

Screening of Soybean Genotypes Against Stem fly and Girdle beetle

P.V. Bhagat^{1*}, F. S. Khan¹, R. S. Jadhav², P. R. Puri¹, D.R. Kshirsagar¹

¹Department of Entomology, VNMKV, Parbhani

²AICRP on Soybean, VNMKV, Parbhani

*Corresponding Author: E-mail: bhagatpratiksha46@gmail.com

ABSTRACT

Field trial was conducted in kharif 2024-25 at AICRP on Soybean, VNMKV, Parbhani (M.S.). Total 20 genotypes were screened against stem borers viz., stem fly and girdle beetle. Against girdle beetle, overall infestation was ranged from 8.53% to 29.65%. Among 20 genotypes, lowest of 8.53% infestation was recorded in genotype JS 95-60 and was categorized as resistant (R) against girdle beetle. Twelve genotypes showed moderate resistance (MR) including JS 21-72 (11.09%), MACS 1520 (11.15%), KDS 726 (12.10%), DLSb 1 (12.60%), DS 3108 (12.58%), RVSM 2011-35 (12.69%), MAUS 612 (13.80%) and DSb 23 (13.90%). Four genotypes were low resistant (LR), two susceptible (S) and maximum infestation was recorded in RVS 13-20 (29.65%) and was found highly susceptible (HS) against girdle beetle. Stem fly infestation was ranged from 15.36% to 44.87%. Among 20 genotypes, JS 95-60 (15.36%) and JS 21-72 (17.16%) were recorded lowest infestation and found resistant (R) against stem fly. Six genotypes viz., DS 3108 (27.46%), MAUS 731 (28.31%), NRC 130 (22.98%), RVS 13-20 (28.82%), SKF-SPS-11 (27.28%) and MAUS 158 (18.36%) were moderately resistant (MR). Twelve genotypes were low resistant (LR). Highest infestation was recorded in genotype RVS 2007-06 (44.87%) and found low resistant (LR) against stem fly.

Keywords: Soybean, Screening, Girdle beetle, Stem fly

1 | INTRODUCTION

Soybean (*Glycine max* L. Merrill), a major leguminous crop of the Fabaceae family, is globally recognized for its high nutritional value, containing approximately 40% protein and 20% oil. It serves as an essential source of plant-based protein, particularly in vegetarian diets, contributing significantly to addressing protein-calorie malnutrition in India, where a majority of the population depends on pulses for protein intake. (Dhore *et al.*, 2024).

The crop originated in China and was introduced to India during the 1970 (Andole, 1984). Currently, major soybean-producing countries include the USA, Brazil, Argentina, China, and India. For the 2024–25 season, global soybean production was projected at 420.78 million metric tons (USDA, 2024). In India, soybean is cultivated over 129.35 lakh hectares, producing 133.60 lakh metric tons with an average productivity of 1033 kg/ha. Maharashtra is a key contributor, with 84.38 lakh metric tons harvested from 51.59 lakh hectares (productivity: 1636 kg/ha), while the Marathwada region alone accounts for 42.535 lakh metric tons from 26.193 lakh hectares (productivity: 1623 kg/ha). (Anonymous, 2024).

Despite its economic and nutritional importance, soybean production is constrained by a wide array of insect pests. In India, over 273 insect species have been reported on soybean, with key pests including defoliators (*Spodoptera litura*, *Chrysodeixis acuta*, *Helicoverpa armigera*), sap feeders

(*Aphis glycines*, *Bemisia tabaci*, *Empoasca kerri*), stem borers (*Melanagromyza sojae*, *Obereopsis brevis*), and others (Patil *et al.*, 2014; Chaudhari *et al.*, 2020). Yield losses due to these pests range from 20% to 100% depending on pest severity and crop stage (Sharma *et al.*, 2014). In particular, stem fly *M. sojae* infestation may reduce grain weight by over 85% (Dhore *et al.*, 2024). The girdle beetle, *Obereopsis brevis* (Swedenborg) is one of the significant hidden pests of soybean in Marathwada region of Maharashtra (Bhamare *et al.*, 2018). In case of heavy incidences yield may reduce by up to 40 per cent (Thipse, 2012).

Host plant resistance is considered an eco-friendly and economically viable approach to manage insect pests. According to Kogan (1982), insect resistance was an inheritable trait that allows plants to inhibit pest development or recover from pest-induced injury through biochemical or morphological mechanisms. Identifying resistant genotypes through systematic screening not only aids in sustainable pest management but also reduces reliance on chemical pesticides and associated environmental hazards. Hence, in present study screening of different genotypes was carried out.

2 | MATERIAL AND METHODS

An experiment was conducted during kharif 2024-25 to screen soybean genotypes against major insect pests using twenty genotypes, including 18 test entries and 2 local checks MAUS 2 (susceptible check) and MAUS 158 (resistant check). The trial was laid out in a randomized block design (RBD) with

two replications. Each gross plot consisted of three rows of 5-meter length, spaced at 45 cm × 5 cm. The sowing was carried out on 12th July 2024 at the Experimental farm of AICRP on Soybean, VNMKV Parbhani (MS) under uniform agronomic conditions. The genotypes used included DLSb 1, DSb 23, DS 3108, JS 21-72, JS 95-60, KDS 726, MACS 1520, MAUS 2, MAUS 158, MAUS 612, MAUS 725, MAUS 731, MAUS 780, NRC 130, NRC 152, RSC 10-52, RVS 13-20, RVS 2007-06, RVSM 2011-35 and SKF-SPS-11.

To determine the level of resistance or susceptibility, the AICRP method of classification was followed, which categorizes genotypes based on their deviation from the mean pest incidence using critical difference (CD) at 1% and 5% levels.

The classification includes six categories:

Highly resistant (HR) : values < (mean – CD at 1%)

Resistant (R) : values between (mean – CD at 1%) and (mean – CD at 5%)

Moderately resistant (MR) : values between (mean – CD at 5%) and the mean

Low resistant (LR) : values between the mean and (mean + CD at 5%)

Susceptible (S) : values between (mean + CD at 5%) and (mean + CD at 1%)

Highly susceptible (HS) : values > (mean + CD at 1%).

This classification was used to determine the genotypic reaction to specific insect pests based on observed data and statistical significance (Proceeding and Technical Programme 2023-24)

2.1 | Method of recording observations

Observations for genotype screening were recorded weekly, starting from 7 days after germination (DAG) until peak pest incidence, following the AICRP classification method to assess genotype reactions.

1) Stem fly:- Stem tunneling was assessed at physiological maturity by measuring plant height and the length of tunneled stem in five plants, with the results expressed as a percentage.

2) Girdle beetle:- The number of total and girdled plants were recorded from one meter row lengths at 3 - 5 locations and percent plant infestation was calculated.

2.2 | Statistical analysis

The field data collected during the course of experimentation was subjected to statistical analysis after appropriate transformation for interpretation of result. Randomized block design used in order to test level of significance among the various treatments as per Gomez and Gomez (1984).

3 | RESULTS AND DISCUSSION

Screening of Soybean Genotypes Against Major Insect Pests

Twenty soybean genotypes along with two local checks, resistant (MAUS 158) and susceptible (MAUS 2), were evaluated under field conditions against major insect pests. Entries were categorized into six resistance groups: Highly resistant (HR), resistant (R), Moderately resistant (MR), Low resistant (LR), Susceptible (S) and Highly susceptible (HS) following the AICRP method.

3.1 | Girdle Beetle (*Obereopsis brevis*)

Against girdle beetle overall percent infestation ranged from 8.53 to 29.65. Among 20 genotypes, lowest of 8.53% infestation was recorded in genotype JS 95-60 and was categorized as resistant (R) against girdle beetle. Whereas, twelve genotypes viz., DLSb 1 (12.60), DSb 23 (13.90), DS 3108 (12.58), JS 21-72 (11.09), KDS 726 (12.10), MACS 1520 (11.15), MAUS 158 (15.97), MAUS 612 (13.80), MAUS 780 (15.10), NRC 130 (14.77), NRC 152 (16.43), RVSM 2011-35 (12.69) were found moderately resistant (MR). While four genotypes MAUS 2 (24.34), MAUS 725 (24.38), RSC 10-52 (21.18), SKF -SPS -11 (17.56) were low resistant (LR). However genotypes MAUS 731 (29.36) and RVS 2007-06 (26.46) were susceptible (S) and genotype RVS 13-20 (29.65) was highly susceptible (HS).

Previous studies reported JS 93-05 as highly resistant to girdle beetle (Awasthi *et al.*, 2005), similar to JS 95-60 in present study. (Shinde *et al.*, 2018) reported RVS 2007-06 and MAUS 158 as highly resistant; however, in the present study, RVS 2007-06 showed susceptible behaviour, and MAUS 158 was moderately resistant. Khandwe and Nema (2009) classified JS 95-60 as moderately resistant (7.0 - 7.80 per cent infestation), which is in agreement with the present study where JS 95-60 showed lowest infestation (8.53%) with resistant (R) reaction.

Table 1 | Screening of soybean genotypes against Girdle beetle, (*O. brevis*)

S.N.	Entries	Girdle beetle percent infestation*	Category
1	DLSb 1	12.60 (20.67)	MR
2	DSb 23	13.90 (21.79)	MR
3	DS 3108	12.58 (20.72)	MR
4	JS 21-72	11.09 (19.43)	MR
5	JS 95-60	8.53 (16.93)	R
6	KDS 726	12.10 (20.29)	MR
7	MACS 1520	11.15 (19.50)	MR
8	MAUS 2 (Sus. Check)	24.34 (29.50)	LR
9	MAUS 158 (Res. Check)	15.97 (23.53)	MR
10	MAUS 612	13.80 (21.61)	MR
11	MAUS 725	24.38 (29.54)	LR
12	MAUS 731	29.36 (32.79)	S
13	MAUS 780	15.10 (22.83)	MR
14	NRC 130	14.77 (22.46)	MR
15	NRC 152	16.43 (23.75)	MR
16	RSC 10-52	21.18 (27.33)	LR
17	RVS 13-20	29.65 (32.97)	HS
18	RVS 2007-06	26.46 (30.82)	S
19	RVSM 2011-35	12.69 (20.78)	MR
20	SKF-SPS-11	17.56 (24.72)	LR
SE±		2.00	
CD at 5%		5.97	
CD at 1%		8.09	
CV%		11.74	
Mean		24.10	

*Figures in the parentheses are angular transformed values

3.2 | Stem Fly (*Melanagromyza sojae*)

Against stem fly overall percent infestation ranged from 15.36 to 44.87. Among 20 genotypes, JS 95-60 (15.36) and JS 21-72 (17.16) were recorded lowest infestation and found resistant (R) against stem fly. Whereas six genotypes DS 3108 (27.46), MAUS 158 (18.36), MAUS 731 (28.31), NRC 130 (22.98), RVS 13-20 (28.82), SKF-SPS-11 (27.28) were moderately resistant (MR). However twelve genotypes viz., DLSb 1 (36.18), DSb 23 (35.13), KDS 726 (38.53), MACS 1520 (40.27), MAUS 2 (36.77), MAUS 612 (35.93), MAUS 725

(34.76), MAUS 780 (38.52), NRC 152 (33.73), RSC 10-52 (35.91), RVS 2007- 06 (44.87), RVSM 2011-35 (31.83) were low resistant (LR).

Khandwe and Nema (2009) reported JS 95-60 as highly resistant with minimum tunnel length (1.10%) and MAUS 612 lower resistant. The current study confirms JS 95-60 resistant (15.36 % stem tunneling) and lower resistance of MAUS 612 (35.93%). Motaphale *et al.*, (2016) evaluated that MAUS 158 as moderately resistant, consistent with the present study.

Table 2 | Screening of soybean genotypes against Stem fly, (*M. sojae*)

S.N.	Entries	Stem fly percent infestation*	Category
1	DLSb 1	36.18 (36.95)	LR
2	DSb 23	35.13 (36.32)	LR
3	DS 3108	27.46 (31.44)	MR
4	JS 21-72	17.16 (24.46)	R
5	JS 95-60	15.36 (23.06)	R
6	KDS 726	38.53 (38.29)	LR
7	MACS 1520	40.27 (39.37)	LR
8	MAUS 2 (Sus. Check)	36.77 (37.29)	LR
9	MAUS 158 (Res. Check)	18.36 (25.24)	MR
10	MAUS 612	35.93 (36.81)	LR
11	MAUS 725	34.76 (36.10)	LR
12	MAUS 731	28.31 (32.13)	MR
13	MAUS 780	38.52 (38.34)	LR
14	NRC 130	22.98 (28.59)	MR
15	NRC 152	33.73 (35.17)	LR
16	RSC 10-52	35.91 (36.72)	LR
17	RVS 13-20	28.82 (32.45)	MR
18	RVS 2007-06	44.87 (41.93)	LR
19	RVSM 2011-35	31.83 (34.28)	LR
20	SKF-SPS-11	27.28 (31.46)	MR
SE±		3.03	
CD at 5%		9.04	
CD at 1%		12.25	
CV%		12.68	
Mean		33.82	

*Figures in the parentheses are angular transformed values

REFERENCES

- Andole, V.C. (1984). Soybean, its cultivation, uses and values in dietetics, pp.29.
- Anonymous, (2024). Annual report 2024-25 of AICRP on Soybean, VNMKV, Parbhani (M.S.)
- Awasthi, M. K., Sharma, A. N. and Deshpande, R. R. (2005). Screening of soybean genotypes for resistance against stem-fly (*Melanagromyza sojae*, Zehnt). *Soybean Genetics Newsletter, Archive Issue*, 32.
- Bhamare, V.K., Phatak, S.V. Kumbhar, S.C. and Bade, A.S. (2018). Influence of ambient weather on the incidence of major insect-pests of sole soybean and soybean intercropped with pigeonpea. *Journal of Entomology Zoology Study* ;6(5): 437-443.
- Chaudhari, M. S., Patil, S. S. and Deshpande, S. P. (2020). Major insect pests of soybean and their management. *Indian Journal of Entomology*, 82(2), 165-174.
- Dhore, S. M., Wagh, A. N. and Kulkarni, V. R. (2024). Nutritional and economic importance of soybean in India. *Journal of Agricultural Science*, 12(3): 102-110.
- Gomez, K. A. and Gomez, A. A. (1984). *Statistical procedures for agricultural research* (2nd Edn). A Wiley Interscience Pub, John Wiley and Sons, New York, 302-307.
- Khandwe, S. A., & Nema, R. C. (2009). Resistance of soybean genotypes against stem fly and girdle beetle. *Crop Research*, 38(1-3), 116-119.
- Kogan, M. (1982). Plant resistance in pest management. *American Journal of Alternative Agriculture*, 7(1-2), 5-9.
- Motaphale, R. R., Chougale, B. K. and Patil, V. M. (2016). Screening of soybean genotypes for stem fly resistance. *International Journal of Agricultural Science*, 12(2): 56-61.
- Patil, S. S., Chaudhari, M. S. and Deshpande, S. P. (2014). Insect pests of soybean in India: Distribution and management strategies. *Journal of Entomology and Zoology Studies*, 2(3): 125-130.
- Proceeding and Technical Programme 2023-24, 53rd Annual Group Meeting (Hybrid mode) May 16 - 17 2023
- Sharma, A. K., Singh, P. and Kumar, V. (2014). Yield loss in soybean due to insect pests. *International Journal of Pest Management*, 60(3): 207-213.
- Shinde, V. B., Patil, V. M. and Khandwe, S. A. (2018). Resistance evaluation of soybean genotypes against major insect pests. *Journal of Pest Science*, 91(4): 1435-1444.
- Thipse, C. D. (2012). Soybean girdle beetle, Factsheet for farmer. ©CAB International. Published under a CC-BY-SA 4.0 licence. IN042En,.
- USDA.
(2024).<https://www.fas.usda.gov/data/production/commodity/2222000>.