Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(2): 661-663

Received: 14-01-2020
Accepted: 18-02-2020

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Screening of chilli (*Capsicum annuum* L.) germplasms/varieties against chilli thrips, *Scirtothrips dorsalis* (Hood) and aphid, *Myzus persicae* (Sulzer) under field condition

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Abstract
Screening of seventy Chilli germplasms/varieties was carried out against Chilli Thrips, *Scirtothrips dorsalis* (Hood) and aphid, *Myzus persicae* (Sulzer) under field condition at Vegetable Research Farm, Kalyanpur, C. S. Azad University of Agriculture and Technology, Kanpur during 2017-18. The investigation regarding the screening of chilli germplasms/varieties, it was observed that out of 70 germplasms, none of the germplasms were found immune against the thrips and aphids. Five lines of Chilli viz. Pusa Jwala, NT-74, Selection-2010, G-4 and GS-15 were found highly resistant to have resistance index 0.01-0.30. The 10 lines viz. 810-45, selection long-1, M-7-1, selection-1, 67-1-1, selection-60, selection-2008, NA-11, Selection-16 and 7701 were found moderately resistant with resistance index 0.31-0.60 and 12 lines viz. NT-74-1, 410-2 Selection-2011, 810-66-1, Raj-1, Achar-8 selection-12, selection-54, 35-30, selection 2017, selection-1 (yellow) and selection-2017-1 were found low resistant with resistance index 0.61-0.90. Nineteen lines were found less susceptible with resistance index 0.91-1.20 and 15 lines were found moderately susceptible with resistance index 1.21-1.50 and remaining 9 lines were found highly susceptible against thrips and aphids with resistance index >1.5.

Keywords: Chilly, aphids, thrips, screening, germplasms

Introduction
Chilli (*Capsicum annuum* L.) is one of the most important commercial vegetable crops of India, which belongs to the family Solanaceae. It is also called as hot pepper, red pepper, cayenne pepper, capsicum, *etc.* It is grown almost throughout the country. Different varieties of chilli are cultivated for varied uses like vegetables, pickles, spices and condiments. Nutritionally, it is rich in vitamins particularly, vitamin A and vitamin C. Hundred gram of edible portion of capsicum provides 24 k cal of energy, 1.3 g of protein, 4.3 g of carbohydrate and 0.3 g of fat [2]. India is the largest producer of chillies in the world and earns valuable foreign exchange for the country [12]. India is the single largest producer contributing for about 39 per cent of world production [3]. The pest infesting vegetables causes yield losses upto 30-40 per cent [9]. Particularly in chilli, the yield losses caused by chilli Thrips, *Scirtothrips dorsalis* (Hood) and chilli aphid, *Myzus persicae* (Sulzer) are ranges from 50-90 percent and 40-70 percent in chilli crop respectively [11].

A total of 57 insects and mites pests were recorded damaging chilli [10]. Sucking pest complex attack on different crop stages and causes "*Churda murda* or leaf curl". Chilli thrips, *Scirtothrips dorsalis* Hood, is a serious pest on chilli and sweet pepper in India [1, 6]. In Asia, [5] reported that aphid, *Myzus persicae* (Sulzer), and *Aphis gossypii* (Glover), yellow mite, *Polyphagotarsonemus latus* (Banks) and thrips, *Scirtothrips dorsalis* (Hood), are the major insect pests attack on chilli. Therefore, an effective pest management is the basic requirement for reaping good crop. It was hoped that chemical control measures will effectively control or even eliminate the insect pests. But the experience with pesticides has shown that such hope was entirely misplaced. During the last two decades insecticidal control of chilli pests in general and especially in irrigated crop characterized by high pesticides usage, has posed problems of residues in the fruits.

Materials and Methods

The present investigation was carried out during *rabi* season of 2017-18 at Vegetable Research Farm Kalyanpur, C. S. Azad University of Agriculture and Technology Kanpur (U.P.).The various Chilli germplasms/varieties were obtained from the Department of Vegetable Science of the university. The observations were taken three times at vegetative, flowering and fruiting stage of the crop by counting the total number of thrips and aphids to categorize in to the various groups. These germplasms/varieties are used for screening against the thrips and aphids are given below:

Table 1: List of Chilli germplasms/varieties:

S. N.	Chilli germplasms/Varieties	S.N.	Chilli germplasms/varieties
1.	7901	36.	2016
2.	9501	37.	8506
3.	2031	38.	Selection-2008
4.	810-45	39.	NA-11
5.	Selection Long-1	40.	8304-A
6.	M-7-1	41.	410-2
7.	3530-1	42.	2031-1
8.	Selection-1	43.	2013
9.	G-4	44.	Selection-2011
10.	45-9	45.	2014
11.	NT-74	46.	810-66-1
12.	810-27	47.	Pusa Jwala
13.	710-3	48.	Selection-54
14.	67-1-1	49.	SPS-Selection-5
15.	35-30	50.	7225
16.	910-27	51.	737-7
17.	Selection-60	52.	67-3-10
18.	7701	53.	M-2-1
19.	Selection-2010	54.	35-30-1
20.	Selection-25	55.	Selection-2017
21.	GS-15	56.	Selection-1 (Yellow)
22.	810-42	57.	Selection-2017-1
23.	Achar-36	58.	Selection-2 (Yellow)
24.	810-16	59.	Selection-2017-2
25.	Raj-1	60.	Chaman
26.	810-15	61.	A.M.-8
27.	Achar-8	62.	A-8
28.	810-66	63.	G-4-1
29.	NT-74-1	64.	Selection-54-1
30.	Selection-12	65.	Selection-25-1
31.	850-10	66.	KS-2013
32.	47-3	67.	Selection-1-1
33.	Selection-16	68.	KS-2016
34.	71-15	69.	7901-1
35.	48-8	70.	Selection-11

Two lines of each germplasms/varieties having 10 plants of each row were transplanted in single rod row method in the field, to maintain 45×45 cm distance between plant to plant and row to row. Out of 20 plants per lines, 5 plants were randomly selected and three leaves were selected from each plant, for recording observations on pests infesting chilli. The average pest population per leaf were taken on the basis of numerical counts of thrips and aphids with the help of hand lens, on the lower as well as upper surface of leaves. The indices for categorizing their resistance scale (0-6) were made as per techniques [8].

Table 2: General scale for the varietal resistance in thrips and aphids

Resistance Scale	Aphids/Thrips index	Rating
0	0.00	Immune
1	0.01-0.30	Highly Resistance
2	0.31-0.60	Moderately Resistance
3	0.61-0.90	Low Resistance
4	0.91-1.20	Less Susceptible
5	1.21-1.50	Moderately Susceptible
6	>1.50	Highly Susceptible

The crop was kept free from insecticides application and the rest of the agronomic practices were followed. No plant protection measures were given. Resistance rating based on the aphid and thrips count/leaves was worked out at fortnightly intervals.

Results and Discussion

The screening of chilli germplasms/varieties against chilli thrips and aphids (*Scirtothrips dorsalis*, and *Myzus persicae*) was recorded. Seventy germplasms/varieties were transplanted in the month of 10 September 2017, and maintained upto their maturity of the crop. Among 70 lines, none lines were found immune against thrips and aphids (Resistance index 00), 5 lines were found highly resistant (Resistance index 0.01-0.30), 10 lines were found moderately resistant (Resistance index 0.31-0.61), 12 lines were found low resistant (Resistance index 0.61-0.90), 19 lines were found less susceptible (Resistance index 0.91-1.20), 15 lines were found moderately susceptible (Resistance index 1.21-1.50) and 9 lines were found highly susceptible (Resistance index >1.50).

Table 3: Resistant lines of chilli germplasms/varieties against thrips and aphids.

Resistance scale	Aphids/Thrips index	Rating	Germplasms/varieties
0	0.00	Immune	00
1	0.01-0.30	Highly Resistance	Pusa Jwala, NT-74, Selection-2010, G-4, GS-15.
2	0.31-0.60	Moderately Resistant	810-45, Selection long-1, M-7-1, Selection-1, 67-1-1, Selection-60, Selection-2008, NA-11, Selection-16, 7701.
3	0.61-0.90	Low Resistant	NT-74-1, 410-2, Selection-2011, 810-66-1, Raj-1, Achar-8, Selection-12, Selection-54, 35-30, Selection-2017, Selection-1 (Yellow), Selection-2017-1.
4	0.91-1.20	Less Susceptible	KS-2013, SPS-Selection-5, 7225, 737-7, 67-3-10, Selection-11, 7901, 2031-1, 45-9, 810-27, 710-3, 910-27, 8304-A, 2013, Selection-54-1, Selection-25, Achar-36, 810-16, 810-66.
5	1.21-1.50	Moderately Susceptible	47-3, 71-15,48-8, Selection-2017-2, GS-15, G-4-1, 7901-1, 810-15, Selection-2017-2, 850-10, 9501, 3530-1, 2016, 8506, A.M.-8.
6	>1.50	Highly Susceptible	2031, 2014, M-2-1, 810-42, Selection-2017, Selection-25-1, 35-30-1, Chaman, Selection-2 (yellow).

Stated that, [8] the pest infestation may be categorized into various scales (0-6), to find out the resistance degree in the present finding none lines were found immune (Resistance index 00), five lines were found highly resistant (Resistance index 0.01-0.30), 10 lines were found moderately resistant (Resistance index 0.31-0.61), 12 lines were found low resistant (Resistance index 0.61-0.90), 19 lines were found less susceptible (Resistance index 0.91-1.20), 15 lines were found moderately susceptible (Resistance index 1.21-1.50) and 9 lines were found highly susceptible against thrips and aphids (Resistance index >1.50). Identified, [4] the sources of resistance against the leaf curl caused by thrips, *S. dorsalis*. In the preliminary study screening of 308 accessions of chilli germplasm carried out during 1998-1999, out of which 17 accessions were found to be promising on the basis of visual rating of Leaf curl, caused thrips followed by mites. These 17 genotypes were further screened during 1999-2000 and 2000-2001 and scored for leaf curl complex and thrips population. In their reaction to thrips leaf curl, three entries EC-391082, PBC-613, NIC-23906 were found resistant. The thrips population in the varieties ranged from 4.2 to 13.2 thrips per 25 buds. Lowest thrips population was recorded in EC-391090 (4.2/25 buds), PBC-613 (4.2/25 buds) and IC-214989 (4.8/25 buds) while, the highest population was recorded in IC-214991 (13.2/25 buds). Reveled that, [7] out of 80 chilli accessions, sixteen varieties of chilli showed resistance to thrips while fourteen varieties were susceptible to the thrips infestation. The promising genotypes with resistant reaction included IC 324894, Pant C-1, DCA-7, DCA- 11, DCA-40 and Arka Lohit to both the pests. Whereas, DCA-4, DCA-8, DCA-41, Byadagi Kaddi were found susceptible to mites. For thrips, the genotypes IC 538029, IC 361908, Surajmukhi, DPCH-07-01, DCA-9, DCA-16, DCA-25, DCA-26, DCA-29, DCA-36, DCA-41, DCA-43, DCA-46 and Byadagi Kaddi were severely damaged by the pests. As many as 50 and 45 genotypes were found to be moderately resistant to thrips and mites, respectively with score between 11 to 25.

Conclusion

It is concluded that, out of 70 chilli germplasms/varieties had high degree of variability against the thrips and aphids as the 5 lines were found to be highly resistant and 10 lines were found to be moderately resistant against the thrips and aphids. These lines may be utilized as good source of resistance against the chilli thrips and aphids for developing resistant varieties.

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