

SUSCEPTIBILITY OF MAIZE VARIETIES TO *Rhyzopertha dominica* (FABRICIUS) UNDER STORAGE CONDITION

JILU, V. S., BORAD, P. K*. AND PATEL, R. D.

DEPARTMENT OF ENTOMOLOGY
B. A. COLLEGE OF AGRICULTURE
ANAND AGRICULTURAL UNIVERSITY,
ANAND- 388 110, GUJARAT, INDIA

*E-mail: pkb5458@yahoo.com

ABSTRACT

Three laboratory trials for three different aspects, population growth, weight loss and germination loss were carried out at Department of Agricultural Entomology, B. A. College of Agriculture, Anand Agricultural University, Anand during 2010-11 using ten different maize varieties/ genotypes for their susceptibility to lesser grain bore *R. dominica* under storage condition. The variety CML 269 had lowest number of adult emergence (3.30) and it was at par with Amber (3.62) and GM 2 (4.98). The per cent weight loss in stored maize after 6 months due to infestation of *R. dominica* indicated that the weight loss was lowest in case of CML 269 (1.40%) and it was at par with Amber (1.56%), GM 2 (1.63%) and Narmada Moti (1.72%). The germination loss after 6 months due to infestation of *R. dominica* was lowest in CML 269 (13.03%) and it was at par with Amber (13.62%) and GM 2 (13.74%). The varieties/ genotypes CML 269, Amber, GM 2, Narmada Moti and GM 6 comes under tolerant category based on all the three parameters can be considered as tolerant. Madhuri and HM 5 were also tolerant based on population growth and weight loss. Variety GM 4 falls under less susceptible category and GM 3 under more susceptible category. Variety HQPM 1 was highly susceptible to *R. dominica* based on population growth and weight loss.

KEY WORDS: Lesser grain borer, maize, *Rhyzopertha dominica*, susceptibility

INTRODUCTION

Maize, *Zea mays* L., belongs to family Graminae is the most versatile crop with wider adaptability in varied agro-ecologies. In India, maize is the third most important food crop after rice and wheat. It is cultivated in 7.27 million hectare with a production of 15.86 million tonne (Anon. 2011). Grain produced should be stored to meet home consumption and for sale. Insect pests are causing enormous losses in terms of quality, quantity and germination of seeds. Under storage conditions, maize grains suffer heavy loss due to rice weevil, khapra beetle, lesser grain borer and angoumois grain moth (Jitender *et al.*, 2001). *R. dominica* along with *Sitophilus spp.* ranks as the most important pest of stored cereals worldwide. Lesser grain borer appears to be

most closely associated with stored products in the storage environment. The grub and adult cause damage to grains by feeding inside them. The most eco-friendly method to manage lesser grain borer is to use maize varieties, which are resistant to storage insect pests.

MATERIALS AND METHODS

Three different laboratory trials were carried out at Department of Agricultural Entomology, B. A. College of Agriculture, Anand Agricultural University, Anand during 2010-11 to study the susceptibility of maize varieties/genotypes to *R. dominica* in stored condition. Ten varieties/genotypes of maize were evaluated.

Evaluation based on population growth

Three samples of maize grain each of 50 g (one sample for one repetition) of each variety/genotype were filled in plastic tube (6 cm height and 5 cm diameter) individually. Twenty adults of *R. dominica* (5 to 10 days old) were released in each tube for egg laying and each tube was covered with two-fold muslin cloth kept in position using rubber band. The adults were discarded from each tube after 7 days. The observations on number of adults (live + dead) developed in each repetition were made after 6 months of storage.

Evaluation based on weight loss

100 grains were collected randomly from each sample and segregated into grains damaged by lesser grain borer and germ eaten grain. The damaged grains, germ eaten and 100 undamaged grains were weighed using monopan electronic balance. Based on data, the per cent loss in weight was calculated using the formula given by Srivastava *et al.* (1973).

Evaluation based on germination loss

For these, three samples of maize grains were drawn from each treatment. The test was carried out on circular Whatman No.1 filter paper kept in petri-plates (diameter 10 cm) and moist for germination of seeds. The seeds were spread on germination paper at uniform distance in the petri-plates. The petri-plates were covered with the lid carrying the moist filter paper and kept in a seed germinator maintained at $21 \pm 1^\circ\text{C}$ temperature and 95 ± 2 per cent relative humidity. Small quantity of distilled water was sprinkled on filter paper once a day to keep it moist. The number of grains germinated was counted after 7 days of incubation. Based on germination counts, the percentage of germination before and 6 months after adult release, per cent loss in germination was worked out for each varieties/genotypes.

Categorization of varieties

The maize varieties/genotypes were grouped into four categories of susceptibility to *R. dominica* viz., tolerant, less susceptible, more susceptible and highly susceptible based on three parameters viz., population growth, per cent loss in weight and germination loss. For the purpose,

mean value of individual variety ($\bar{X}_i$) was compared with mean value of all varieties/genotypes ($\bar{X}$) and standard deviation (SD) following the scale as adopted by Patel *et al.* (2002).

RESULTS AND DISCUSSION

Evaluation based on population growth

The variety CML 269 had lowest number of adult emergence (3.30) and it was at par with Amber (3.62) and GM 2 (4.98) (Table 1). Variety, Narmada Moti had adult mortality of 5.65 and it was equally effective as GM 2. These varieties were less susceptible to *R. dominica* than rest of the varieties. The adult emergence was 11.47, 12.32 and 12.97 in GM 6, Madhuri and HM 5, respectively and they were at par with each other. Among the tested varieties, significantly higher (45.33) adult emergence was found in HQPM 1 followed by GM 3 (29.97) and GM 4 (18.68).

Evaluation based on weight loss

The data on per cent weight loss in stored maize after 6 months due to infestation of *R. dominica* (Table 1) indicated that the weight loss was lowest in case of CML 269 (1.40%) and it was at par with Amber (1.56%), GM 2 (1.63%) and Narmada Moti (1.72%). The weight loss due to *R. dominica* was almost equal in case of GM 6 (2.11%), Madhuri (2.22%), HM 5 (2.26%) and GM 4 (2.35%). The variety GM 3 had higher (3.10%) weight loss and it was at par with GM 4. Among the evaluated genotypes/varieties, HQPM 1 was found to be most susceptible to *R. dominica* with significantly highest weight loss (7.16%).

Evaluation based on germination loss

The germination loss after 6 months due to infestation of *R. dominica* (Table 1) was lowest in CML 269 (13.03%) and it was at par with Amber (13.62%) and GM 2 (13.74%). Variety, Narmada Moti and GM 6 had germination loss of 22.55 and 29.27 per cent, respectively and they did not differ significantly. Madhuri (32.69%) and HM 5 (33.75%) were found statistically at par with GM 6 in germination loss. The highest (58.80%) germination loss was found in HQPM 1 and it was at par with GM 3 (52.91%).

Categorization of varieties for susceptibility

Based on population growth, the varieties/ genotypes CML 269 (3.30), Amber (3.62), GM 2 (4.98), Narmada Moti (5.65), GM 6 (11.47), Madhuri (12.32) and HM 5 (12.97) had adult emergence less than 14.83 were considered as tolerant to *R. dominica*. Variety GM 4 (18.68) recorded adult emergence of more than 14.83 to less than 28.31 was considered as less susceptible. The variety GM 3 (29.97) had adult emergence between 28.31 and 41.79 was more susceptible to *R. dominica*. Maize variety HQPM 1 (45.33) recorded adult emergence more than 41.79 which comes under highly susceptible category (Table 2).

According to per cent loss in weight, CML 269 (1.40), Amber (1.56), GM 2 (1.63), Narmada Moti (1.72), GM 6 (2.11), Madhuri (2.22), HM 5 (2.26) and GM 4 (2.35) recorded less than 2.55 per cent weight loss and they were categorized in to tolerant. Variety GM 3 (3.10) recorded weight loss between 2.55 and 4.24 per cent was considered as less susceptible. None of the varieties fall under more susceptible category. Variety HQPM 1 (7.16) comes under highly susceptible category with more than 5.94 per cent weight loss (Table 2)

Based on per cent loss in germination, CML 269 (1.40), Amber (1.56), GM 2 (1.63), Narmada Moti (1.72) and GM 6 (2.11) recorded less than 31.48 per cent loss in germination and they were categorized in to tolerant. Madhuri (32.69), HM 5 (33.75) and GM 4 (44.39) were less susceptible with germination loss ranging from 31.48 to 47.93 per cent. GM 3 (52.91) and HQPM 1 (58.80) were more susceptible to *R. dominica* with germination loss of 47.93 to 64.39 per cent. None of the variety was highly susceptible with respect to germination loss (Table 2).

CONCLUSION

The varieties/ genotypes CML 269, Amber, GM 2, Narmada Moti and GM 6 comes under tolerant category based on all the three parameters can be considered as tolerant. Madhuri and HM 5 were also tolerant based on population growth and weight loss. Variety GM 4 falls under less susceptible category and GM 3 under more susceptible category. Variety HQPM 1 was highly susceptible to *R. dominica* based on population growth and weight loss.

REFERENCES

- Anonymous (2011). All India, area, production and yield of maize along with coverage under irrigation (<http://dacnet.nic.in>).
- Jitender, K., Kashyap, N. P. and Sharma, S. D. (2001). Pests of maize and their management in Himachal Pradesh - A review. *Agric. Rev.*, **22** (1): 47-51.
- Patel, I. S., Prajapati, B. G., Patel, G. M. and Pathak, A. R. (2002). Response of castor genotypes to castor semilooper, *Achaea janata* Fab. *J. Oilseeds Res.*, **19** (1) : 153-154.
- Srivastava, P. K., Tripathi, B. P., Girish, G. K. and Krishnamurthy, K. (1973). Studies on the assessment of losses. *Bull. Grain Tech.*, **11** (2): 129-139.

Table 1: Susceptibility of maize varieties/genotypes to *R. dominica* based on population growth, weight loss and germination loss after 6 months of storage

Varieties/Genotypes	Number of Adults emerged *	Weight Loss (%) **	Germination Loss (%) **
GM 2	2.34 (4.98)	7.33 (1.63)	21.76 (13.74)
GM 3	5.52 (29.97)	10.14 (3.10)	46.67 (52.91)
GM 4	4.38 (18.68)	8.81 (2.35)	41.78 (44.39)
GM 6	3.46 (11.47)	8.35 (2.11)	32.75 (29.27)
Narmada Moti	2.48 (5.65)	7.54 (1.72)	28.35 (22.55)
HQPM 1	6.77 (45.33)	15.52 (7.16)	50.07 (58.80)
HM 5	3.67 (12.97)	8.65 (2.26)	35.52 (33.75)
Amber	2.03 (3.62)	7.17 (1.56)	21.66 (13.62)
Madhuri	3.58 (12.32)	8.56 (2.22)	34.87 (32.69)
CML 269	1.95 (3.30)	6.79 (1.40)	21.16 (13.03)
S. Em. ±	0.15	0.45	1.58
C. D. at 5 %	0.43	1.33	4.65
C. V. %	7.00	8.79	8.17

Figures in parentheses are retransformed values, those outside are $\sqrt{x+0.5}$ * and arc sine ** transformed values

Table 2: Categorization of different varieties/genotypes of maize for their susceptibility to *R. dominica* based on different parameters

Category of Resistance	Scale	Varieties/Genotypes
Based on number of adults emerged		
$\bar{X} = 14.83$	SD = 13.48	
Tolerant	$\bar{X}_i < 14.83$	CML 269 (3.30), Amber (3.62), GM 2 (4.98), Narmada Moti (5.65), GM 6 (11.47), Madhuri (12.32), HM 5 (12.97)
Less susceptible	$\bar{X}_i > 14.83 < 28.31$	GM 4 (18.68)
More susceptible	$\bar{X}_i > 28.31 < 41.79$	GM 3 (29.97)
Highly susceptible	$\bar{X}_i > 41.79$	HQPM 1 (45.33)
Based on per cent loss in weight		
$\bar{X} = 2.55$	SD = 1.69	
Tolerant	$\bar{X}_i < 2.55$	CML 269 (1.40), Amber (1.56), GM 2 (1.63), Narmada Moti (1.72), GM 6 (2.11), Madhuri (2.22), HM 5 (2.26), GM 4 (2.35)
Less susceptible	$\bar{X}_i > 2.55 < 4.24$	GM 3 (3.10)
More susceptible	$\bar{X}_i > 4.24 < 5.94$	--
Highly susceptible	$\bar{X}_i > 5.94$	HQPM 1 (7.16)
Based on per cent loss in germination		
$\bar{X} = 31.48$	SD = 16.46	
Tolerant	$\bar{X}_i < 31.48$	CML 269 (13.03), Amber (13.62), GM 2 (13.74), Narmada Moti (22.55), GM 6 (29.27),
Less susceptible	$\bar{X}_i > 31.48 < 47.93$	Madhuri (32.69), HM 5 (33.75), GM 4 (44.39)
More susceptible	$\bar{X}_i > 47.93 < 64.39$	GM 3 (52.91), HQPM 1 (58.80)
Highly susceptible	$\bar{X}_i > 64.39$	--

[MS received: July 20, 2012]

[MS accepted: August 27, 2012]