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Screening of Groundnut Varieties against Bruchid, *Caryedon serratus* (Olivier)

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ABSTRACT

Background: Groundnut bruchid (*Caryedon serratus* Olivier) is one of the most important stored grain insect pests of groundnut. It adversely affects the quality and market acceptance of groundnut. The grub bore into pods and kernels causing damage by feeding on seeds internally. Therefore, an investigation on evaluation of varietal resistance of groundnut to bruchid, *Caryedon serratus* (Olivier) was carried out at the Department of Entomology, N.M. College of Agriculture, Navsari Agricultural University, Navsari during 2023 to 2024.

Methods: Screening of 10 groundnut varieties were carried out in completely randomized design with 3 repetitions. The reaction of varieties were assessed on the basis of adult emergence, pod damage and weight loss of pods after 60, 90 and 120 days of storage.

Result: The groundnut varieties GJE-9 and GG-HIPS-2 were found least susceptible among 10 screened genotypes. While, varieties GJE-33, GG-38, GG-35, GJG-31, GG-20 and TG-37-A were found moderately susceptible. However, varieties GJG-32 and GJG-22 were found highly susceptible. Maximum per cent adult emergence, per cent pod damage and per cent weight loss were observed in GJG-32 variety and minimum in variety GJG-9.

Key words: Bruchid, *Caryedon serratus*, Groundnut, Resistance reaction, Susceptibility.

INTRODUCTION

Groundnut, *Arachis hypogaea* L. is one of the most important oilseed crop grown in semi-arid regions of Asia and Africa. It is the sixth most important oilseed crop in the world. It contains 48-50 per cent of oil and 26-28 per cent of protein and is a rich source of dietary fiber, minerals and vitamins. It is often stored as nuts in shell or as kernels and about 10 per cent of the harvested produce is lost during postharvest operations. The groundnut pods harvested in the field passes through various stages to reach the ultimate consumer and are subjected to appreciable losses during storage. The losses due to abiotic factors such as temperature and humidity as well as biotic factors *viz.* insects, pathogen, rodents, mites and birds. The groundnut bruchid, *Caryedon serratus* (Oliver) is considered as a major storage pest affecting the groundnut produce. This pest is widely distributed across Asian and African countries. In India, it was first reported infesting groundnut in Tamil Nadu and Andhra Pradesh in 1914 (Fletcher, 1914) and has wide host range (Mohan and Akhil, 2004). The primary infestation of this pest starts from the field which is very critical in the establishment of this pest during storage. The female beetle lays eggs on pods, after hatching the grub bore into pods and kernels causing damage up to 60 per cent and the resultant weight loss of about 50 per cent (Oaya *et al.,* 2012). The pods and kernels are infested by bruchids are further prone to aflatoxin contamination which make it unfit for human consumption. In a survey at Jaipur, Rajasthan 17 to 47 per cent pod damage was recorded due *C. serratus* in groundnut in different areas during storage (Shukla and Rathore, 2007). Insecticides and fumigants are used against this pest, but this leads to development of resistance and residues (Bhoraniya *et al.,* 2003; Sharma *et al.,* 2007). Host plant resistance can be a best alternative, as it is simple and less expensive (Painter, 195; Shaheen *et al.,* 2006). To combat this problem, varietal resistance to the bruchid seems to be a potential weapon for reducing these losses. The present study, therefore, was undertaken to evaluate the different varieties of groundnut against bruchis, *C. serratus* under laboratory conditions.

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MATERIALS AND METHODS

Groundnut bruchid was reared on pods of ten different varieties of groundnut repeated thrice to study the reaction of bruchid to different varieties. For this purpose, 500 g pods of each variety were kept into glass bottles and 10 pairs of newly emerged adults were released. The mouth of the jar was covered with a muslin cloth and tightened with a rubber band. There were three repetitions for each variety. The observations made on adult emergence, weight loss and pod damage by *C. serratus* at 60, 90 and 120 days after adults release at storage.

Adult emergence

The adults of *C. serratus* that emerged from different treatments were counted daily and removed from the respective jars. Counting was continued till they cease to emerge as most of the cases it was stopped in 120 days. Final data were pooled to get the total number of adults who emerged from each variety and per cent adult emergence was calculated by following formula:

Per cent adult emergence =

$$\frac{\text{Number of adult emergence}}{\text{Initial egg population (No.)}} \times 100$$

Weight loss

The weight loss was calculated by deducting the final weight of the sample from the initial weight and then converted to the percentage.

$$\text{Per cent weight loss} = \frac{W1 - W2}{W1} \times 100$$

Where,
W1 = Initial weight of pods.
W2 = Final weight of pods.

Pod damage

Damaged groundnut pods were separated, counted and expressed as per cent pod damage. Following formula was used to work out per cent pod damage.

Per cent weight loss =

$$\frac{\text{Number of damaged pods}}{\text{Total number of pods}} \times 100$$

The data thus obtained were statistically analyzed by using completely randomized design.

Categorization of the varieties

The varieties were grouped into three class's *viz.* highly susceptible, moderately susceptible and least susceptible based on the parameters described by Shivalingaswamy and Balasubramaniam (1992) *i.e.,* per cent adult emergence, per cent weight loss and per cent pod damage. The values exceeding the sum of mean and standard deviation were grouped into highly susceptible and values less than the difference of mean and standard deviation were considered as least susceptible. The moderately susceptible group comprised the values which fall in between the highest and least susceptible.

RESULTS AND DISCUSSION

Ten varieties of groundnut were screened to know their resistance/susceptibility against bruchid, *C. serratus* up to 4 months of storage. However, there was a wide variation in adult emergence, pod damage and weight loss present in different varieties. The findings are presented hereunder.

Adult emergence

The results presented in Table 1 clearly showed that there were significant differences in per cent adult emerged from the pods of different groundnut varieties. The adult emergence after 60 days ranged between 46.82 to 82.39 per cent. Among varieties, GJG-9 recorded the lowest per cent adult emergence (46.82%) followed by GG-HPS-2 (50.35%), GJG-33 (53.08%) and GG-38 (55.42%). Among varieties, GJG-32 (82.39%) recorded the highest adult emergence followed by GJG-22 (75.32%). The adult emerged after 90 days ranged from 52.35 to 86.84 per cent. The variety GJG-9 recorded lowest per cent adult emergence (52.35%) and the variety GJG-32 recorded the maximum adult emergence (86.84%). However, the varieties like GJG-31 and GG-20 recorded a moderate adult emergence *i.e.,* 65.34 and 74.82 per cent, respectively. There were significant difference in the adult emerged after 120 days from the pods of different groundnut varieties. The adult emergence ranged between 55.35 to 91.81 per cent. The groundnut variety, GJG-9 recorded lowest per cent adult emergence (55.35%) and the variety GJG-32 recorded the maximum per cent adult emergence (91.81%). The number of groundnut bruchid adult emergence varied in different groundnut varieties (Harish *et al.,* 2012). The present results are also in conformity with the results of Bhoraniya (2011) who reported that the per cent adult emergence from different groundnut varieties ranged from 80.00 to 100.00 per cent. Similarly, the reports of Ramadevi *et al.* (2014), Nadaf (2008) and Rekha *et al.* (2017) also revealed the differential response of adult emergence by bruchid in different varieties of groundnut.

Per cent pod damage

The data on the per cent pod damage after 60 days in each repetition of different varieties together with the total number of pods observed, healthy and damaged pods were counted. The data in Table 1 showed that maximum and minimum infestation of 2.90 to 23.61 per cent occurred in varieties GJG-9 and GJG-32, respectively. A significantly minimum *i.e*., 2.90 per cent pod damage was found in variety like GJG-9 was significantly maximum pod damage was noticed in varieties GJG-32 (23.61%). The data on the per cent pod damage after 90 days showed that maximum and minimum pod damage of 6.23 to 29.36 per cent occurred in variety GJG-9 and GJG-32, respectively (Table 1). A significantly minimum 6.23 per cent pod damage was noticed in variety GJG-9 whereas significantly maximum per cent pod damage was recorded in varieties like GJG-32 (29.36%) followed by GJG-22 (25.32%). The data on the pod damage after 120 days showed that the maximum and minimum infestation was ranging between 9.62 to 34.24 per cent in varieties GJG-9 and GJG-32, respectively. A significantly minimum 9.62 per cent pod damage was recorded in variety GJG-9 while significantly maximum pod damage was recorded in variety GJG-32 (34.24%). In a study Ramadevi (1996) observed up to 20 per cent of pod damage by this pest. Najitha *et al.* (2013) studied the damage potential of groundnut bruchid and recorded pod damage up to 84.46 per cent in groundnut variety Kadiri 1641. Harish *et al.* (2012) noted the maximum pod damage

Table 1: Response of groundnut varieties against bruchid, *C. serratus*.

Variety	% Adult emergence			% Pod damage			% Weight loss		
	60 days	90 days	120 days	60 days	90 days	120 days	60 days	90 days	120 days
GJG-9	43.19 (46.82)*	46.37 (52.35)	48.10 (55.35)	9.64 (2.90)	14.35 (6.23)	17.99 (9.62)	10.35 (3.23)	16.45 (8.14)	18.32 (10.11)
GJG-22	60.26 (75.32)	65.32 (82.20)	70.59 (88.72)	26.88 (20.44)	30.22 (25.32)	34.83 (32.60)	25.33 (18.31)	31.33 (27.05)	35.90 (34.36)
GJG-31	49.95 (58.50)	54.00 (65.34)	59.27 (73.06)	20.91 (12.73)	24.46 (17.15)	28.25 (22.45)	20.09 (11.80)	25.83 (18.97)	29.90 (24.85)
GJG-32	65.31 (82.39)	69.03 (86.84)	73.43 (91.81)	29.07 (23.61)	32.82 (29.36)	35.83 (34.24)	27.91 (21.90)	33.00 (29.67)	38.01 (37.89)
GJG-33	46.79 (53.08)	49.05 (57.00)	53.05 (63.65)	14.66 (6.51)	20.54 (12.36)	22.36 (14.54)	14.47 (6.27)	20.97 (12.83)	23.86 (16.41)
GG-20	53.71 (64.65)	60.05 (74.82)	65.53 (82.54)	22.69 (14.87)	27.49 (21.29)	29.51 (24.27)	22.58 (14.76)	28.62 (22.93)	32.00 (28.07)
GG-35	49.55 (57.81)	52.47 (62.76)	55.80 (68.34)	19.03 (10.63)	24.03 (16.59)	27.03 (20.65)	18.32 (9.88)	24.53 (17.24)	27.97 (22.01)
GG-38	48.14 (55.42)	51.20 (60.66)	53.79 (65.00)	18.35 (9.92)	22.72 (14.95)	25.28 (18.26)	17.86 (9.41)	21.58 (13.57)	25.45 (18.53)
TG-37-A	57.93 (71.71)	62.86 (78.86)	65.94 (83.14)	25.56 (18.60)	28.06 (22.12)	31.75 (27.67)	23.86 (16.43)	29.86 (24.77)	34.37 (31.85)
GG-HPS-2	45.22 (50.35)	47.52 (54.34)	50.74 (59.89)	12.03 (4.38)	17.90 (9.52)	20.48 (12.28)	12.55 (4.78)	18.36 (9.98)	21.87 (14.10)
S.Em.±	2.11	2.19	2.41	0.81	0.89	1.04	0.78	0.93	1.28
CD at 5%	6.23	6.46	7.12	2.40	2.63	3.08	2.32	2.77	3.80
CV%	7.04	6.80	7.02	7.10	6.37	6.63	7.06	6.49	7.76

Data in parentheses are retransformed values. Those outside data are arcsin transformed values.

i.e., 80.7 per cent was recorded in GG-20. Thus, in the present investigation similar trends were observed and was closely support the present findings.

Weight loss

The results on weight loss after 60 days presented in Table 1 depicted that maximum and minimum weight loss of 21.90 and 3.23 per cent occurred in varieties GJG-32 and GJG-9, respectively. A significantly minimum 3.23 per cent weight loss was recorded in variety GJG-9 and was followed by GG-HPS-2 (4.78%). Further, significantly maximum weight loss (21.90%) was recorded in variety GJG-32. The weight loss after 90 days showed that significantly minimum 8.14 per cent weight loss was recorded in variety GJG-9 and it was followed by GG-HPS-2 (9.98%). Further, significantly higher weight loss was observed in varieties GJG-32 (29.67%). Further, weight loss after 120 daysshowed that maximum and minimum weight loss of 37.89 and 10.11 per cent occurred in varieties GJG-32 and GJG-9, respectively. A significantly minimum 10.11 per cent weight loss was recorded in varieties GJG-9 and followed by GG-HPS-2 (14.10%). Moreover, significantly higher *i.e*., 37.89 per cent weight loss was recorded in varieties GJG-32. Behera *et al.* (2017) reported that per cent weight loss due to groundnut bruchid infestation was varied from 1.2 to 17.8 per cent in first month of storage. Najitha *et al.* (2013) studied the damage potential of groundnut bruchid and recorded 19.5 and 21.14 per cent weight loss in Kadiri 008 Bold and Kadiri 1641 groundnut varieties, respectively. In the present study, more or less similar trends were observed and closely supported the present findings.

Grouping of the groundnut varieties against bruchid

An attempt was made to categorize different groundnut varieties into three categories of susceptibility to bruchid, *C. serratus viz.*, least susceptible, moderately susceptible and highly susceptible as per Shivalingaswamy and Balasubramaniam (1992). The details of categorization are presented in Table 2. Based on the per cent adults emerged after 120 days of the storage period, the varieties GJG-9 and GG-HPS-2 found least susceptible varieties which recorded less than 61.11 per cent adults emerged. The varieties *viz.,* GJG-31, GJG-33, GG-20, GG-35, GG-38 and TG-37-A were found moderately susceptible which recorded 61.11 to 85.19 per cent adults emerged. However, the varieties GJG-22 and GJG-32 found highly susceptible varieties which recorded more than 85.19 per cent adults emerged. Based on the per cent pod damage after 120 days of the storage period, the data presented in Table 2 showed that the varieties GJG-9 and GG-HPS-2 found the least susceptible, which recorded less than 13.37 per cent damage. The varieties *viz.,* GJG-31, GJG-33, GG-20, GG-35, GG-38 and TG-37-A were found moderately susceptible which recorded 13.37 to 29.93 per cent damage. However, the varieties GJG-22 and GJG-32 found highly susceptible varieties which recorded more than 29.93 per cent damage. On the basis of per cent weight loss after 120 days of the

Table 2: Grouping of groundnut varieties based on reaction against bruchid, *C. serratus.*

Category	Mean	S.D.	Least susceptible	Moderately susceptible	Highly susceptible
Based on percentage of adults emerged after 60 days of storage	61.60	11.00	(<50.6) GJG-9,GG-HPS-2	(50.6 to 72.60) GJG-31, GJG-33,GG-20, GG-35, GG-38, TG-37-A	(>72.60) GJG-22, GJG-32
Based on percentage of adults emerged after 90 days of storage	67.51	11.66	<55.85 GJG-9,GG -HPS-2	55.85 to 79.17 GJG-31, GJG-33,GG-20, GG-35, GG-38, TG-37-A	>79.17 GJG-22, GJG-32
Based on percentage of adults emerged after 120 days of storage	73.15	12.04	<61.11 GJG-9,GG-HPS-2	61.11 to 85.19 GJG-31, GJG-33,GG-20, GG-35,GG-38, TG-37-A	>85.19 GJG-22, GJG-32
Based on pod damage after 60 days of storage	12.45	6.93	<5.52 GJG-9, GG-HPS-2	5.52 to 19.38 GJG-31, GJG-33, GG-20, GG-35, GG-38, TG-37-A	>19.38 GJG-22, GJG-32
Based on pod damage after 90 days of storage	17.48	7.16	<10.32 GJG-9, GG-HPS-2	10.32 to 24.64 GJG-31, GJG-33, GG-20, GG-35, GG-38, TG-37-A	>24.64 GJG-22, GJG-32
Based on pod damage after 120 days of storage	21.65	8.28	<13.37 GJG-9, GG-HPS-2	13.37 to 29.93 GJG-31, GJG-33, GG-20, GG-35, GG-38, TG-37-A	>29.93 GJG-22, GJG-32
Based on per cent loss in weight after 60 days of storage	11.67	6.12	<5.55 GJG-9, GG-HPS-2	5.55 to 17.79 GJG-31, GJG-33, GG-20, GG-35, GG-38, TG-37-A	>17.79 GJG-22, GJG-32
Based on per cent loss in weight after 90 days of storage	18.51	7.41	<11.10 GJG-9, GG-HPS-2	11.10 to 25.92 GJG-31, GJG-33, GG-20, GG-35, GG-38, TG-37-A	>25.92 GJG-22, GJG-32
Based on per cent loss in weight after 120 days of storage	23.81	9.19	<14.62 GJG-9, GG-HPS-2	14.62 to 33.00 GJG-31, GJG-33, GG-20, GG-35, GG-38, TG-37-A	>33.00 GJG-22, GJG-32

storage period, the data presented in Table 2 showed that the varieties GJG-9 and GG-HPS-2 found the least susceptible varieties which recorded less than 14.62 per cent loss. The varieties *viz.,* GJG-31, GJG-33, GG-20, GG-35, GG-38 and TG-37-A were found moderately susceptible which recorded 14.62 to 33.00 per cent loss. However, the varieties GJG-22 and GJG-32 found highly susceptible varieties which recorded more than 33.00 per cent loss. Overall, it was concluded that the varieties GJG-9 and GG-HPS-2 fall under the least susceptible category of all the parameters and can be considered as least susceptible to *C. serratus*. The varieties GJG-22 and GJG-32 fall under the highly susceptible category of all parameters and can be considered as highly susceptible to *C. serratus*. These findings are in agreement with the findings of Radadia (2003) who screened 22 different groundnut cultivars and reported that cultivars GG-2 and GAUG-10 had the highest infestation of *C. serratus*. Bhoraniya (2011) screened groundnut cultivars against *C. serratus* in terms of oviposition, larval period, pupal period, total development period, survival percentage and growth index and found GG 13 and GG 11 were resistant whereas, GG 2 was susceptible. Moreover, Harish *et al.* (2012) observed that the number of eggs and adults of *C. serratus* that emerged in groundnut were highest in GG 20 and also revealed that genotypes with large seed sizes as more susceptible to bruchid infestation. The present findings are more or less in accordance with the findings of earlier workers.

CONCLUSION

Based on the present study it can be concluded that after 120 days of storage period out of ten different varieties, GJG-9 was found comparatively least susceptible to the groundnut bruchid *Caryedon serratus* as it recorded significantly less per cent adult emergence (55.35%), less per cent pod damage (9.62%) and significantly less per cent weight loss (10.11%).

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Conflict of interest

All authors declare that they have no conflict of interest.

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