

Susceptibility of maize varieties/ genotypes against *Sitophilus oryzae* Linnaeus under storage condition

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ABSTRACT

Investigations on maize varieties/ genotypes for their susceptibility against *Sitophilus oryzae* Linnaeus in storage were carried out at Anand Agricultural University, Anand during 2009-10. Among various varieties/ genotypes, the less number of adults emerged in Madhuri, GYC 9006 and GYC 9666. The weight loss due to infestation of *S. oryzae* was lower in these varieties. After six month of storage, higher germination occurred in Madhuri and GYC 9006. On the basis of categorization, varieties/ genotypes Madhuri, GYC 9006, GYC 9666, GM 3 and HQPM 1 fall under all the three parameters and were considered as tolerant to *S. oryzae*. Varieties GM 4, GM 6 and Narmada Moti were grouped as susceptible, whereas GM 2 and Pratap Makka Hybrid 1 were more susceptible.

Key words: *S. oryzae*, susceptibility, maize varieties/ genotypes

Sitophilus oryzae Linnaeus is one of the most noxious pests among the various pests associated with stored maize. The weight loss of 18.3 per cent in maize was recorded throughout the developmental period of *S. oryzae* grub (Adams, 1976). Initial infestation of maize grain occurs in the field just before harvest and insects are carried into the store where the population builds up rapidly (Adedire and Lajide, 2003). Feeding by larvae make large cavities inside grains while, newly emerging adults leave behind large ragged emergence holes. Adults cause further damage by feeding, mainly by attacking previously damaged grains. Infestations of *S. oryzae* produces a lot of heat and moisture, encourages extensive quality loss. Heavily infested grains give bad smell and sometimes black fungus also develops. The relative susceptibility of maize varieties/ genotypes to *S. oryzae* were studied by many research workers at different places (Guzzo *et al.*, 2002, Hasan-ul *et al.*, 2002 and Santos *et al.*, 2006). However, research on identification of maize

varieties/ genotypes resistant or susceptible to the stored grain pests in Gujarat is very limited, whereas development of new varieties and identification of genotypes are the continuous process. Therefore, to know the relative susceptibility of maize varieties/ genotypes to *S. oryzae*, an experiment was carried out at AAU, Anand.

MATERIALS AND METHODS

The *S. oryzae* culture collected from tribal area of Gujarat was maintained at laboratory of Entomology on maize variety GM 6 and used for the susceptibility study. The population growth, weight loss and loss in germination were taken to evaluate relative susceptibility to *S. oryzae*. All the experiments were carried out in Completely Randomized Design with three repetitions.

Evaluation based on adult emergence

For the assessment of population growth of *S. oryzae*, three samples each of 50 g of maize grain drawn from of each variety/ genotype and filled in

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plastic tube (6 cm height and 5 cm diameter) individually. Twenty adults of *S. oryzae* (5 to 10 days old) were released in each tube and it 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

For the purpose, 100 grains were collected randomly from each sample and segregated into weevilled grain and germ eaten grain. The weevilled, 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

Three samples (one sample as one repetition) of maize grains (100 seeds) were drawn from each of the treatment and placed on Whatman no. 1 filter paper kept in petri-plates by using standard germination test in a seed germinator. The number of grains germinated was counted after 7 days of incubation. Per cent loss in germination was worked out for each variety/ genotype based on germination counts before releasing *S. oryzae* and germination counts after releasing *S. oryzae*.

Categorization of varieties

The maize varieties/ genotypes were grouped into four categories of susceptibility to *S. oryzae* viz., tolerant, 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 ($\bar{x}$) 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 adult emergence

The significantly lowest (2.32) number of adults (*S. oryzae*) emerged in Madhuri as well as GYC 9006

and they were at par with GYC 9666 (Table 1). The adult emergence was 3.58 and 4.30 in GM 3 and HQPM 1, respectively whereas HQPM 1 was at par with Amber. Varieties HM 5, GM 4 and GM 6 were at par with each other in their susceptibility against *S. oryzae* but significantly superior to remaining varieties/ genotypes. Of the tested varieties, the higher (21.31) number of adults was emerged in Pratap Makka Hybrid 1 followed by GM 2 and Narmada Moti.

Evaluation based on weight loss

The data on per cent loss in weight due to infestation by *S. oryzae* in stored maize after 6 months of storage period (Table 1) indicated that the lowest (3.97%) weight loss was obtained in Madhuri and it was at par with GYC 9006 (4.89%), GYC 9666 (4.99%) and GM 3 (4.99%). Varieties Amber, HQPM 1, HM 5 and GM 4 were statistically at par with each other. Variety Pratap Makka Hybrid 1 recorded highest (7.13%) weight loss and it was at par with GM 2 (7.12%), Narmada Moti (6.92%) and GM 6 (6.83%).

Evaluation based on germination loss

The data on per cent germination before artificial infestation (Table 1) revealed that the differences among the varieties/ genotypes were non-significant indicating uniform germination among the varieties/ genotypes. After 6 month of storage, the significantly higher (55.00%) germination occurred in Madhuri than all the varieties/ genotypes under evaluation except GYC 9006 (49.98%). The per cent germination between 39.95 and 46.63 was found in varieties/ genotypes GYC 9666, GM 3, HQPM 1, HM 5 and Amber. Prior one genotype and one variety showed equal germination with genotype GYC 9006, whereas later three varieties with GM 4 and GM 6. The variety Pratap Makka Hybrid 1 had more adverse effect on germination and recorded lowest (24.88%) germination followed by varieties GM 2 (28.21%) and Narmada Moti (33.29%).

The data on per cent loss in germination after 6 months storage of varieties/ genotypes under artificial infestation (Table 1) indicated that the lowest (24.23%) loss in germination recorded in variety Madhuri than all the tested varieties/

Table 1 Screening of maize varieties/ genotypes to *S. oryzae*

Varieties/ Genotypes	Number of adult emerged	Weight loss** (%)	Germination** (%)		Loss (%) in germination**
			Before infestation	After 6 months of storage	
Narmada Moti	3.94 (15.02)	15.25 (6.92)	61.12 (76.67)	35.24 (33.29)	50.22 (59.06)
Pratap Makka Hybrid 1	4.67 (21.31)	15.49 (7.13)	61.12 (76.67)	29.92 (24.88)	55.27 (67.54)
HM 5	3.38 (10.92)	13.77 (5.67)	61.12 (76.67)	39.20 (39.95)	43.62 (47.59)
HQPM 1	2.19 (4.30)	13.34 (5.32)	60.05 (75.08)	40.18 (41.63)	42.42 (45.50)
GM 2	4.41 (18.95)	15.48 (7.12)	63.52 (80.12)	32.08 (28.21)	52.53 (62.99)
GM 3	2.02 (3.58)	12.91 (4.99)	62.26 (78.33)	43.07 (46.63)	40.89 (42.85)
GM 4	3.44 (11.33)	13.84 (5.72)	63.52 (80.12)	38.24 (38.31)	46.04 (51.81)
Amber	2.34 (4.98)	13.34 (5.32)	58.91 (73.33)	39.20 (39.95)	44.42 (48.99)
Madhuri	1.68 (2.32)	11.50 (3.97)	58.98 (73.44)	47.87 (55.00)	29.49 (24.23)
GYC 9666	1.86 (2.96)	12.91 (4.99)	64.67 (81.70)	43.07 (46.63)	40.17 (41.61)
GYC 9006	1.68 (2.32)	12.77 (4.89)	64.67 (81.70)	44.99 (49.98)	36.87 (36.00)
GM 6	3.58 (12.32)	15.15 (6.83)	64.67 (81.70)	36.23 (34.93)	46.76 (53.07)
S. Em. $\pm$	0.11	0.52	1.54	1.50	2.17
C.D. at 5 %	0.31	1.53	NS	4.38	6.35
C.V. %	6.33	6.56	4.29	6.65	8.55

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

genotypes. Genotypes GYC 9006 (36.00%) and GYC 9666 (41.61%) as well as varieties GM 3 (42.85%) and HQPM 1 (45.50%) had statistically equal loss in germination due to *S. oryzae*. The per cent loss in germination was between 47.59 and 51.81 in varieties HM 5, Amber and GM 4. The variety Pratap Makka Hybrid 1 recorded significantly higher (67.54%) loss in germination than all the varieties/ genotypes screened except GM 2 (62.99%) and Narmada Moti (59.06%).

Categorization of varieties for susceptibility

It can be concluded that the varieties/ genotypes Madhuri, GYC 9006, GYC 9666, GM 3 and HQPM 1 fall under the tolerant category of all the three parameters can be considered as tolerant to *S. oryzae* (Table 2). Varieties GM 4, GM 6 and Narmada Moti fall under the susceptible category, while GM 2 and Pratap Makka Hybrid 1 fall under the more susceptible category of all the three parameters can be considered as more susceptible

Table 2 Categorization of different varieties/genotypes of maize for their susceptibility to *S. oryzae* based on different parameters

Category of resistance	Scale	Varieties/ genotypes
Based on number of adults emerged	$\bar{X} = 9.19$	SD = 6.74
Tolerant	$\bar{X}_i < 9.19$	Madhuri (2.32), GYC 9006 (2.32), GYC 9666 (2.96), GM 3 (3.58), HQPM 1 (4.30) and Amber (4.98)
Susceptible	$\bar{X}_i > 9.19 < 15.93$	HM 5 (10.92), GM 4 (11.33), GM 6 (12.32) and Narmada Moti (15.02)
More susceptible	$\bar{X}_i > 15.93 < 22.67$	GM 2 (18.95) and Pratap Makka Hybrid 1 (21.31)
Highly susceptible	$\bar{X}_i > 22.67$	--
Based on per cent loss in weight	$\bar{X} = 5.74$	SD = 1.03
Tolerant	$\bar{X}_i < 5.74$	Madhuri (3.97), GYC 9006 (4.89), GYC 9666 (4.99), GM 3 (4.99), HQPM 1 (5.32), Amber (5.32), HM 5 (5.67) and GM 4 (5.72)
Susceptible	$\bar{X}_i > 5.74 < 6.77$	--
More susceptible	$\bar{X}_i > 6.77 < 7.8$	GM 6 (6.83), Narmada Moti (6.92), GM 2 (7.12) and Pratap Makka Hybrid (7.13)
Highly susceptible	$\bar{X}_i > 7.8$	--
Based on per cent loss in germination	$\bar{X} = 48.44$	SD = 11.87
Tolerant	$\bar{X}_i < 48.44$	Madhuri (24.23), GYC 9006 (36.00), GYC 9666 (41.61), GM 3 (42.85), HQPM 1 (45.50) and HM 5 (47.59)
Susceptible	$\bar{X}_i > 48.44 < 60.31$	Amber (48.99) GM 4 (51.81), GM 6 (53.07) and Narmada Moti (59.06)
More susceptible	$\bar{X}_i > 60.31 < 72.18$	GM 2 (62.99) and Pratap Makka Hybrid 1 (67.54)
Highly susceptible	$\bar{X}_i > 72.18$	--

Tolerant - ($\bar{X}_i < \bar{X}$), Susceptible- ($\bar{X}_i > \bar{X} < (\bar{X} + 1 \text{ SD})$), More susceptible - $\bar{X}_i > (\bar{X} + 1 \text{ SD}) < (\bar{X} + 2 \text{ SD})$, Highly susceptible - $\bar{X}_i > (\bar{X} + 2 \text{ SD})$

to *S. oryzae*. None of the tested maize varieties/ genotypes was fall under the category of highly susceptible.

The results obtained in present investigation could not be compared with the investigation done elsewhere due to uncommonness of varieties/ genotypes except Singh *et al.* (1972) who reported that Amber recorded maximum growth of *S. oryzae* and found susceptible. In present investigation, variety Amber emerged as tolerant. It might be due to

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