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Susceptibility of different wheat varieties/ genotypes to lesser grain borer, *Rhyzopertha dominica* (Fabricius)

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Abstract

A Laboratory experiment on “Susceptibility of different wheat varieties/ genotypes to lesser grain borer, *Rhyzopertha dominica* Fabricius” was carried out at PG research laboratory, Department of Entomology, College of Agriculture, Navsari Agricultural University, Bharuch during 2020-21. Among ten wheat varieties/genotypes (GADW-1, GADW-3, N-820, N-817, N-814, N-810, N-807, N-813, N-809, N-811) screened against *R. dominica* on stored wheat. N-813 and N-809 were found resistant which exhibited minimum seed damage of 25.09% and 25.94%, minimum per cent weight loss of 11.77% and 14.64% and higher per cent germination 58.45% and 53.64% respectively, at 180 days after storage. So far as population build up of *R. dominica* in varieties/genotypes is concerned, minimum adults (61.33 and 44.47) were emerged in genotypes N-813 and N-809, respectively at 180 days of storage. Variety GADW-3 and N-811 were found susceptible as it recorded higher seed damage 44.44% and 40.44%, higher weight loss 35.79% and 33.72% and minimum germination 14.30% and 22.69% as well as higher population build up 390.33 and 367.00, respectively.

Keywords: Genotypes, germination, lesser grain borer, seed damage, susceptibility, wheat

Introduction

Wheat is the staple food of more than 60% world population and most of the people of South West Asia, about 90% of Wheat grown in the world is produced and consumed in Asia. It is a crop of tropical climate and also grown in sub-humid tropical. In world, India is on the second position in wheat among the cereal in respect of area. China is on the first position in production followed by India and Russia, but USA is the first in productivity followed by Japan and China. In India UP is on the first position in respect of area and production followed by Haryana but the productivity was the highest in Punjab.

Wheat crop is relatively safe from insect in field but the seed of wheat suffer relatively high losses during storage. In stored wheat, a number of insect pest *Sitotroga cerealella* Olivier, *Ephestia cautella* walker Olivier, *Rhyzopertha dominica* Fab., *Tribolium castaneum* clae, *Trogoderma granarium* (Everest) are found to damage the grains. Among these, lesser grain borer, *Rhyzopertha dominica* Fabricius is major insect pest of wheat and also known Australian wheat weevil.

In India the damage of stored grains by insect pests was estimated to 6.5 percent of the total grain storage (Raju, 1984) ^[10]. About 39 species of insect pests attack the stored grains and grain produce. Out of these the lesser grain borer (*Rhyzopertha dominica* Fabricius) (Coleoptera: Bostrichidae) (Adedire, 2001) ^[1] caused heavy losses of stored food grain quantitatively and qualitatively throughout the world (Arannillewa *et al.* 2002).

The lesser grain borer, *R. dominica* is a primary pest of stored grain, with the great economic importance in the Republic of Serbia and many regions of the world. A lot of research was conducted which dealt with the influence of the species and variety of the plant on the development of *R. dominica* and occurrence of the progeny (Arthur *et al.*, 2013; Astuti *et al.*, 2013; Metwaly *et al.*, 2015; Pires, 2016) ^[2,3,8,9]. However, there are no studies in which adults of *R. dominica* have been directly exposed to small grains and assessed the influence of these species on progeny production and feeding preferences. Among the various pest management components, the use of resistant varieties under IPM seems to be one of the most effective, eco-friendly and cheapest methods to prevent the loss due to insect-pest in field as well to as in storage. In view of above mentioned facts, the present investigation was carried out to identify the tolerant genotypes to lesser grain borer.

Materials and Methods

Study site

The study on *R. dominica* was carried out during 2020 in the P. G. Research Laboratory, Department of Entomology, College of Agriculture, NAU, Bharuch.

Disinfestations of grains

The required quantity of wheat grains were collected. The wheat grain was sterilized at 55 °C temperatures in an oven for four hours for disinfecting it. The seeds then were kept in refrigerator for condensation purpose for 24 hours to make it suitable for pest infestation. The sterilized wheat grain were used to maintain the culture for experimental needs.

Preparation and maintenance of main culture of *R. Dominica*

For preparation of stock culture adult borer of *R. dominica* were collected from infested grains of shop keeper. Five pair of adults were released in glass jar (20 x 15cm) containing 250g of disinfested wheat grains. The top of the jar was covered with muslin cloth and tied with the help of rubber band to avoid the escape of adults as well as entry of other insects. The glass jar was kept in incubator at 27 ± 1 °C temperature and 70% relative humidity. After emergence, a

pair of freshly emerged adult weevil from the laboratory-maintained culture was used to study various aspects.

Methodology

The study on susceptibility of different wheat varieties/genotypes against lesser grain borer, *R. dominica* was carried out during 2020 in the P. G. Research Laboratory, Department of Entomology, College of Agriculture, NAU, Bharuch. Lesser grain borer was reared on grains of ten different varieties/genotypes of wheat repeated thrice to study the reaction of pest. The healthy, sound, unaffected grains of each varieties/genotypes were dried in hot air oven for six hours at 42 °C in order to eliminate the infestation by store grain pests. The moisture content of grains was 10.7 ± 2 per cent. For the study 100 g grains of each varieties/genotypes was kept in plastic bottle having 500 ml capacity. Five pairs of five days old lesser grain borer adult were introduced in each bottle and top was kept covered with muslin cloth and tightly fixed with rubber band. These were kept in observations up to 180 days. Each bottle was examined periodically at 30, 90 and 180 days after storage to note the per cent loss of weight of seed, percentage of damaged seeds, per cent germination and population build up of pest. The data were subjected to statistical analysis.

Table 1: List of different varieties/genotypes

1.	GADW- 1 (C)	9.	N- 810
2.	GADW- 3 (C)	10.	N- 807
3.	N- 820	11.	N- 813
4.	N- 817	12.	N- 809
5.	N- 814	13.	N- 811

Results and Discussion

Per cent Seed Damage

The data on per cent seed damage and weight loss were presented in Table 2 and Fig. 1 and 2. The data were recorded at 30, 90 and 180 days after storage. Among different genotypes, N-813 recorded significantly minimum seed damage of (2.45%) followed by N-809 (3.24%) and N-810 (5.56%). On other hand, significantly maximum (13.27%) seed damaged was observed in GADW- 3 and it was at par with N-817(12.74%) and N-811 (12.72%) after 30 days of storage. After 90 days of storage, genotype N-809 and N-813

recorded significantly minimum seed damage of (14.28% and 14.34%), respectively than rest of the varieties/genotypes screened and both were at par with each other. Variety GADW-3 significantly maximum damage (26.74%) but was at par with N-811 (26.35%) and N-817 (25.91%). Genotype N-813 recorded significantly minimum (25.09%) seed damage after 180 days of storage followed by N-809 (25.94%). Significantly higher (44.44%) seed damage was exhibited in GADW-3 followed by N-817 (41.74%) and N-811 (40.44%).

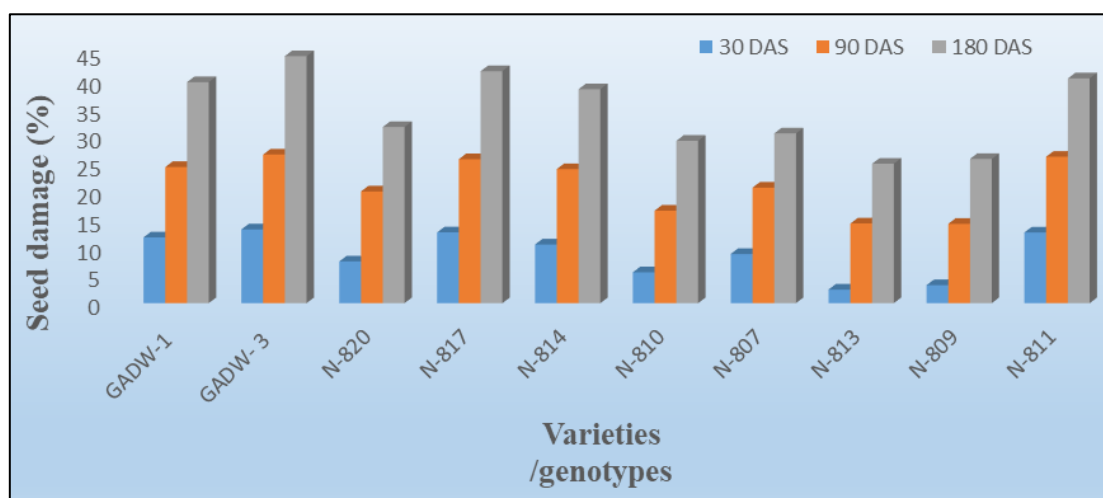


Fig 1: Per cent seed damage in different wheat varieties/genotypes due to *R. dominica*

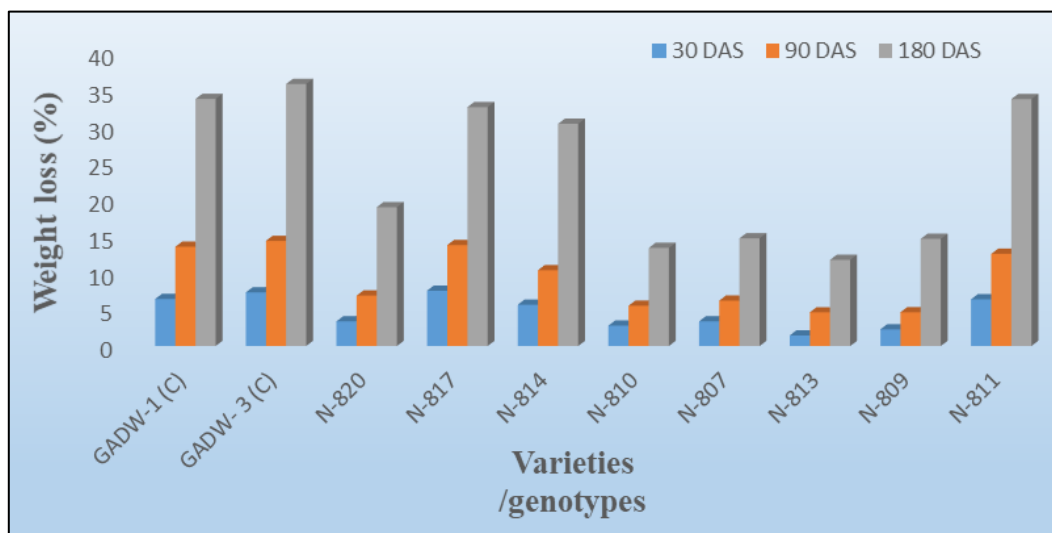


Fig 2: Per cent weight loss in different wheat varieties/genotypes due to *R. dominica*

Per cent Weight Loss

After 30 days of storage, the data on per cent weight loss revealed that genotype N-813 recorded significantly minimum (1.45%) weight loss followed by N-809 (2.28%) and N-810 (2.79%). Genotypes N-817 (7.56%) and GADW-3 (7.32%) exhibited significantly higher weight loss as compared to rest of the genotypes screened and both were at par with each other.

After 90 days, genotype N-813 (4.60%) and N-809 (4.62%) recorded significantly minimum weight loss among the

varieties/genotypes screened and both were at par with each other. Varieties GADW- 3 (14.36%) had significantly higher weight loss and was at par with N-817 (13.79%) and GADW- 1 (13.56). After 180 days, genotype N-813, N-810 and N-809 recorded significantly lower weight loss of 11.77%, 13.40% and 14.64, respectively. Variety GADW-3 (35.79%) exhibited significantly the highest weight loss followed by GADW-1 (33.72%), N-811 (33.73%) and N-817 (32.62%). The later three were at par with each other.

Table 2: Seed damage and weight loss in different wheat varieties/genotypes due to *R. dominica*

Sr. No.	Varieties /Genotypes	Seed Damage (%) DAS			Weight loss (%) DAS		
		30	90	180	30	90	180
1.	GADW-1	20.12bc (11.83)	29.67b (24.50)	39.04cd (39.67)	14.70b (6.43)	21.61ab (13.56)	33.51b (33.73)
2.	GADW- 3	21.38a (13.27)	31.14a (26.74)	41.81a (44.44)	15.70a (7.32)	22.27a (14.36)	36.75a (35.79)
3.	N-820	15.92e (7.52)	26.64c (20.10)	34.26e (31.69)	10.69d (3.37)	15.34d (6.90)	25.82d (18.96)
4.	N-817	20.92ab (12.74)	30.60a (25.91)	40.25b (41.74)	15.97a (7.56)	21.80ab (13.79)	34.83b (32.62)
5.	N-814	18.96c (10.55)	29.42b (24.12)	38.35d (38.49)	13.74c (5.64)	18.77c (10.35)	33.56c (30.35)
6.	N-810	13.64f (5.56)	24.08d (16.64)	32.72f (29.21)	9.63e (2.79)	13.58e (5.51)	21.48f (13.40)
7.	N-807	17.31d (8.85)	27.13c (20.79)	33.55e (30.54)	10.56d (3.37)	14.43de (6.20)	22.55e (14.70)
8.	N-813	9.02h (2.45)	22.26f (14.34)	30.06h (25.09)	6.92g (1.45)	12.39f (4.60)	21.07f (11.77)
9.	N-809	10.37g (3.24)	22.21e (14.28)	30.62g (25.94)	8.69f (2.28)	12.42f (4.62)	22.50f (14.64)
10.	N-811	20.90ab (12.72)	30.89a (26.35)	39.49c (40.44)	14.65b (6.39)	20.79b (12.59)	35.50b (33.72)
S. E.m. ±		0.40	0.29	0.24	0.47	0.38	0.28
C. D. at 5%		1.18	0.86	0.71	1.39	1.13	0.84
C. V. (%)		4.12	3.85	4.17	4.35	3.83	4.72

Note: 1 Figures in the parentheses are retransformed values and those outside are arcsine transformed values.

2. The letters in common are not significantly differ at 5% level of significance.

Per cent Seed Germination

The data on seed germination and population build up were presented in Table 3. The data were recorded at 30, 90 and 180 days after storage. Among the different wheat varieties/genotypes, genotype N-813 recorded significantly the highest seed germination of (66.36%) at 30 days of storage followed

by N-810 (64.41%) and N-809 (64.28%). Significantly minimum per cent seed germination was observed in GADW- 3 (51.91%) which was followed by N-817 (53.62%). After 90 days of storage, genotype N-813 recorded significantly the highest (61.11%) seed germination followed by N-809 (57.45%). Significantly minimum per cent seed germination

was observed in GADW- 3 (27.70%) and followed by N-817 (34.86%). After 180 days of storage, significantly the maximum seed germination was obtained in genotype N-813 (58.45%) followed by N-809 (53.64%). Variety GADW-3 exhibited significantly minimum (14.30%) seed germination followed by GADW-1 (22.69%), N- 817 (22.85%) and N-814 (23.96%).

Population Buildup

After 30 days of storage, significantly minimum number of adults were emerged in genotype, N-810 (4.47) and at par with N-809 (4.56) and N-807 (4.83). Significantly maximum number of adults were emerged in GADW- 3 (12.57) which was followed by N-811 (11.50) and GADW-1 (10.78). After 90 days, genotype N-813 and N-820 were at par with each other but significantly minimum (16.27 and 17.23,

respectively) adults were emerged followed by N-810 (18.40). Significantly maximum number of adults were emerged in GADW- 3 (243.17) followed by N-811 (173.00) and GADW-1 (147.00). Significantly minimum number (44.47) of adults were emerged in genotype N-809 followed by N-807 (53.17). On other hand, significantly maximum number of adults were emerged in GADW- 3 (390.33) followed by N-811 (367.00) and GADW-1 (344.60). Many research workers viz., Kher and Jhala (2009) [6], Meenakshi and Srivastava (2010) [7], Khanzada *et al.* (2011) [5], Kakade *et al.* (2014) [4] and Saad *et al.* (2018) [11] screened different wheat varieties/genotypes against *R. dominica*. However, results of present investigation could not be compared with the result of other research workers as the wheat varieties/genotypes selected in present investigation are local one which were not evaluated elsewhere for their susceptibility to *R. dominica*.

Table 3: Percentage seed germination and Population build up in different wheat varieties/genotypes due to *R. dominica*

Sr. No.	Varieties /Genotypes	Seed germination (%) DAS			Population build up DAS		
		30	90	180	30	90	180
1.	GADW-1	49.36d (57.58)	38.40f (38.58)	28.45f (22.69)	3.36bc (10.78)	12.14c (147.00)	18.58c (344.60)
2.	GADW- 3	46.10f (51.91)	31.76i (27.70)	22.22g (14.30)	3.61a (12.57)	15.61a (243.17)	19.77a (390.33)
3.	N-820	53.06bc (63.88)	47.04c (53.55)	42.72c (46.02)	2.79ef (7.33)	4.21gh (17.23)	7.87g (61.77)
4.	N-817	47.08e (53.62)	36.19h (34.86)	28.56f (22.85)	3.16cd (9.47)	5.88d (34.13)	9.32d (86.33)
5.	N-814	49.14d (57.20)	37.26g (36.45)	29.31f (23.96)	2.98de (8.40)	5.74d (32.47)	8.71e (75.30)
6.	N-810	53.38b (64.41)	40.43e (42.05)	33.46e (30.39)	2.23g (4.47)	4.34g (18.40)	8.07f (64.73)
7.	N-807	52.40c (62.77)	42.90d (46.33)	38.66d (39.02)	2.31g (4.83)	5.07e (25.20)	7.32h (53.17)
8.	N-813	54.55a (66.36)	51.42a (61.11)	49.87a (58.45)	2.70f (7.10)	4.09h (16.27)	7.86g (61.33)
9.	N-809	53.30b (64.28)	49.29b (57.45)	47.09b (53.64)	2.24g (4.56)	4.72f (21.84)	6.71i (44.47)
10.	N-811	49.30d (57.30)	40.23e (41.71)	34.42e (31.95)	3.46ab (11.50)	13.17b (173.00)	19.17b (367.00)
S. E.m. ±		0.23	0.31	0.40	0.07	0.06	0.07
C. D. at 5%		0.69	0.90	1.18	0.21	0.19	0.20
C. V. (%)		4.79	3.27	4.96	4.30	5.53	5.07

Note: 1 Figures in the parentheses are retransformed values and those outside are arcsine transformed values.

2. The letters in common are not significantly differ at 5% level of significance.

Conclusions

A laboratory experiments were conducted to study the “susceptibility of different wheat varieties/ genotypes to lesser grain borer, *R. dominica*” was carried out at P. G. Research laboratory, College of Agriculture, Navsari Agricultural University, Bharuch (Gujarat) during, 2020. Overall, it can be concluded that wheat genotypes, N-813, N-809 and N-810 were found to be less susceptible; while genotype N-817 and variety GADW-1 and GADW-3 were more susceptible to *R. dominica*.

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