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GROWTH AND DEVELOPMENT OF *TRIBOLIUM CASTANEUM* (HERBST) (COLEOPTERA: TENEBRIONIDAE) ON CORN FLOURS

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Abstract: The present investigation deals with the effects of corn flour (varieties: NK-40, BARI-5, Khai-Vutta and Hera) on the growth and development of the red flour beetle *Tribolium castaneum* (Herbst). Corn flours produced lighter larvae, pupae and adults in comparison with the control (Wheat+yeast). Corn flours also significantly (P <0.001) lengthened the larval period. The lowest percentage of adults was obtained on Hera flour and the highest on control. There were significant reductions in pupation and adult emergence (%) of the beetle on corn flours. Hera produced the most detrimental effects on *T. castaneum*.

mvi-ms‡¶c: eZgvb M‡elYv KgwU‡Z AvUvi jvj ewUj *Tribolium castaneum* (Herbst) Gi ew× I cwi¯úi‡Yi Dci fÆvi AvUvi (RvZ: NK-40, BARI-5, Khai-Vutta Ges Hera) cfve Av‡jvPbv K‡i| wbqwšZ Lv‡`¨i (M‡gi AvUv + Có) Zjbvq fÆvi AvUv A‡c¶vKZ nvjKv ïKKxU, gKKxU Ges cYv½ †cvKv Drcb K‡i| fÆvi AvUv ïKKx‡Ui w¯wZKvj‡KI ZvrchcYfv‡e (P<0.001) `xNwqZ K‡i| kZKiv nv‡i m‡ewbg cYv½ †cvKv cvIqv hvq Hera Rv‡Z Ges m‡ev"P wbqwšZ Lv‡`¨| gKKxU Drcv`b Ges cYv½ †cvKv †ei"‡bvi nvi (%) fÆvi AvUvi ZvrchcYfv‡e K‡g hvq| Hera RvZwU *T. castaneum*- Gi Dci mev‡c¶v †ekx ¶wZKi cfve †d‡j|

Key words: *Tribolium castaneum*, corn flours, growth, development.

INTRODUCTION

The red flour beetle *Tribolium castaneum* (Herbst) is a serious pest of a great variety of stored products and is cosmopolitan in distribution. It lives on flour, cracked grain or breakfast food or meal (Chapman 1931). It also feeds on chocolate, spices, peppers, peas, oil seeds, semolina, coffee, cocoa, beans and various kinds of nut and sometimes feeds on specimens in insect collection (Good 1933). *Tribolium* species contaminate flour more than they consume it. Their feeding and metabolic activities alter the colour of the flour into pinkish, with an offensive odour and disgusting taste (Mondol 1983). Stored products insects pose many problems associated with insecticidal treatment. According to Geier (1966), one way to control insect pests is to modify intrinsically favourable habitats in such a way that they no longer provide adequate environments for the pest population concerned, e.g. by furnishing unsuitable sources of food. Recently, there is a growing interest in insect pest control through nutritional regulations.

Among cereals grown in Bangladesh, corn (*Zea mays*) is the third most important crop after rice and wheat. Corn has gained an increasingly important attention by the Government. This is mainly due to the huge demand of corn, particularly for poultry feed industry.

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OBJECTIVE

The following investigation was undertaken to determine the effect of the flours of different corn varieties, *viz. NK-40, BARI-5, Khai vutta* and *Hera,* on the growth and development of *T. castaneum*, which seemed very much promising from the point of nutritional regulation of the pests.

MATERIAL AND METHODS

The adult beetles collected from the culture maintained in the Department of Zoology, Rajshahi University were put on a thin layer of whole meal flour previously passed through a fine sieve in a petri dish. The eggs were collected by sieving the flour and were incubated at room temperatures 29 ± 2 °C in a petri dish. Newly hatched larvae, 250 larvae for each food, were transferred to glass jars (20×8 cm) containing 250 g control (whole meal flours + yeast, 19:1) and corn flours of the varieties, *NK-40*, *BARI-5*, *Khai-vutta* and *Hera*.

The mature larvae were collected from the culture, cleaned carefully with a soft brush and weighed individually on an electric balance. The pupae emerged from the larvae were sexed examining the exogenital processes of the females under a microscope (model Swift Stereo, Eighty) by following Halstead (1963). The male and female pupae were weighed individually immediately after the larval-pupal ecdysis. The sexed pupae were put on separate petri dishes for adult emergence (%) and the freshly emerged adults were weighed individually according to their sex on an electric balance. The experiment was replicated three times with the same number of insects. The larval and pupal periods, and the percent pupation and adult emergence were also carefully recorded. The growth indices (GIs) of *T. castaneum* on different feeds were calculated using the following formula (Saxena 1969):

$$\text{G.I.} = \frac{\text{Adult emergence (\%)}}{\text{Total larval + pupal periods}}$$

The experiment was conducted at a room temperature of 29 ± 2°C.

RESULTS AND DISCUSSION

The mean weight at different developmental stages of *T. castaneum* is presented in Table 1. The corn flours significantly reduced the growth of *T. castaneum* in the following order: wheat flour (control) > NK-40 > BARI-5 > Khai-Vutta > Hera as shown by analysis of variance and LSD-test. The corn flours also significantly prolonged the larval period (Table 2). The suitability of the feeds was in the following order : wheat flour (control) > NK-40 > BARI-5 > Khai-Vutta > Hera. The pupal period was not significantly lengthened (Table 2). There

was no significant distorsion of the typical Mendelian sex-ratio of 1:1 in the beetle due to rearing on different flours (Table 3). There were also reductions in pupation and adult emergence (%) in the insect when reared on corn flours (Table 3)

Table 1. Effect of corn flours on the growth of *T. castaneum* (N=45 for each food).

Food	Weight of mature larvae (mg) Mean±SD	Weight of pupae (mg) Mean ± SD		Weight of adults (mg) Mean ± SD	
		Male	Female	Male	Female
Wheat flour (control)	3.30±0.56	2.69±0.34	3.04±0.32	2.34±0.44	2.63±0.47
NK-40	3.06±0.74	2.52±0.48	3.08±0.34	2.28±0.41	2.52±0.43
BARI-5	2.78±0.53	2.34±0.47	2.99±0.52	2.21±0.46	2.52±0.52
Khai-Vutta	2.90±0.36	2.38±0.48	2.92±0.48	2.15±0.44	2.50±0.45
Hera	2.69±0.51	2.25±0.41	2.42±0.43	1.73±0.35	2.04±0.35
F-value	10.56	6.83	18.01	14.82	11.84
	(P<0.001)	(P<0.01)	(P<0.001)	(P<0.001)	(P<0.001)
LSD-value	0.18	0.17	0.17	0.17	0.25

*Higher significant at P = 0.001.

Table 2. Effect of corn flours on the developmental periods of *T. castaneum* (days). (P > 0.001)

Food	Larval period				Pupal period				
	No.	Mean ± SD	C.V. (%)	t-value	No.	Mean ± SD	C.V. (%)	t-value	Probability
Wheat flour (control)	712	18.67±0.76	4.07	-	681	7.5±0.5	6.67	-	-
NK-40	720	21.00±0.50	2.38	14.74*	676	7.67±0.29	3.78	1.00	insignificant
BARI-5	668	22.83±0.29	1.27	19.10*	614	8.17±0.76	9.30	1.50	insignificant
Khai-Vutta	669	23.17±0.29	1.25	14.75*	594	8.17±0.29	3.55	1.99	insignificant
Hera	616	23.00±0.50	2.17	7.30*	596	7.33±0.29	2.81	6.45	(P<0.001)

*Highly significant at P = 0.001

Table 3. Effect of corn flours on the sex-ratio, pupal recovery and adult emergence (%) and growth index of *T. castaneum*.

Foods	Male (%)	Female (%)	Male: Female	χ^2-value	Pupation (%)	Adults emergence (%)	G.I.
Wheat flour (control)	53.65	46.35	1:0.86	3.80	94.93	90.80	3.47
NK-40	52.69	47.31	1:0.90	0.56	96.00	90.13	3.14
BARI-5	46.79	53.21	1:1.14	1.94	89.07	81.87	2.64
Khai-Vutta	48.61	51.39	1:1.06	2.76	89.20	79.20	2.53
Hera	47.24	52.76	1:1.12	1.88	82.13	75.60	2.27

Note: GI = growth index

According to Gopalan *et al.* (1981), *NK-40* contains 66.70% carbohydrates, 11.90% proteins and 3.70% fat; *BARI-5* contains 65.20% carbohydrates, 4.25% proteins and 3.25% fat, and *Khai-vutta* contains 62.45% carbohydrates, 10.87%

proteins and 2.77% fat. The differential susceptibility of *T. castaneum* to the experimental corn flours is due to the chemical composition of these foods. When a food lacks in essential components, the metabolic functions are deprived of normal and optimum activities. Thus abnormal nutrition in insect can result in disease and mortality and in the choice of diets (House 1963, 1967a, 1967b), slow growth and development (House 1966), curtailed feeding (House 1965a, 1965b) and low population density at a given amount of food (Gordon 1959). Hosen *et al.* (2004) obtained similar results working with the tenebrionid *Alphitobius diaperinus* .

The perusal of the data shows that corn flours significantly reduced the growth and development of *T. castaneum*. This means that corn flours will significantly reduce the population build up in the pest, and obviously, there will be a reduced rate of infestation. This seems to be promising from the point of nutritional regulation of the pest.

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