6	2	9	17
		May	0	8	5	11	24
		June	0	5	3	3	11
		July	0	22	21	13	56
		August	0	34	39	19	92
	Total		0	78	71	60	209
2.	<i>Drosophila immigrans</i>	March	40	5	0	6	51
		April	10	7	0	8	25

		May	12	6	2	5	25
		June	6	2	0	3	11
		July	60	9	4	16	89
		August	73	11	7	29	120
	Total		201	40	13	67	321
3.	<i>Drosophila busckii</i>	March	0	8	5	2	17
		April	3	12	10	8	33
		May	0	20	15	17	52
		June	0	6	3	9	18
		July	5	34	19	33	91
		August	3	59	27	43	132
	Total		11	139	79	112	343

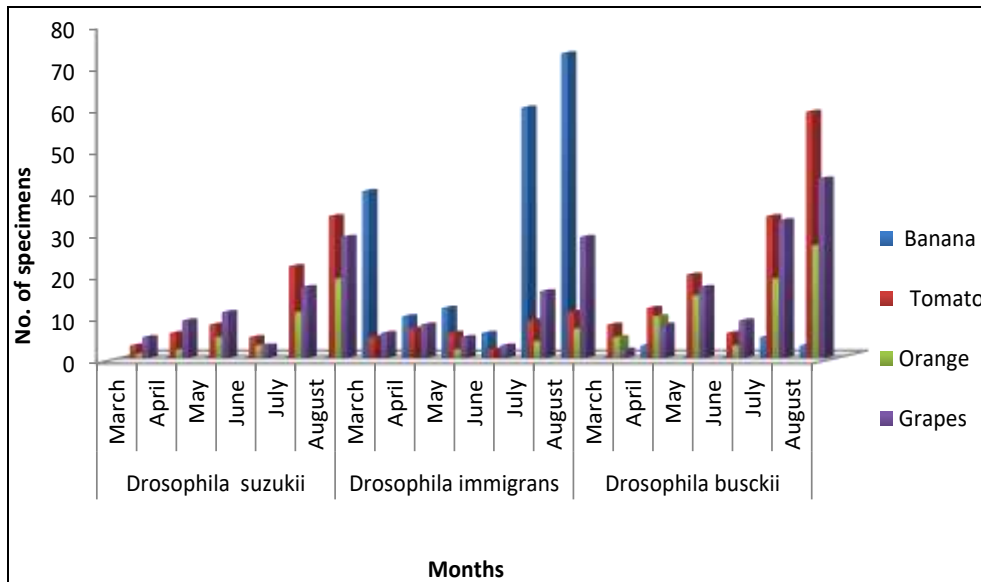


Fig 3: Monthly variation in number of *Drosophila* flies collected from different baits

Table 2: Number of survived and died *Drosophila* flies in yeast artificial food medium

S. No.	Species	No. of flies transferred (yeast medium)	No. of flies emerged	Survived	Died
1.	<i>Drosophila suzukii</i>	3	26	20	6
2.	<i>Drosophila immigrans</i>	3	48	35	13
3.	<i>Drosophila busckii</i>	6	28	20	8

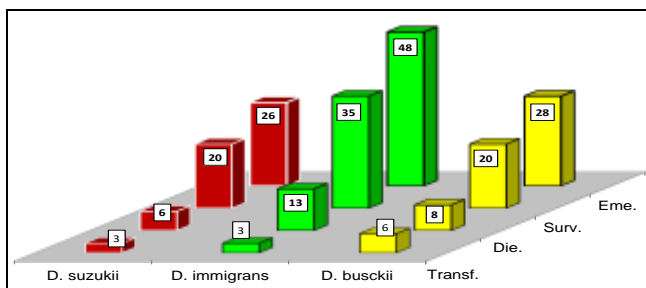


Fig 4: Number of survived and died *Drosophila* flies in yeast artificial food medium

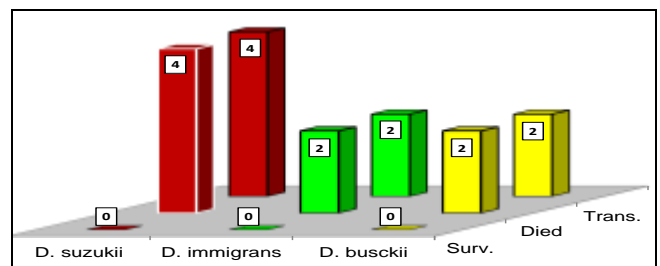


Fig 5: Number of survived and died *Drosophila* flies in yeast free media

Table 3: Number of survived and died *Drosophila* flies in yeast free media

S. No.	Species	No. of flies transferred (yeast free medium)	Survive d	Die d
1.	<i>Drosophila suzukii</i>	4	0	4
2.	<i>Drosophila immigrans</i>	2	0	2
3.	<i>Drosophila busckii</i>	2	0	2

5. Conclusion

Our study indicates that, yeast is an essential component in the artificial culture food medium of *Drosophila* flies and affects many aspects of their lives and development. It has also been consider that, different species of drosophilids differ in their ability to utilize for food and may be differentiated with respect to their food preferences. Further study will be helpful for understanding the ecology of

Drosophilids in future and will provide an output of the local and seasonal variations in drosophilid diversity by placing similar or different fruit baits at different points.

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7. References

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