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## Screening of wheat varieties for resistance against *Tribolium castaneum* Herbst

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### Abstract

The varieties of wheat screened for resistance against *Tribolium castaneum* revealed that none of the variety was immune. The maximum developmental period of this insect (30.83 days each) was recorded in Raj-4083 and Raj-1482. The minimum developmental period (29.67 days) was observed in Raj-4120. The minimum adults (68.83) were emerged from variety Raj-1482 followed by Raj-4083 (155.50), Raj-3765 (163.17) and Raj-3077 (175.67). Maximum number of adults (223.00) emerged from Raj-4120 followed by Raj-1972 (219.33), Raj-3777 (218.33) and Raj-1555 (216.83). The maximum weight loss (5.53%) was recorded in Raj-4120, whereas, minimum (1.27%) in Raj-1482. The varieties Raj-1972, Raj-1555, Raj-3777, Raj-4037, Raj-6560, Raj-3077, Raj-3765 and Raj-4083 stood in the middle order to reveal the weight loss caused by *T. castaneum*. The maximum growth index (18.22) was obtained in variety, Raj-4120 followed by Raj-1972 (17.97) and Raj-3777 (17.95). The minimum growth index was obtained in Raj-1482 (13.73) followed by Raj-4083 (16.37). The growth index in other varieties was found in the middle order.

**Keywords:** *Tribolium castaneum*, wheat, resistance, growth index, developmental period

### Introduction

The economic losses caused to the major grains by insect pests are not only the actual material consumed by them but also the amount contaminated with their excreta which render food unfit for human consumption. Today thousands of tonnes of the food grains and their products are damaged by the ravages of the pests that not only cause quantitative loss but also qualitative and aesthetic changes in food grains. Stored product insect pests diminish the food value of a product, initiate pathogens, parasites and toxins ultimately making grains and their products unpalatable.

Insect infestation, causing losses are the most serious problems in grain storage, particularly in villages and towns in developing countries because of humid-tropical conditions, poor sanitation and inappropriate storage facilities (Semple, 1985) [4]. In the present scenario, food quality and management efficiency are the most important guidelines for planning and for any decision making process, it is even more important that all people responsible for storage and conservation of agricultural products concentrate their efforts to reduce the high level of product loss. Although, there are about 200 species of insects and mites found infesting grains but few are serious pests. The wheat and wheat products are attacked by number of different insect pests under storage conditions, among them the rust red flour beetle, *Tribolium castaneum* (Herbst) (Tenebrionidae: Coleoptera) is a cosmopolitan species causing considerable losses as secondary pest. Both the larva and adult cause damage, but the former is more destructive.

The development, population build-up and degree of infestation caused by insect pests depend on type of food. Unfortunately, very little attention has been paid to this aspect of the relationship between the food and the insect development. The present investigations were, therefore, carried out with a view to study the suitability of several hosts in the development of pest and extent of damage caused to different types of foods. It is well known fact that food constituents play a vital role in the survival and reproductive potential of the insects. The grain characters also interfere with the normal physiology or feeding of the insects, affect adversely the biology of the pest and make a variety resistant to insect attack. Although, grains of almost all the varieties of wheat grown in the country are infested by stored grain pests but the extent of damage is influenced by the physical and chemical characters of the variety. Keeping this in view, an attempt has been made to study the growth and development of this pest on some promising wheat varieties.

### Materials and methods

The seeds of different varieties of wheat (Raj-3765, Raj-4037, Raj-6560, Raj-4083, Raj-1972, Raj-3077, Raj-3777, Raj-1555, Raj-4120 and Raj-1482) were procured from Wheat breeder, Agricultural Research Station, Durgapura, Jaipur. The experiment was laid out in a completely randomized design with three replications. The sound and healthy grains of different varieties were selected after mechanical separation. The grains were sterilized in oven at 60°C for five hours to avoid any hidden infestation. The sterilized grains were grinded with a grinder and converted into broken grain. A sample of 25 g of each variety was taken in glass jar (200 ml). Two pairs of newly emerged adults of equal sex (0-24 hours old) were released in each glass jars.

The observations were recorded on developmental period (egg to adult), number of adults emerged ( $F_1$ ), weight loss and growth index or susceptibility index. The developmental period of *T. castaneum* (egg to adult emergence) on different varieties of wheat was also recorded. The adult emergence ( $F_1$ ) was recorded at every alternate day. The weight loss due to incessant feeding by the grubs and adults was recorded after sieving the flour.

The per cent values of weight loss were transferred into angular values (arc sine  $\sqrt{\text{percentage}}$ ) and developmental period and adult emerged into  $\sqrt{x}$  values. The growth index or susceptibility index (S.I.) was worked out on the basis of the formula given by Dobbie, (1977)<sup>[1]</sup>:

$$\text{S.I.} = \frac{\text{Log } F_1}{D} \times 100$$

Where,

$F_1$  = Total number of  $F_1$  adults emerged

D = Developmental period

### Results and discussion

The resistant varieties provide insect pest management free of cost as no extra input is required to store these varieties. The resistance is the major component of integrated pest management (IPM) programme. In the present investigations, the varieties evaluated for resistance against *T. castaneum* were Raj-3765, Raj-4037, Raj-6560, Raj-4083, Raj-1972, Raj-3077, Raj-3777, Raj-1555, Raj-4120 and Raj-1482 and were procured from Wheat Breeder, Agricultural Research Station, Durgapura, Jaipur. The observations on developmental period, number of adults emerged ( $F_1$ ), weight loss and growth index were taken as the criteria to judge the resistance. Similar parameters were studied by Tiwari and Sharma (2002)<sup>[6]</sup> and Meena *et al.* (2010)<sup>[2]</sup> to judge the resistance in the varieties.

The data revealed that the developmental period recorded in various wheat varieties ranged from 29.67 to 30.83 days

(Table-1, fig.1). The maximum developmental period was recorded in Raj-4083 and Raj-1482 (30.83 days each). The minimum developmental period was recorded in Raj-4120 (29.67 days). The maximum and minimum developmental period differed non-significantly to each other. The descending order of developmental period in different varieties was found to be: Raj-1482, Raj-4083, Raj-3765, Raj-3077, Raj-6560, Raj-4037, Raj-1555, Raj-3777, Raj-1972 and Raj-4120. These results partially corroborate with the findings of Naga *et al.* (2008)<sup>[3]</sup> and Meena *et al.* (2010)<sup>[2]</sup> as few varieties matched with the present investigations.

The  $F_1$  adults emerged was in the range of 68.83 to 223.00. The minimum adults were emerged from Raj-1482 (68.83), Raj-4083 (155.50) Raj-3765 (163.17) and Raj-3077 (175.67) and stood statistically non-significant to each other. The maximum number of adults were emerged from Raj-4120 (223.00), Raj-1972 (219.33), Raj-3777 (218.33) and Raj-1555 (216.83) and remained statistically at par to each other. Rests of the varieties were in the middle order to reveal the adult emergence. The descending order of adult emergence was recorded as: Raj-4120, Raj-1972, Raj-3777, Raj-1555, Raj-4037, Raj-6560, Raj-3077, Raj-3765, Raj-4083 and Raj-1482. These results partially get support from the findings of Naga *et al.* (2008)<sup>[3]</sup>.

The weight losses inflicted by *T. castaneum* in different varieties of wheat were in the range of 1.27 to 5.53 per cent. The minimum weight loss was recorded in variety Raj-1482 (1.27%) which differed significantly over rest of the varieties. Maximum weight loss was observed in Raj-4120 (5.53%) and stood significantly inferior to other varieties. The other varieties remained in the middle order to reveal the weight loss by *T. castaneum* infestation. On the basis of weight loss caused by the pest in different wheat varieties, the resistance in ascending order was: Raj-1482, Raj-4083, Raj-3765, Raj-3077, Raj-6560, Raj-4037, Raj-1555, Raj-3777, Raj-1972 and Raj-4120. Syed *et al.* (2001)<sup>[5]</sup> considered the weight loss as main index of susceptibility of resistance but none of the varieties of present study matched with the varieties of their studies. However, results partially corroborate with the findings of Naga *et al.* (2008)<sup>[3]</sup> and Meena *et al.* (2010)<sup>[2]</sup>.

The growth index of *T. castaneum* reared on different varieties ranged from 13.73 to 18.22, being maximum in variety, Raj-4120 (18.22) followed by Raj-1972 (17.97) and Raj-3777 (17.95). The minimum growth index was recorded in Raj-1482 (13.73) followed by Raj-4083 (16.37). The growth index in other varieties was found in the middle order. On the basis of growth index of different wheat varieties, the resistance in descending order was found to be: Raj-4120, Raj-1972, Raj-3777, Raj-1555, Raj-4037, Raj-6560, Raj-3077, Raj-3765, Raj-4083 and Raj-1482. This could not be discussed due to unavailability of suitable references in the literature. Further, none of the wheat varieties was found immune to the incidence of *T. castaneum*.

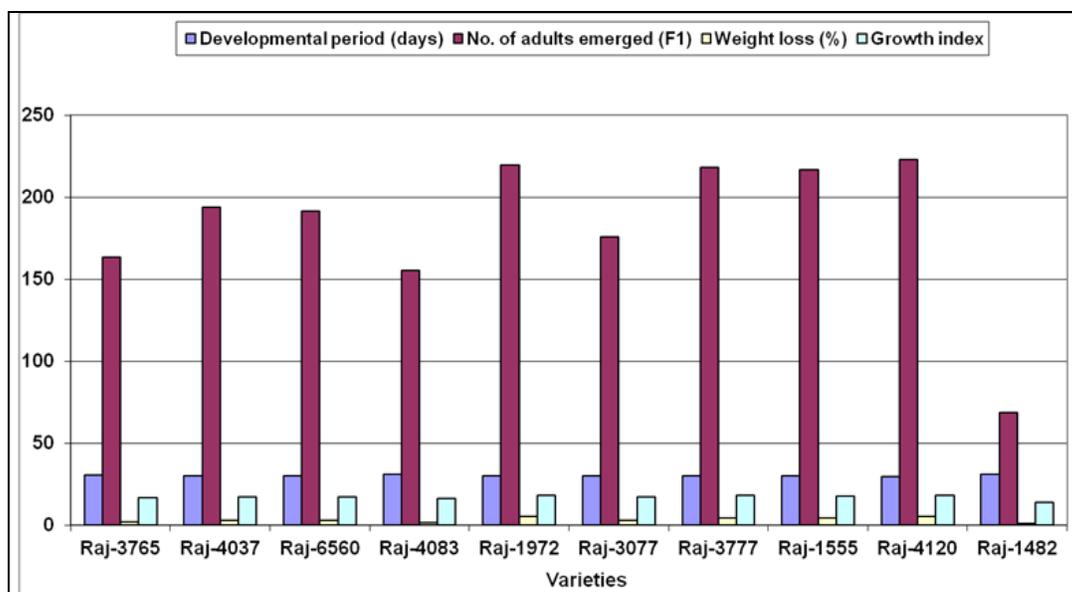
**Table 1:** Developmental period, adult emergence (F<sub>1</sub>), weight loss and growth index of *T. castaneum* on different wheat varieties

S.No.	Varieties	Developmental period (days) *	No. of adults emerged (F <sub>1</sub> ) *	Weight loss (%)**	Growth index
1	Raj-3765	30.70 (5.54)	163.17 (12.77)	2.07 (8.27)	16.60
2	Raj-4037	30.17 (5.49)	194.00 (13.93)	2.93 (9.86)	17.42
3	Raj-6560	30.17 (5.49)	191.50 (13.84)	2.87 (9.75)	17.42
4	Raj-4083	30.83 (5.55)	155.50 (12.44)	1.73 (7.56)	16.37
5	Raj-1972	30.00 (5.48)	219.33 (14.81)	5.13 (13.09)	17.97
6	Raj-3077	30.17 (5.49)	175.67 (13.25)	2.80 (9.63)	17.13
7	Raj-3777	30.00 (5.48)	218.33 (14.78)	4.60 (12.38)	17.95
8	Raj-1555	30.17 (5.49)	216.83 (14.73)	4.47 (12.21)	17.83
9	Raj-4120	29.67 (5.45)	223.00 (14.93)	5.53 (13.60)	18.22
10	Raj-1482	30.83 (5.55)	68.83 (8.30)	1.27 (6.47)	13.73
	S.Em. <sub>±</sub>	0.17	0.19	0.15	
	CD at 5%	NS	0.57	0.44	

Data based on two pairs of adults (three replications)

\* Figures in the parenthesis are  $\sqrt{X}$  values

\*\* Figures in the parenthesis are angular transformed values

**Fig 1:** Development period, adult emergence (F<sub>1</sub>), weight loss and growth index of *T. castaneum* on different wheat varieties

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