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STUDIES ON FOOD PREFERENCE OF WHEAT AND WHEAT PRODUCTS TO *TRIBOLIUM CASTANEUM* (HERBST)

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ABSTRACT

Out of seven wheat products (*suji,* wheat flour, *maida, dalia,* whole grain mixed with broken grain, whole grain and biscuits) studied for food preference of *Tribolium castaneum* (Herbst), the maximum fecundity (273.75 eggs), hatchability (83.75%), pupation (84.48%) and adult emergence (62.25%) was recorded on *suji*, while minimum fecundity 18.38 eggs, hatchability (7.75%), pupation (41.92%) and adult emergence (2.25%) was observed in biscuits. The developmental period was maximum (31.00 days) on biscuits, which differed significantly with the whole grain (30.13 days); while minimum (26.25%) (26.25 days) and differed significantly with the wheat flour (28.13 days). Significantly maximum weight loss (4.05%) was recorded in biscuits. The growth index was maximum (15.74) on *suji* followed by wheat flour (14.42) and *maida* (13.75), whereas, minimum (2.62) on biscuits followed by whole grain (3.36). The overall preference on the basis of all the parameters studied was: *suji*> wheat flour > *maida* > *dalia* > whole grain mixed with broken grain > whole grain > biscuits.

Key words: *Tribolium castaneum*, food preference, wheat products

Studies on the food preference by different stored grain pests have attracted the attention of several workers in the past, but comparatively little information is available on the food preference of rust red flour beetle, *Tribolium castaneum* (Herbst). It is an important coleopteran pest of wide variety of stored commodities; *viz.*, flour of cereals, millets, pulses, groundnut, rice, cotton seed and dry fruits. Very scanty information is available on the food preference of *T. castaneum,* therefore, the present study was conducted to investigate the food preference of *T. castaneum* on different wheat products.

MATERIALS AND METHODS

Seven predominating hosts (food) in the locality, *viz.*, whole grain, whole grain mixed with broken grain (10:1), *dalia*, wheat flour, *suji*, *maida* and biscuits were selected for the food preference studies. Sterilization of the different foods was done and conditioned grains were ground with the help of an electric grinder.

The experiment was laid out in completely randomized design. Two pairs of newly emerged adults (0–24 h equal sex) were obtained from the stock culture and were carefully introduced with the help of a camel hair brush into each glass culture jars (100 ml) containing 25 g of different hosts as food materials. The jars were covered with muslin cloth and were kept at 29 ± 1.5°C temperature and 70 ± 5.0 per cent relative humidity. Observations were recorded every day till completion of the experiment. The beetles were allowed to mate and oviposit. Four replications of the culture were maintained. The eggs laid by the beetles were separated with the help of 100 mesh sieve and counted daily till natural death of the female. The viability of eggs was calculated on the basis of total number of eggs laid and total number of grubs emerged. For determining the pupation percentage, larvae pupated out of total larvae was taken into account. Adult emergence (F_1) was recorded at every alternate day. After counting the newly emerged adults, they were discarded from the samples so that further generation could not develop from them. From the day fresh emergence started, the dates and number of adults emerged were recorded twice (morning and evening) daily to work out the total developmental period (egg to adult). The weight loss in flour due to incessant feeding by the grub and adult stage was recorded with the help of an electronic balance after sieving the flour to exclude the excreta and insect stages.

The data were subjected to the statistical analysis and hatchability, pupation and weight loss were expressed as a percentage. The data on fecundity were converted into log X values, whereas, total developmental period and adult emergence into $\sqrt{X}$ for analysis of variance. The percentage values were transformed into angular values (arc in $\sqrt{\text{percentage}}$) for analysis of variance (Gomez and Gomez, 1976). The suitability of hosts was assessed on the basis of number of adults emerged and the length of developmental period, *i.e.*, on the basis of

growth index. The growth index or susceptibility index (S.I.) was calculated on the basis of the following formula (Dobbie, 1977):

$$S.I. = \frac{LogF_1}{D} \times 100$$

Where,

F_1 = Total number of F_1 adults emerged

D = Developmental period

RESULTS AND DISCUSSION

The data on fecundity indicated that the foods, on which the *T. castaneum* was allowed to feed and breed, significantly affected the egg laying capacity (fecundity). The fecundity on different foods differed greatly (18.38 to 273.75 eggs/ female). Maximum numbers of eggs were laid by the females reared on *suji* (273.75 eggs) and stood at par with wheat flour (272.38 eggs) and *maida* (212.00 eggs) but differed significantly from rest of the foods. The minimum fecundity (18.38 eggs) was recorded on biscuits, which differed significantly from rest of the foods. The whole grain (26.38 eggs) and whole grain mixed with broken grain (27.00 eggs) were at par with each other. The descending order of ovipositional preference recorded in different foods was: *suji*, wheat flour, *maida, dalia*, whole grain mixed with broken grain, whole grain and biscuits.

The hatchability on different foods was in the range of 7.75 to 83.75 per cent and differed significantly with each other. The maximum hatchability of the eggs was recorded on *suji* (83.75%) that differed significantly from rest of the treatments. The minimum hatchability (7.75%) was recorded on biscuits followed by whole grain (13.25%), whole grain mixed with broken grain (19.50%), *dalia* (44.25%), *maida* (71.75%) and wheat flour (79.50%). The ascending order of hatchability was found to be biscuits, whole grain, whole grain mixed with broken grain, *dalia, maida*, wheat flour and *suji*.

The pupation percentage on different foods was in the rage of 41.92 to 84.48 per cent. The maximum pupation percentage was recorded on *suji* (84.48%), whereas, minimum on biscuits (41.92%). With respect to the pupation percentage *suji* differed significantly with wheat flour (81.19%), *maida* (77.01%) and *dalia* (52.72%). The pupation percentage on biscuits and whole grain differed non–significantly with each other. The descending order of pupation percentage was recorded to be *suji*, wheat flour, *maida, dalia,* whole grain mixed with broken grain, whole grain and biscuits.

Adult emergence (F_1) recorded in the different foods was in the range of 2.25 to 62.25. The maximum adults emerged from *suji* (62.25), whereas, minimum in biscuits (2.25). The adult emergence from biscuits and whole grain differed non–significantly with each other. The whole grain mixed with broken grain, *dalia* and *maida* ranked in the middle order with respect to the food preference and differed significantly to each other. The descending order of adult emergence was recorded to be *suji*, wheat flour, *maida, dalia*, whole grain mixed with broken grain, whole grain and biscuits.

The developmental period recorded on the various foods varied from 26.25 to 31.00 days. The maximum developmental period was recorded on biscuits (31.00 days), which differed significantly with whole grain (30.13 days). The minimum developmental period was recorded on *suji* (26.25 days) which differed significantly with wheat flour (28.13 days). The developmental period recorded on wheat flour, *maida, dalia*, and whole grain mixed with broken grain ranked in the middle order having 28.13, 28.63, 28.88 and 28.88 days, respectively, however, non–significant difference existed among these treatments. The ascending order of developmental period was *suji*, wheat flour, *maida, dalia*, whole grain mixed with broken grain, whole grain and biscuits.

The maximum loss in weight was noticed for *suji* (4.05%), which was significantly higher over rest of the except wheat flour (3.75%). The minimum weight loss inflicted by *T. castaneum* was recorded in biscuits (0.25%) differed significantly over other foods. On the basis of weight loss inflicted by pest on different foods, the order of preference was: *suji* > wheat flour > *maida*> *dalia* > whole grain mixed with broken grain > whole grain > biscuits.

The growth index of *T. castaneum* reared on different foods ranged from 2.62 to 15.74, being maximum in *suji* (15.74) followed by wheat flour (14.42) and *maida* (13.75). The minimum growth index was recorded on biscuits (2.62) followed by whole grain (3.36), whole grain mixed with broken grain (5.74) and *dalia* (9.81). The order of preference was: *suji* > wheat flour > *maida* > *dalia* > whole grain mixed with broken grain > whole grain > biscuits. The overall preference on the basis of all the parameters studied was: *suji* > wheat flour > *maida* > *dalia* > whole grain mixed with broken grain > whole grain > biscuits.

The present results get support from the findings of Punj (1967) who found the dietic efficiency for *T. castaneum* in the descending order as *suji*, wheat flour, *maida* and maize. Though, food (whole grain, whole grain mixed with broken grain, *dalia*, wheat flour, *suji*, *maida* and biscuits) preference studies on different foods were also conducted by some workers (Sattigi *et al.*, 1995 and Odeyemi *et al.*, 2005), however, they did not include wheat food products.

Table 1. Fecundity, hatchability and pupation percentage of *T. castaneum* on different hosts

S. No.	Food products	Fecundity/ female*	Hatchability (%)**	Pupation percentage**
1.	Wheat flour	272.38 (2.44)	79.50 (63.08)	81.19 (64.30)
2.	*Maida*	212.00 (2.33)	71.75 (57.89)	77.01 (61.35)
3.	*Suji*	273.75 (2.44)	83.75 (66.23)	84.48 (66.80)
4.	*Dalia*	113.50 (2.02)	44.25 (41.70)	52.72 (46.56)
5.	Biscuits	18.38 (1.25)	7.75 (16.16)	41.92 (40.35)
6.	Whole grain	26.38 (1.41)	13.25 (21.35)	45.16 (42.22)
7.	Whole grain mixed with broken grain (10: 1)	27.00 (1.42)	19.50 (26.21)	48.68 (44.24)
	S.Em. ±	0.05	0.46	0.72
	CD at 5%	0.15	1.39	2.16

Data based on two pairs of adults (four replications); * Figures in the parenthesis are log X values; ** Figures in the parenthesis are angular transformed values

Table 2. Adult emergence (F_1), developmental period, weight loss and growth index of *T. castaneum* on different hosts

S.	Food products	Adult emergence (F_1)*	Total developmental period (days)*	Weight loss (%)**	Growth index
1.	Wheat flour	57.75 (7.60)	28.13 (5.30)	3.75 (11.17)	14.42
2.	*Maida*	51.25 (7.16)	28.63 (5.35)	2.35 (8.82)	13.75
3.	*Suji*	62.25 (7.89)	26.25 (5.12)	4.05 (11.61)	15.74
4.	*Dalia*	17.00 (4.12)	28.88 (5.37)	1.20 (6.29)	9.81
5.	Biscuits	2.25 (1.50)	31.00 (5.57)	0.25 (2.87)	2.62
6.	Whole grain	2.75 (1.66)	30.13 (5.49)	0.55 (4.25)	3.36
7.	Whole grain mixed with broken grain (10: 1)	5.25 (2.29)	28.88 (5.37)	0.80 (5.13)	5.74
	S.Em. ±	0.08	0.04	0.20	
	CD at 5%	0.24	0.11	0.59	

Data based on two pairs of adults (four replications); * Figures in the parenthesis are log $\sqrt{X}$ values; ** Figures in the parenthesis are angular transformed values.

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