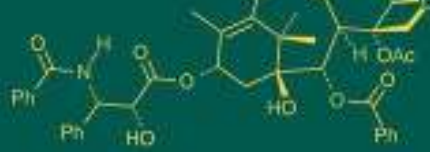
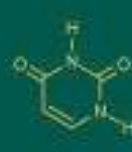
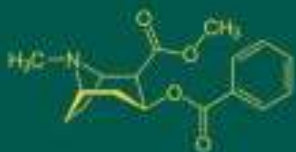


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Evaluation of soybean genotypes for resistance to key insect pests

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Abstract

The investigation of “Evaluation of Soybean Genotypes for Resistance to Key Insect Pests” was carried out *kharif* 2023-24 at research farm of department of entomology, VNMKV Parbhani. Which is in randomize block design with two replications and 15 treatments (genotypes). 15 soybean genotypes were screened and it was found that RVS 2001-18 genotype was categories as a highly resistance and DSB 32, NRC 146 and KDS 753 were categories as resistant to girdle beetle, minimum stem tunneling found in DSB 32 which was resistance to stem fly. In case of defoliators RVS 2001-18 was categories as a resistant for semilooper. DSB 32, PS 1611 and RVS 2001-18 are categories as a resistant for *S. litura* and for *H. armigera* RVS 2001-18 was categories as a resistant. MAUS 2 was used as susceptible check and MAUS 158 was used as resistant check.

Keywords: Soybean genotypes, insect pest resistance, girdle beetle, stem fly, defoliators

Introduction

Soybean or soya bean, [*Glycine max* (L.) Merrill] belongs to family Leguminosae, sub-family Papilionaceae, plays major role in the world food trade and is known as the “Golden bean, Miracle bean and Wonder bean” of the 20th century. Its cultivation and use could be traced back to the beginning of China’s agricultural age. Chinese medical compilations, dating back 6,000 years, mention its utilization for human consumption (Krishnamurthy and Shivashankar, 1975) ^[1]. To the populace of China, Japan, Korea, Manchuria, Philippines, and Indonesia, for centuries, soybean has meant to be meat, milk, cheese, bread and oil. This could well be the reason, why in these countries, it has earned epithets like “Cow of the field” or “Gold from soil” (Horvath, 1926) ^[9]. In the scenario of world’s oilseed cultivation, soybean occupies an important place due to its high productivity, economic viability and important contribution towards maintaining fertility of soil. According to estimates by the Soybean Processors Association of India (SOPA) for the *Kharif* 2025-26 season, soybean in India was cultivated on approximately 114.4 lakh hectares, with a total production of about 105.36 lakh tonnes and an average productivity of around 920 kg/ha, reflecting a decline in both production and yield compared to earlier years (Anonymous, 2025) ^[2]. Madhya Pradesh contributes more than 50 per cent in total area and production of soybean and is called as “Soya State”. Which having sowing area 52.000 lakh/ha, expected yield 1065 kg/ha and estimated production 55.529 lakh MT. In Maharashtra area under soybean 45.00 lakh/ha, production is 50.16 lakh/MT and productivity is 1063 kg/ha (Anonymous, 2024) ^[1]. In Maharashtra area under soybean 45.00 lakh/ha, production is 50.16 lakh/MT and productivity is 1063 kg/ha (Anonymous, 2024) ^[1]. For the *Kharif* season in 2025, the soybean area in Maharashtra was estimated to be around 48.2 lakh hectares, with production projected at approximately 46.74 lakh tonnes, resulting in an average productivity of about 970-1000 kg/ha (Anonymous, 2025) ^[2]. About 380 insect species on soybean have been reported from different regions of the world. Out of them 65 insect species had been reported to attack soybean from cotyledon stage to harvesting stage from Karnataka (Rai *et al.* 1973) ^[12]. The defoliators [tobacco caterpillar, *Spodoptera litura* (Fab.), Semilooper, *Thysanoplusia orichalcea* (Fab.), Bihar hairy caterpillar, *Spilarctia obliqua* (Walk.) and gram pod borer, *Helicoverpa armigera* (Hubner) are feeding on foliage, flower and pods causing significant yield losses. The productivity of soybean is low in India due to various biotic and abiotic factors. Among the biotic factors, the ravages caused by the insect pests are of great importance in causing considerable yield losses.

Materials and Methods

Screening of soybean genotypes for their reaction to insect pests was carried out in *kharif* Seasons 2023-2024. The seeds of genotypes are procured from All India coordinated research project on soybean (AICRP) VNMKV, Parbhani.

Experimental details are given below

- Design: Randomized Block Design
- Replications: two
- Plot size: 3m x 3m
- Spacing: 45cm x 5cm
- Seasons: *Kharif* 2023-24
- No of treatments/Entries: 15

Treatment details

Treatments	Genotypes
T ₁	DSB-32
T ₂	JS 97-52
T ₃	KDS 726
T ₄	KDS 753
T ₅	MAUS 612
T ₆	NRC 136
T ₇	NRC 146
T ₈	PS 1611
T ₉	RSC 11-07
T ₁₀	RSC 11-15
T ₁₁	RVS 2001-18
T ₁₂	RVS 2007-06
T ₁₃	RVS 2009-09
T ₁₄	MAUS 2
T ₁₅	MAUS 158

Methods of recording observations

1. **Girdle Beetle:** One meter row length was marked at 5 places. Total number of plants and girdled plants was recorded and data was presented in per cent plant infestation.
2. **Stem Fly:** Seedling mortality-Stem tunneling-Plant height and length of stem tunneled in 10 plants at physiological maturity. Express stem tunneling in per cent.
3. **Defoliators:** Observations on number of larvae of lepidopteran pests were recorded at three places of one meter row length (mrl).

AICRP method of categorization (ICAR-IISR, 2025)

All the genotypes were categorized by following AICRP's (based on CD at 1% and CD at 5%) to know their reaction against a particular pests as below.

1. HR = values < (mean-CD at 1%)
2. R = values between (mean-CD at 1%) and (mean-CD at 5%)
3. MR = values between (mean-CD at 5%) and mean
4. LR = values between mean and (mean + CD at 5%)
5. S = values between (mean + CD at 5%) and (mean + CD at 1%)
6. HS = values > (mean + CD at 1%).

Results and Discussion

The results obtain from the screening of soybean genotypes against girdle beetle, stem fly and defoliators

Table 1: Screening of genotypes against major pests of soybean (2023)

Sr. no	Genotypes	Girdle beetle (%)	Stem tunneling (%)	Semilooper (larvae/mrl)	<i>S. litura</i> (larvae/mrl)	<i>Helicoverpa</i> (larvae/mrl)
1	DSB 32	11.90 (20.08)*R	4.32 (12.06)*R	7.17 (2.76)#LR	2.33 (1.68)#R	2.33 (1.68)LR
2	JS97-52	19.05 (25.83)LR	7.41 (15.76)MR	8.00 (2.91)LR	3.66 (2.02)MR	1.66 (1.47)MR
3	KDS 726	22.62 (28.38)LR	4.94 (12.84)MR	8.17 (2.94)LR	5.66 (2.48)LR	2.00 (1.58)LR
4	KDS 753	11.90 (20.08)R	9.62 (18.05)LR	9.17 (3.10)LR	5.00 (2.34)LR	2.00 (1.58)LR
5	MAUS 612	23.81 (29.20)S	8.03 (16.38)LR	7.83 (2.88)LR	6.44 (2.63)LR	2.33 (1.68)LR
6	NRC 136	17.86 (24.98)LR	5.88 (13.98)MR	8.83 (3.04)LR	4.00 (2.12)MR	1.66 (1.47)MR
7	NRC 146	11.90 (20.08)R	8.64 (16.94)LR	6.33 (2.58)MR	3.06 (1.89)MR	1.33 (1.35)MR
8	PS1611	20.24 (26.72)LR	8.92 (17.32)LR	7.83 (2.88)LR	2.30 (1.67)R	1.66 (1.47)MR
9	RSC 11-07	16.67 (24.09)MR	9.34 (17.79)LR	8.83 (3.04)LR	6.33 (2.61)LR	2.33 (1.68)LR
10	RSC 11-15	19.05 (25.87)LR	9.62 (18.05)LR	7.50 (2.82)LR	5.33 (2.41)LR	2.33 (1.68)LR
11	RVS 2001-18	10.71 (19.07)HR	8.63 (17.07)LR	3.67 (2.03)R	2.33 (1.68)R	1.11 (1.27)R
12	RVS 2007-06	19.05 (25.87)LR	6.03 (14.21)MR	5.33 (2.41)MR	4.66 (2.26)LR	1.66 (1.47)MR
13	RVS 2009-9	17.86 (24.98)LR	6.88 (15.17)MR	5.83 (2.51)MR	4.33 (2.19)MR	1.66 (1.47)MR
14	MAUS 2	30.95 (33.78)HS	9.50 (17.90)LR	7.00 (2.72)MR	8.00 (2.92)HS	3.00 (1.87)S
15	MAUS 158	17.86 (24.98)LR	6.56 (14.83)MR	6.50 (2.63)MR	5.33 (2.41)LR	2.00 (1.58)LR
	SE (m)+/-	1.29	1.12	0.17	0.14	0.08
	CD at 1%	5.43	4.71	0.71	0.58	0.33
	CD at 5%	3.92	3.40	0.53	0.43	0.25

#Figures in parenthesis are square root transformed values.

*Figures in parenthesis are angular transformed values.

The data from table 1 revealed significant differences with respect to girdle beetle infested plants among various soybean genotypes. The overall girdle beetle infestation in various genotypes varied from 10.71 to 30.95 per cent at peak infestation. The genotype RVS 2001-18 recorded least girdle beetle infested plants (10.71%) which is categories highly resistant followed by DSB 32(11.90)R, NRC 146(11.90)R, KDS 753(11.90)R Which is categories resistant genotypes. The genotypes RSC 11-07 found medium resistant, eight genotypes JS97-52 (19.05), KDS 726 (22.62), NRC 136 (17.86), PS1611 (20.24), RSC 11-15 (19.05), RVS 2007-06 (19.05), RVS 2009-9 (17.86), MAUS 158 (17.86) which found lower resistant against girdle beetle. Susceptible reaction against girdle beetle was observed on MAUS 612 genotype and MAUS 2 which is found highly susceptible to girdle beetle.

The present findings are in conformity with the finding of various workers. Sekhar *et al.* (2000) ^[14] screened seventy soybean cultivars against stem fly (*Melanagromyza sojae*) during kharif 1994 at New Delhi under natural infestation. No cultivar was resistant. Thirty-nine cultivars were moderately resistant (28.9-41.7% stem tunnelling), with DS93-P-40-3 showing the least damage (28.9%). Twenty-eight cultivars showed low resistance (43.0-59.4%), while DSK 92-19 and DS93 MPT 16-1 were susceptible and DS91-2-1 was highly susceptible (68.5% tunnelling). The present finding are in similar with the finding of Salunke *et al.* (2002) ^[13] studied fourteen soybean genotypes at Parbhani during kharif 1998-99 and observed wide variation in major insect pests. NRC-37 recorded the lowest damage from leaf miner, stem fly, and girdle beetle, while MAUS-20, JS (SH)-9246, and RSC-3 showed the highest incidence of leaf miner, stem fly, and girdle beetle, respectively.

Gupta *et al.* (2004) ^[5] evaluated field resistance of soybean cultivars against major insect pests. Based on pooled mean infestation, cultivars MACS-13, JS-84-200, JS-86-24, JS-81-1610 and JS-78-41 were resistant to stem fly, several JS and J8 lines showed resistance to girdle beetle, and cultivars such as JS-77-81, PK-478, JS-86-24 and related lines were found resistant to pod borer.

In that table 1 data showed for stem fly tunneling is varied from 4.32 to 9.62 percent. DSB 32 is resistant found least infestation from stem fly, JS 97-52 (7.41), KDS 726 (4.94), NRC 136 (5.88), RVS 2007-06, RVS 2009-09 (6.88), MAUS 158 (6.56) these seven genotypes medium resistant for stem fly, followed by KDS 753 (9.62), MAUS 612 (8.03), NRC 146 (8.64), PS1611 (8.92), RSC 11-07 (9.34), RSC 11-15 (9.62), RVS 2001-18 (8.63), MAUS 2 (9.50) these nine genotypes are lower resistant for stem fly.

From table 1 the data revealed that infestation of defoliators which including semilooper, *S. litura* and *H. armigera*. The infestation of semilooper varied from 3.67 to 7 (larvae/mrl). RVS 2001-18 (3.67 larvae/mrl) which is resistant for semilooper followed by five genotypes which were found medium resistance against semilooper infestation NRC 146 (6.33 larvae/mrl), RVS 2007-06 (5.33 larvae/mrl), RVS 2009-9 (5.83 larvae/mrl), MAUS 2 (7.00 larvae/mrl), MAUS 158 (6.50 larvae/mrl). Remaining nine genotypes showed lower resistance to semilooper DSB 32 (7.17 larvae/mrl), JS97-52 (8.00 larvae/mrl), KDS 726 (8.17 larvae/mrl), KDS 753 (9.17 larvae/mrl), MAUS 612 (7.83 larvae/mrl), NRC 136 (8.83 larvae/mrl), PS 1611(7.83 larvae/mrl), RSC 11-07 (8.83 larvae/mrl), RSC 11-15 (7.50 larvae/mrl). DSB 32(2.33 larvae/mrl), PS 1611(2.30 larvae/mrl) and RVS 2001-18(2.33 larvae/mrl) are resistant

to *S. litura* followed by JS97-52(3.66 larvae/mrl), NRC 136 (4.00 larvae/mrl), NRC 146 (3.06 larvae/mrl), RVS 2009-09 (4.33 larvae/mrl) which is medium resistant and KDS 726 (5.66 larvae/mrl), KDS 753 (5.00 larvae/mrl), MAUS 612 (5.00 larvae/mrl), RSC 11-07 (6.33 larvae/mrl), RSC 11-15 (5.33 larvae/mrl), RVS 2007-06 (4.66 larvae/mrl) and MAUS 158 (5.33 larvae/mrl) which showed lower resistant against *S. litura*, and MAUS 2 (Ch) is highly susceptible for *S. litura*. The genotype MAUS 2 is susceptible to *H. armigera*, RVS 2001-18 which is resistant for *H. armigera* followed by JS97-52 (1.66 larvae/mrl), NRC 136 (1.66 larvae/mrl), NRC 146 (1.33 larvae/mrl), PS 1611 (1.66 larvae/mrl), RVS 2007-06 (1.66 larvae/mrl), The genotypes DSB 32(2.33 larvae/mrl), KDS 726 (2.00 larvae/mrl), KDS 753 (2.00 larvae/mrl), MAUS 612(2.33 larvae/mrl), RSC 11-07(2.33 larvae/mrl), RSC 11-15(2.33 larvae/mrl), MAUS 158(2.00 larvae/mrl) showed lower resistant for *H. armigera*. The findings of the present study corroborate the results reported by Harish *et al.* (2006) ^[8] screened eleven soybean genotypes for resistance to major defoliators and found KHSb-2, DSb-2, DSb-1 and Bragg to be moderately resistant, while DSb-6-1 and JS93-05 were susceptible; JS-335 and Monetta were highly susceptible.

From table 2 data showed that significant differences with respect to girdle beetle infested plants among various soybean genotypes. The overall girdle beetle infestation in various genotypes varied from 4.76 to 30.95 per cent at peak infestation. The genotypes JS97-52 (7.14%), NRC 146 (4.76%) and RVS 2001-18 (7.14%) are categorized as highly resistant, followed by RVS 2009-9 (10.71%) is resistant, KDS 726 (14.29%) and NRC 136 (16.67%) were at par with resistant genotype RVS 2009-9 after that genotypes KDS 753 (22.62%), PS 1611 (21.43%), RSC 11-07 (23.81%) and RVS 2007-06 (21.43%) are categories as lower resistance, the genotypes RSC 11-15 (25%) and MAUS 158 were susceptible to girdle beetle and the genotype MAUS 612 (28.57%) and MAUS 2 (30.95%) are categorized as highly resistant for girdle beetle.

The data revealed that from table 2 stem tunneling percent was minimum in genotype KDS 726 (22.11%), NRC 146 (23.57%) and MAUS 158 (22.47%) are categories as resistant to stem fly followed by DSB 32 (30.35%), JS97-52 (31.52%), KDS 753 (28.64%), RSC 11-07 (32.02%), RVS 2007-06 (29.63%) were categorized as medium resistant. MAUS 612 (37.10%), NRC 136 (32.64%), PS 1611(35.47%), RSC 11-15 (37.89%), RVS 2001-18 (36.84%) and RVS 2009-9 (40.15%) these genotypes were at par with medium resistant genotypes i.e. lower resistant and MAUS 2(43.57%) is susceptible check genotype.

Highly resistance (HS) reaction of semilooper was observed on the two genotypes viz., DSB 32 and PS 1611 recorded which 2.83 and 2.50 larvae/mrl respectively. Followed by RVS 2001-18 (3.67 larvae/mrl) which categories as resistant, the genotypes JS97-52, RVS 2009-9 showed moderately resistant reaction against semilooper which recorded 4.17 and 4.67 larvae/mrl respectively, Eight genotypes viz., KDS 726, KDS 753, MAUS 612, NRC 136, NRC 146, RSC 11-07, RVS 2007-06, MAUS 158 recorded semilooper populations of 6.0, 6.17, 6.33, 5.83, 6.0, 6.67, 7.0, 6.0 larvae/mrl respectively, categories as lower resistant to semilooper. The genotypes RSC 11-15 which categorized as susceptible and MAUS 2 categorized as highly susceptible having populations 7.83 and 9.83 larvae/mrl respectively.

Table 2: Screening of genotypes against major pests of soybean (2024)

Sr. no	Genotypes	Girdle beetle (%)	Stem tunneling (%)	Semilooper (larvae/mrl)	<i>S. litura</i> (larvae/mrl)	<i>H. armigera</i> (larvae/mrl)
1	DSB 32	22.62 (28.38)*LR	30.35 (33.39)*MR	2.83 (1.81)#HR	2.83 (1.82)R	2.00 (1.57)LR
2	JS97-52	7.14 (15.28)HR	31.52 (24.14)	4.17 (2.15)MR	3.00 (1.87)MR	1.33 (1.35)MR
3	KDS 726	14.29 (22.20)MR	22.11 (28.64)R	6.00 (2.54)LR	3.33 (1.95)MR	1.66 (1.47)LR
4	KDS 753	22.62 (28.38)LR	28.64 (32.27)MR	6.17 (2.57)LR	3.33 (1.95)MR	1.66 (1.47)LR
5	MAUS-612	28.57 (32.28)HS	37.10 (37.51)LR	6.33 (2.61)LR	4.17 (2.16)HS	2.00 (1.57)LR
6	NRC 136	16.67 (23.81)MR	32.64 (34.83)LR	5.83 (2.51)LR	3.33 (1.95)MR	1.33 (1.35)MR
7	NRC 146	4.76 (12.60)HR	23.57 (29.04)R	6.00 (2.54)LR	3.00 (1.87)MR	1.00 (1.21)R
8	PS1611	21.43 (27.57)LR	35.47 (36.54)LR	2.50 (1.73)HR	3.00 (1.87)MR	1.00 (1.21)R
9	RSC 11-07	23.81 (29.20)LR	32.02 (34.45)MR	6.67 (2.67)LR	4.00 (2.12)S	2.00 (1.57)LR
10	RSC 11-15	25.00 (29.99)S	37.89 (37.98)LR	7.83 (2.88)S	3.67 (2.04)LR	2.00 (1.57)LR
11	RVS 2001-18	7.14 (15.28)HR	36.84 (37.18)LR	3.67 (2.03)R	2.83 (1.82)R	1.00 (1.21)R
12	RVS 2007-6	21.43 (27.57)LR	29.63 (32.95)MR	7.00 (2.73)LR	3.33 (1.95)MR	1.66 (1.47)LR
13	RVS 2009-9	10.71 (10.07)R	40.15 (39.26)LR	4.67 (2.27)MR	3.00 (1.87)MR	1.33 (1.29)MR
14	MAUS 2	30.95 (33.79)HS	43.57 (41.30)S	9.83 (3.21)HS	4.33 (2.20)HS	2.66 (1.78)HS
15	MAUS 158	25.00 (29.99)S	22.47 (28.29)R	6.00 (2.54)LR	3.66 (2.04)LR	1.66 (1.47)LR
	SE (m)+/-	1.54	1.74	0.10	0.044	0.068
	CD at 1%	6.48	7.32	0.42	0.158	0.28
	CD at 5%	4.68	5.27	0.31	0.135	0.20

#Figures in parenthesis are square root transformed values.

*Figures in parenthesis are angular transformed values.

The data presented in table 2 showed that the average population of *S. litura* in soybean genotypes recorded in the range of 2.83 to 4.33 larvae/mrl. the genotype RVS 2001-18 and DSB 32 categorized as resistant for *S. litura* having population 2.83 larvae/mrl followed by JS97-52, KDS 726, KDS 753, NRC 136, NRC 146, PS 1611, RVS 2007-06, RVS 2009-9 were categorized as moderately resistant reaction having populations 3.00, 3.33, 3.33, 3.33, 3.00, 3.00, 3.33 and 3.00 larvae/mrl. Lower resistant reaction against *S. litura* was recorded in the genotype RSC 11-15 and MAUS 158 having population 3.67 and 3.66 larvae/mrl. The susceptible reaction against *S. litura* was recorded RSC 11-07 having population 4.00 larvae/mrl. The genotypes MAUS 612 and MAUS 2 which showed highly susceptible against *S. litura* which population are 4.17 and 4.33 larvae/mrl.

The data pertaining to field reaction of soybean genotypes against *H. armigera* are presented in table 2. It was revealed from the data that average population of *H. armigera* was in the range from 1.00 to 2.66 larvae/mrl. Resistant reaction against *H. armigera* was observed in the soybean genotypes viz., NRC 146, PS 1611 and RVS 2001-18 in which *H. armigera* population was 1.00 larvae/mrl, followed by JS97-52, NRC 136 and RVS 2009-9 these are categorized as moderately resistant and their population is 1.33 larvae/mrl. the genotypes DSB 32, KDS 726, KDS 753, MAUS 612, RSC 11-07, RSC 11-15, RVS 2007-06 and MAUS 158 are

at par with MR resistant genotypes having population 2.00, 1.66, 1.66, 2.00, 2.00, 2.00, 1.66 and 1.66 respectively. The genotype MAUS 2 which was recorded population of *H. armigera* 2.66 larvae/mrl categorized as highly susceptible.

Pooled mean of two seasons (Kharif 2023-24 and 2024-25)

The overall pooled mean populations of girdle beetle during kharif 2023-24 and kharif 2024-25 are presented in table 3 revealed that, the average mean population of girdle beetle during crop growth ranged from 8.93 to 30.95 percent. The genotypes NRC 146 and RVS 2001-18 were the most promising and recorded least average population 8.33 and 8.93% respectively and showed highly resistant (HR) reaction against girdle beetle. The genotypes JS97-52 which at par with highly resistant genotypes and categorized as resistant. It is revealed from the data the moderately resistant (MR) girdle beetle was recorded in genotypes DSB 32, KDS 753, NRC 136 and RVS 2009-9 in which girdle beetle infestation was 17.26, 17.26, 17.26 and 14.29 respectively. The genotypes KDS 726, PS 1611, RSC 11-07, RSC 11-15, RVS 2007-06 and MAUS 158 were categorized as lower resistant having population 18.45, 20.83, 20.24, 22.02, 20.24, 21.43 respectively, the genotypes MAUS 612 and MAUS 2 were categorized as highly susceptible and having population 26.19 and 30.95 respectively.

Table 3: Screening of genotypes against major pests of soybean (Pooled *Kharif* 2023-24 and *Kharif* 2024-25).

Sr. no	Genotypes	Girdle beetle (%)	Stem tunneling (%)	Semilooper (larvae/mrl)	<i>S. litura</i> (larvae/mrl)	<i>H. armigera</i> (larvae/mrl)
1	DSB-32	17.26* (24.47)MR	17.33 (24.59)MR	5.00# (2.34)R	2.66# (1.78)R	2.16# (1.60)LR
2	JS97-52	13.10 (21.09)R	19.46 (26.17)MR	6.08 (2.57)MR	3.24 (1.93)MR	1.49 (1.41)MR
3	KDS 726	18.45 (25.37)LR	13.53 (21.52)HR	7.08 (2.75)LR	4.49 (2.23)LR	1.83 (1.53)LR
4	KDS-753	17.26 (24.55)MR	19.13 (25.91)MR	7.67 (2.86)S	5.16 (2.38)S	1.83 (1.53)LR
5	MAUS-612	26.19 (30.77)HS	22.56 (28.34)LR	7.08 (2.75)LR	5.30 (2.41)S	2.16 (1.63)LR
6	NRC-136	17.26 (24.51)MR	19.26 (26.00)MR	7.33 (2.80)LR	3.66 (2.04)MR	1.49 (1.43)MR
7	NRC-146	8.33 (16.75)HR	16.10 (23.62)MR	6.16 (2.58)MR	3.03 (1.88)MR	1.66 (1.47)MR
8	PS1611	20.83 (27.13)LR	22.19 (28.08)LR	5.16 (2.38)R	2.65 (1.77)R	1.33 (1.35)MR
9	RSC 11-07	20.24 (26.74)LR	21.18 (27.30)LR	7.75 (2.87)S	4.16 (2.16)LR	1.66 (1.47)MR
10	RSC 11-15	22.02 (27.99)LR	23.75 (29.17)LR	7.66 (2.85)S	4.50 (2.24)LR	2.16 (1.63)LR
11	RVS 2001-18	8.93 (17.39)HR	22.73 (28.47)LR	3.67 (2.03)HR	2.66 (1.78)R	1.05 (1.24)R
12	RVS 2007-6	20.24 (26.74)LR	17.83 (24.98)MR	6.16 (2.58)MR	3.99 (2.12)LR	1.66 (1.47)MR
13	RVS 2009-9	14.29 (22.21)MR	23.51 (29.00)LR	5.25 (2.40)R	3.58 (2.00)MR	1.49 (1.41)MR
14	MAUS-2	30.95 (33.79)HS	26.53 (31.00)S	8.41 (2.98)HS	6.16 (2.57)HS	2.83 (1.82)S
15	MAUS-158	21.43 (27.58)LR	14.51 (22.38)R	6.24 (2.60)MR	4.49 (2.23)LR	1.83 (1.53)LR
	SE (m)+/-	1.12	1.14	0.07	0.08	0.08
	CD at 1%	4.71	4.80	0.29	0.33	0.33
	CD at 5%	3.40	3.46	0.22	0.25	0.24

#Figures in parenthesis are square root transformed values

*Figures in parenthesis are angular transformed values

The data presented in table 3 it is revealed from data that the stem tunneling was minimum in KDS 726 which categorized as highly resistant having population 13.53%. Followed by genotype MAUS 158 was at par with HR genotypes and having stem tunneling 14.51%. The six genotypes viz., DSB 32, JS97-52, KDS 753, NRC 136, NRC 146 and RVS 2007-06 showed moderately resistant reaction against stem fly which recorded 17.33, 19.46, 19.13, 19.26, 16.10, 17.83 respectively. The genotypes MAUS 612, PS 1611, RSC 11-07, RSC 11-15, RVS 2001-18 and RVS 2009-9 were at par with MR genotypes i.e categorized as lower resistant to stem fly which having population 22.56, 22.19, 21.18, 23.75 and 22.73 respectively. The susceptible (S) reaction against stem fly was recorded in MAUS 2 was 26.53 percent. The present findings are consistent with those reported by Kanjarla *et al.* (2020) ^[10] studied eight genotypes comprising of advanced breeding lines, released varieties were evaluated for resistance against stem fly and stem girdler. Some new parameters that have direct impact on grain yield have been used to categorize the genotypes into resistance groups. Accordingly, Basara, JS-335, JS-9305, DSB-2803 and KDS-756 were found to be highly resistant and KDS-869, MACS-1460 and RSC-1046 were found to be highly susceptible against stem fly and stem girdler.

From table 3 the highly resistant reaction against semilooper was recorded in soybean genotype RVS 2001-18 3.67 larvae/mrl, followed by DSB 32, PS 1611 and RVS 2009-9 which categorized as resistant having population 5.00, 5.16

and 5.25 larvae/mrl respectively. Four genotypes viz., JS97-52, NRC 146, RVS 2007-06 and MAUS 158 showed moderately resistant (MR) reaction in which semilooper population 6.08, 6.16, 6.16 and 6.24 larvae/mrl respectively, the genotypes KDS 726, MAUS 612 and NRC 136 are categorized as lower resistant to semilooper which having population 7.08, 7.08 and 7.33 larvae/mrl. The susceptible reaction against semilooper was recorded in three genotypes viz., KDS 753, RSC 11-07 and RSC 11-15 in which semilooper populations were 7.63, 7.75 and 7.66 larvae/mrl respectively. The highly susceptible reaction was found in susceptible check MAUS 2 which having population 8.41 larvae/mrl.

From table 3 the average populations of *S. litura* during the crop growth range from 2.66 to 6.16 larvae/mrl. The resistant reaction against *S. litura* was recorded in three genotypes viz., DSB 32, PS 1611 and RVS 2001-18 in which population of *S. litura* are 2.66, 2.65 and 2.66 larvae/mrl respectively, the four genotypes JS97-52, NRC 136, NRC 136 and RVS 2009-9 categorized as resistant against *S. litura* in which their populations were recorded 3.24, 3.66, 3.03 and 3.58 larvae/mrl respectively, followed by KDS 726, RSC 11-07, RSC 11-15, RVS 2007-06 and MAUS 158 were categorized as lower resistant reaction (LR) in which population was found 4.49, 4.16, 4.50, 3.99 and 4.49 larvae/mrl respectively. The two genotypes KDS 753 and MAUS 612 were showed susceptible reaction against *S. litura* in which their populations were recorded 4.49 and 5.30 larvae/mrl respectively. The highly

susceptible (HS) reaction was showed by MAUS 2 in which population was 6.16 larvae/mrl.

The data revealed from table 3 average population of *H. armigera* are varied from 1.05 to 2.83 larvae/mrl. Resistant reaction against *H. armigera* was recorded in soybean genotype RVS 2001-18 having population 1.05 larvae/mrl, followed by seven genotypes viz., JS97-52, NRC 136, NRC 146, PS 1611, RSC 11-07, RVS 2007-06 and RVS 2009-9 were categorized as moderately resistant in which their population was 1.49, 1.49, 1.66, 1.33, 1.66, 1.66 and 1.49 larvae/mrl respectively. Six genotypes viz., DSB 32, KDS 726, KDS 753, MAUS 612, RSC 11-15 and MAUS 158 were showed the low resistant reaction against *H. armigera* in which population were ranged between 1.82 to 2.16 larvae/mrl. MAUS 2 showed susceptible reaction against *H. armigera* and population of 2.83 larvae/mrl.

Upadhyay, J. (2017) [15] evaluated the nine soybean cultivars with one check variety (JS 20-29) were screened against stem fly. In the group of cultivars JS 20-122 found the minimum percent stem tunneling (4.67%) which was significantly at par all other cultivars and check. The maximum percent tunneling (20.82%) was found in cultivars JS20-111. On the basis of incidence of stem fly, cultivar JS 20-108 observed to be less susceptible and check variety JS 20-29 was susceptible.

Bayu *et al.* (2018) [3] evaluated eighteen soybean genotypes against *Spodoptera litura* and found no fully resistant genotypes. Most were moderately resistant, including G511H/Anjs 11, G511H/Arg-30-7, G511H/Kaba-4-4, G511H/Anjs-3-3, G511H/Anjs-1-2, G511H/Anjs-5-5, G511H/Anjs-6-11, and Argomulyo.

Fattah *et al.* (2023) [4] studied six rows of soybeans and two rows of corn and found that the lowest attack of *Spodoptera litura* and *Etiella zinckenella*, the lowest population of *Aphis glycines* and *Riptortus linearis*, the highest predatory population of *Crocothemis servilia* and *Coccinella sp.* and the highest predator populations of *Euborellia annulata*. The highest infestation rate of *S. litura* was in Dena-1. In contrast, the highest intensity of *E. zinckenella* pest damage was in Dena-1 and Deja-1. The corn-soybean intercropping was recommended as the best practice for sustainable agriculture production due to facilitating in the increase of growth of predator population and reducing the level of crop damage due to pest attacks.

Hadiwiyono *et al.* (2024) [7] evaluated seven soybean genotypes for pod borer damage in mahogany and pine agroforestry systems. Damage was higher in the pine system. Dena-2 showed the lowest damage in pine but was still vulnerable, Anjasmoro was highly susceptible, and Devon-1 was relatively resistant in both systems.

Conclusion

The results obtained from the screening studies carried out with fourteen genotypes against major insect pests of soybean during seasons *kharif* 2023-24 and *kharif* 2024-25 are The genotypes NRC 146 and RVS 2001-18 were the most promising and recorded least average population 8.33 and 8.93% respectively and showed highly resistant (HR) reaction against girdle beetle. In the pooled data across both years, stem tunneling was minimal in KDS 726, which was categorized as highly resistant, with a population incidence of 13.53%. The highly resistant reaction against semilooper was recorded in soybean genotype RVS 2001-18 which had population 3.67 larvae/mrl. The resistant reaction against *S.*

litura was recorded in three genotypes viz., DSB 32, PS 1611 and RVS 2001-18 in which population of *S. litura* are 2.66, 2.65 and 2.66 larvae/mrl respectively, Resistant reaction against *H. armigera* was recorded in soybean genotype RVS 2001-18 having population 1.05 larvae/mrl.

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