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Field screening of some open pollinated genotypes of chilli against thrips and yellow mite infestation under new alluvial zone of West Bengal

Arka Samanta, Koushik Sen and Ajay Kumar Sahoo

Abstract
Twenty two open pollinated genotypes of chilli were screened against infestation of thrips and yellow mite based on percent of plant showing visible symptoms at 'C' Block Farm, BCKV, Kalyani, Nadia, West Bengal during 2012-13 and 2013-14. The results of the investigation showed that genotypes 2011/-7 (16.47%), 2011/-6 (17.92%) and 2012/-2 (19.00%) were identified as field tolerant to thrips whereas 2011/-8 (21.33%), 2013/-1 (21.78%) and 2011/-3 (22.01) were found as mostly moderately field tolerant. Chilli germplasms 2011/-7 (15.97%) and 2013/-1 (18.25%) were recorded as field tolerant to yellow mite whereas 2011/-6 (21.55%), 2011/-8 (21.98%) and 2012/-2 (22.43%) were graded as mostly moderately field tolerant. 2011/-9 was identified as the most susceptible genotype to both thrips (33.43%) and yellow mite (38.05%). The results suggest that chilli open pollinated cultivar 2011/-7 was found least affected or tolerant to both thrips and yellow mite and may be utilized in the resistance breeding programme.

Keywords: Chilli, Genotype, *Scirtothrips dorsalis*, *Polyphagotarsonemus latus*, Screening

1. Introduction
Chilli (*Capsicum annum* L. and *Capsicum frutescens* L.) is one of the most important commercial spice and vegetable crop growing all over the world [6]. In India, green chilli is cultivated in an area of 292 thousand hectares with 2955 thousand metric tonnes of production during 2015-16 [2]. Beside a rich source of vitamin C, it also contains vitamin A, vitamin B and minerals [18]. Chilli is infested by several insect and non-insect pests of which the yellow mite, *Polyphagotarsonemus latus* Banks and thrips, *Scirtothrips dorsalis* Hood are two most destructive sucking pests of chilli [12] with 30-55 per cent severity causing extensive leaf curl and yield loss [10]. They have got some bio-ecological advantages than the other pests, due to having very small in size, high biotic potential, lack of effective natural enemies, capacity to adopt newer environment quickly and quick resistance development against toxicants [20]. In India, chilli suffers a typical malady which is a characteristic leaf curl syndrome called "Murda" [5]. The syndrome is due to the attack of either mites or thrips or both [9]. The mechanical feeding injury and desapping by the young and adults of these two pests on apical part of the plant, coupled with the suspected injection of the toxins result in extensive leaf curling [5, 7]. To control these pests, frequent application of excessive and indiscriminate use of several insecticides causes heavy environmental pollution and health hazards along with pest resurgence problems which ultimately increases the cost of cultivation without giving satisfactory production. To overcome this menace, host plant resistance can play a key role in formulating alternative pest management strategies. Selection of tolerant germplasm can be alternative control measures against the yellow mite and thrips. Screening of chilli genotypes for sources of resistance against thrips and yellow mites was reported by several workers in India [1, 3, 4, 5, 13, 16, 17, 19]. Hence, the present study was carried out to screen some open pollinated genotypes of chilli against thrips and yellow mite based on visible leaf symptoms under field condition.

2. Materials and Methods
2.1 Site of Field Study
Supervised field experiment was conducted at Kalyani 'C' Block Farm under the research field of AICRP on Vegetable Crops, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal during rabi seasons of 2012-13 and 2013-14.

2.2 Experimental Layout

The present investigation was laid out in Randomized Block Design (RBD) with three replications. Twenty two open pollinated genotypes of chilli were collected from Indian Institute of Vegetable Research, Varanasi and other sources and were utilized for screening against thrips, *Scirtothrips dorsalis* and yellow mite, *Polyphagotarsonemus latus*. Seedlings were raised in nursery beds and 35 days old seedlings of different genotypes were transplanted with 50 cm between rows and 50 cm between plants on raised beds. Each genotype in each replication was represented by 5 rows having plot size of 2.5m x 2.5m accommodating 15 plants in each plot. A light irrigation was applied immediate after transplanting to prevent "transplanting shock" or wilting of transplanted seedlings. All recommended agronomic package of practices free from pesticide application were adopted for raising the crop.

2.3 Observations Recorded

Observations on thrips and mite population were recorded from 3 leaves per plant of randomly selected 5 plants per plot. All the collected leaves from the field were put in a zip lock polypropelene bag and brought to the laboratory for observation under stereo-zoom binocular microscope (Olympus SZ-40). From each plot, 15 observations were made. Data were recorded on percent of plant showed visible symptoms due to thrips and yellow mite infestation and the number of thrips and yellow mite per leaf was counted at 15 days interval.

2.4 Statistical Analysis

The data recorded were analyzed by using the software SPSS 20.0 (IBM 2011). On the basis of percent of plant showing visible symptoms by yellow mite and thrips grading of different chilli genotypes was done as described by Sanap and Nawale [15] with some modifications for the present study.

Table 1: Grading method based on percent of plant showing visible symptoms due to thrips and yellow mite infestation

Grade	Category
Grade I	Field tolerant (less than 20% of plants showed visible symptoms)
Grade II	Moderately field tolerant (20% to 30% of plants showed visible symptoms)
Grade III	Susceptible (30% to 40% of plants showed visible symptoms)

3. Results and Discussion

Results of the experiment conducted during 2012-13 and 2013-14 indicated significant variations in the reaction of genotypes to the incidence of thrips and yellow mites in all the three observation dates. The average data based on percent of plant infested with visible symptoms due to thrips and yellow mite for two years (Tables 2 and 3) revealed that none of the chilli genotypes were found free from the infestation. Chilli genotype 2011/-9 recorded maximum number of thrips (3.10, 2.97 and 3.00) and mite (5.18, 4.95 and 3.91) population per leaf in all observations, respectively. The least incidence of thrips (1.71, 1.25 and 1.29 per leaf) and mite (1.63, 1.15 and 1.85 per leaf) was recorded on chilli genotype 2011/-7 in all the observation dates. Chilli genotype 2011/-9 recorded highest mean population of thrips (3.02 per leaf) and yellow mite (4.68 per leaf). Lowest mean population of thrips (1.42 thrips/leaf) and yellow mite (1.54 mite/leaf) was found on the genotype 2011/-7.

Table 2: Reaction of chilli genotypes to thrips (*Scirtothrips dorsalis*) infestation under field condition during 2012-13 and 2013-14.

Sl. No.	Chilli germplasms	No. of thrips per leaf			Mean*	% plant infested with visible symptoms			Mean **
		45 DAT*	60 DAT*	75 DAT*		45 DAT**	60 DAT**	75 DAT**	
1	2011/-1	2.33 (1.68)	2.12 (1.62)	2.25 (1.66)	2.23 (1.65)	22.74 (28.48)	21.79 (27.82)	23.04 (28.68)	22.52 (28.33)
2	2011/-2	2.68 (1.78)	2.53 (1.74)	2.78 (1.81)	2.66 (1.78)	25.04 (30.03)	23.92 (29.28)	26.17 (30.77)	25.04 (30.02)
3	2011/-3	2.25 (1.66)	2.02 (1.59)	2.04 (1.59)	2.10 (1.61)	22.33 (28.20)	21.57 (27.68)	22.11 (28.05)	22.01 (27.98)
4	2011/-4	2.50 (1.73)	2.37 (1.69)	2.54 (1.74)	2.47 (1.72)	24.28 (29.52)	22.84 (28.55)	25.28 (30.19)	24.14 (29.42)
5	2011/-5	2.20 (1.64)	2.08 (1.61)	2.14 (1.62)	2.14 (1.62)	22.52 (28.33)	21.65 (27.73)	22.57 (28.36)	22.24 (28.14)
6	2011/-6	2.02 (1.59)	1.27 (1.33)	1.70 (1.48)	1.66 (1.47)	17.90 (25.03)	17.59 (24.79)	18.29 (25.32)	17.92 (25.05)
7	2011/-7	1.71 (1.48)	1.25 (1.32)	1.29 (1.34)	1.42 (1.38)	16.11 (23.66)	16.44 (23.92)	16.85 (24.23)	16.47 (23.94)
8	2011/-8	2.17 (1.63)	1.81 (1.52)	1.75 (1.50)	1.91 (1.55)	21.51 (27.63)	21.22 (27.43)	21.26 (27.45)	21.33 (27.51)
9	2011/-9	3.10 (1.90)	2.97 (1.86)	3.00 (1.87)	3.02 (1.88)	32.92 (35.01)	32.85 (34.97)	34.51 (35.97)	33.43 (35.32)
10	2012/-2	2.06 (1.60)	1.34 (1.36)	1.72 (1.49)	1.71 (1.48)	18.77 (25.67)	18.96 (25.81)	19.26 (26.03)	19.00 (25.84)
11	2012/-3	2.44 (1.71)	2.30 (1.67)	2.44 (1.72)	2.39 (1.70)	23.90 (29.26)	22.47 (28.29)	24.40 (29.60)	23.59 (29.05)
12	2012/-4	2.35 (1.69)	2.27 (1.66)	2.39 (1.70)	2.33 (1.68)	23.68 (29.12)	22.17 (28.09)	23.88 (29.25)	23.24 (28.82)
13	2012/-5	2.38 (1.70)	2.21 (1.65)	2.33 (1.68)	2.31 (1.68)	23.48 (28.98)	22.05 (28.01)	23.70 (29.13)	23.08 (28.71)
14	2012/-6	2.79 (1.81)	2.70 (1.79)	2.86 (1.83)	2.78 (1.81)	25.88 (30.58)	24.63 (29.76)	26.80 (31.18)	25.77 (30.51)
15	2012/-8	2.74 (1.80)	2.62 (1.77)	2.83 (1.83)	2.73 (1.80)	25.52 (30.34)	24.21 (29.47)	26.41 (30.92)	25.38 (30.25)
16	2012/-9	2.54 (1.74)	2.40 (1.70)	2.55 (1.75)	2.50 (1.73)	24.48 (29.66)	22.95 (28.62)	25.34 (30.22)	24.26 (29.50)
17	2013/-1	2.21 (1.65)	1.89 (1.55)	1.84 (1.53	1.98 (1.57)	22.03 (27.99)	21.46 (27.60)	21.85 (27.87)	21.78 (27.82)
18	2013/-2	2.61 (1.76)	2.47 (1.72)	2.63 (1.77)	2.57 (1.75)	24.74 (29.83)	23.66 (29.11)	25.81 (30.53)	24.74 (29.82)
19	2013/-3	2.32 (1.68)	2.20 (1.64)	2.32 (1.68)	2.28 (1.67)	22.88 (28.58)	21.91 (27.91)	23.40 (28.93)	22.73 (28.47)
20	2013/-4	2.48 (1.73)	2.35 (1.69)	2.47 (1.72)	2.43 (1.71)	24.08 (29.39)	22.77 (28.50)	24.71 (29.81)	23.85 (29.23)
21	LCA-334	2.59 (1.76)	2.45 (1.72)	2.62 (1.77)	2.56 (1.75)	24.65 (29.77)	23.16 (28.77)	25.70 (30.46)	24.50 (29.67)
22	KASHI ANMOL	2.67 (1.78)	2.52 (1.74)	2.72 (1.80)	2.64 (1.77)	24.93 (29.95)	23.84 (29.23)	25.91 (30.60)	24.89 (29.92)
SE (m) ±		0.01	0.02	0.02	0.02	0.13	0.14	0.18	0.17
CD (0.05)		0.04	0.05	0.06	0.06	0.36	0.40	0.51	0.49

*Values in parentheses are square root transformed and ** angular transformed

Table 3: Reaction of chilli genotypes to yellow mite (*Polyphagotarsonemus latus*) infestation under field condition during 2012-13 and 2013-14.

Sl. No.	Chilli germplasms	No. of mites per leaf			Mean*	% plant infested with visible symptoms			Mean **
		45 DAT*	60 DAT*	75 DAT*		45 DAT**	60 DAT**	75 DAT**	
1	2011/-1	3.35 (1.96)	2.63 (1.77)	2.77 (1.81)	2.92 (1.85)	23.64 (29.09)	22.94 (28.62)	23.41 (28.93)	23.33 (28.88)
2	2011/-2	4.73 (2.29)	4.17 (2.16)	3.56 (2.01)	4.15 (2.15)	26.77 (31.16)	28.63 (32.35)	28.03 (31.97)	27.81 (31.82)
3	2011/-3	3.24 (1.93)	2.43 (1.71)	2.72 (1.79)	2.80 (1.81)	23.15 (28.76)	22.63 (28.41)	22.81 (28.53)	22.87 (28.57)
4	2011/-4	3.87 (2.09)	3.27 (1.94)	3.08 (1.89)	3.41 (1.97)	24.78 (29.85)	25.73 (30.48)	25.64 (30.42)	25.38 (30.25)
5	2011/-5	3.45 (1.99)	2.74 (1.80)	2.81 (1.82)	3.00 (1.87)	23.76 (29.17)	23.23 (28.82)	23.88 (29.25)	23.62 (29.08)
6	2011/-6	2.88 (1.84)	2.07 (1.60)	2.55 (1.75)	2.50 (1.73)	21.89 (27.90)	21.02 (27.29)	21.74 (27.79)	21.55 (27.66)
7	2011/-7	1.63 (1.46)	1.15 (1.28)	1.85 (1.53)	1.54 (1.43)	14.91 (22.68)	16.81 (24.20)	16.19 (23.72)	15.97 (23.55)
8	2011/-8	2.93 (1.85)	2.14 (1.62)	2.59 (1.76)	2.55 (1.74)	22.30 (28.18)	21.54 (27.65)	22.10 (28.04)	21.98 (27.96)
9	2011/-9	5.18 (2.38)	4.95 (2.34)	3.91 (2.10)	4.68 (2.27)	37.48 (37.75)	38.53 (38.37)	38.15 (38.14)	38.05 (38.09)
10	2012/-2	3.03 (1.88)	2.29 (1.67)	2.69 (1.79)	2.67 (1.78)	22.66 (28.42)	22.07 (28.02)	22.56 (28.36)	22.43 (28.27)
11	2012/-3	3.94 (2.11)	3.41 (1.98)	3.18 (1.92)	3.51 (2.00)	24.98 (29.99)	26.05 (30.69)	25.92 (30.61)	25.65 (30.43)
12	2012/-4	3.65 (2.04)	3.00 (1.87)	2.93 (1.85)	3.19 (1.92)	23.94 (29.29)	24.40 (29.60)	24.69 (29.79)	24.34 (29.56)
13	2012/-5	3.80 (2.07)	3.15 (1.91)	3.05 (1.88)	3.33 (1.96)	24.60 (29.74)	24.99 (29.99)	25.15 (30.10)	24.92 (29.94)
14	2012/-6	4.66 (2.27)	3.94 (2.11)	3.49 (2.00)	4.03 (2.13)	26.05 (30.69)	28.23 (32.09)	27.69 (31.75)	27.32 (31.51)
15	2012/-8	4.88 (2.32)	4.77 (2.30)	3.79 (2.07)	4.48 (2.23)	34.11 (35.73)	36.69 (37.28)	36.81 (37.35)	35.87 (36.79)
16	2012/-9	4.36 (2.20)	3.87 (2.09)	3.45 (1.99)	3.89 (2.09)	25.73 (30.48)	27.78 (31.81)	26.96 (31.28)	26.82 (31.19)
17	2013/-1	2.36 (1.69)	1.57 (1.44)	2.15 (1.63)	2.03 (1.59)	18.28 (25.30)	18.03 (25.12)	18.44 (25.43)	18.25 (25.29)
18	2013/-2	4.79 (2.30)	4.63 (2.26)	3.65 (2.04)	4.35 (2.20)	27.91 (31.89)	29.11 (32.65)	29.09 (32.64)	28.70 (32.39)
19	2013/-3	3.76 (2.06)	3.08 (1.89)	2.98 (1.87)	3.27 (1.94)	24.35 (29.57)	24.73 (29.82)	24.92 (29.94)	24.66 (29.78)
20	2013/-4	3.56 (2.01)	2.90 (1.84)	2.88 (1.84)	3.11 (1.90)	23.85 (29.24)	23.74 (29.16)	24.37 (29.58)	23.99 (29.32)
21	LCA-334	4.09 (2.14)	3.59 (2.02)	3.30 (1.95)	3.66 (2.04)	25.18 (30.12)	26.62 (31.06)	26.01 (30.67)	25.94 (30.62)
22	KASHI ANMOL	4.21 (2.17)	3.65 (2.04)	3.38 (1.97)	3.75 (2.06)	25.42 (30.28)	27.21 (31.44)	26.66 (31.09)	26.43 (30.94)
SE (m) ±		0.02	0.02	0.01	0.04	0.27	0.13	0.18	0.22
CD (0.05)		0.06	0.06	0.03	0.11	0.78	0.36	0.50	0.62

*Values in parentheses are square root transformed and ** angular transformed

There exist significant differences in terms of the damaged plants by the attack of thrips and yellow mite among different open pollinated genotypes of chilli. In all the observation dates the highest percentage of infestation for thrips (32.92%, 32.85% and 34.51%) and mite (37.48%, 38.53% and 38.15%) was recorded in chilli germplasm 2011/-9 and graded as most susceptible to both pests. The genotype 2011/-7 (16.11%, 16.44% and 16.85%) followed by 2011/-6 (17.90%, 17.59% and 18.29%) and 2012/-2 (18.77%, 18.96% and 19.26%) was recorded minimum percentage of infestation by thrips in all the three observation dates. On the other hand, chilli genotype 2011/-7 (14.91%, 16.81% and 16.19%) followed by 2013/-1 (18.28%, 18.03% and 18.44%) was found least for yellow mite in terms of percentage of plant infestation. The lowest mean percentage of plant infestation with visible symptoms was recorded on the genotype 2011/-7 due to thrips (16.47%) and yellow mite (15.97%), respectively. Chilli open pollinated genotype 2011/-9 was identified as maximum mean percentage of plant infested with visible symptoms against thrips (33.43%) and mite (38.05%), respectively.

The results of the field screening trials on the basis of percent of plant showing visible symptoms revealed that out of 22 chilli open pollinated genotypes 3 and 2 cultivars were found field tolerant, 18 and 18 lines were moderately field tolerant and 1 and 2 genotypes were categorised as susceptible against thrips and yellow mite, respectively (Table 4). Chilli open pollinated genotypes showing differential reaction against thrips and mites may be due to the factors like plant morphological [13, 14, 21] or biochemical [8, 13, 14] or genetic traits [21] and/or effects of some environmental factors. The results of the present study are similar and is supported by the findings of Bala [1], Lingeri [7], Rai [11], Sharma [17] and Singh [19] who had screened different chilli germplasm against thrips and yellow mite infestation but none was found resistant. In West Bengal, information on screening of chilli genotypes against thrips and mite infestation are scanty and hence, the present investigation might help in the identification of suitable chilli genotypes for sources of resistance against these pests.

Table 4: Grading of chilli open pollinated genotypes based on visible symptom by thrips and yellow mite.

Grade	Category	Genotypes for thrips, *S. dorsalis*	Genotypes for yellow mite, *P. latus*
Grade I	Field tolerant	2011/-7, 2011/-6, 2012/-2	2011/-7, 2013/-1
Grade II	Moderately field tolerant	2011/-8, 2013/-1, 2011/-3, 2011/-5, 2011/-1, 2013/-3, 2012/-5, 2012/-4, 2012/-3, 2013/-4, 2011/-4, 2012/-9, LCA-334, 2013/-2, Kashi Anmol, 2011/-2, 2012/-8, 2012/-6	2011/-6, 2011/-8, 2012/-2, 2011/-3, 2011/-1, 2011/-5, 2013/-4, 2012/-4, 2013/-3, 2012/-5, 2011/-4, 2012/-3, LCA-334, Kashi Anmol, 2012/-9, 2012/-6, 2011/-2, 2013/-2
Grade III	Susceptible	2011/-9	2012/-8, 2011/-9

4. Conclusion

The findings of the present investigation suggest that chilli open pollinated genotypes 2011/-7, 2011/-6 and 2012/-2 against thrips; 2011/-7 and 2013/-1 against yellow mite and 2011/-7 were found less affected or tolerant against both thrips and yellow mite and may be utilized in the resistance breeding programme.

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