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# Screening of genotypes for the resistance against sucking insect pests in soybean during summer

**Krishna VR, R Channakeshava, G Somanagouda and Rohini Sugandi**

**Abstract**
Studies on screening of soybean genotypes for the resistance against sucking insect pests of soybean was carried out during Summer, 2021. Out of the twenty soybean genotypes screened for field resistance against sucking insect pests, the genotypes DLSb 1 and DLSb 2 were found to be highly resistant to whiteflies, leaf hoppers and thrips. The genotypes SL 958 and SL 979 were resistant to sucking pests and DSb 21 exhibited moderate resistance to sucking pests. The above mentioned genotypes registered highest seed yield as well as lowest Yellow Mosaic Virus (YMV) incidence and can be used for breeding programme for developing insect resistance. The studies on correlation between sucking pests incidence and leaf characteristics of different soybean genotypes exhibited a significant positive correlation of whitefly incidence with leaf trichome density (r = 0.564), whereas leaf hoppers and thrips exhibited a non-significant negative correlation with trichome density and all three sucking pests were non-significantly correlated with leaf thickness.

**Keywords:** Sucking insect pests, genotypes, screening, soybean

## Introduction
Soybean (*Glycine max* (L.) Merrill) belongs to Fabaceae family and it is considered as major oilseed crop. Soybean is valued for its high protein content (40%) and oil content (20%). Soybean is the cheapest, richest and easiest source of best quality proteins, fats and it has multiple uses both as food and as industrial product, because of this it is known as 'Wonder crop' or 'Golden crop' or 'Miracle crop' of 21st century. The major soybean growing states in India are Madhya Pradesh, Maharashtra, Rajasthan, Andhra Pradesh, Karnataka and Gujarat. The area, production and productivity of soybean in Karnataka are 0.33 m.ha, 0.27 m.t and 816 kg/ha respectively (Anon., 2020) [2]. In Karnataka, Bidar, Belagavi, Dharwad, Haveri and Bagalkot are the major soybean growing regions. The major soybean growing season is *kharif* season and in summer, soybean is mainly cultivated for seed production.
Soybean has a high yield potential and it also has a potential to eliminate protein malnutrition in poor sections of society due to high protein content. To combat widespread energy-protein deficiency, high quality soybean protein should be included in the daily diet of people. Therefore, it is important to increase the area and production of the soybean to meet the increasing demand. But crop production is limited by many constraints including the effect of various biotic and abiotic factors. One among the major biotic factor is incidence of pests and diseases. All stages of the crop are prone to heavy infestation by pest complex. The luxuriant growth of the crop makes room for space and shelter, which also provides an unlimited source of food for the multiplication of pests. Among different insect pests affecting soybean cultivation, sucking pests *viz.*, whiteflies, leaf hoppers and thrips causes significant economic damage during summer season. These insects cause damage to plant by sucking plant sap, secreting honeydew, which results in development of dark sooty mold inhibiting light penetration and thus reducing photosynthesis. In addition, these insects act as vectors of plant diseases. Therefore, identification of the resistant genotypes and cultivation of resistant genotypes along with integrated pest management practices helps to reduce the infestation by these insect pests.

## Materials and Methods
The field experiment has been carried out at Main Agricultural Research Station (MARS), Dharwad during *Summer*-2021. Dharwad is a district head quarter in northern Karnataka situated at 15°26 North latitude, 70° 07 East latitude and at an altitude of 731.8 m above mean sea level (MSL).

It is located in northern transitional zone (Zone-8) and receives an annual rainfall of 600-800 mm.

About 20 soybean genotypes obtained from All India Co-ordinated Research Project on soybean, Indore and All India Co-ordinated Research Project on soybean, Dharwad centre were evaluated in the field to find out the genotype resistant to sucking pests by following Randomized Block Design (RBD) with each entry having two replications. Each of the soybean entries has been sown in three rows of 5 m length with a spacing of 30 cm ×10 cm and JS 335 (susceptible check) sown after every two entries. All the recommended packages of practices were followed in establishing the crop except the control measures for sucking pests.One blanket insecticide spray with Chlorantraniliprole 18.5% SC @ 0.2 ml/l of water was taken against defoliators. Observations on incidence of sucking pests in soybean were recorded from top, middle and bottom leaves of five randomly selected plants in each entries. This was recorded at weekly interval after the appearance of pest till harvesting of the crop. Then the genotypes were categorized into different groups *viz.*, Highly resistant (HR), Resistant (R), Moderately resistant (MR), Low resistant (LR), Susceptible (S) and Highly susceptible (HS) by considering the means (X) and standard deviation (σ) of pest incidence, as per formula approved in "All India Co-ordinated Research Project on Soybean (AICRPS)".

The per cent Yellow Mosaic Virus (YMV) incidence was recorded by counting the number of plants infected with YMV and the total number of plants in the plot. The seed yield obtained from each entry has been documented separately and converted to kg per hectare. Five plants were selected randomly from each row for recording observations on various biophysical parameters during vegetative stage of the crop. Biophysical parameters *viz.*, leaf thickness and trichome density were recorded and that has been correlated with sucking pest incidence. Data obtained were subjected to ANOVA after transformation with web based software, WASP (WEB AGRI STAT PACKAGE) by ICAR goa.res.in.

**Results and discussion**

From the twenty different soybean genotypes used for screening, it is observed that DLSb 1 and DLSb 2 were found to be highly resistant to sucking pests *viz.*, whitefly, leaf hoppers and thrips compared to the susceptible check JS 335. Similarly, SL 958 and SL 979 were resistant and genotype DSb 21 was moderately resistant to sucking insect pests (Table 1). Other genotypes remained as moderately resistant, low resistant, susceptible and highly susceptible. Genotype BAUS 102 was found to be highly susceptible to whiteflies (15.19 whiteflies per three leaves), whereas, RVSM 2011-35 (12.03 leaf hoppers per three leaves) and PS 1637 (12.70 thrips per three leaves) were found to be highly susceptible to leaf hoppers and thrips respectively. The present investigations were supported by findings of Ahirwar (2013) [1], who reported that soybean genotype SL 958 was least preferred by sucking pests (whiteflies and leaf hoppers) among different genotypes used for screening.

The incidence of sucking pests was correlated with leaf characteristics like trichome density (no. of trichomes per 5 $mm^2$) and leaf thickness (mm). Whitefly exhibited a significant positive correlation with leaf trichome density; whereas leaf hoppers and thrips exhibited a non-significant negative correlation with trichome density and all three sucking pests showed a non-significant negative correlation with leaf thickness. From this data it is evident that whitefly population increased with increase in trichome density (Table 2). The positive correlation between trichome density and whitefly incidence was due to preference of a place near trichome base for oviposition by whiteflies to minimize the selection pressure of natural enemies (Heinz and Zalom, 1995) [3]. These results were in close agreement with Vieira *et al*. (2011) [8] who reported a positive correlation of whitefly incidence with trichome density in soybean. The cultivar IAC Holambra Stwart with a considerable number of trichomes had a higher whitefly population than the other cultivars, IAC 19, Barreiras, and IAC17, which had fewer trichomes. Lutfi *et al*. (2019) [5] observed a higher population of whitefly in soybean genotypes with denser and longer trichomes and thinner epidermal thickness.

The YMV incidence ranged from 11.33 to 38.60 per cent in different genotypes. The genotype BAUS 102 recorded highest percentage (38.60%) of disease incidence, whereas, lowest is found in DLSb 1 (11.33%). The YMV incidence was 34.65% in genotype JS 335, which was used as a susceptible check (Table 3).While screening the genotypes for resistance against whitefly, lowest number of whiteflies was observed on genotype DLSb 1 and highest in BAUS 102. Since the whiteflies act as a vector to yellow mosaic virus, the lowest and highest YMV disease incidence was observed in DLSb 1 and BAUS 102, respectively.In confirmation with above findings, Khan *et al.* (2013) [4] reported that genotype JS 335 was susceptible to YMV with 30.90 per cent incidence. Naveesh *et al*. (2020) [7] reported that DSb 21 was moderately resistant to soybean yellow mosaic virus with 13.33 per cent disease incidence, whereas, JS 335 was highly susceptible to YMV incidence with 80 per cent disease incidence.

Highest seed yield was obtained from genotype DLSb 1 (1579 kg/ha), since, DLSb 1 exhibited high resistance to all sucking pests and lowest YMV incidence was also recorded lowest from the same genotype. The next best genotype was DLSb 2 (1518 kg/ha). The genotype BAUS 102 recorded lowest yield (769 kg/ha) and JS 335, which was used as susceptible check, recorded 1056 kg/ha (Table 3). The present findings were similar with the findings of Murry *et al*. (2018) [6], who recorded 1726 kg/ha and 1173 kg/ha seed yield from respective soybean genotypes JS 335 and RKS 18 under the influence of the major insect pests.

**Table 1:** Screening of different soybean genotypes for resistance against sucking pests

| Sl. No. | Genotype | Mean number of whiteflies per three leaves | Reaction of genotypes | Mean number of leaf hoppers per three leaves | Reaction of genotypes | Mean number of thrips per three leaves | Reaction of genotypes |
|---|---|---|---|---|---|---|---|
| 1 | AMS 100-39 | 9.88 (3.22) | MR | 10.02 (3.24) | LR | 9.42 (3.15) | LR |
| 2 | BAUS 102 | 15.19 (3.96) | HS | 8.79 (3.05) | LR | 7.55 (2.84) | MR |
| 3 | DLSb 1 | 6.35 (2.62) | HR | 5.72 (2.49) | HR | 5.68 (2.48) | HR |
| 4 | DLSb 2 | 7.02 (2.74) | HR | 5.89 (2.53) | HR | 5.99 (2.55) | HR |
| 5 | DLSb 3 | 10.17 (3.26) | MR | 7.60 (2.84) | MR | 12.30 (3.57) | HS |
| 6 | DLSb 4 | 9.00 (3.08) | MR | 9.14 (3.10) | LR | 9.19 (3.11) | LR |
| 7 | DS 9421 | 14.07 (3.82) | S | 8.00 (2.91) | MR | 9.49 (3.16) | LR |
| 8 | DSb 21 | 8.95 (3.07) | MR | 9.04 (3.08) | LR | 8.08 (2.93) | MR |
| 9 | DSb 34 | 8.95 (3.07) | MR | 11.04 (3.39) | S | 11.03 (3.39) | LR |
| 10 | JS 21-72 | 11.16 (3.41) | LR | 6.59 (2.66) | R | 7.52 (2.83) | MR |
| 11 | KDS 753 | 12.04 (3.54) | LR | 10.25 (3.28) | LR | 10.25 (3.27) | LR |
| 12 | MACSNRC 1667 | 10.34 (3.29) | MR | 9.32 (3.13) | LR | 9.47 (3.16) | LR |
| 13 | NRC 149 | 11.31 (3.44) | LR | 8.42 (2.98) | MR | 7.74 (2.87) | MR |
| 14 | PS 1637 | 13.35 (3.72) | S | 8.32 (2.97) | MR | 12.70 (3.63) | HS |
| 15 | RKS 18 | 10.92 (3.38) | LR | 12.16 (3.56) | S | 8.42 (2.98) | MR |
| 16 | RSC 11-15 | 13.03 (3.68) | S | 11.82 (3.51) | S | 11.65 (3.48) | S |
| 17 | RVSM 2011-35 | 8.85 (3.05) | MR | 12.03 (3.54) | HS | 10.59 (3.33) | LR |
| 18 | SL 958 | 7.89 (2.89) | R | 6.46 (2.64) | R | 6.69 (2.68) | R |
| 19 | SL 979 | 7.92 (2.90) | R | 6.57 (2.66) | R | 6.53 (2.65) | R |
| 20 | JS 335 (Susceptible check) | 12.88 (3.66) | S | 11.40 (3.45) | S | 11.51 (3.46) | S |

**Table 2:** Correlation between incidence of sucking pests and leaf characteristics of different soybean genotypes

| Sl. No. | Genotypes | Mean no. of sucking insects per three leaves | | | Leaf trichome density (No. per 5 mm$^2$) | Leaf thickness (mm) |
|---|---|---|---|---|---|---|
| | | Whitefly | Leaf hopper | Thrips | | |
| 1 | AMS 100-39 | 9.88 | 10.02 | 9.42 | 62 | 0.23 |
| 2 | BAUS 102 | 15.19 | 8.79 | 7.55 | 124 | 0.13 |
| 3 | DLSb 1 | 6.35 | 5.72 | 5.68 | 24 | 0.23 |
| 4 | DLSb 2 | 7.02 | 5.89 | 5.99 | 33 | 0.19 |
| 5 | DLSb 3 | 10.17 | 7.60 | 12.30 | 43 | 0.13 |
| 6 | DLSb 4 | 9.00 | 9.14 | 9.19 | 46 | 0.21 |
| 7 | DS 9421 | 14.07 | 8.00 | 9.49 | 110 | 0.21 |
| 8 | DSb 21 | 8.95 | 9.04 | 8.08 | 37 | 0.13 |
| 9 | DSb 34 | 8.95 | 11.04 | 11.03 | 68 | 0.19 |
| 10 | JS 21-72 | 11.16 | 6.59 | 7.52 | 109 | 0.20 |
| 11 | KDS 753 | 12.04 | 10.25 | 10.25 | 98 | 0.13 |
| 12 | MACSNRC 1667 | 10.34 | 9.32 | 9.47 | 88 | 0.18 |
| 13 | NRC 149 | 11.31 | 8.42 | 7.74 | 94 | 0.21 |
| 14 | PS 1637 | 13.35 | 8.32 | 12.70 | 95 | 0.21 |
| 15 | RKS 18 | 10.92 | 12.16 | 8.42 | 65 | 0.20 |
| 16 | RSC 11-15 | 13.03 | 11.82 | 11.65 | 55 | 0.16 |
| 17 | RVSM 2011-35 | 8.85 | 12.03 | 10.59 | 49 | 0.17 |
| 18 | SL 958 | 7.89 | 6.46 | 6.69 | 74 | 0.19 |
| 19 | SL 979 | 7.92 | 6.57 | 6.53 | 81 | 0.22 |
| 20 | JS 335 (Susceptible check) | 12.88 | 11.40 | 11.51 | 43 | 0.13 |
| Correlation co-efficient (r), Whitefly | | | | | 0.564** | -0.359 |
| Leaf hoppers | | | | | -0.138 | -0.339 |
| Thrips | | | | | -0.115 | -0.387 |

Table value – 0.444 (at 5%), 0.561 (at 1%)
** Significant at 1%

**Table 3:** Incidence of yellow mosaic virus (YMV) disease and seed yield in different soybean genotypes under unprotected condition during summer

| Sl. No. | Genotype | YMV incidence (%) | Seed yield (kg/ha) |
|---|---|---|---|
| 1 | AMS 100-39 | 25.00 (30.00) | 1174 |
| 2 | BAUS 102 | 38.60 (38.41) | 769 |
| 3 | DLSb 1 | 11.33 (19.67) | 1579 |
| 4 | DLSb 2 | 12.04 (20.30) | 1518 |
| 5 | DLSb 3 | 26.35 (30.88) | 1320 |
| 6 | DLSb 4 | 23.16 (28.77) | 1339 |
| 7 | DS 9421 | 36.48 (37.15) | 876 |
| 8 | DSb 21 | 22.15 (28.05) | 1419 |
| 9 | DSb 34 | 20.34 (26.80) | 1527 |
| 10 | JS 21-72 | 29.63 (32.98) | 1218 |
| 11 | KDS 753 | 31.98 (34.44) | 1165 |
| 12 | MACSNRC 1667 | 28.16 (32.05) | 1207 |
| 13 | NRC 149 | 30.25 (33.37) | 1049 |
| 14 | PS 1637 | 33.65 (35.46) | 885 |
| 15 | RKS 18 | 31.58 (34.19) | 1070 |
| 16 | RSC 11-15 | 34.69 (36.08) | 1039 |
| 17 | RVSM 2011-35 | 21.33 (27.05) | 1088 |
| 18 | SL 958 | 14.26 (22.19) | 1487 |
| 19 | SL 979 | 15.23 (22.97) | 1465 |
| 20 | JS 335 (Susceptible check) | 34.63 (36.05) | 1056 |
| S. Em. ± | | 1.85 | 2.65 |
| CD at 5% | | 5.48 | 8.03 |
| CV (%) | | 10.06 | 10.12 |

*Figures in the parentheses are arc sin transformed values

## Conclusion

Based on the findings of this field experiment it is concluded that among all genotypes of soybean, DLSb 1, DLSb 2, SL 958, SL 979 and DSb 21 were found to be the best genotypes with respect to resistance against sucking pests and could be used in future breeding programme. The physico-chemical characteristics conferring resistance to sucking pests, which can be used to select sucking pests resistant lines from the breeding materials for use in breeding improvement.

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