



SCREENING OF WHEAT VARIETIES FOR THEIR RESISTANCE AGAINST *RHIZOPERTHA DOMINICA* (FAB.)

KAVITA KUMAWAT*, B.S. RANA AND ARVIND VERMA

Department of Entomology, Rajasthan College of Agriculture, MPUAT, Udaipur- 313001 (Raj.)

*kumawatkavita2008@rediffmail.com

ABSTRACT

The present investigation was conducted under laboratory conditions in the Department of Entomology, Rajasthan College of Agriculture, Udaipur during March, 2013 to June, 2014. Fifteen varieties were screened i.e. Raj-4037, HI-153, MP-1234, HI-8627, GW-366, HI-1500, KRL-1-4, HI-1544, Lok-1, MPO-1203, HD-2932, MPO-1215 and HI-1567 against *Rhizopertha dominica*. Minimum adult emergence (15.53 adults), longest duration of life cycle (51.33 days), lowest grain damage (22.17 per cent) and lowest weight loss (7.64 per cent) was recorded in Raj -4037, while maximum adult emergence (54.30 adults), shortest duration of life cycle (35.00 days), maximum grain damage (60.48 per cent) and maximum weight loss (22.64 per cent) was recorded in HI-1567. Out of fifteen varieties screened Raj-4037, HI-153, MP-1234, HI-8627, GW-366, MP-3288 and HI-1500 were found moderately resistant while Anuradha, KRL-1-4, HI-1544, Lok-1, MPO-1203, HD-2932 and MPO-1215 were susceptible and HI-1567 was the highly susceptible variety.

Key words: *Rhizopertha dominica*, wheat varieties, grain damage, weight loss, susceptible index

INTRODUCTION

Wheat is infested by many insect pests in field as well as under storage. Although, there are about 200 species of insects and mites found infesting wheat grains, few of them are major as primary pests. Among different stored grain pests, the lesser grain borer, *Rhizopertha dominica* (Fab.) is an important internal feeder and so far considered as secondary pest, but has emerged as a primary pest feeding on various stored grains (Campbell and Sinha, 1976). *R. dominica*, attacks a wide range of stored cereals such as barley, paddy, wheat, maize and sorghum. It also infests various other commodities including pulses and dried cassava root. With the help of strong jaws it can also damage any part of wooden structure to tide over unfavorable conditions. The beetle is a strong flier, spreads with great rapidity and is also found attacking wheat in the field. Both the adult and larvae bore into healthy kernels of grain, reducing them to hollow husk. It not only feeds on food grains but also affects their nutritional and baking quality as well as germination capacity (Patel and Vekaria, 2013).

So far very little work has been carried out on the evaluation of different varieties of wheat grains against *R. dominica* which is major pest causing significant economic losses during storage. The resistant varieties to the pest if explored, would provide post harvest

protection free of cost. Resistant varieties are an important component, which is one of most economic and ecofriendly approaches of pest management during storage. Therefore, keeping all these facts in view the present studies were undertaken.

MATERIAL AND METHODS

1. Maintenance of stock culture

The nucleus culture of lesser grain borer, *R. dominica* Feb. was obtained from post-harvest Division CTAE, Udaipur, which was further mass multiplied and maintained throughout the experimental period in the laboratory of Department of Entomology, Rajasthan College of Agriculture, on wheat grains (variety Lok-1). The grains were sterilized at 55°C for 6 hours in order to eliminate both apparent and hidden infestation of insects and mites, if any. These grains were conditioned at least for a week in an incubator maintaining 28±2°C and 60 ± 5 per cent relative humidity to raise their moisture content. These grains were used for mass rearing of the insect using glass jars of 2 liter capacity. The adults so emerged were used for further experimentation.

2. Method of observation

To study the varietal susceptibility, fifteen different varieties of wheat were collected from the Department of Agronomy, Rajasthan College of Agriculture, Udaipur.

These seeds were conditioned before use as described in the maintenance of insect culture. Moisture content of the test cultivar was estimated with OSAW universal moisture meter and maintained at 12 per cent as per the method described by Prakash *et al.* (1987).

Table 1. Varieties of wheat tested for their relative susceptibility

1. MP-1234	6. MP-3288	11. GW-366
2. Raj -4037	7. HI-1544	12. HD-2932
3. HI-8627	8. HI-153	13. HI-1500
4. Anuradha	9. Lok-1	14. HI-1567
5. KRL-1-4	10. MPO-1203	15. MPO-1215

From each variety, 100 g healthy seeds were taken in plastic jars of 250 ml capacity and replicated thrice in a Complete Randomized Design, wherein 10 pairs of newly emerged adults of *R. dominica* were released in each container. The mouth of container was covered with muslin cloth and tightened with rubber band. After 10 days of oviposition the insects (dead/live) were removed and then the containers were kept at the same experimental condition for F_1 progeny emergence. The following parameters were taken to compare the varietal susceptibility of wheat against *R. dominica*.

F_1 Progeny Emergence: The grains were examined after 25 days of the release of test insect daily for the observation of first generation of *R. dominica*. The newly emerged adults were counted and removed regularly to check further breeding.

Mean developmental period: The total number of days taken by the test insect for completing its life cycle from oviposition to adult emergence was recorded on different varieties.

Insect weight: The weight of newly emerged adults was recorded.

Susceptibility index: Based on the number of beetles that emerged in each test variety and mean developmental period; susceptibility index was calculated with the help of following formula (Dobie, 1977).

$$\text{Susceptibility index} = \frac{\log_e F_1}{D} \times 100$$

Where F_1 is the total number of adults emerged in first generation and D is the median developmental period in days (Dobie, 1977).

The susceptible index ranging from 0 to 11 was used to categorize the wheat varieties considering 0 to 3 resistant, 4 to 7 moderately resistant 8 to 10 susceptible and more than 11 highly susceptible.

After three months per cent grain damage and weight loss was calculated using the equation suggested by Khattak *et al.* (1987):

$$\text{Grain damage (\%)} = \frac{\text{No. of damaged grains}}{\text{Total number of grains in the sample}} \times 100$$

$$\text{Weight loss (\%)} = \frac{\text{Initial weight} - \text{final weight}}{\text{Initial weight}} \times 100$$

The data were subjected to statistical analysis by means of analysis of variance (ANOVA) and significant means were compared using Duncan's new multiple range test at 5% level of significance.

RESULTS AND DISCUSSION

The varieties screened for resistance against *R. dominica* were MP-1234, Raj-4037, HI-8627, Anuradha, KRL-1-4, MP-3288, HI-1544, HI-153, Lok-1, MPO-1203, GW-366, HD-2932, HI-1500, HI-1567 and MPO-1215. The observations on F_1 progeny that emerged, development period, per cent grain damage, per cent weight loss and susceptible index were recorded (Table 2).

Adult emergence (F_1):

The number of adults emerged (Table 2) from different wheat varieties ranged from 15.53 to 54.30. The maximum number of adults, 54.30 emerged in HI-1567 followed by 46.10, 42.13, 40.47 and 39.63 in KRL-1-4, Lok-1, HD-2932 and MPO-1203 varieties, respectively; however, these were statistically at par. Minimum number of adult emergence (15.53) was recorded in cultivar Raj-4037 followed by 17.80, 21.40 and 24.0 in HI-153, MP-3288 and MP-1234, respectively, that were statistically at par. The order of preference of wheat varieties for the adult emergence of *test insect* in a descending order were HI-1567 > KRL-1-4 > Lok-1 > HD-2932 > MPO-1203 > HI-1544 > Anuradha > MPO-1215 > HI-1500 > GW-366 > HI-8627 > MP-1234 > MP-3288 > HI-153 > Raj-4037. Similar results have also been reported earlier by Mahla *et al.* (2005) who reported maximum population was recorded in Raj-3037 and at par to Lok-1 (94.50%). Nemaram and Bhargava (2012) reported minimum population (65.55%) in Raj-4037; whereas, maximum in Lok-1(77.77%). Lal *et al.* (2014) screened five wheat varieties against *R. dominica* and found that the Lok-1 was most susceptible as it recorded the highest population built up (26.25 adults).

Mean development period (days):

The data on mean duration of life cycle of *R. dominica* on different wheat varieties are presented in Table (2). It is apparent from the data that mean duration of life cycle varied from 35.00 to 51.33 days. The shortest developmental period of 35.00 days was observed on HI-1567, which significantly differed with

Table 2. Screening of different wheat varieties against *Rhizopertha dominica*.

S.N.	Variety	F ₁ emergence/pairs	Development period	Grain damage(%)	Weight loss (%)	Susceptibility index	Resistance category
1.	MP-1234	4.95 (24.0)	48.67	34.62 {32.27}	19.75 {11.42}	6.12	Moderately resistant
2.	Raj-4037	4.00 (15.53)	51.33	28.09 {22.17}	16.05 {7.64}	4.95	Moderately resistant
3.	HI -8627	5.20 (26.53)	48.33	37.03 {36.26}	21.13 {13.00}	6.52	Moderately resistant
4.	Anuradha	5.96 (35.0)	44.67	43.09 {46.66}	22.79 {15.00}	7.74	Susceptible
5.	KRL-14	6.83 (46.10)	37.33	48.09 {55.38}	25.41 {18.41}	9.99	Susceptible
6.	MP-3288	4.68 (21.40)	49.67	31.73 {27.66}	18.63 {10.20}	5.74	Moderately resistant
7.	HI -1544	6.14 (37.20)	42.33	41.23 {43.45}	23.57 {15.99}	8.42	Susceptible
8.	HI -153	3.54 (17.80)	50.00	29.98 {24.97}	17.11 {8.66}	5.16	Moderately resistant
9.	Lok-1	6.51 (42.13)	39.00	49.56 {57.92}	26.80 {20.33}	9.12	Susceptible
10.	MPO-1203	6.34 (39.63)	41.33	43.86 {48.00}	24.25 {16.87}	8.69	Susceptible
11.	GW-366	5.35 (28.17)	47.67	36.15 {34.79}	20.64 {12.43}	6.68	Moderately resistant
12.	HD -2932	6.40 (40.47)	39.67	17.13 {53.71}	24.62 {17.35}	9.25	Susceptible
13.	HI-1500	5.63 (31.20)	47.00	39.68 {40.77}	21.39 {13.30}	7.02	Moderately resistant
14.	HI-1567	7.40 (54.30)	35.00	51.05 {60.48}	28.41 {22.64}	11.09	Highly Susceptible
15.	MPO-1215	5.85 (33.67)	46.67	40.76 {42.63}	22.09 {14.14}	7.49	Susceptible
	S.E.m±	0.38	0.52	1.14	0.56	0.54	
	CD(P=0.05)	1.11	1.50	3.29	1.63	1.56	

Figures in parentheses retransformed square root ($x \pm 0.5$) values.

Figures in {} are retransformed per cent values.

KRL-1-4 (37.33 days). The maximum developmental period was recorded on Raj-4037 (51.33 days) followed by HI-153 (50.00 days). The descending order in the duration of life cycle on wheat varieties was HI-1567 < KRL-1-4 < Lok-1 < HD-2932 < MPO-1203 < HI-1544 < Anuradha < MPO-1215 < HI -1500 < GW-366 < HI-8627 < MP-1234 < MP-3288 < HI-153 < Raj-4037. The present results corroborate with the findings of Singh *et al.* (2001) who observed that the developmental period of *R. dominica* on different wheat varieties varied from 39.82 to 43.29 days. Mahla *et al.* (2005) reported 35.11 days development period in Lok-1, that was found susceptible. Nemaram and Bhargava (2012) reported developmental period of 50.53 days in Raj- 4037; whereas, 41.65 days in Lok-1.

Grain damage and weight loss (%):

The data presented in Table (2) reveal that a significant difference was observed among different wheat varieties in terms of damaged grains and weight loss due to infestation of *R. dominica*. The extent of grain damage and weight loss ranged from 22.17 to 60.48 per cent and 7.64 to 22.64 per cent in different varieties. Maximum grain damage and weight loss 60.48 and 22.64 per cent, respectively was recorded in HI-1567 followed by 57.92 and 20.33 in Lok-1, which were statistically at par. Minimum grain damage (22.17%) and weight loss (7.64%) per cent was recorded in Raj-4037 followed by 24.97 and 8.66 per cent in HI-153, but was statistically at par. The descending order of grain damage by *R. dominica* in different wheat varieties were HI-1567 > Lok-1 > KRL-1-4 > HD-2932 > MPO-1203 > Anuradha > HI -1544 > MPO-1215 > HI -1500 > HI-8627 > GW- 366 > MP-1234 > MP- 3288 > HI-153 > Raj- 4037. Similar results have also been reported earlier by Singh *et al.* (2003), who reported the percentage of loss range from 7.35 to 14.65 and 12.00 to 21.25 in different cultivars Lok-1, HI-1077, GW-173, Raj-3077, DL-8033, Kalyansona, HD-2236 and GW-190 after 45 and 60 days of released test insect, respectively. Mahla *et al.* (2005) reported grain damage (35.11%) and weight loss (3.77%), in Lok-1, that was found susceptible. Nemaram and Bhargava (2012) reported 19.75 and 7.35 per cent grain damage and weight loss in Raj- 4037, respectively; whereas, in Lok-1, 24.84 and 12.50 grain damage and weight loss per cent. Our results on grain damage and weight loss are in agreement with Bhargava and Hussain (2014) who reported that grain damage and weight loss were 17.32 to 45.79 and 6.15 to 18.50 per cent, respectively in 15 varieties of wheat against lesser grain borer. Lal *et al.* (2014) screened five wheat varieties against *R. dominica* and found that Lok-1 had highest grain damage (20.28 %) and weight loss.

Susceptibility index:

On the basis of observations recorded it is evident that none of the tested varieties were completely free

from the attack of *R. dominica*. However, on the basis of susceptible index, tested varieties could be categorized as moderately resistant, susceptible and highly susceptible. Susceptible index of different wheat varieties ranged from 4.95 to 11.09. Varieties Raj-4037, HI-153, MP-3288, MP-1234, HI-8627 and GW-366 were categorized as moderately resistant, which had susceptible index between 4.95 to 6.68 and remaining except HD-1567 were susceptible, which had susceptible index between 7.02-9.99; whereas, HD- 1567 was highly susceptible (Table 2). Similar results were also reported earlier by Samyal *et al.* (2006) and Sayed *et al.* (2006). Mahla *et al.* (2005) and Lal *et al.* (2014) screened five wheat varieties against *R. dominica* and found that Lok-1 was most susceptible.

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