

Screening of rice cultivars against Angoumois grain moth, *Sitotroga cerealella* (Olivier) (Lepidoptera, Gelechiidae)

Vaishali Zote and Abhishek Shukla

Department of Entomology, N.M. College of Agriculture, Navsari Agricultural University, Navsari 396450, Gujarat, India.

Email: abhishekshukla@nau.in

ABSTRACT: A study was conducted to screen twenty-five different rice cultivars against Angoumois grain moth, *Sitotroga cerealella* (Olivier) under laboratory conditions during 2020 - 2021 and 2021-2022 at Navsari Agricultural University, Navsari. From the pooled data of two year, it is observed that the cultivar IET-25470 recorded lowest number of adult emergence (72.83 adults) whereas the cultivar GNR -4 recorded highest number of adult emergence (119.33 adults) followed by the cultivar Ratnagiri-4 (110.50 adults). Regarding susceptibility index, the cultivar GNR 4 recorded highest susceptibility index (15.36) whereas cultivar IET- 25470, IET-25453, IET-24336, and IET-28713 recorded the lowest susceptibility index. The damage caused by *S. cerealella* to the grains of different rice cultivars revealed that the percentage of loss in grain weight was ranging between 4.08 to 8.19 per cent in different paddy cultivars. Further, Ratnagiri-5 recorded the lowest weight loss (4.08%) while the maximum weight loss was recorded in GNR 4 (8.19%).
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KEY WORDS: Resistance, cultivars, adult emergence, susceptibility index, grain weight loss

Rice (*Oryza sativa* L.) is the most widely consumed staple food in the world. It accounts for about of 60 to 70 per cent of the body calorie intake of the consumers (Das *et al.*, 2018). It is commonly known as ‘the Global grain’. About 90 per cent of the world’s rice is grown and consumed in Asia. Among Asia, India has the largest area under rice of 46.25 m ha (Kamboj *et al.*, 2023). The common biological agent for the loss and deterioration of stored rice are beetles and moths. Among the moths, the Angoumois grain moth, *Sitotroga cerealella* (Olivier) (Lepidoptera, Gelechiidae) is one of the principal causes of loss in storage (Hall, 1970). It is carried over from field to the storage through infested grains. In a field level survey Zote and Shukla (2023) reported 62.26 to 70.83 per cent grain

infestation. It is cosmopolitan in distribution. The moths are generally able to infest the surface layer of bulk-stored grain, as adults are unable to penetrate deeply. Only larvae are able to damage the commodities by boring into the grains and feeds about 30-50 per cent contents of the grain which ultimately gives unpleasant smell and unhealthy appearance (Bushra *et al.*, 2013). The emerging adult pushes the flap, which was already made by the final instar larva and forms the typical ‘circular-hole symptom’. The use of chemical insecticides has toxic effects on the environment and humans. It is very important to find an alternative against the chemical method of control. The innate capacity to resist the attack and damage by this pest on different rice genotypes will provide valuable

* Author for correspondence

information to the plant breeder for developing new cultivars, hence the studies were undertaken.

Experiments were conducted under laboratory conditions during 2020 - 2021 and 2021-2022 at Post Graduate Research Laboratory, Department of Entomology, N.M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat. Twenty-five different rice cultivars were screened for their susceptibility against *S. cerealella*. Twenty-five grams of apparently sound paddy grains of each cultivar were kept separately in plastic jars (6.0cm x 8.0cm). The paddy cultivars were obtained from Main Rice Research Station, Navsari Agricultural University, Navsari. Five pairs of newly emerged male and female moths were released for oviposition in each jar for three days. The top of the jar was covered with muslin cloth which was secured firmly with a rubber band. The jars were kept under laboratory conditions at $27 \pm 5^\circ\text{C}$ temperature and 70 ± 5 per cent relative humidity for the fresh moth emergence. From the day the new moth emergence started, moths were counted daily and removed from the jars to prevent further oviposition. The observations were recorded until the emergence stopped. When emergence of adults stopped, number and weight of healthy and damaged grains in each jar were recorded. The experiment was repeated thrice with complete randomized block design. The cultivars were screened on the basis of susceptibility index and damage.

The susceptibility index of each cultivar was calculated by applying formula suggested by Dobie (1977) based on total number of adults emerged and mean developmental period.

$$\text{Susceptibility Index} = \frac{\text{Natural log F}}{D} \times 100$$

Where, F= Number of adults emerged,
D=Mean developmental period

For the determination of damage, healthy and damaged grains in each jar were counted and weighed separately. The per cent weight loss was calculated using formula suggested by Adams and Schulten (1978) as below -

$$\text{Weight loss(\%)} = \frac{(UNd) - (DNU)}{U (Nd + Nu)} \times 100$$

Where, U = Weight of undamaged grains, Nu = Number of undamaged grains, D= Weight of damaged grains and Nd = Number of damaged grains.

The pooled data of two years showed that the cultivar IET -25470 recorded lowest number of adult emergence (72.83 adults) which was significantly superior over rest of the cultivar. The cultivar GNR-4 recorded highest number of adult emergence (119.33 adults) followed by the cultivar Ratnagiri-4 (110.50 adults). Regarding susceptibility index, the cultivar GNR -4 recorded highest susceptibility index (15.36) followed by the cultivar GNR-7(14.98) and Panvel-2 (13.98) and they are at par with each other. The cultivar IET-25470, IET-25453, IET-24336 and IET-28713 recorded the lowest susceptibility index *i.e.* 11.15, 11.18, 11.46, and 11.87, respectively and they were at par with each other (Table 1).

The damage caused by *S. cerealella* to the grains of different rice cultivars on the basis of weight and number, (in the pooled data of two year), showed grain weight loss in the range of 4.08 to 8.19 per cent (Table 1). Among cultivars, Ratnagiri-5 recorded the lowest weight loss (4.08%) where as it was at par with rice cultivars IET-25477, IET-25453, IET-26376 and IET-28005. The maximum weight loss was noticed in cultivar GNR-4 (8.19%), it was at par with the cultivars like GNR-3, GR-17, IET-25453, IET-24336 and IET-26376. The per cent damaged grains (number basis), the cultivar GR-19 recorded lowest number of grain loss (3.15). The maximum grain weight loss was observed in Panvel-1 (10.15).

In present investigation the results revealed that none of the cultivars was completely immune to the attack of *S. cerealella* in storage only the degree of infestation varies. Pandey *et al.* (1980), Khattak and Shafique (1981) and Khattak and Shafique (1986) reported similar results. Shifque and Chaudry (2007) suggested that the low insect population and low weight loss of grain can be used as one of the attributes of the grain resistance to insect. Singh *et al.* (2007) screened 10 rice varieties against

Table 1. Mean number of adults emerged, susceptibility index and grain damage (on weight and number basis) of different paddy cultivars due to *Sitotroga cerealella* (Two year pooled data)

Cultivar	AE	SI	Damage (%) on	
			Weight	No.
GNR-4	119.33	15.36	8.19	9.57
GNR-3	97.67	13.00	7.04	7.05
GNR-7	98.17	14.98	5.73	5.62
GNR-8	73.83	12.64	5.10	5.81
GR-15	90.50	12.72	6.27	5.84
GR-17	84.83	12.12	5.41	7.58
GR-19	95.50	12.67	7.00	3.15
IET-25453	94.00	11.18	5.15	6.23
IET-25470	72.83	11.15	5.64	6.18
IET-25477	77.67	11.86	5.38	5.25
IET-26376	98.83	12.33	6.46	5.05
IET-28713	87.67	11.87	5.75	6.04
IET-24336	82.17	11.46	6.14	5.45
IET-28005	91.67	12.02	6.61	4.03
IET-28705	95.33	12.58	4.66	7.31
NAUR-1	95.50	13.67	5.34	10.05
Ratnagiri-1	107.17	13.86	5.31	8.37
Ratnagiri-4	110.50	12.99	5.58	5.63
Ratnagiri-5	103.00	12.73	4.08	6.75
Ratnagiri-7	98.17	12.78	5.04	7.81
Ratnagiri-8	97.67	12.04	6.80	6.59
Ratnagiri-24	109.00	12.01	5.80	8.31
Panvel-1	103.00	13.02	4.31	10.15
Panvel-2	98.00	13.98	5.20	7.15
Panvel-3	99.00	13.29	4.07	5.18
SEm+	7.52	0.49	0.87	1.29
CD at 5 %	21.96	1.44	2.54	3.76
CV(%)	4.02	3.15	11.21	7.02

AE = Adult emergence; SI = Susceptibility Index

S. cerealella up to 3, 6 and 9 months of storage and reported that Kalanamak appeared with 23.5 per cent grain damage (greater susceptibility) followed by Pankaj, Sona and Basmati during 9 months of storage. However, IR-8 and Jaya showed the least infestation with 7.9 and 9.8 per cent grain damage, respectively. The results of this study closely matched those of Saadia *et al.* (2011), who found that no cultivar was totally resistant to *S. cerealella* infestation. In a study, Kumar *et al.* (2018) also reported that the rice varieties with the most *S. cerealella* grain damage showed the greatest weight loss. Further, Mathew *et al.* (2019) observed that none of the fourteen varieties and sixty-six genotypes of paddy were entirely resistant to *S. cerealella*. These past works mostly support the current findings. From the study it can be concluded that out of 25 rice cultivars, none of the cultivar found resistant against grain moth only the degree of infestation varied. Cultivars IET-25470 and IET-25453 were relatively less susceptible.

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