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Identification of Host Plant Resistance to Leaf Curl in Chilli (*Capsicum frutescens* L.)

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A B S T R A C T

Seventy eight bird chilli genotypes were screened against leaf curl virus. Leaf curl disease scoring was done at 30th, 60th and 90th days after planting (DAP) based on visual symptoms of each observational plant. Initial screening was done under field conditions based on vulnerability index score (0 to 4 scale), disease reaction to each genotype was assigned based on Leaf pubescence which can be observed on the youngest mature leaves and it was classified as sparse (3), intermediate (5) and dense (7). These resistant lines were challenged by growing white fly infected susceptible varieties, out of which ten genotypes performed better, viz. Kumarapuram-I (A50) showed resistance and some of other genotypes showed tolerance viz.A4, A24, A28, A34, A52, A55, A57, A62 and A70.

Introduction

India is the major producer, consumer, and exporter of chilli pepper (*Capsicum annuum L.*), contributing almost one fourth of the world production (Krishnamurthy *et al.*, 2013). Bird chilli (*Capsicum frutescens L.*) or bird's eye chilli is a stimulating herb renowned for aroma, taste, flavour and pungency. Besides its culinary use, it possesses many medicinal and nutritional values. Bird chilli or cayenne pepper is widely used to treat stomach ulcers, cold, sore throat, fevers and cholesterol aggregation, thus prevents the risk of heart attacks and strokes. Most important thing is that chilli helps to fight prostate cancer by killing prostate cancer cells themselves. Some hot varieties of chilli can be used as a remedy for painful joints and to stop bleeding. Daily use of hot chillies can stimulate blood flow to the affected area and reduce discomfort and inflammation. Thus bird chilli has a beneficial effect on the circulatory system (Kang 1992). Bird chilli (*C. frutescens L.*) is commercially cultivated only in Mizoram (approximately 140 hectare with annual production of 560 tones) and in some areas of Manipur (approximately 122 hectare with annual production of 488 tonnes) whereas in other areas it is widely grown as a homestead crop (Barua and Barua, 2004).

Some major factors responsible for the low productivity of bird chilli are lack of varieties

adapted to different agro-climatic conditions and resistant to pests and diseases. Among pathogenic diseases, more than 45 viruses have been reported infecting chilli worldwide (Green and Kim 1991). The occurrence of chilli leaf curl disease caused by white fly (Bemisiatabaci) transmitted Gemnivirus, namely, pepper leaf curl virus has been reported from India (Raj *et al.,* 2005), United States (Stenger *et al.,* 1990), Nigeria (Alegbejo, 1999). 'Leaf curl' is considered to be one of the major limiting factors in chilli production. The present investigation was carried out to determine host plant resistant and the results are reported herein.

Materials and Methods

Seventy eight chilli (*Capsicum frutescens* L.) genotypes were collected from different part of Kerala and cultivated in the experimental field at Department of Plant Breeding and Genetics, College of Agriculture, Vellayani, during September-February, 2013-14. The four weeks old seedlings were transplanted in a spacing of 50cm × 50cmbetween rows and 75cm × 75cm between plants. Timely management practices as per the package of practices recommendations of Kerala Agricultural University [5] were carried out. The observations were recorded on five randomly selected plants of each genotype on number of days to first flowering, number of primary branches, number of secondary branches, number of fruits per plant, average fruit length (cm), average fruit width (cm), individual fruit weight (g), fruit yield per plant (g), number of seeds per fruit, plant height (cm), incidence of leaf curl disease, number of white flies per plant, number of aphids per plant, number of thrips per leaf, number of mites per leaf and leaf pubescence. Leaf pubescence was observed on the youngest mature leaves and it was classified as sparse (3), intermediate (5) and dense (7).Leaf curl disease scoring was done at 30^{th}, 60^{th} and 90^{th} days after planting (DAP) based on visual symptoms of each observational plant. The scoring was based on 0 to 4 scale developed by Rajamony *et al.,* (1990) in melons with slight modification. The individual plant score was utilized to work out the 'severity index' or 'vulnerability' index so as to measure the degree of resistance. The index was calculated using an equation adopted by Silbernagel and Jafri (1974) to measure the degree of resistance in snap bean (*Phaseolus vulgaris*) against beet curly top virus and later modified by Bos (1982).

$$\text{Vulnerability index (V.I.)} = \frac{(0n_o+1n_1+2n_2+3n_3+4n_4)}{n_t\,(n_c-1)} \times 100$$

Where,

n_o, n_1, - - -, n_4 = number of plants in the category 0, 1, - - -, 4 respectively

n_t = total number of plants

n_c = total number of categories = (5)

The genotypes were classified according to vulnerability index as given below (Mathew, 2006).

Results and Discussion

Vulnerability index calculated on the basis of disease scoring (Fig. 1) and showed a range of 0 Kumarapuram-I (A50) to 98.2 Palakkad-III (A40) and the accessions were classified as tolerant viz. A4Vandithadam-I, (6.2), A70 Narikkuni-II (8.3), A52 Kumarapuram-II (9.3), A34 Kozhencheri (10), A42 Ilavumthitta (10), A28 Kottakkal-IV (10), A55 Thamallakkal (10.7), A7 Vandithadam-II (12.5), A13 Kakkamoola-III (12.5), A24 Kakkamoola-IX (12.5), A57 Kalitthatu (12.5), A62 Chappanangadi-III (13.8) and A32 Karamana (15) (Table 1).

Score Index	Symptoms
0	No symptoms
1	Slight curling of terminal leaves
2	Curling of terminal and adjacent leaves
3	Curling and appearance of blisters on leaves
4	Severe curling and puckering of leaves; stunted appearance of plants

V.I	Category
0.00	Resistant(R)
1.00-25.00	Tolerant (T)
25.01- 50.00	Susceptible(S)
>50.00	Highly susceptible (HS)

Table.1 Vulnerability index and leaf pubescence score of different genotypes

Treatment Number	Name of genotypes	Vulnerability Index score	Leaf pubescence
T1 (A04)	Vandithadam-I	2.77	3
T2 (A24)	Kakkamoola-IX	5.53	3
T3(A28)	Kottakkal-IV	10.27	3
T4 (A34)	Kozhencheri	13.87	3
T5 (A50)	Kumarapuram-I	0.00	3
T6 (A52)	Kumarapuram-II	12.50	3
T7 (A55)	Thamallakkal	11.07	3
T8 (A57)	Kalitthatu	8.87	3
T9 (A62)	Chappanangadi-III	13.87	3
T10 (A70)	Narikkuni-II	10.27	3

Table.2 Categorization of accessions based on vulnerability index of leaf curl disease incidence

Sl. No.	V. I	Category	Genotypes
1.	0.00	Resistant(R)	A50
2.	1.00-25.00	Tolerant (T)	A4, A7, A13, A24, A28, A32, A34, A42, A52, A55, A57, A62 and A70
3.	25.01- 50.00	Susceptible(S)	A1, A5, A23, A44, A45, A61, A71, A72 and A73
4.	>50.00	Highly susceptible (HS)	A2, A3, A6, A8, A9, A10, A11, A12, A14, A15, A16, A17, A18, A19, A20, A21, A22, A25, A26, A27, A29, A30, A31, A33, A35, A36, A37, A38, A39, A40, A41, A43, A46, A47, A48, A49, A51, A53, A54, A56, A58, A59, A60, A63, A64, A65, A66, A67, A68, A69, A74, A75, A76, A77 and A78

Fig.1 Scoring chart for leaf curl disease

Vulnerability index calculated on the basis of disease scoring of 0 to 4 scale. If the plant showed no symptoms the index score was 0, if it is showed slight curling of terminal leaves the score was 1, the score was 2 when curling of terminal and adjacent leaves, when the score was 3 it means that curling and if the score was 4 it means appearance of blisters on leaves and severe curling and puckering of leaves and stunted appearance of plants. Among the seventy eight accessions one accession was found to be resistant, thirteen accessions were found to be tolerant, nine accessions were found to be susceptible and fifty five accessions were found to be highly susceptible (Table 2). The resistant accession can be utilized to develop resistant variety through crop improvement programme. These findings were supported by Mathew (2006). Leaf pubescence was observed on the youngest mature leaves and it was classified as sparse (3), intermediate (5) and dense (7).

Hence it may be concluded that one genotype has showed no symptom and may possess mechanism to avoid transmission of viral genome in their sap (true resistance). The results also validated the usefulness of degenerate. Since the identification of resistant source from the germplasm is first step in a resistant breeding programme, the identified symptom-less sources are pre-requisite basic materials to study the inheritance of host plant resistance against leaf curl disease and execute resistance breeding against this devastating virus.

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