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Screening in different varieties of soybean for resistance against major insect pests

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Abstract

The field trial was conducted at Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh. During the *Kharif*, 2018 to evaluate soybean germplasm against defoliators, thrips and jassids. The different entries screened under advanced varietal trial AVT-I and AVT-II were sown in Randomized Block Design of four replications having a plot size of 6m². The attack of Defoliators and sucking pests were noted to find the resistance and susceptible varieties in these two trial.

Keywords: Soybean, Bragg, maximin-minimax, advanced varietal trial, thrips

Introduction

Soybean is recognized as one of the premier crops around the world and it has been a major source of vegetable oil protein and animal feed because of its high protein content (40%) and high content (20%), and it contains 26% carbohydrate, 35% minerals and 2% Phospholipids it is a herbaceous oilseed crop important for food commodity. The luxuriant growth of soybean accompanied by green, soft and succulent foliage, provides an ultimate source of food, space and shelter to insects. The sucking pest (whitefly and thrips) and defoliators (tobacco caterpillar and green semilooper) of soybean damage the crop at the vegetative stage and in severe cases of infestation completely defoliate the crop and drastically reduce the yield (Patil *et al.*, 2014) [2]. Hence there is a direct need to explore the most eco-friendly methods of pest control by developing pest-resistant varieties. Various trials have been conducted regularly to develop different sources against insect pests.

Materials and Methods**Experimental details**

Season: Kharif

Design: RBD

Plot size: 2 rows of 3 m length

Row to Row: 30 cm

Replications: 4 (2 protected + 2 unprotected)

Trial	AVT I	AVT II
Total no. of entries	30 (26+4)	12(8+4)
Date of sowing	2 July 2018	4 July 2018

During the screening of AVT I and AVT II about 30 and 12 entries were sown in 3m row length in 2 rows and replicated twice was sown along. The observations were recorded during the cropping period by counting many caterpillars from five randomly selected plants of one m² from every plot at maximum infestation by insect pests. Similarly, for sucking pests, from each plot, five plants were selected randomly and insect counts were noted from three leaves; (upper, middle and bottom part of the plant). This observation was recorded only in treated and untreated plots.

The varieties were sown in each replication. A different package of practices was followed in establishing the plants except for the insect control measure. Attack of defoliator and sucking pests, at flowering stage. Grain yield was recorded in each genotype from both protected and unprotected plots and the data by maximin-minimax (Odulaja and Nokoe, 1993) [1].

The genotypes were tested together with one each of resistant and susceptible checks, percentage yield loss due to pest attack for the resistant susceptible and the varieties are obtained as:

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PR=100 (ZR-YR)/ZR

PS=100 (ZS-YS)/ZS

Pi=100 (Zi-Yi)/Zi

Name of entries of AVT-I Name of entries of AVT-II

S. No	Name of Entries
1	SL-1104
2	DS-3106
3	KDS-921
4	RSC-10-71
5	DSb-32
6	RSC-10-52
7	MACS-1520
8	AMS-MB-5-18
9	RKS-18
10	Bragg
11	J5-335
12	J5-97-32
S. No	Name of Entries
1	NRC-128
2	Dsb-34
3	SL-1068
4	NRC-137
5	CSb-10084
6	MACS-1493
7	SL-1123
8	BAUS-102
9	MACS NRC-1575
10	NRC-132
11	AMS-2014-1
12	DS-3108
13	AMS-10039
14	NRC-136
15	CSb-10112
16	PS-1613
17	KDS-992
18	RSC-11-07
19	NRC-SL-1
20	PS-1611
21	RSC-11-03
22	NRC-134
23	SKF-SPS-11
24	NRC-147
25	MACS NRC-1667
26	MACS-450
27	RKS-18
28	Bragg
29	J5-335
30	J5-97-32

Results and Discussion

The experiment on screening trial was conducted during *Kharif*, 2018 under two categories Advanced Varietal Trial I (AVT I) and Advanced Varietal Trial II (AVT II). The different entries were screened as given in the Methodologies explained in materials and methods.

AVT-I

Under AVT I thirty soybean genotypes were screened for resistance against defoliators, thrips and whitefly. The experiment results of the different varieties in the screening trials are given in the following paragraphs and Table 1. Based on total defoliators, genotype DS-3108 with 3.4 larvae/meter row was the least attacked by the defoliator's pests. It was followed by SL-1068 and NRC -128 each with 3.6 larvae/meter row. Whereas, genotypes SKF-SPS-11 and

RKS-18 with 5.0 larvae/meter row were attacked by the defoliator.

Among the sucking pests, the incidence of whiteflies was comparatively higher than that of thrips. The incidence of whiteflies ranged from 3.0 to 4.6 whiteflies per plant. Genotype BAUS-102 and NRC-132 were the least attacked by whiteflies with 3.0 whiteflies/ three leaves. The highest incidence of whiteflies was on genotype MACS-1493 with 4.6 whiteflies/ three leaves.

Similarly, the thrips incidence ranged from 1.0 to 2.8 thrips/three leaves on the test entries. Genotype NRC-132 and NRC-136 with 1.0 thrips/three leaves were the least preferred by the thrips followed by MACS-1493, MACS-NRC- 1575 and AMS-10039 with 1.4 thrips/three leaves.

Whereas, the maximum incidence of thrips was observed on genotype NRC-128 with 2.8 thrips/three leaves. Based on overall pest incidence, genotype DS-3108 with 3.4 larvae per meter row was least attacked by the lepidopterous pests. Genotype BAUS-102 and NRC-132 were least attacked by whiteflies with 3.0 whiteflies/three leaves followed by genotype DS-3108 with 3.2 whiteflies/ three leaves and NRC-127 and genotype NRC-132 and NRC-136 with 1.0 thrips per three leaves was least preferred by the thrips and followed by MACS-1493, MACS- NRC-1575 and AMS-10039 with 1.7 thrips/three leaves.

Grain yield and categorization of varieties AVT-I

All entries were grown in two sets, one with complete plant protection measures and the other with no plant protection measures. One spray of Profenophos 50 EC @ 500 l/ha, variably increased grain yield in all the varieties. The grain yield ranged from 0.562 to 0.118 gm/plot, and the highest yield was obtained from genotype JS97-52 (0.562 gm/plot) followed by KDS-992 (0.525 gm/plot).

In the present investigation, thirty soybean varieties were further grouped into four categories based on the Maximin-minimax method (Odulaja and Nokoe, 1993)^[1]. Two varieties (DSb-34 and PS-1613) were resistant high yielding (R-HY) whereas twenty-eight varieties (NRC-128, SL-1068, NRC-137, Csb-10084, MACS-1493, SL-1123, BAUS-102, MACS-NRC-1575, NRC-132, AMS-2014-1, DS-3108, AMS-10039, NRC-136, CSb-10112, KDS-992, RSC-11-07, NRC-SL-1, PS-1611, RSC-11-03, NRC-134, SKF-SPS-11, NRC-147, MACS-NRC-1667, MACS-450, RKS-18, Bragg, JS97-52) were susceptible low yielding (S-LY).

AVT II

In AVT II, twelve soybean genotypes were screened against major insect pests of soybeans during *Kharif*, 2018. The results of the response of the genotypes in the screening trials are presented in the following paragraphs and table 2.

Based on total defoliator infestation, genotype JS-335, with 3.0 larvae/meter row was the least attacked by the defoliator pests. It was followed by RKS- 18, Bragg each with 3.2 larvae/meter row. Whereas, genotype MACS-1520 with 4.8 larvae/meter row was most attacked by caterpillar pests.

The incidence of whiteflies ranged from 3.4 to 4.4 whiteflies/three leaves. Genotype RKS-18, DS-3106 was least attacked with whiteflies 3.4 whiteflies/three leaves followed by genotype MACS-1520 with 3.8 whiteflies/three leaves. The highest incidence of whiteflies was on genotype RSC-10-71 with 4.4 whiteflies/there leaves.

Genotype SL-1104, KDS-921, Dsb-32, RSC-10-52, AMS-MB-5-18, JS97-52 with 1.6 thrips/three leaves was least

preferred by the thrips and followed by RKS-18, JS-335 with 1.8 thrips/three leaves. Whereas, the maximum incidence of thrips was observed on genotype RSC-10-71, Bragg with 2.2 thrips/three leaves.

Based on overall pest incidence, genotype J5-335 with 3.0 larvae/meter row was least attacked by the defoliator's pests.

Genotype RKS-18, DS-3106 was least attacked by whiteflies with 3.4 whiteflies/ three leaves followed by genotype RSC-10-71 with 4.4 whiteflies/three leaves and genotype SL-1104, KDS-921, Dsb-32, RSC-10-52, AMS-MB-5-18, JS97-52 with 1.6 thrips/three leaves were least preferred by the thrips.

Table 1: Insect pest incidence in AVT-I entries

S. No	Name of Entries	No. of Defoliators/mrl	No. of whitefly/three leaves	Thrips/three leaves	Overall reaction of varieties	Average yield (gm/plot)
1	NRC-128	3.6 (2.14)	4.2 (2.28)	2.8 (1.94)	SLY	0.35
2	Dsb-34	4.0 (2.23)	4.2 (2.28)	1.8 (1.66)	RHY	0.462
3	SL-1068	3.6 (2.14)	4.0 (2.23)	2.0 (1.72)	SLY	0.225
4	NRC-137	3.8 (2.19)	4.1 (2.25)	1.6 (1.60)	SLY	0.275
5	CSb-10084	4.2 (2.28)	4.4 (2.32)	2.0 (1.72)	SLY	0.312
6	MACS-1493	4.4 (2.32)	4.6 (2.36)	1.4 (1.54)	SLY	0.487
7	SL-1123	4.4 (2.32)	3.6 (2.14)	1.8 (1.67)	SLY	0.118
8	BAUS-102	4.4 (2.32)	3.0 (2.00)	1.6 (1.61)	SLY	0.262
9	MACS NRC-1575	4.2 (2.28)	4.4 (2.32)	1.4 (1.54)	SLY	0.275
10	NRC-132	3.8 (2.19)	3.0 (2.00)	1.0 (1.40)	SLY	0.175
11	AMS-2014-1	4.0 (2.23)	3.8 (2.19)	1.6 (1.61)	SLY	0.425
12	DS-3108	3.4 (2.09)	3.2 (2.04)	1.6 (1.61)	SLY	0.137
13	AMS-10039	4.4 (2.32)	4.2 (2.28)	1.4 (1.54)	SLY	0.412
14	NRC-136	3.8 (2.19)	4.2 (2.28)	1.0 (1.41)	SLY	0.45
15	CSb-10112	3.8 (2.19)	4.0 (2.23)	2.0 (1.72)	SLY	0.275
16	PS-1613	4.2 (2.28)	3.8 (2.19)	1.6 (1.61)	RHY	0.187
17	KDS-992	4.6 (2.36)	4.2 (2.28)	2.0 (1.72)	SLY	0.525
18	RSC-11-07	4.4 (2.32)	4.2 (2.28)	1.6 (1.61)	SLY	0.35
19	NRC-SL-1	4.2 (2.28)	4.2 (2.28)	2.2 (1.78)	SLY	0.275
20	PS-1611	4.2 (2.28)	3.6 (2.14)	2.0 (1.72)	SLY	0.25
21	RSC-11-03	4.2 (2.28)	4.0 (2.23)	2.0 (1.72)	SLY	0.475
22	NRC-134	4.0 (2.09)	4.0 (2.23)	1.8 (1.66)	SLY	0.275
23	SKF-SPS-11	5.0 (2.32)	4.2 (2.28)	1.6 (1.61)	SLY	0.187
24	NRC-147	3.8 (2.19)	4.0 (2.23)	1.6 (1.61)	SLY	0.2
25	MACS NRC-1667	4.0 (2.19)	4.0 (2.23)	1.6 (1.61)	SLY	0.37
26	MACS-450	4.2 (2.28)	4.0 (2.23)	1.8 (1.66)	SLY	0.137
27	RKS-18	5.0 (2.36)	4.4 (2.32)	2.0 (1.72)	SLY	0.175
28	Bragg	4.6 (2.32)	4.4 (2.32)	1.8 (1.66)	SLY	0.437
29	J5-335	4.8 (2.28)	4.0 (2.23)	1.8 (1.66)	SLY	0.212
30	J5-97-32	4.4 (2.28)	3.8 (2.19)	2.2 (1.79)	SLY	0.562

Grain yield and categorization of varieties AVT-II

All entries were grown in two sets, one with complete plant protection measures and the other with no plant protection measures. One spray of Profenophos 50 EC @ 500 l/ha, variably increased grain yield in all the varieties. The grain yield ranged from 0.575 to 0.162 gm/plot and the highest yield was obtained from genotype JS97-52 (0.575 gm/plot) followed by AMS-MB-5-18 (0.537 gm/plot).

The varieties were further grouped into four categories based on the maximin-minimax method. Two varieties (SL-1104, RSC-10-71) were resistant low yield (R-LY), three varieties (KDS-921, Bragg, J597-52) was resistant high yielding (R-HY) whereas five varieties (DS-3106, Dsb-32, MACS-1520, RKS-18, JS-335) were susceptible low yielding (S-LY) and two varieties (RSC-10-52, AMS-MB-5-18) were susceptible high yielding (S-HY).

Table 2: Insect pest incidence in AVT-II entries

S. No	Name of Entries	No. of Defoliators/mrl	No. of whitefly/ three leaves	Thrips/three leaves	Overall reaction of varieties	Average yield(gm/plot)
1	SL-1104	3.4 (2.10)	4.2 (2.28)	1.6 (1.61)	RLY	0.3875
2	DS-3106	3.4 (2.10)	3.4 (2.10)	2.0 (1.73)	SLY	0.35
3	KDS-921	3.8 (2.18)	4.0 (2.23)	1.6 (1.61)	RHY	0.5125
4	RSC-10-71	3.8 (2.18)	4.4 (2.32)	2.2 (1.78)	RLY	0.4375
5	Dsb-32	3.8 (2.18)	4.0 (2.23)	1.6 (1.61)	SLY	0.475
6	RSC-10-52	3.6 (2.14)	4.2 (2.28)	1.6 (1.61)	SHY	0.4875
7	MACS-1520	4.8 (2.14)	3.8 (2.19)	2.0 (1.73)	SLY	0.4375
8	AMS-MB-5-18	3.4 (2.10)	4.0 (2.23)	1.6 (1.61)	SHY	0.5375
9	RKS-18	3.2 (2.05)	3.4 (2.10)	1.8 (1.66)	SLY	0.175
10	Bragg	3.2 (2.05)	4.2 (2.28)	2.2 (1.78)	RHY	0.575
11	J5-335	3.0 (2.00)	4.0 (2.23)	1.8 (1.66)	SLY	0.1625
12	J5-97-32	3.4 (2.10)	4.2 (2.28)	1.6 (1.61)	RHY	0.5625

Based on the maximin-minimax method Singh *et al.*, (2007) [4] also categorized and concluded that the ten genotypes were resistant high yielding and eight were resistant low yielding. Twenty-three were susceptible to yielding. Further Using the Maximin-minimax method, Harish *et al* (2009) [5] reported that JS-335, DSb-1, PK 1029, JS 93-05, Monetta and Bragg were classified as susceptible but high-yielding. Similarly, in present findings (SL-1104, RSC-10-71) were resistant to low yield.

Similarly, Sundar *et al.* (2017) [3] found that out of 50 soybean genotypes/varieties screened against tobacco caterpillar, two varieties HIMSO 1685 and 1347 were found highly resistant, five varieties namely RVS 2007-6, RVS 2008-24, SL-955, NRC-86 and SL-688 were resistant low yielding, JS 335, JS 93-05 were susceptible low yielding.

Entries are characterized in AVT-I and AVT-II

R-HY Resistant High Yielding

R-LY Resistant Low Yielding

S-HY Susceptible High Yielding

S-LY Susceptible Low Yielding

Conclusion

The screening trial was conducted during *kharif*, 2018 under two categories the Advanced Varietal Trial (AVT I) and Advanced Varietal Trial (AVT II). Under AVT I there are thirty soybean genotypes were screened for resistance against defoliators, thrips and whiteflies. Based on total defoliator, genotype DS-3108 with 3.4 larvae/meter row was the least attacked by the defoliator pests whereas Genotype BAUS-102 and NRC-132 were the least attacked by whiteflies with 3.0 whiteflies/ three leaves and Genotype NRC-132 and NRC-136 with 1.0 thrips/three leaves was the least preferred by the thrips.

Based on total defoliator infestation, genotype JS-335, with 3.0 larvae meter row was the least attacked by the defoliator pests. Genotype RKS-18, DS-3106 was least attacked by whiteflies with 3.4 whiteflies/three leaves, Genotype SL-1104, KDS-921. Dsb- 32, RSC-10-52, AMS-MB-5-18, JS-97-52 with 1.6 thrips/three leaves were least preferred by the thrips. The grain yield ranged from 0.562 to 0.118 gm/plot, and the highest yield was obtained from Genotype JS97-52 (0.562 gm/plot) followed by KDS-992 (0.525 gm/plot).

In AVT II, twelve soybean genotypes were screened against major insect pests of soybean during *kharif*, 2018. Based on total defoliator infestation, genotype JS-335, with 3.0 larvae row was the least attacked by the defoliator pests. The incidence of whiteflies ranged from 3.4 to 4.4 whiteflies / three leaves. Genotype RKS-18, DS-3106 was least attacked by whiteflies with 3.4 whiteflies/three leaves. Genotype SL-1104, KDS- 921, Dsb-32, RSC-10-52, AMS-MB-5-18, JS97-52 with 1.6 thrips/three leaves was least preferred by the thrips.

The grain yield ranged from 0.575 to 0.162 gm/plot, and the highest yield was obtained from Genotype JS97-52 (0.575 gm/plot) followed by AMS-MB-5-18 (0.537 gm/plot). The varieties were further grouped into different categories based on the Maximin-Minimax method (Odulaja and Nokoe, 1993) [1].

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