International Journal of Plant & Soil Science

Volume 35, Issue 21, Page 418-429, 2023; Article no.IJPSS.108278
ISSN: 2320-7035

Evaluation of Mung Bean [*Vigna radiata* (L.) Wilczek] Genotypes against Pulse Beetle in Stored Grain

Chaman Kumar [a*], P. K. Singh [a], Pankaj Kumar [b], Munna Yadav [a] and Amrendra Kumar [c]

[a] Department of Agricultural Entomology, Birsa Agricultural University, Ranchi, Jharkhand, India.
[b] Department of Agricultural Entomology, Bihar Agricultural University, Sabour, Bhagalpur, Bihar, India.
[c] Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar. India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2023/v35i213992

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/108278

Original Research Article

Received: 11/08/2023
Accepted: 14/10/2023
Published: 20/10/2023

ABSTRACT

The pulse beetle is a significant issue for the stored pulses. The adoption of resistant sources is a dependable, environmentally friendly prerequisite for sustainable grain protection, even though chemical management is still the most efficient method of controlling pulse beetles at large-scale storage. The impact of mung bean genotypes against pulse beetles (*Callosobruchus chinensis*) in stored grain was conducted under laboratory conditions in the Department of Agricultural Entomology, Ranchi Agriculture College, Birsa Agricultural University Kanke, Ranchi, from September to October 2018. The experiment was laid out in completely randomized design under the laboratory conditions. The results of the studies carried out on 52 genotypes of mung bean seed. the genotypes (SML 1829, VGG 16-058, IPM 2-14, KM 2355, SML 669, VGG 16-036, IPM 512-1, MH 1320 and Pusa Vishal), (IPM 2-14, HUM 16, SML 668 and KM 2355), (HUM 16, SML

Corresponding author: E-mail: chamankumararya@gmail.com;

668, IPM 2-14, MH 421, COGG 13-19, KM 2355, SML 1829, SML 1082, COGG 13-39, MH 13-20, VGG 16-058, VMS 13-12, SVM 61-61 and SML 669) and (IPM 2-14 and HUM 16) were performed best against *C. chinensis* on the basis of number of eggs laid, adult emergence, per cent grain weight loss and per cent seed germination, respectively.

Keywords: Callosobruchus chinensis; mung bean; pulse beetle; storage pest.

1. INTRODUCTION

In India, mung bean seed holds immense economic significance as a leguminous food crop. After chickpea and pigeon pea, it is the 3rd most popular pulse crop in India. Pulses have the richest sources of proteins, some amino acids, minerals and certain vitamins and are affordable to the poor people. The pulse is also called the "poor man's meat" [1]. By consuming just 56 grams of pulses, an adult can satisfy a daily protein requirement [2]. In spite of its short duration, nearly 85 insect pests attack mung bean seeds from field to storage. The pulse beetle (*Callosobruchus chinensis*) (coleoptera: chrysomelidae), is a serious pest for the pulses in storage. the insect has a global distribution, but is more widely distributed in tropical and subtropical regions [3]. The seed is not eaten by the adult pulse beetle, but they mate and ovulate on it. The newly hatched larvae bore in to the seed and feed on its contents until the entire endosperm is eaten. The economic losses of pulse beetles in various legumes range from 30 to 40 percent over a period of six months, and losses can reach 100 percent if left untreated [4,5,1]. Although chemical control is still the most effective means of controlling pulse beetles at large-scale storage, the use of resistant sources is a reliable, eco-friendly requirement for sustainable grain protection [6]. It is important to determine the source of resistance so that resistant factors may be used as part of a breeding programme to store pulses safely.

2. MATERIALS AND METHODS

In order to study the evaluation of mung bean genotypes against pulse beetle (*Callosobruchus chinensis*) in stored grain was carried out under the laboratory conditions in the Department of Agricultural Entomology, Ranchi Agriculture College, Birsa Agricultural University Kanke, Ranchi at 28 – 31.5°C and 67.5 - 90% relative humidity. The experiment was laid out in completely randomized design with number of replicates after the experimental conditions. The results of the studies carried out on 52 genotypes of mung bean seed in storage condition. The genotypes of mung bean seed were evaluated against *C. chinensis,* on the basis of number of eggs, adult emergence, per cent weight loss and per cent seed germination during storage.

2.1 Identification of Test Insect

The adult beetles of *C. chinensis* (coleoptera: chrysomelidae) were identified as per the key given by Vats [7] and Begum et al. [8]. The adult are brownish beetles, narrower towards the head region and broad at the posterior side measuring 2-3 mm long. The adult beetles possess two ivory spots one on each elytra. The sexing of the insect was done mainly based on its antennal characteristics. Antennae are pectinate in male and serrate in female. Abdomen is not covered by the elytra and pygidium is well exposed in case of females. Females have dark strips, which are not found in males, on each side of the posterior dorsal abdomen. Nevertheless, adults have an average body length of 4-6 mm. [9].

2.2 Maintenance and Mass Culture of Pulse Beetle, *C. chinensis*

The pulse beetle, *C. chinensis* was used as the test insect, as it is the major storage pest of mung bean causing damage both under field and storage condition.

For mass culturing about 20-25 pairs of adult beetles were released in to plastic containers containing 500 g of healthy seeds of mung bean and the mouth of the container was covered with muslin cloth and fastened with rubber bands. Such containers were maintained for mass culturing of test insect. The container was kept undisturbed under ambient condition till emergence of F1 progeny. The newly emerged adults (1-2 days old) obtained from the culture after 25-30 days of the release were utilized for the maintenance of sub cultures by following the same procedure as described above. Sub culturing of beetle was done to ensure continuous supply of test insects for conducting the laboratory experiments. Thus, the pulse beetle was mass cultured in the laboratory for 2-4 generations and the freshly emerged adults were used in the experimental studies [10,11,12].

2.3 Releasing of Test Insect

The seeds of 52 genotypes of mung bean were healthy, sound and disinfested which were weighed about 50 g with electronic weighing balance were placed in plastic containers (6cm × 4cm, height × diameter). Each cultivar was replicated three times. 3 pairs of freshly emerged pulse beetles were released in to each container for oviposition. The aspirator was used for transferring of beetles. The containers were secured with muslin cloth and fastened with rubber bands [13,14]. The test varieties were screened based on the following parameters.

2.4 Number of Eggs

Three days after release of adult beetles, the number of eggs laid by pulse beetle on the surface of the seeds was calculated to check the effect of treatments on its oviposition. Ten grains were randomly selected from each replication and eggs laid on those grains were counted with the help of hand lens. At the end the mean number of eggs was calculated in each jar [13,14,11].

2.5 Adult Emergence (Number)

The F1 progeny emerged from each treatment after 45 days of release were counted and adult beetles were discarded daily to avoid further mating and egg laying. The process was continued till they completely cease to emerge [13,14]. The mean adult emergence was worked out by pooling the data.

2.6 Per cent Grain Weight Loss

The final weight of the seed was taken after 45 days of release and the weight loss due to insect infestation was calculated by using the following formula [15,16,11].

$$\text{Grain weight loss \%} = \frac{\text{initial weight of grains (g)} - \text{final weight of grains (g)}}{\text{initial weight of grains (g)}} \times 100$$

2.7 Per cent Seed Germination

100 seeds were selected randomly from each genotype and seeds were kept in between paper towels soaked with distilled water and were kept in germinator for 7 days as per ISTA, 2005. Germinated seeds were counted on 7th day as per cent germination was calculated as follows [17,18].

$$\text{Germination \%} = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds tested in each petri dish}} \times 100$$

2.8 Statistical Analysis

All the data related to percentage were subjected to angular transformation and average population data were subjected to √n + 0.5 square root transformation. Data was subjected to statistical analysis by completely randomized block design further more Mean, SE (m), CD and CV were also assessed.

3. RESULTS AND DISCUSSION

The results of the studies carried out on 52 genotypes of mung bean were evaluated against *C. chinensis,* on the basis of number of eggs, adult emergence, per cent weight loss and per cent seed germination during storage.

3.1 Evaluation Based on Number of Eggs

The data recorded on number of eggs per 10 seeds were acquainted in Table 1 and exhibited in Fig. 1. The number of eggs laid per 10 seeds of mung bean among 52 different genotypes varied from 1 to 7.7. The highest number of eggs were recorded in SML 1901 (7.7 eggs/10 seeds) followed by VGG 16-029 (7.3 eggs/10 seeds) and VGG 16-055 (6.0 eggs/10 seeds). This indicates that these genotypes were most preferred in terms of oviposition given by female adult beetle, *C. chinensis*.

On the other hand the genotypes IPM 2-14, KM 2355, SML669, and VGG 16-036 (1.3 eggs/10 seeds), IPM 512-1, MH 13-20 and Pusa Vishal (1.7 eggs/10 seeds) were at par with SML 1082, SML 1829 and VGG 16-058 (1.0 eggs/10 seeds) and recorded lowest numbers of eggs/10seeds. The results revealed that these genotypes were least susceptible for egg laying.

The results of the present experiment were in agreement with the findings of Shafique and Ahmed [19] recorded that chickpea genotypes CM-72 and Paidar-91 showed minimum number of eggs, adult progeny development and grain weight loss indicating resistance to this beetle.

3.2 Evaluation Based on Number of Adult Emergence

The data on number of adult emergence recorded after 45 days of release of pulse beetle in storage on different genotypes of mung bean in laboratory acquainted in Table 2 and exhibited in Fig. 2. The adults emerged from 50 g seed of different mung bean genotypes ranged from 60 to 362.7. The minimum number of adult emergence was observed in the genotypes IPM 2-14 (60) followed by HUM 16 (61), SML 668 (70.3) and KM 2355 (71.3). The highest number of adult (362.7) emergence was reported in VGG 16-055 and proved to be most preferred genotypes of mung bean followed by MH 13-15 (334.7). The mung bean genotypes, IPM 2-14 and KM 2355 exhibiting minimum number of eggs also recorded minimum number of adult emergence indicating that these genotypes are superior to resistance/tolerance against pulse beetle.

These results were in agreement with the findings of Talekar and Lin [20] in mung bean, Chandel et al. [21] in red gram, Prasad et al. [22] in Dolichos bean and Siddiqa et al. [23] in chickpea who attributed resistance/tolerance for bruchid infestation to minimum adult emergence.

3.3 Evaluation Based on per cent Grain Weight Loss

The data on per cent weight loss in grain due to infestation by *C. chinensis* in stored grain of 52 genotypes of mung bean acquainted in Table 3 and exhibited in Fig. 3. The per cent grain weight loss was observed immediately 45 days after the adults ceased to emerge from the stored grain of different mung bean genotypes. The per cent grain weight loss was varied from 18.7% to 42.3%. The minimum per cent weight loss was observed in HUM 16 and IPM 2-14 (18.7%) followed by MH 421 (19.9%), SML 668 (20.1%), COGG 13-19 (20.2%), KM 2355 (20.7%), SML 1829 (20.8%), SML 1082 (20.8%), COGG 13-39 (21.5%), MH 13-20 (21.7%), VGG 16-058 (22%), VMS 13-12 (22.2%), SVM 61-61 (22.2%) and SML 669 (22.4%). The maximum per cent grain weight loss was recorded in the genotypes, VGG 16-055 (42.2%) and MH 13-15 (39.8%) were found to be at par with each other. The maximum grain weight loss by infestation of pulse beetle could be due to internal feeding habit of the insect which might have eaten major portion of the cotyledon, consequently leading to reduction in grain weight. Egg laid on the seeds get fixed and immediately after hatching bore in to the seed damaging the embryo and endosperm leading to loss in seed weight and quality of grain [24]. Divya et al. [25] observed that the genotypes which were less preferred by the *C. chinensis* for egg laying, adult emergence and insect damage showed less per cent weight loss (0.0 to 4.3%) as against the highly preferred genotypes NS/05/42 and NSJ/NAIP/BD/ADB 35-1 which found a maximum weight loss (49.26 to 46.81%, respectively).

3.4 Evaluation Based on per cent Seed Germination

The data on per cent seed germination were recorded as per randomly selected 100 seeds of each genotype acquainted in Table 4 and exhibited in Fig. 4. The highest per cent of seed germination was observed in IPM 2-14 (92%) while the lowest per cent of seed germination was recorded in VGG 16-055 (15.7%), the genotypes MH 13-15 (20.3%) was recorded statistically at par with VGG 16-055. The minimum per cent of seed germination recorded due to the infestation of *C. chinensis* which was observed more preferred for egg laying and adult emergence. The genotype HUM 16 (89.7%) recorded statistically at par with IPM 2-14 (92%), where less number of eggs, adult emergence and per cent weight loss was observed. The reduction in per cent germination due to infestation of *C. chinensis* and attributes this reduction to increased damage to the grain and metabolic wastes such as uric acid production by bruchids [25]. Patil et al. [26] observed the reduction in per cent germination from 93.46% to 61.0% due to artificial infestation of pulse beetle (*C. analis*) under lab condition in chickpea.

The results were in confirmation with Chankaewmanee et al. [27] observed that no insect infestation or even any live insect were found in the air tight storage, whereas in normal storage, damaged seed reached 30.2% with 271 adults mungbean weevils, *C. maculatus* collected in 100 grams of seed. The germination of mung bean seedin the airtight storage decreased from 95.4 to 80%, while germination of mung bean seed in normal storage (control) decreased from 97 to 26%. Mahmud et al. [28] Studied the reaction of *C. chinensis* to 20 genotypes of mung bean, chickpea and urad bean was evaluated in no choice test in the laboratory and observed the highest (73.1) number of eggs was laid on chickpea, while the lowest (19.5) was in urad bean. Maximum (24.4%) of seed damage was

Table 1. Evaluation of number of eggs of *C. chinensis* on different genotypes

Sr. No.	Genotypes	No. of eggs/10 seeds
1	COGG 13-19	2.0 (1.7)
2	COGG 8	2.3 (1.8)
3	TMB 136	3.3 (2.1)
4	SVM 61-61	3.7 (2.2)
5	NMK 15-12	5.7 (2.6)
6	IPM 06-05-1	3.7 (2.2)
7	PDM 139	3.7 (2.2)
8	Pant M-5	4.0 (2.2)
9	Pant M-2	4..0 (2.2)
10	PM 14-13	2.3 (1.8)
11	PM 14-19	3.7 (2.2)
12	PM 14-11	2.3 (1.84)
13	VGG 16-027	3.0 (2.0)
14	VGG 16-055	6.0 (2.6)
15	VGG 16-036	1.3 (1.5)
16	VGG 16-064	3.3 (2.0)
17	VGG 16-058	1.0 (1.4)
18	VGG 16-029	7.3 (2.9)
19	VMS 13-12	3.0 (2.0)
20	GAM 5	3.0 (2.0)
21	KM 2355	1.3 (1.5)
22	Pusa BM-7	3.0 (2.0)
23	Pusa 1842	2.7 (1.9)
24	Pusa 1641	2.3 (1.8)
25	Pusa 9531	4.0 (2.2)
26	Pusa 1831	2.0 (1.7)
27	Pusa 1832	5.3 (2.5)
28	Pusa 1841	3.7 (2.2)
29	Pusa Vishal	1.7 (1.6)
30	HUM 16	3.7 (2.2)
31	SML 832	3.7 (2.2)
32	SML 1082	1.0 (1.4)
33	IPM 2-14	1.3 (1.5)
34	IPM 99-125	2.0 (1.7)
35	IPM 512-1	1.7 (1.6)
36	IPM 312-4	2.3 (1.8)
37	SML 1827	3.3 (2.1)
38	SML 1901	7.7 (2.9)
39	SML 669	1.3 (1.5)
40	SML 1829	1.0 (1.4)
41	IPM 205-7	3.7 (2.2)
42	IPM 410-3	5.0 (2.4)
43	IPM 2-3	2.7 (1.9)
44	IPM 410-9	3.3 (2.1)
45	MH 421	2.0 (1.7)
46	MH 1323	5.3 (2.5)
47	MH 13-14	3.7 (2.2)
48	MH 13-15	4.0 (2.2)
49	MH 13-20	1.7 (1.6)
50	COGG 13-39	4.0 (2.2)
51	Pusa Vishal	2.7 (1.9)
52	SML668	4.0 (2.2)
SE(m)±		0.08
CD at 5%		0.23
CV		6.96

Table 2. Evaluation of number of adult emergence of *C. chinensis* on different genotypes

Sr. No.	Genotypes	No. of adult emergence
1	COGG 13-19	78.0 (8.9)
2	COGG 8	145.0 (12.1)
3	TMB 136	124.0 (11.2)
4	SVM 61-61	113.3 (10.7)
5	NMK 15-12	143.3 (12.0)
6	IPM 06-05-1	114.7 (10.8)
7	PDM 139	177.7 (13.4)
8	Pant M-5	185.0 (13.6)
9	Pant M-2	128.7 (11.4
10	PM 14-13	257.3 (16.1)
11	PM 14-19	131.0 (11.5)
12	PM 14-11	123.7 (11.2)
13	VGG 16-027	212.0 (14.6)
14	VGG 16-055	362.7 (19.1)
15	VGG 16-036	239.3 (15.5)
16	VGG 16-064	196.3 (14.1)
17	VGG 16-058	108.3 (10.5)
18	VGG 16-029	268.3 (16.4)
19	VMS 13-12	95.3 (9.8)
20	GAM 5	154.7 (12.5)
21	KM 2355	71.3 (8.5)
22	Pusa BM-7	211.7 (14.6)
23	Pusa 1842	179.3 (13.4)
24	Pusa 1641	171.3 (13.1)
25	Pusa 9531	148.7 (12.1)
26	Pusa 1831	168.7 (13.0)
27	Pusa 1832	163.3 (12.8)
28	Pusa 1841	221.3 (14.9)
29	Pusa Vishal	184.0 (13.6)
30	HUM 16	61.0 (7.9)
31	SML 832	128.3 (11.4)
32	SML 1082	78.0 (8.9)
33	IPM 2-14	60.0 (7.8)
34	IPM 99-125	285.0 (16.9)
35	IPM 512-1	180.0 (13.5)
36	IPM 312-4	114.3 (10.7)
37	SML 1827	246.7 (15.7)
38	SML 1901	269.3 (16.4)
39	SML 669	108.7 (10.5)
40	SML 1829	81.7 (9.1)
41	IPM 205-7	120.3 (11.0)
42	IPM 410-3	226.7 (15.1)
43	IPM 2-3	280.7 (16.8)
44	IPM 410-9	151.3 (12.3)
45	MH 421	75.0 (8.7)
46	MH 1323	253.0 (15.9)
47	MH 13-14	173.0 (13.2)
48	MH 13-15	334.7 (18.3)
49	MH 13-20	119.67 (11.0)
50	COGG 13-39	106.7 (10.4)
51	Pusa Vishal	111.3 (10.6)
52	SML668	70.3 (8.4)
SE(m)±		0.26
CD at 5%		0.72
CV		3.55

Table 3. Evaluation of per cent grain weight loss caused by *C. chinensis* on different genotypes

Sr. No.	Genotypes	Per cent grain weight loss
1	COGG 13-19	20.2 (26.6)
2	COGG 8	26.5 (30.9)
3	TMB 136	22.7 (28.4)
4	SVM 61-61	22.2 (28.1)
5	NMK 15-12	26.9 (31.2)
6	IPM 06-05-1	24.5 (29.6)
7	PDM 139	29.4 (32.8)
8	Pant M-5	29.4 (32.8)
9	Pant M-2	24.8 (29.9)
10	PM 14-13	34.9 (36.2)
11	PM 14-19	24.5 (29.8)
12	PM 14-11	24.0 (29.3)
13	VGG 16-027	32.1 (34.5)
14	VGG 16-055	42.2 (40.5)
15	VGG 16-036	33.3 (35.2)
16	VGG 16-064	29.6 (33.0)
17	VGG 16-058	22.1 (28.0)
18	VGG 16-029	34.6 (36.0)
19	VMS 13-12	22.2 (28.1)
20	GAM 5	27.8 (31.8)
21	KM 2355	20.7 (27.0)
22	Pusa BM-7	31.5 (34.2)
23	Pusa 1842	29.4 (32.8)
24	Pusa 1641	28.3 (32.1)
25	Pusa 9531	26.1 (30.7)
26	Pusa 1831	27.4 (31.6)
27	Pusa 1832	27.2 (31.4)
28	Pusa 1841	34.7 (36.1)
29	Pusa Vishal	28.7 (32.4)
30	HUM 16	18.7 (25.6)
31	SML 832	23.1 (28.7)
32	SML 1082	20.8 (27.1)
33	IPM 2-14	18.8 (25.7)
34	IPM 99-125	35.4 (36.5)
35	IPM 512-1	29.3 (32.8)
36	IPM 312-4	22.8 (28.5)
37	SML 1827	33.3 (35.2)
38	SML 1901	32.7 (34.8)
39	SML 669	22.4 (28.2)
40	SML 1829	20.8 (27.0)
41	IPM 205-7	27.0 (31.3)
42	IPM 410-3	33.2 (35.6)
43	IPM 2-3	35.2 (36.4)
44	IPM 410-9	26.3 (30.9)
45	MH 421	19.9 (26.5)
46	MH 1323	33.7 (35.5)
47	MH 13-14	29.4 (32.7)
48	MH 13-15	39.8 (39.1)
49	MH 13-20	21.7 (27.7)
50	COGG 13-39	21.5 (27.6)
51	Pusa Vishal	24.3 (29.5)
52	SML668	20.1 (26.6)
SE(m)±		1.00
CD at 5%		2.81
CV		5.53

Table 4. Evaluation of per cent seed germination on different genotypes

Sr. No.	Genotypes	Per cent seed germination
1	COGG 13-19	83.3 (66.0)
2	COGG 8	52.7 (46.5)
3	TMB 136	64.3 (53.3)
4	SVM 61-61	63.7 (52.9)
5	NMK 15-12	53.0 (46.7)
6	IPM 06-05-1	72.7 (58.5)
7	PDM 139	68.0 (55.5)
8	Pant M-5	63.7 (52.9)
9	Pant M-2	63.7 (52.9)
10	PM 14-13	37.7 (37.8)
11	PM 14-19	59.7 (50.6)
12	PM 14-11	61.3 (51.6)
13	VGG 16-027	37.7 (37.8)
14	VGG 16-055	15.7 (23.2)
15	VGG 16-036	25.7 (30.4)
16	VGG 16-064	41.7 (40.2)
17	VGG 16-058	54.3 (47.5)
18	VGG 16-029	37.3 (37.6)
19	VMS 13-12	74.7 (59.8)
20	GAM 5	75.7 (60.5)
21	KM 2355	77.0 (61.4)
22	Pusa BM-7	49.7 (44.8)
23	Pusa 1842	48.0 (43.8)
24	Pusa 1641	62.7 (52.3)
25	Pusa 9531	64.3 (53.3)
26	Pusa 1831	54.3 (47.5)
27	Pusa 1832	53.3 (46.7)
28	Pusa 1841	37.3 (37.6)
29	Pusa Vishal	65.3 (54.0)
30	HUM 16	89.7 (71.3)
31	SML 832	70.3 (57.0)
32	SML 1082	83.3 (66.0)
33	IPM 2-14	92.0 (73.6)
34	IPM 99-125	29.7 (33.0)
35	IPM 512-1	48.7 (44.2)
36	IPM 312-4	63.7 (52.9)
37	SML 1827	38.7 (38.4)
38	SML 1901	29.3 (32.7)
39	SML 669	71.0 (57.4)
40	SML 1829	81.0 (64.2)
41	IPM 205-7	62.7 (52.3)
42	IPM 410-3	47.0 (43.3)
43	IPM 2-3	36.0 (36.8)
44	IPM 410-9	64.7 (53.5)
45	MH 421	74.7 (59.8)
46	MH 1323	34.0 (35.6)
47	MH 13-14	53.3 (46.9)
48	MH 13-15	20.3 (26.8)
49	MH 13-20	64.0 (53.1)
50	COGG 13-39	65.3 (54.0)
51	Pusa Vishal	66.7 (54.7)
52	SML668	82.0 (64.9)
SE(m)±		1.31
CD at 5%		3.69
CV		4.58

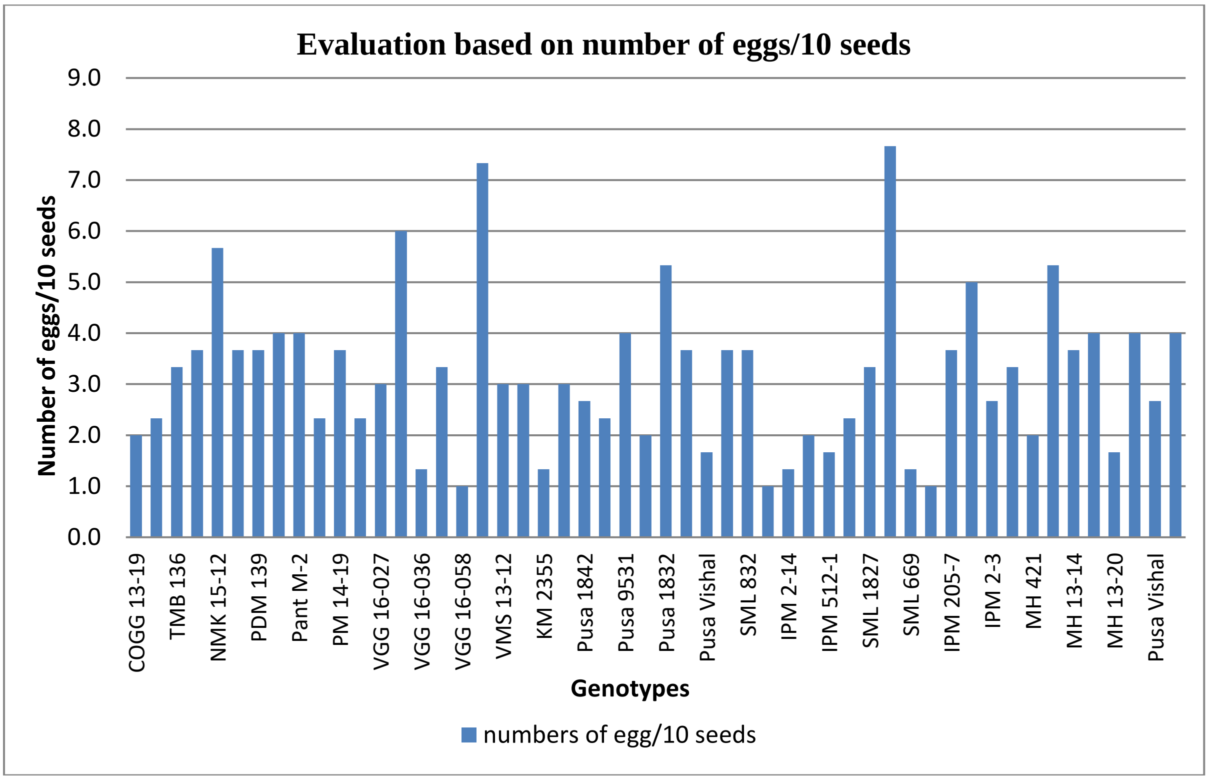

Fig. 1. Evaluation based on number of eggs of *C. chinensis* on different genotypes

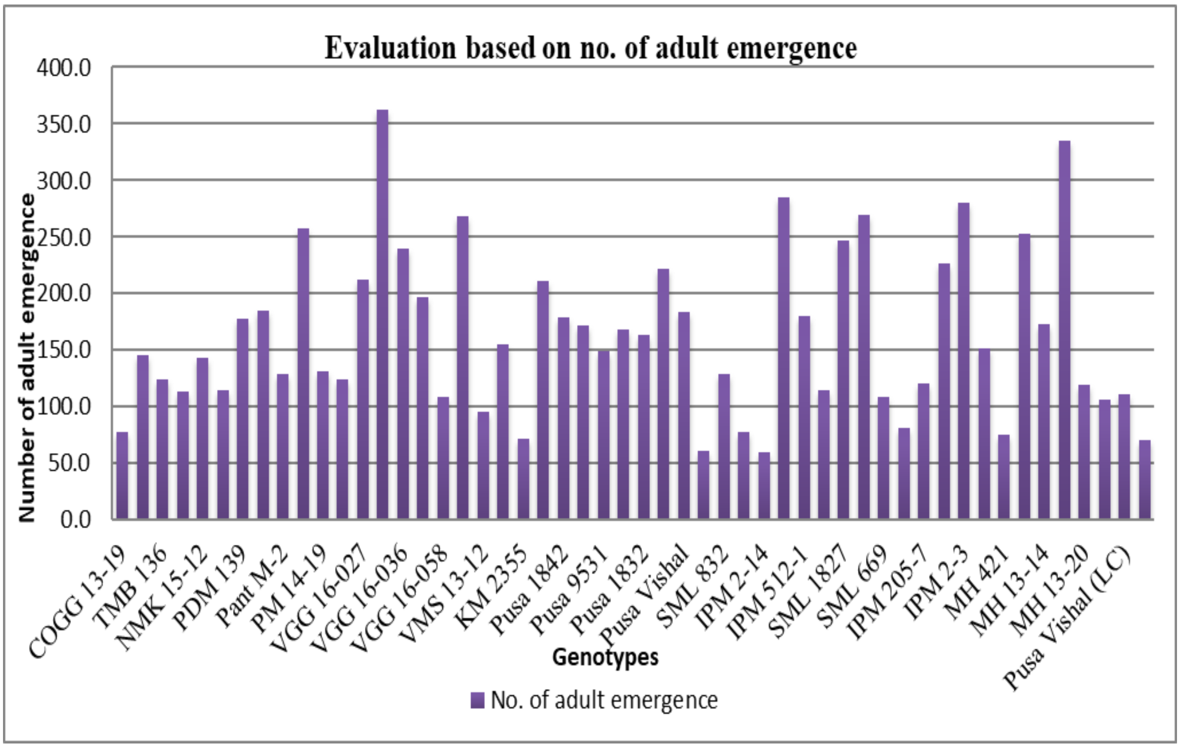

Fig. 2. Evaluation based on number of adult emergence of *C. chinensis* on different genotypes

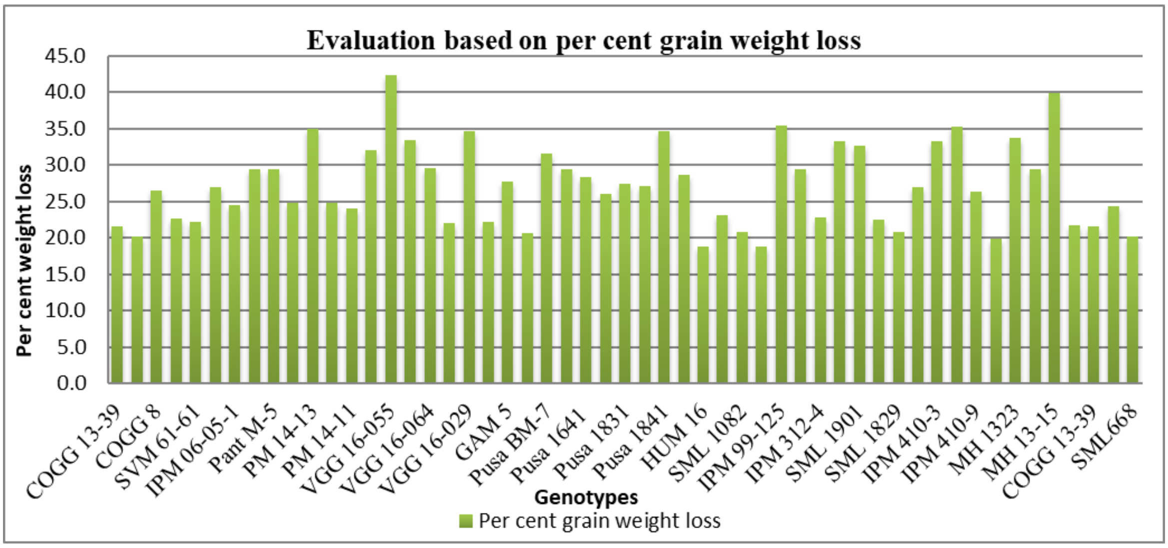

Fig. 3. Evaluation based on per cent grain weight loss caused by *C. chinensis* on different genotypes

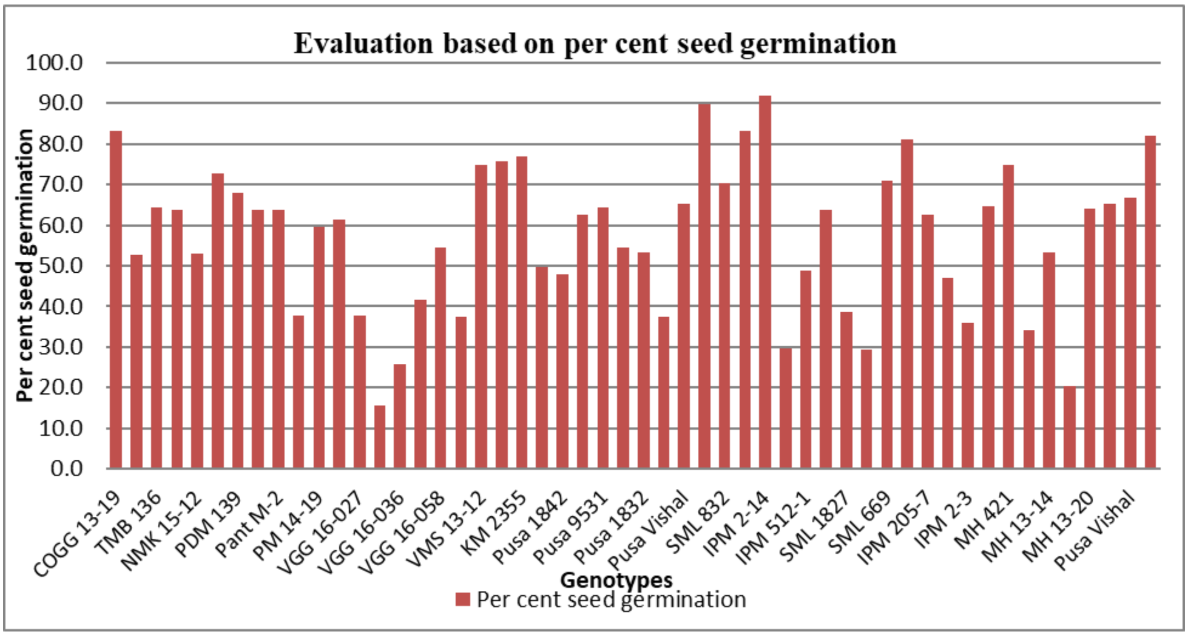

Fig. 4. Evaluation based on per cent germination on different genotypes

observed on chickpea and the minimum (6-9%) was recorded in urd bean. The genotypes ML-22 of lentil, MC-21 of mung bean, Hyprosola of chickpea and MAK–1-79 of urd bean were marked least susceptible in comparison with the tested genotypes of respective pulse species [29-31].

4. CONCLUSION

The exhibited results from the evaluation of mung bean genotypes against pulse beetle in stored grain acquainted that the genotypes (SML 1829, VGG 16-058, IPM 2-14, KM 2355, SML 669, VGG 16-036, IPM 512-1, MH 1320 and Pusa Vishal), (IPM 2-14, HUM 16, SML 668 and KM 2355), (HUM 16, SML 668, IPM 2-14, MH 421, COGG 13-19, KM 2355, SML 1829, SML 1082, COGG 13-39, MH 13-20, VGG 16-058, VMS 13-12, SVM 61-61 and SML 669) and (IPM 2-14 and HUM 16) were performed best on the basis of number of eggs laid, adult emergence, per cent grain weight loss and per cent seed germination.

ACKNOWLEDGEMENT

The author is extremely grateful to the Chairman, Department of Agricultural Entomology, Birsa Agricultural University Kanke, Ranchi, India for his support and facilitation for carrying out the research work successfully.

I express my heartfelt gratitude and thanks to my seniors Dr. Munna Yadav and Pankaj Kumar who helped me during my research work.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Sharma OP, Bambawale OM, Gopali JB, Bhagat S, Yelshetty S, Singh SK, et al. Field guide, mungbean and urd bean. National Centre for Integrated Pest Management, 2011;40.
2. Das S. Pulses production in Bangladesh: status and drivers for enhancement. Dhaka: Bangladesh Agricultural Research Council; 2016.
3. Mensah GWK. Infestation potentials of bruchids on cowpea cultivars stored under subtropical conditions. Fac Agril Univ Swaziland. 1986;7(6):781-4.
4. Dongre TK, Pawar SE, Thakare RG, Harwalkar MR. Identification of resistant sources to cowpea weevil (*Callosobruchus maculates* (F.)) in Vigna sp. and inheritance of their resistance in black gram (Vigna mungo var. mungo). J Stored Prod Res. 1996;32(3):201-4.
5. Akinkurolere RO, Adedire CO, Odeyemi OO. Laboratory evaluation of the toxic properties of forest Anchomanes, *Anchomanes difformis* against pulse beetle Callosobruchus maculatus (Coleoptera: Bruchidae). Insect Sci. 2006;13(1):25-9.
6. Sarwar M, Tofique M. Resistance variability with in gram seeds of different genotypes against the intrusion of cowpea weevil, Callosobruchus analis L. (Coleoptera: Bruchidae). Pak J Seed Technol. 2006;34(3):287-91.
7. Vats LK. Distinctive characters of the larvae of three species of Callosobruchus (Bruchidae: Coleoptera), together with a key to their identification. Indian J Entomol. 1974;36(1):17-22.
8. Begum A, Rahman MS, Seal DR. Comparative morphology of the larval instars of *Callosobruchus chinensis* (L.) and *Callosobruchus analis* (f.) (Coleoptera: Bruchidae). Bangladesh J Zool. 1982; 10(1):66-79.
9. Christopher WB, Lawrence SB, Bean B. A Handbook on Bean Beetles. N Atl. sci. foundation. Emory University, Morehouse College. 2009;14.
10. Ahad MA, Nahar MK, Amin MR, Suh SJ, Kwon YJ. Effect of weed extracts against pulse beetle, *Callosobruchus chinensis* L. (Coleoptera: Bruchidae) of mung bean. Bangladesh J Agric Res. 2016;41(1):75-84.
11. Roja BL, Venkateswarlu N, Rajesh A, Ramanamurthy B. Evaluation of different storage containers against pulse beetle *Callosobruchus chinensis* (Linnaeus) in black gram. Andhra Pradesh J Agric Sci. 2021;7(1):13-7.
12. Roy B, Amin MR, Jalal S, Kwon YJ, Suh SJ. Evaluation of common cocklebur X anthium strumarium leaf extract as post-harvest grain protectant of black gram against pulse beetle *Callosobruchus chinensis* (C oleoptera: B ruchidae) and isolation of crude compound. Entomol Res. 2014;44(6):254-61.
13. Rathod L, Kumre SB, Ingole JS, Marwade KD. Effects of botanicals on egg laying and adult emergence of pulse beetle in stored green gram. J Entomol Zool Stud. 2019; 7(3):01-4.
14. Rathod L, Sasane AR, Kawre PR, Chaware GG, Rathod PK. Effect of botanicals on pulse beetle and per cent seed germination of stored green gram. J Pharmacogn Phytochem. 2019;8(3):2428-30.
15. Chauhan R, Meena RS, Singh PS. Estimation of losses caused by pulse beetle, *Callosobruchus chinensis* (L.) in stored mung bean seed. J Exp Zool India. 2022;25(2):2013-7.
16. Pradhan L, Singh PS, Singh SK, Saxena RPN. Evaluation of certain chickpea genotypes against pulse beetle, *Callosobruchus chinensis* (L.) under laboratory conditions. J Entomol Res. 2020;44(4):535-9.
17. Nehra S, Lekha HS, Chhangani G. Assessment of various packaging materials for pulse storage against pulse beetle (*Callosobruchus chinensis* L.). The Pharm Innov J. 2021;10(9):554-8.

18. Miah MA, Ali MR, Husna A, Mollah MM. Efficacy of some botanicals against pulse beetle, Callosobruchus maculatus (Fab.) on stored greengram, Vigna radiata. Bangladesh Entomol. 2013;23(1):11-20.
19. Shafique M, Ahmad M. Screening of pulse grains for resistance to *Callosobruchus analis* (f.). Pak J Zool. 2002;34(4):293-6.
20. Talekar NS, Lin CP. Characterization of *Callosobruchus chinensis* resistance in mungbean. J Econ Entomol. 1992;85(4): 1150-3.
21. Chandel BS, Chauhan AK, Mamta B. Varietal resistance in pigeon pea genotypes against pulse beetle. Indian J Entomol. 2012;74(3):295-7.
22. Prasad BSR, Babu CSJ, Gowda MB. Screening Dolichos bean (*Lablab purpurea* L.) genotypes for resistance to pulse beetle, *Callosobruchus theobromae* in laboratory. Curr Biotica. 2013;7(3):153-60.
23. Siddiqa A, Parveen F, Rafi A, Mazhar-ul-Islam AM, Zubair Anwar Z, Ahmad S et al. Evaluation of resistance in local five Pakistani chickpea varieties against *Callosobruchus* spps. J Nat Sci Res. 2015;5(1):2224-3186.
24. Gujar GT, Yadav TD. Feeding of *Callosobruchus maculatus* F. and *Callosobruchus chinensis* Linn. on green gram. Indian J Entomol. 1978;40(2):108-12.
25. Divya P. Studies on characterization of genotypes and seed storability against pulse beetle (*Callosobruchus chinensis* L.) in horse gram. M.Sc. (ag.) [thesis]. Rajendranagar, Hyderabad: Acharya N G Ranga Agricultural University; 2012.
26. Patil SK, Tanpure SV, Mate SN. Effects of different levels of pulse beetle (*Callosobruchus maculatus* (Fab.)) infestation on chickpea during storage. Seed Res. 2003;31:119-20.
27. Chankaewmanee B, Visarathanondh P, Thanormsub S. Trial on storage of mung bean seed in airtight storage. In: Proceedings of the international conference controlled atmosphere and fumigation in stored products; 2001.
28. Mahmood MT, Ahmad M, Ali I, Hussain M, Latif A, Zubrair M. Evaluation of chickpea genotypes for genetic diversity through multivariate analysis. J Environ Agric Sci. 2018;15:11-7.
29. ISTA. International rules for seed testing. Seetf Sci Technol. 1985;13(2): 299-355.
30. Mahmoud AEM, El-Sebai OA, Shahen AA, Marzouk AA. Impact of kaolin-based particle film dusts on *Callosobruchus maculatus* F. and C. chinensis L. after different storage periods of treated broad bean seeds. International Working Conference on Stored Product Protection. 2010;638-46.
31. Sharma SS. Review of literatures of the losses caused by *Callosobruchus species* (Bruchidae: Coleoptera) during storage of pulses. Bull Grain Technol. 1984;22(1): 62-8.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/108278