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Plant Protection

Relative Resistance in Soybean Germplasms against White Fly, (*Bemisia Tabaci* Gennadius) and Yellow Vein Mosaic Virus Spread in Field

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Abstract

Absence of resistance against diseases and insect pests in soybean is one of the main reasons for their low yield. During the *kharif* season, yellow mosaic epidemic damages the crop in most of the soybean growing areas of Uttarakhand. A field experiment was conducted during *kharif* season of 2012-13 at N. E. Borlaug Crop Research Centre of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (Uttarakhand) for the purpose of identifying resistance in soybean germplasms, a disease screening plot, comprising of 41 test entries, was developed. Despite being highly susceptible, some test entries produced good yield and showed tolerance to yellow vein mosaic disease. Screening of forty one genotypes of soybean against White fly, *Bemisia tabaci* (Genn.) revealed that the soybean genotypes (1.11 per 3 plants) SL- 900 with 67.49% disease spread was found the least susceptible, followed by AMS-MB-5-18, AMS-243, AMS-MB-5-19, DS-12-5, DS-2708, DSb-16, DSb-20, JS-20-29, JS-20-34, KDS-8, KS-103, MACS-1336, MACS-504, PS-1476, PS-1477, RVS -2001-18 germplasms were found resistant to White fly infestation as well as Yellow Vein Mosaic Virus (YVMV) damage.

Highlights

- White fly, *Bemisia tabaci* (Genn.) is one of the important insect pest of soybean which cause direct damage by sucking sap of plant and indirectly by transmitting Yellow Vein Mosaic disease.
- SL-900, AMS-MB-5-18, AMS-243, AMS-MB-5-19, DS-12-5, DS-2708, DSb-16, DSb-20, JS-20-29, JS-20-34, KDS-8, KS-103, MACS-1336, MACS-504, PS-1476, PS-1477, RVS-2001-18 germplasms were found resistant to whitefly infestation as well as YVMV damage.

Keywords: Soybean, white fly, YVMV

Soybean ranks first amongst various oilseed crops, contributing approximately 25% to the world's total oil and fat production, which is next only to palm oil, having 26% share. The estimate of world soybean area, production and productivity in 2012-13 is 108.75 million ha, 268.00 million tons and 2.5 t/ha respectively (Anonymous 2011). The White fly, *Bemisia tabaci* Gennadius, is a polyphagous insect pest. Besides causing direct loss to plant vigour by sucking cell sap, it is also a potential vector of various viral diseases viz. yellow vein mosaic disease. Yellow Vein Mosaic Virus (YVMV) of soybean is ubiquitous in tarai region and its incidence is cent percent in rainy season. A late attack of the disease reduces the yield of pods by over 25% but when attack is early, the crop is often a total loss. White fly was formerly, pest of secondary importance for soybean crops, but in recent years it has become a key pest in our state, reducing yields and increasing costs due to the insecticides used for its control (Vieira *et al.* 2011) without an established Economic Threshold (ET).

Materials and Methods

The field study was conducted during *kharif* season of 2012-13 at G.B. Pant University of Agriculture and

Technology, Pantnagar (29°N latitude, 79.29°E longitude and 243.8 m above the mean sea level) district U.S. Nagar, Uttarakhand, India. The climate of Pantnagar is humid subtropical with hot summers, heavy rains in monsoon period and extreme cold in winters. The soil of the experimental site was silty clay loam in texture.

41 Germplasms of soybean was sown in furrows opened to a depth of 4-5 cm by hand liner. Row to row distance of 45 cm was maintained. Insecticides were not applied on the test site throughout the growing season. All the plots were rated for whitefly infestations on standard weeks, especially when the plants were in the pod filling stage and pods with full sized seeds growth stage. The four uppermost trifoliates were visually examined on all plants on each two row plot, at three spots per replication. Simultaneous counts were also made on the number of YVMV affected plants. The data were subjected to statistical analysis and the correlation coefficient to test the association between the number of whiteflies and the percentage incidence was found out.

Table 1. Population fluctuation of *Bemisia tabaci* at different Days after germinationin test germplasms

Sl. No.	Germplasm	28DAG	42DAG	56DAG	70DAG	84DAG	98DAG
1	AMS-56	5.60	8.26	3.51	1.77	1.55	1.33
2	AMS-59	4.00	7.50	3.83	0.194	0.88	0.19
3	AMS-243	5.06	8.63	3.66	2.88	1.88	1.98
4	AMS-MB-5-18	5.30	8.00	3.42	3.11	2.11	3.13
5	AMS-MB-5-19	5.06	7.60	3.66	2.11	2.00	2.14
6	BAUS-40	5.50	7.93	2.33	1.77	2.88	2.88
7	DS-12-5	3.50	8.20	3.55	1.88	2.11	1.77
8	DS-2706	5.10	7.40	3.42	1.55	2.00	1.34
9	DS-2708	4.73	7.76	3.51	2.55	1.44	2.44
10	DSb-16	4.20	7.73	2.43	1.55	2.66	1.44
11	DSb-18	5.50	8.00	2.66	0.55	1.11	0.95
12	DSb-19	4.60	5.16	3.16	1.77	1.66	2.00
13	DSb-20	5.36	8.73	3.53	0.86	1.03	00.56
14	DSb-21	4.26	8.60	3.33	1.50	1.96	1.70
15	JS-20-29	3.90	9.06	3.66	1.03	1.80	2.23
16	JS-20-34	4.36	8.86	3.10	00.93	1.20	1.20
17	JS-20-41	3.40	10.13	3.40	1.90	3.53	1.20
18	KDS-8	4.68	8.46	3.43	00.96	1.50	1.73
19	KDS-344	3.73	9.50	3.23	00.83	1.20	1.10
20	KDS-378	3.10	9.26	2.93	00.76	00.90	00.43
21	KDS-699	4.10	9.70	3.13	00.80	1.20	1.63
22	KDS-701	4.10	9.16	3.33	1.26	1.46	2.70
23	KS-103	3.16	9.73	3.60	1.16	1.73	2.70
24	MACS-1311	4.10	8.59	2.90	0.66	1.50	2.73
25	MACS-1336	4.00	8.73	3.10	0.70	1.22	1.90
26	MACS-1340	3.30	8.60	3.53	0.86	1.03	0.16
27	MACS-504	5.00	9.06	3.33	1.50	1.96	1.70
28	NRC-86	4.10	8.86	3.66	1.03	1.80	2.23
29	PS-1476	2.90	10.03	3.10	00.93	1.20	1.20
30	PS-1477	5.50	8.46	3.40	00.90	1.53	1.20
31	PS-1499	4.50	9.50	3.43	00.96	1.50	1.73
32	RKS-63	6.60	9.26	3.23	0.83	1.20	1.10
33	RVS-2001-18	2.50	4.70	2.93	0.76	0.90	0.43
34	SL-778	5.84	9.16	3.13	0.80	1.20	1.63
35	SL-871	6.30	9.73	3.33	1.26	1.46	2.70
36	SL-900	6.79	8.59	3.60	1.16	1.73	2.70
37	SL-958	4.44	8.73	2.90	00.66	1.50	2.73
38	VLS-76	3.46	8.60	3.40	0.60	1.25	1.63
39	SL-688	5.79	9.06	4.36	1.30	1.20	1.70
40	PS-1347	4.44	8.86	4.20	2.50	1.46	1.70
41	Bragg	3.46	10.03	5.10	2.10	1.73	1.73
	S.EM±	**00.50**	**00.58**	**00.36**	**00.27**	**00.34**	**00.42**
	CD at 5%	**NS**	**1.72**	**NS**	**NS**	**NS**	**1.24**

Results and Discussion

Seasonal fluctuation of *Bemisia tabaci* in different germplasms

The study reveals that the *B. tabaci* population was low upto 15th August and started building up reaching the peak on 30th September. During 28 Days after germination (DAG), the populations of *B. tabaci* varied non significantly from 2.50 on RVS-2001-18 to 6.30 on SL-900. The *B. tabaci* population at 42 DAG varied significantly from 4.70 on RVS-2001-18 to 10.13 on JS-20-41. During 56 DAG population varied from 2.33 on BAUS-40 to 5.10 on Bragg. At 70 DAG the population varied from 0.60 on VLS-76 to 3.11 on AMS-MB-5-18. During 84 DAG population varied non significantly from 0.88 on AMS-59 to 3.53 on JS-20-41. The *B. tabaci* population at 98 DAG varied significantly from 0.16 on MACS-1340 to 3.13 on AMS-MB-5-18. The relative susceptibility of the promising soybean cultivars NRC-12, JS 71-05, PK- 564, NRC-7, JS-335, PUSA-16 and NRC-8 was studied in a field experiment conducted during the *kharif* season of 1996-97 in Madhya Pradesh, India. NRC-12 was tolerant to the infestation of White fly (*Bemisia tabaci*). NRC-7 recorded tolerance Whitefly. (Gaur and Deshpande 1998).

Table 2. Number of whiteflies and diseased plants in soybean

Sl. No.	Genotype	Mean no. of whiteflies	Per cent YVMV Affected Plants
1	AMS-56	2.75* (1.79)	100 (90.00)
2	AMS-59	0.75 (1.71)	100 (90.00)
3	AMS-243	2.0 (1.54)	90 (80.78)
4	AMS-MB-5-18	1.5 (1.40)	100 (80.78)
5	AMS-MB-5-19	2.75 (1.79)	100 (80.78)
6	BAUS-40	1.5 (1.28)	100 (90.00)
7	DS-12-5	2.0 (1.58)	100 (80.78)
8	DS-2706	4.0 (2.10)	100 (90.00)
9	DS-2708	2.0 (1.20)	100 (80.78)
10	DSb-16	1.75 (1.47)	100 (73.39)
11	DSb-18	1.5 (1.60)	100 (90.00)
12	DSb-19	1.5 (1.40)	100 (90.00)
13	DSb-20	2.75 (1.46)	100 (80.78)
14	DSb-21	0.75 (1.51)	100 (90.00)
15	JS-20-29	2.0 (1.44)	90 (80.78)
16	JS-20-34	2.75 (1.73)	60 (70.38)
17	JS-20-41	3.75 (2.03)	100 (90.00)
18	KDS-8	0.25 (0.83)	90 (71.56)
19	KDS-344	1.75 (1.57)	100 (90.00)
20	KDS-378	0.75 (1.61)	100 (90.00)
21	KDS-699	4.5 (2.23)	100 (90.00)
22	KDS-701	1.5 (1.41)	100 (90.00)
23	KS-103	2.25 (1.61)	90 (80.78)
24	MACS-1311	1.0 (1.20)	100 (90.00)
25	MACS-1336	1.25 (1.31)	60 (70.38)
26	MACS-1340	1.5 (1.28)	100 (90.00)
27	MACS-504	1.75 (1.49)	100 (80.78)
28	NRC-86	0.75 (1.06)	100 (90.00)
29	PS-1476	2.5 (1.73)	80 (76.71)
30	PS-1477	3.0 (1.86)	80 (76.71)
31	PS-1499	2.0 (1.57)	100 (90.00)
32	RKS-63	1.75 (1.53)	100 (90.00)
33	RVS-2001-18	1.25 (1.31)	90 (71.56)
34	SL-778	2.0 (1.54)	100 (90.00)
35	SL-871	0.75 (1.81)	100 (90.00)
36	SL-900	0.75 (1.11)	80 (67.49)
37	SL-958	2.0 (1.54)	100 (90.00)
38	VLS-76	1.0 (1.80)	100 (90.00)
39	SL-688	0.75 (1.86)	100 (90.00)
40	PS-1347	1.0 (1.54)	100 (90.00)
41	Bragg	1.5 (1.58)	100 (90.00)
	CD at 5%	**2.28 (0.78)**	**17.18 (21.02)**
	SEm±	**0.79 (0.27)**	**6.01 (7.35)**

The population of Whitefly *B. tabaci* and its correlation with incidence of YVMV in Soybean

The studies on correlation between *B. tabaci* population and incidence of yellow vein mosaic in soybean conclusively indicated that the population of *B. tabaci* reached maximum in the month of September followed by 100% YVMV incidence. Thus, the disease incidence proportionately increased as the number of *B. tabaci* abounded. This positive correlation confirmed that the incidence of disease depends upon the population of its vector, *B. tabaci*. SL 900 , AMS-MB-5-18, AMS-243, AMS-MB-5-19, DS-12-5, DS-2708, DSb-16, DSb-20, JS-20-29, JS-20-34, KDS-8, KS-103, MACS-1336, MACS-504, PS-1476, PS-1477, RVS 2001-18 germplsms were found having minimum number of *B. tabaci* while maximum *B. tabaci* adults were found on AMS-56, AMS-59, BAUS-40, DS-2706, DSb-21, JS-20-34, JS-20-41, KDS-378, KDS-699, KDS-701, MACS-1311, MACS-1340, NRC-86, PS-1499, RKS-63, SL-778, SL-871, SL-958, PS-1347 and irrespective of their population YVMV spread was 90 to 100%. Parallel results have also been reported in other whitefly transmitted diseases such as tomato yellow leaf curl (Cohen and Nitzani 1996).

The germplasms AMS-MB-5-19 and JS-20-29 were found most promising for yield as well as found resistant against *B. tabaci* incidence as well as YVMV spread. So, these germplasms may be recommended for large scale cultivation among the farmers after proper testing in multi-locational trials and these superior germplasms can be used in breeding programmes.

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