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Evaluation of sunflower germplasm lines against whitefly, *Bemisia tabaci* (Genn.) (Hemiptera: Aleyrodidae) under field condition

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Abstract

An experiment was conducted on evaluation of sunflower germplasm lines against whitefly, *Bemisia tabaci* (Genn.) at college of agriculture Raichur, Karnataka during *rabi* 2016-17. The objective of the study was to find out the promising sunflower germplasm lines against whitefly under field condition. Among 150 sunflower germplasm lines evaluated for their reaction against whitefly, the germplasm lines *viz.*, PM-4, PM-18, PM-19, PM-26, PM-30, PM37, PM- 39, PM-42, PM-43, PM-52, PM-67, PM-69, PM-73, PM-97 and 85 other germplasm lines were found to be promising against whitefly (category-I). Similarly, PM-6, PM-11, PM-12, PM-13, PM-62, PM-83, PM-87, PM-94, PM-103, PM-107, PM-112, PM-117, PM-121, PM-123, PM-128 and 27 other germplasm lines were grouped as category-II. Further, seven germplasm lines *viz.*, PM-3, PM-78, PM-91, PM-78-1, PM-91-1, PM-92 and PM-155 were grouped under category-III.

Keywords: *Bemisia tabaci*, sunflower germplasm lines, evaluation

Introduction

Sunflower is an important short duration crop grown for its edible oils. It is a crop of choice for farmers due to its wider adaptability, high yield potential shorter duration and profitability (Lavanya *et al.*, 2005) [6]. In India, sunflower is being grown over an area of 0.52 m ha with a production of 0.34 million tonnes and the productivity of 643 kg per ha. In Karnataka sunflower is being grown over an area of 0.35 m ha with a production of 0.20 million tonnes and the productivity of 579 kg per ha (Anon., 2016). Recently, whitefly has emerged as the new potential sucking insect pest of sunflower and also acting as the vector of leaf curl begomovirus in Northern Karnataka, India. This has attracted lot of attention of the Entomologists and pathologists, as it affects the productivity of sunflower an important oilseed crop in the country (Katti Pramod, 2007) [5]. Sunflower leaf curl disease vectored by whitefly was noticed for the first time in the country and the disease was recorded on sunflower hybrid 'Sun breed-275' up to 40 per cent disease incidence in the fields of Main Agricultural Research Station, University of Agricultural Sciences, Raichur, Northern Karnataka, during *rabi* season of 2009 (Govindappa *et al.*, 2011) [4]. Since then, the whitefly infestation has been noticed in an endemic form consecutively for the last two years in sunflower growing areas of northern districts of Karnataka. Sunflower is an important oil seed of the country. The studies on screening of sunflower germplasm lines against whiteflies was limited. Therefore present study was done to evaluate sunflower germplasm lines against whiteflies under field condition.

Material and Methods

The investigations on evaluation of sunflower germplasm lines against whitefly, *Bemisia tabaci* (Genn.) and management were carried out during *rabi* season of 2016-17. The experiments were conducted at Main Agriculture Research Station, UAS, Raichur, Karnataka. Five plants were randomly selected in each of the test entries and the total number of whiteflies (both adults and nymphs) were counted from six leaves in each germplasm line *i.e.*, two leaves each from top, middle and bottom portion of the plant canopy and later it was expressed as mean number per plant (*i.e.*, mean no./ 6 leaves/ plant). Observations were recorded from 15 days after sowing of the crop until harvest at weekly interval. Categorization of germplasm lines was done based on population density of whitefly during the cropping period as given in table 1.

Results and Discussion

Performance of sunflower germplasm lines against *B. tabaci*

A total of 150 germplasm lines were screened against whitefly during *rabi* season 2016-17.

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The visual observations were made from 15 DAS until harvest of the crop on whitefly population density on different germplasm lines. The mean seasonal incidence of whiteflies was ranged from 1.55 per six leaves (PM-26) to 9.82 per six leaves (PM-92) (Table 6). The germplasm lines were screened at the peak infestation period (mid December) by visual observation on whitefly population density. The sunflower germplasm lines showed differential reactions against whitefly and the population ranged from 3.00 per plant (PM-26) to 26.80 per six leaves (PM-92) (Table 2). Based on the population density of whiteflies the germplasm lines were categorized into different groups and are presented in table 8. Germplasm lines in category-I recorded minimum whitefly population in PM-26 (3 whiteflies per six leaves) followed by PM-69 (4.40 whiteflies per six leaves), PM-18 (4.60 per six leaves), PM-19 (4.70 per six leaves) and a maximum of 10 whiteflies per six leaves in PM-84, PM-148-2 and PM-156-6 (Scale 1). Among category-II group, minimum whitefly population was recorded in PM-153 (11 whiteflies per six leaves) followed by PM-62, PM-103, PM-112, PM-148 (11.10 per six leaves), PM-6 (11.20 per six leaves) and maximum of 18.90 whiteflies per six leaves in PM-129 (Scale 2). Among the category-III group the density of whiteflies ranged from 21.40 to 26.80 per six leaves in PM-91 and PM-92 respectively (Scale 3). Out of 150 sunflower germplasm lines screened 99 were in category-I with density of whitefly ranging from 3.00 to 10.00

per six leaves, 42 germplasm lines were in category-II with whitefly population density ranging from 11.00 to 18.90 per six leaves and seven germplasm lines were in category-III with whitefly population density ranging from 21.40 to 26.80 per six leaves (Table 3).

Studies made by Aslam and Rehman (2000) [3] reported that SF-187 was found resistant against whitefly among six different genotypes of sunflower screened viz., Hysun-33, PARSUN-1, SF-187, SMH-9706, SMH-9707, Suncross-24. Further, Ashfaq and Aslam (2001) [1] reported that sunflower genotype 9705 was found partially resistant to whitefly whereas JH₂ 99S and JH₁ 99S were partially susceptible. The sunflower genotypes Parsun-1, PSF-025, Hysun-777, Award and 9707 were found intermediately susceptible. The sunflower germplasm XF-263, T-562 and PNSF-1 were susceptible. The genotypes 1435 and 9706 were considered as highly susceptible to whiteflies. Rana and Sheoran (2004) [7] reported that HSFH-848 recorded lowest number of whiteflies among the different sunflower hybrids tested. Sarwan and Dhillon (2014) [8] reported that the population of whitefly adults on sunflower hybrids ranged from 1.53 to 2.27 adults per three leaves on different lines. It was minimum (1.53 adults per 3 leaves) in the case of PSFH-118 followed by GKSFH-2002 (1.63 adults per 3 leaves). The maximum population of 2.27 adults per three leaves was recorded in SH-3322.

Table 1: Whitefly scale for categorization of germplasm lines

Sl. No.	Whitefly population per six leaves	Scale	Category
1.	1-5	1	Category-I
2.	6-10		
3.	11-15	2	Category-II
4.	16-20		
5.	21-25	3	Category-III
6.	25-30		

Table 2: Screening of sunflower germplasm lines against whitefly, *B. tabaci* under field condition at peak infestation level

Sl. No	Entry	Standard week		Mean whitefly population*	Sl. No	Entry	Standard week		Mean whitefly population*
		50	51				50	51	
1.	PM-1	10.60	8.00	9.30	26.	PM-37	4.20	5.40	4.80
2.	PM-4	6.00	4.00	5.00	27.	PM-38	7.20	5.60	6.40
3.	PM-6	7.00	15.40	11.20	28.	PM-39	5.20	4.80	5.00
4.	PM-7	10.40	9.40	9.90	29.	PM-40	9.20	6.60	7.90
5.	PM-8	8.40	10.20	9.30	30.	PM-41	6.20	9.40	7.80
6.	PM-11	8.00	22.00	15.00	31.	PM-42	6.20	3.80	5.00
7.	PM-12	11.60	17.80	14.70	32.	PM-43	5.20	4.00	4.60
8.	PM-13	9.00	13.60	11.30	33.	PM-44	6.60	9.40	8.00
9.	PM-14	6.00	8.00	7.00	34.	PM-45	10.00	9.80	9.90
10.	PM-15	5.80	8.80	7.30	35.	PM-46	5.60	6.40	6.00
11.	PM-16	5.80	7.00	6.40	36.	PM-49	9.20	7.40	8.30
12.	PM-17	11.20	5.60	8.40	37.	PM-50	8.20	4.80	6.50
13.	PM-18	5.80	3.40	4.60	38.	PM-52	8.60	1.20	4.90
14.	PM-19	6.00	3.40	4.70	39.	PM-53	4.40	11.00	7.70
15.	PM-20	5.40	7.00	6.20	40.	PM-54	11.60	7.80	9.70
16.	PM-21	8.00	4.00	6.00	41.	PM-56	7.00	6.60	6.80
17.	PM-26	2.60	3.40	3.00	42.	PM-57	6.80	6.20	6.50
18.	PM-29	5.00	12.20	8.60	43.	PM-62	8.60	13.60	11.10
19.	PM-30	3.80	5.80	4.80	44.	PM-63	9.60	8.80	9.20
20.	PM-31	10.00	8.40	9.20	45.	PM-64	5.40	7.40	6.40
21.	PM-32	7.20	6.20	6.70	46.	PM-65	10.80	9.00	9.90
22.	PM-33	8.40	7.20	7.80	47.	PM-67	4.20	4.00	4.10
23.	PM-34	10.20	8.40	9.30	48.	PM-68	7.00	6.80	6.90
24.	PM-35	6.20	8.00	7.10	49.	PM-69	4.60	4.20	4.40
25.	PM-36	6.60	7.00	6.80	50.	PM-71	11.40	6.60	9.00

Sl. No.	Entry	Standard week		Mean whitefly population*	Sl. No.	Entry	Standard week		Mean whitefly population*
		50	51				50	51	
51.	PM-72	7.80	10.20	9.00	78.	PM-110	7.20	6.40	6.80
52.	PM-73	6.00	3.80	4.90	79.	PM-111	7.00	5.80	6.40
53.	PM-75	9.20	6.00	7.60	80.	PM-112	11.20	11.00	11.10
54.	PM-76	6.40	5.80	6.10	81.	PM-113	8.60	8.80	8.70
55.	PM-78	23.80	19.40	21.60	82.	PM-114	6.00	7.00	6.50
56.	PM-79	7.40	9.40	8.40	83.	PM-116	17.60	18.00	17.80
57.	PM-83	12.20	15.40	13.80	84.	PM-117	15.80	9.20	12.50
58.	PM-84	11.00	9.00	10.00	85.	PM-118	9.80	8.60	9.20
59.	PM-87	10.80	13.20	12.00	86.	PM-121	14.40	14.00	14.20
60.	PM-89	10.40	8.00	9.20	87.	PM-122	6.50	6.50	6.50
61.	PM-90	8.00	7.80	7.90	88.	PM-123	18.20	9.00	13.60
62.	PM-91	23.00	19.80	21.40	89.	PM-126	7.40	6.80	7.10
63.	PM-92	24.40	29.20	26.80	90.	PM-127	6.00	10.20	8.10
64.	PM-94	13.80	16.20	15.00	91.	PM-128	12.00	18.00	15.00
65.	PM-95	15.40	21.80	18.60	92.	PM-129	27.40	10.40	18.90
66.	PM-96	7.20	5.00	6.10	93.	PM-130	23.00	14.20	18.60
67.	PM-97	7.00	2.80	4.90	94.	PM-131	10.67	9.00	9.83
68.	PM-98	7.60	4.40	6.00	95.	PM-132	7.80	18.20	13.00
69.	PM-99	12.40	7.00	9.70	96.	PM-133	13.40	18.80	16.10
70.	PM-100	11.00	6.40	8.70	97.	PM-134	11.00	15.40	13.20
71.	PM-102	11.20	6.80	9.00	98.	PM-135	8.20	11.60	9.90
72.	PM-103	14.80	7.40	11.10	99.	PM-136	6.40	9.80	8.10
73.	PM-105	10.20	6.00	8.10	100.	PM-137	12.40	12.40	12.40
74.	PM-106	11.80	8.00	9.90	101.	PM-138	9.00	6.20	7.60
75.	PM-107	14.40	10.80	12.60	102.	PM-139	11.60	12.00	11.80
76.	PM-108	24.40	12.80	18.60	103.	PM-140	8.00	9.33	8.67
77.	PM-109	19.20	17.80	18.50	104.	PM-141	5.00	21.50	13.25
Sl. No.	Entry	Standard week		Mean whitefly population*	Sl. No.	Entry	Date Standard week		Mean whitefly population*
		50	51				50	51	
105.	PM-145	6.50	9.50	8.00	129.	PM-26-1	8.80	11.00	9.90
106.	PM-146	10.80	22.40	16.60	130.	PM-26-2	9.00	10.80	9.90
107.	PM-147	10.00	12.80	11.40	131.	PM-78	20.80	22.40	21.60
108.	PM-148	9.20	13.00	11.10	132.	PM-91	19.80	23.00	21.40
109.	PM-149	8.00	8.50	8.25	133.	PM-131	9.50	13.00	11.25
110.	PM-151	6.60	7.80	7.20	134.	PM-139-1	-	-	-
111.	PM-152	17.00	15.60	16.30	135.	PM-139-2	11.60	12.20	11.90
112.	PM-153	9.00	13.00	11.00	136.	PM-139-3	9.80	13.80	11.80
113.	PM-154	5.00	8.00	6.50	137.	PM-148-1	11.50	13.00	12.25
114.	PM-155	24.40	21.80	23.10	138.	PM-148-2	9.80	10.20	10.00
115.	PM-156	6.40	8.60	7.50	139.	PM-135-2	19.20	18.80	19.00
116.	PM-157	11.20	12.80	12.00	140.	PM-159-1	14.00	15.60	14.80
117.	PM-158	7.00	8.20	7.60	141.	PM-156-1	10.40	8.20	9.30
118.	PM-159	6.80	9.00	7.90	142.	PM-156-2	9.00	10.60	9.80
119.	PM-160	8.20	11.40	9.80	143.	PM-156-3	8.20	10.80	9.50
120.	PM-161	8.80	9.60	9.20	144.	PM-156-4	6.60	8.00	7.30
121.	PM-162	6.80	7.60	7.20	145.	PM-156-5	10.20	9.00	9.60
122.	PM-163	13.80	14.40	14.10	146.	PM-156-6	9.60	10.40	10.00
123.	PM-164	9.00	11.00	10.00	147.	PM-112-1	11.00	13.00	12.00
124.	PM-165	6.60	5.60	6.10	148.	PM-1029-2	-	-	-
125.	PM-2	4.20	8.00	6.10	149.	PM-1026-1	8.00	7.00	7.50
126.	PM-3	23.40	21.60	22.50	150.	PM-1026-2	8.00	8.50	8.25
127.	PM-5	8.80	9.20	9.00	151.	KBSH-44	19.00	23.50	21.25
128.	PM-27	13.00	13.20	13.10					

* Whitefly population per six leaves

Table 3: Categorization of sunflower germplasm lines based on whitefly population density

Sl. No	Whitefly population per six leaves	Scale	Germplasm entries	Category	Total No
1.	1-5	1	PM-4, PM-18, PM-19, PM-26, PM-30, PM37, PM- 39, PM-42, PM-43, PM-52, PM-67, PM-69, PM-73, PM-97	Category-I	14
2.	6-10		PM-1, PM-7, PM-8, PM-14, PM-15, PM-16, PM-17, PM-20, PM-21, PM-29, PM-31, PM-32, PM-33, PM-34, PM-35, PM-36, PM-38, PM-40, PM-41, PM-44, PM-45, PM-46, PM-49, PM-50, PM-53, PM-54, PM-56, PM-57, PM-63, PM-64, PM-65, PM-68, PM-71, PM-72, PM-75, PM-76, PM-79, PM-84, PM-89, PM-90, PM-96, PM-98, PM-99, PM-100, PM-102, PM-105, PM-106, PM-		85

			110, PM-111, PM-113, PM-114, PM-118, PM-122, PM-126, PM-127, PM-131, PM-135, PM-136, PM-138, PM-140, PM-145, PM-149, PM-151, PM-154, PM-156, PM-158, PM-159, PM-160, PM-161, PM-162, PM-164, PM-165, PM-2, PM-5, PM-26-1, PM-26-2, PM-148-2, PM-156-1, PM-156-2, PM-156-3, PM-156-4, PM-156-5, PM-156-6, PM-1026-1, PM-1026-2		
3.	11-15	2	PM-6, PM-11, PM-12, PM-13, PM-62, PM-83, PM-87, PM-94, PM-103, PM-107, PM-112, PM-117, PM-121, PM-123, PM-128, PM-132, PM-134, PM-137, PM-139, PM-141, PM-147, PM-148, PM-153, PM-157, PM-163, PM-27, PM-131, PM-139-2, PM-139-3, PM-148-1, PM-159-1, PM-112-1.	Category-II	32
4.	16-20		PM-95, PM-108, PM-109, PM-116, PM-129, PM-130, PM-133, PM-146, PM-152, PM-135-2		10
5.	21-25	3	PM-155, PM-3, PM-78, PM-91, PM-78-1, PM-91-1, KBSH- 44 (Check)	Category-III	7
6.	26-30		PM-92		1

Conclusion

A total of 150 sunflower germplasm lines were evaluated of which 99 were in category-I with population density of whitefly ranging from 3.00 to 10.00 per six leaves, 42 germplasm lines were in category-II with whitefly population density ranging from 11.00 to 18.90 per six leaves and seven germplasm lines were in category-III with whitefly population density ranging from 21.40 to 26.80 per six leaves.

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