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Screening of Groundnut Genotypes against *Spodoptera litura* (Fab.) with Respect to Leaf Damage

Meet C. Dudhatra [a++*], A. M. Bharadiya [b#], Jenish D. Makani [a++] and Bhumi D. Barad [a†]

[a] Department of Entomology, Junagadh Agricultural University, Junagadh, Gujarat, India.
[b] Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh, Gujarat, India.

Authors' contributions

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

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ABSTRACT

A field experiment was conducted at Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh, Gujarat in 2023 during the *kharif* season to investigate the screening of groundnut genotypes against *Spodoptera litura* (Fab.) with respect to leaf damage. The field screening of thirty different genotypes of groundnut against *S. litura* was laid out in a Randomized Block Design (RBD) with two replicationsand revealed that JVB-2597 exhibited the minimum per cent leaf damage (4.69%), while JVB-2577 recorded the maximum per cent leaf damage (9.28%). From the categorization, it can be revealed that JVB-2597, JSSP-76, JB-1572, J-108, JVB-2607

[++]M. Sc. Scholar;
[#]Associate Research Scientist;
[†]Ph. D. Scholar;
**Corresponding author: E-mail: meetdudhatra1515@gmail.com;*

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and JB-1551 are resistant to *S. litura*, with infestations ranging from 4.69% to 5.92% leaf damage. Conversely, JSSP-69, JB-1585, J-118, J-111 and JVB-2577 are susceptible, recording infestation levels between 8.87% to 9.28% leaf damage.

Keywords: Screening; groundnut; genotypes; S. litura; leaf damage.

1. INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is a leguminous oilseed crop native to South America. As the king of oilseeds, it is the fourth most important oilseed in the world. It is the largest source of edible oil and ranks 13th among food crops in the world [1]. In terms of output of groundnuts, China leads India. Gujarat holds the highest percentage in terms of both area and production among all the Indian states that grow groundnuts. Groundnuts are grown on 17.09 lakh hectares in Gujarat, where they yield 28.14 lakh tonnes of yield annually and 1647 kg/ha of productivity [2].

Pests that spread disease or cause direct harm to crops have an impact on groundnut productivity. In India, reports of over a hundred insect pest species have been made on groundnuts [3]. The tobacco caterpillar, *S. litura*, is thought to be the most significant pest among the several insect pests that infest this crop in Gujarat because of its polyphagous behavior and the year-round favorable environment. Together, the newly hatched and early instar larvae of *S. litura* feed on the underside of leaves, skeletonizing the leaves and severely destroying them in later stages until only petioles and branches remain. This scraping of chlorophyll results in a yield loss of up to 15–30% [4] and more than 180 crops [5].

There is scanty information on the screening of different genotypes of groundnut in relation to *S. litura* with respect to leaf damage. Therefore, screening of various genotypes is required in groundnut. The use of resistant or tolerant groundnut genotypes is a very important consideration to minimize the damage by *S. litura*. Therefore, simultaneous evaluation of screening of groundnut genotypes against *S. litura* is needed.

2. MATERIALS AND METHODS

To study the screening of groundnut genotypes against *Spodoptera litura* (Fab.) with respect to leaf damage, the crop was sown at Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh, Gujarat during the *kharif*, 2023. Two lines of various thirty genotypes (Table 1) were laid out in a Randomized Block Design (RBD) with two replications. Each plot had a dimension of 5 m x 0.90 m with spacing of 45 cm between rows and 10 cm between plants. Throughout the experiment, standard agronomical practices were followed and no insecticides were applied. The observation on per cent leaf damage was recorded from randomly selected five plants from each genotypes during vegetative, flowering and post flowering stage. The data obtained was subjected to statistical analysis for assessment of least susceptible genotypes against *S. litura* on groundnut. Per cent leaf damage was calculated using the following formula [6].

$$\text{Per cent leaf damage} = \frac{\text{Number of damaged leaf}}{\text{Total number of leaf}} \times 100$$

Table 1. Treatment details of groundnut genotypes

1.	JSSP-69	11.	JVB-2602	21.	JB-1571
2.	JSSP-70	12.	JVB-2607	22.	JB-1572
3.	JSSP-71	13.	J-108	23.	JB-1583
4.	JSSP-73	14.	J-111	24.	JB-1584
5.	JSSP-76	15.	J-116	25.	JB-1585
6.	JSSP-78	16.	J-118	26.	JB-1589
7.	JVB-2577	17.	J-119	27.	JB-1590
8.	JVB-2596	18.	JB-1550	28.	JB-1595
9.	JVB-2597	19.	JB-1551	29.	GJG-9
10.	JVB-2598	20.	JB-1558	30.	GJG-32

List 1. Categorization of groundnut genotypes were under

Category of resistance	Scale for resistance
Highly susceptible	$\bar{X}i \le (\bar{X} - 2SD)$
Moderately resistant	$(\bar{X} - SD) \ge \bar{X}i > (\bar{X} - 2SD)$
Moderately resistant	$\bar{X} \ge \bar{X}i > (\bar{X} - SD)$
Moderately susceptible	$\bar{X} < \bar{X}i \le (\bar{X} + SD)$
Susceptible	$(\bar{X} + SD) < \bar{X}i \le (\bar{X} + 2SD)$
Highly susceptible	$\bar{X}i > (\bar{X} + 2SD)$

2.1 Categorization of Genotypes

The various groundnut genotypes were grouped into six categories of resistance to *S. litura viz.,* highly resistant, resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible based on per cent leaf damage. For this purpose, the mean value of individual genotype ($\bar{X}i$) was compared with the mean value of all genotypes ($\bar{X}$) and standard deviation (SD). The retransformed data was used for computation of $\bar{X}$, $\bar{X}i$ and SD in case of this parameter. The scale used for categorizing different genotypes was under.

3. RESULTS AND DISCUSSION

The data on per cent leaf damage by *S. litura* during vegetative stage, flowering stage and post flowering stage are presented in Table 2 and depicted in Fig. 1. At vegetative stage, it indicated that lower leaf damage due to *S. litura* was observed in JVB-2597 (5.23%) which was at par with JB-1572 (6.08%), JSSP-76 (6.35%) and J-108 (6.48%). The next best genotypes were JVB-2607 (6.67%), JB-1551 (6.79%), J-119 (7.14%), JVB-2602 (7.35%), JSSP-73 (7.62%), JB-1583 (7.65%), JVB-2598 (7.68%), JB-1558 (7.86%) and JB-1550 (8.02%). While higher leaf damage was registered in JVB-2577 (10.23%).

At flowering stage,it indicated that lower leaf damage due to *S. litura* was observed in JVB-2597 (6.90%) which was at par with JSSP-76 (7.06%), JB-1572 (7.88%) and J-108 (8.03%). The next best genotypes were JVB-2607 (8.31%), JVB-2602 (8.77%), JB-1551 (8.82%), J-119 (8.86%), JB-1583 (9.47%), JSSP-73 (9.47%), JVB-2598 (9.56%) and JB-1558 (9.67%). While the higher leaf damage due to *S. litura* was registered in JVB-2577 (13.21%).

At post flowering stage,it indicated that lower leaf damage due to *S. litura* was observed in JVB-2597 (2.65%) which was at par with JSSP-76 (2.76%), JB-1572 (2.87%), J-108 (2.97%), JVB-2607 (3.06%), JB-1551 (3.19%) and J-119 (3.35%). The next best genotypes were JVB-2602 (3.52%), JB-1583 (3.64%), JSSP-73 (3.68%), JVB-2598 (3.73%), JB-1558 (3.82%), JB-1550 (3.97%) and JB-1571 (4.13%). While the higher leaf damage due to *S. litura* was registered in JVB-2577 (5.55%).

The data on pooled over period indicated that lower leaf damage by *S. litura* was observed in JVB-2597 (4.69%) which was at par with JSSP-76 (5.04%). The next best genotypes were JB-1572 (5.31%), J-108 (5.49%), JVB-2607 (5.66%) and JB-1551 (5.92%). Rest of genotypes recorded *viz.*, J-119 (6.10%), JVB-2602 (6.20%), JB-1583 (6.55%), JSSP-73 (6.56%), JVB-2598 (6.63%), JB-1558 (6.75%), JB-1550 (6.96%), JB-1571 (7.25%), JB-1589 (7.35%), JSSP-71 (7.69%), JVB-2596 (7.72%), JB-1590 (7.75%), JB-1595 (8.00%), JB-1584 (8.30%), JSSP-78 (8.33%), J-116 (8.51%), GJG-32 (8.61%), JSSP-70 (8.66%), GJG-9 (8.69%), JSSP-69 (8.87%), JB-1585 (8.98%), J-118 (9.04%) and J-111 (9.20%) leaf damage by *S. litura*. While the higher leaf damage due to *S. litura* was registered in JVB-2577 (9.28%).

3.1 Categorization of Groundnut Genotypes for their Resistance

The various groundnut genotypes were also grouped in to six categories of resistance *viz*., highly resistant (HR), resistant (R), moderately resistant (MR), moderately susceptible (MS), susceptible (S) and highly susceptible (HS) based on per cent leaf damage on groundnut by comparing the mean incidence of individual genotypes ($\bar{X}i$) with mean incidence of all genotypes ($\bar{X}$) and standard deviation (SD). The categorization of various groundnut genotypes is exhibited in Table 3.

The data shows that none of the genotype fell under highly resistant. Considering the leaf damage, JVB-2597 (4.69%), JSSP-76 (5.04%), JB-1572 (5.31%), J-108 (5.49%), JVB-2607 (5.66%) and JB-1551 (5.92%) were categorized as resistant genotypes, while J-119 (6.10%),

Table 2. Leaf damage by *S. litura* on groundnut genotypes during *kharif*, 2023

Sr. No.	Genotypes	Leaf damage %			Pooled
		Vegetative stage	**Flowering stage**	**Post flowering stage**	
1.	JSSP-69	9.79 (18.23)	12.47 (20.68)	5.40 (13.44)	8.87 (17.33)
2.	JSSP-70	9.52 (17.97)	12.20 (20.44)	5.28 (13.28)	8.66 (17.11)
3.	JSSP-71	8.56 (17.01)	11.12 (19.48)	4.45 (12.18)	7.69 (16.10)
4.	JSSP-73	7.62 (16.02)	9.47 (17.92)	3.68 (11.06)	6.56 (14.84)
5.	JSSP-76	6.35 (14.60)	7.06 (15.41)	2.76 (9.57)	5.04 (12.97)
6.	JSSP-78	9.26 (17.72)	11.80 (20.09)	4.98 (12.89)	8.33 (16.78)
7.	JVB-2577	10.23 (18.65)	13.21 (21.31)	5.55 (13.63)	9.28 (17.74)
8.	JVB-2596	8.77 (17.23)	10.77 (19.16)	4.65 (12.45)	7.72 (16.13)
9.	JVB-2597	5.23 (13.22)	6.90 (15.23)	2.65 (9.36)	4.69 (12.51)
10.	JVB-2598	7.68 (16.09)	9.56 (18.01)	3.73 (11.14)	6.63 (14.92)
11.	JVB-2602	7.35 (15.73)	8.77 (17.23)	3.52 (10.81)	6.20 (14.42)
12.	JVB-2607	6.67 (14.97)	8.31 (16.75)	3.06 (10.07)	5.66 (13.77)
13.	J-108	6.48 (14.75)	8.03 (16.46)	2.97 (9.92)	5.49 (13.55)
14.	J-111	10.04 (18.47)	13.12 (21.24)	5.52 (13.59)	9.20 (17.66)
15.	J-116	9.43 (17.88)	12.03 (20.29)	5.13 (13.09)	8.51 (16.97)
16.	J-118	10.05 (18.48)	12.70 (20.88)	5.48 (13.54)	9.04 (17.50)
17.	J-119	7.14 (15.50)	8.86 (17.32)	3.35 (10.55)	6.10 (14.29)
18.	JB-1550	8.02 (16.45)	9.98 (18.42)	3.97 (11.49)	6.96 (15.30)
19.	JB-1551	6.79 (15.10)	8.82 (17.28)	3.19 (10.29)	5.92 (14.09)
20.	JB-1558	7.86 (16.28)	9.67 (18.12)	3.82 (11.27)	6.75 (15.06)
21.	JB-1571	8.18 (16.62)	10.51 (18.92)	4.13 (11.72)	7.25 (15.62)
22.	JB-1572	6.08 (14.28)	7.88 (16.30)	2.87 (9.76)	5.31 (13.32)
23.	JB-1583	7.65 (16.06)	9.47 (17.92)	3.64 (11.00)	6.55 (14.83)
24.	JB-1584	9.19 (17.65)	11.68 (19.98)	5.02 (12.95)	8.30 (16.74)
25.	JB-1585	9.98 (18.42)	12.61 (20.80)	5.45 (13.50)	8.98 (17.44)
26.	JB-1589	8.39 (16.84)	10.45 (18.86)	4.27 (11.92)	7.35 (15.73)
27.	JB-1590	8.65 (17.10)	11.16 (19.52)	4.50 (12.25)	7.75 (16.16)
28.	JB-1595	9.02 (17.48)	11.27 (19.62)	4.76 (12.60)	8.00 (16.43)
29.	GJG-9	9.58 (18.03)	12.26 (20.50)	5.28 (13.28)	8.69 (17.15)
30.	GJG-32	9.54 (17.99)	12.15 (20.40)	5.18 (13.16)	8.61 (17.06)
V	**S. Em. ±**	**0.58**	**0.51**	**0.43**	**0.29**
	C.D. at 5%	**1.62**	**1.41**	**1.20**	**0.80**
V × P	**S. Em. ±**	**-**	**-**	**-**	**1.05**
	C.D. at 5%	**-**	**-**	**-**	**2.90**
C.V. (%)		**8.49**	**8.56**	**11.58**	**9.45**

Figures in parenthesis are arc sin transformed values, while outsides are original values

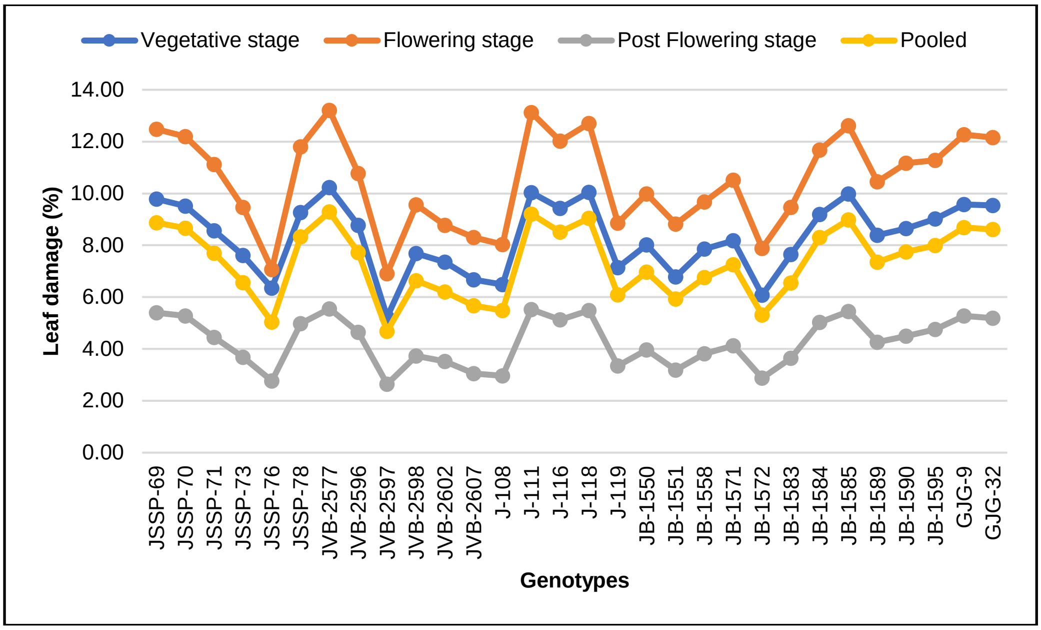

Fig. 1. Leaf damage due to *S. litura* on different genotypes of groundnut during *kharif*, 2023

Table 3. Categorization of different genotypes of groundnut for their susceptibility against *S. litura* based on per cent leaf damage

Category of resistant	Scale	Genotypes X̄i
1	2	3
	Based on per cent leaf damage (%): X̄ = 7.34 SD = 1.35	
Highly resistant	X̄i ≤ 4.64	-
Resistant	5.99 ≥ X̄i > 4.64	JVB-2597 (4.69), JSSP-76 (5.04), JB-1572 (5.31), J-108 (5.49), JVB-2607 (5.66), JB-1551 (5.92)
Moderately resistant	7.34 ≥ X̄i > 5.99	J-119 (6.10), JVB-2602 (6.20), JB-1583 (6.55), JSSP-73 (6.56), JVB-2598 (6.63), JB-1558 (6.75), JB-1550 (6.96), JB-1571 (7.25)
Moderately susceptible	7.34 < X̄i ≤ 8.69	JB-1589 (7.35), JSSP-71 (7.69), JVB-2596 (7.72), JB-1590 (7.75), JB-1595 (8.00), JB-1584 (8.30), JSSP-78 (8.33), J-116 (8.51), GJG-32 (8.61), JSSP-70 (8.66), GJG-9 (8.69)
Susceptible	8.69 < X̄i ≤ 10.04	JSSP-69 (8.87), JB-1585 (8.98), J-118 (9.04), J-111 (9.20), JVB-2577 (9.28)
Highly susceptible	X̄i > 10.04	-

Note: Figures in parentheses are per cent leaf damage
Where, X̄i = Mean value of individual genotype
X̄ = Mean value of all genotype
SD = Standard deviation

JVB-2602 (6.20%), JB-1583 (6.55%), JSSP-73(6.56%), JVB-2598 (6.63%), JB-1558 (6.75%), JB-1550 (6.96%) and JB-1571 (7.25%) categorized as moderately resistant. Genotypes, JB-1589 (7.35%), JSSP-71 (7.69%), JVB-2596 (7.72%), JB-1590 (7.75%), JB-1595 (8.00%), JB-1584 (8.30%), JSSP-78 (8.33%), J-116 (8.51%), GJG-32 (8.61%), JSSP-70 (8.66%) and GJG-9 (8.69%) were rated as moderately susceptible. Whereas, JSSP-69 (8.87%), JB-1585 (8.98%), J-118 (9.04%), J-111 (9.20%) and JVB-2577 (9.28%) proved to be susceptible to *S. litura*, whereas no any genotypes were found to be highly susceptible to *S. litura*.

Dange and Naidu [7] reported that among the 29 pre-breeding genotypes, three genotypes ICGIL 17101, ICGIL 17107 and ICGIL 17111 were resistant to *S. litura* with less than 10 per cent leaf damage by compared to resistant check ICG

2271 (16.0 % leaf damage). Shaik et al. [8] reported that among the forty germplasm lines screened against tobacco caterpillar, three germplasm lines *viz.*, ICGV 16679, ICGV 07222 and ICGV 9346 showed greater resistance than the resistant check, ICGV 86031. Waykule et al. [9] exhibited that among 50 groundnut germplasm, none of the entry was found highly resistant, while 11 germplasm lines were categorized as resistant germplasm, 15 germplasm lines were found as moderately resistant and 12 as susceptible, while 12 varieties were found highly susceptible to *S. litura*. Naik [10] reported that the leaf damage due to *S. litura* was 14.87% and 11.5% in GJG-9 and GJG-32, respectively and fell under moderately susceptible category. Saleem et al. [11] reported that among the 188 accessions in the mini core, only 29 (15%) genotypes showed resistance to *Spodoptera litura* with less than 10% leaf damage. Dharne and Patel [12] reported that the lowest leaf damage (5%) by *S. litura* was found in ICGV 86156, ICGV 86400, ICGV 86528, ICGV 87128, ICGV 87141, ICGV 87290, ICGV 87411 and ICGV 91214.

4. CONCLUSION

From the result of vegetative stage, flowering stage and post flowering stageminimum per cent leaf damage was recorded in the genotype JVB-2597, while the genotype JVB-2577 recorded maximum per cent leaf damage due to *S. litura*. The genotypes JVB-2597, JSSP-76, JB-1572, J-108, JVB-2607 and JB-155 were categorized as resistant (R) to *S. litura*, while the genotypes JSSP-69, JB-1585, J-118, J-111 and JVB-2577 were classified as susceptible (S). Eight genotypes were moderately resistant (MR) ranging from 5.99 to 7.34 per cent leaf damage and eleven genotypes were moderately susceptible (MS) ranging from 7.34 to 8.69 per cent leaf damage. These resistant genotypes may be used in further resistances breeding programmes for developing the resistant varieties.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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