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Short Communication

SCREENING OF CHILLI (*CAPSICUM ANNUM* L.) PARENTAL LINES FOR CHILLI LEAF CURL VIRUS, BACTERIAL LEAF SPOT AND ANTHRACNOSE DISEASES

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INTRODUCTION

Chilli (*Capsicum annuum* L.) is the most important commercially grown vegetable and the second largest commodity in the international trade as a condiment. The area under green chilli cultivation and the annual production in Sri Lanka were around 13,978 ha and 71,767 t, respectively in the year 2014 (Agstat, 2015). Chilli yield is highly affected by diseases, which is the major constrain in Chilli production. Studies have shown that biotic stress conditions and its secondary effects are the main reasons behind the low extent of cultivation and poor yield levels reported in *yala* season in the Dry zone (Gunawardana, 2002). Leaf curl virus (CLCV) is the most devastating disease reported from all the chilli growing areas in Sri Lanka, and it causes a serious yield loss (Rajapakse *et al.*, 2003). Anthracnose caused by *Colletrotricum* spp. and bacterial leaf spot (BLS) caused by *Xanthomonas campestris* are also problematic diseases in chilli cultivation especially in moist environmental conditions (Black *et al.*, 1991). Yield loss of CLCV and anthracnose may reach up to 100% (Akhter *et al.*, 2009; Shankar *et al.*, 2014) and 20% by BLS (Sanogo *et al.*, 2008). Though there are chemicals and other control methods available, identifying resistant lines are the most economical and sustainable strategy to minimize the damages due to diseases. Hence, this experiment was conducted with the objective of identification of resistant/tolerant chilli parental lines for CLCV, Anthracnose and BLS diseases.

MATERIALS AND METHODS

A field experiments were conducted at Field Crops Research and Development institute, Mahailluppallama during *yala* 2015 and *maha* 2015/2016. Twelve parental lines developed by chilli breeding program were screened with the recommended varieties, namely MI 2 and MICH 3. Parental lines used in this experiment were

developed through generation advancement and selection for better agronomic traits, low pests and disease incidences. Nurseries were established separately in plant pathology field to obtain the seedlings. Experiments were conducted in randomized complete block design with three replicates. Thirty five days old seedlings were transplanted in a 4.5 m x 1.8 m plot with 45cm x 60cm spacing. Fungicides and insecticides were not applied during experimental period and other agronomic practices were followed as recommended by the Department of Agriculture, Sri Lanka.

Data collection

Disease severity index (DSI) was calculated using the equation given below for each genotype based on symptomology given in 0-4 scale for CLCV (Table 1) and 0-9 scale (Table 2) for BLS infections.

$$DSI = \frac{\text{Total sum of numerical rating}}{\text{Number of Observations x Maximum disease rating}} \times 100$$

Table 1. Disease Rating scale used for CLCV.

Disease rating scale	Percentage infection
0	Free from viral
1	1-10% canopy showing symptoms
2	11-20% canopy showing symptoms
3	21%- 50% canopy showing symptoms
4	>50% canopy showing symptoms

Table 2. Disease Rating scale used for BLS.

Disease rating scale	Percentage infection
0	Free from disease
1	1-10% canopy showing symptoms
3	11-20% canopy showing symptoms
5	21%- 50% canopy showing symptoms
7	50% -75% canopy showing symptoms
9	>75% canopy showing symptoms

Screening of anthracnose disease was done in the laboratory under artificial inoculation for the detached ripened pods as described by Montri *et al.* (2009). Table 3 shows the disease rating scale for anthracnose screening. The data were analyzed using Statistical Analysis Software (SAS). CATMOD procedure was used to analyze data after the normality test. Normality test was run for the DSI values calculated using disease

counts of the trial. Since all the sets of data did not show normal distribution (Shapiro – Wilk test statistics $p < 0.05$), non- parametric approach in the SAS analysis using CATMOD procedure was adopted.

Table 3. Disease Rating scale used for anthracnose.

Disease rating scale	Resistant levels	Percentage infection
0	HR, Highly resistant	No infection
1	R, Resistant	1-2% of the fruit show necrotic lesion or a large water soaked lesion surrounding the infection site
3	MR, Moderate resistant	2-5% of the fruit area show necrotic lesion, acervuil may be present, or water soaked lesion up to 5% of the fruit surface
5	MS, Moderate Susceptible	5-15% of the fruit area shows necrotic lesion, acervuil may be present, or water soaked lesion up to 25% of the fruit
7	S, Susceptible	15-25% of the fruit area shows necrotic lesion with acervuil
9	HS, Highly susceptible	More than 25% of the fruit area shows necrotic lesion often encircling of the fruit; abundant acervuil

RESULTS AND DISCUSSION

Parental lines MICH PL 08, MICH PL 09 and MICH PL 42 lines show significantly low DSI values for CLCV compared to both the check varieties in both seasons (Table 4). Hence, these parental lines could be a good source for breeding programme to develop CLCV tolerant varieties. MICH PL 42 is showing low disease reactions compared with MICH PL 08 and MICH PL 09 though there is no significant differences according to the comparisons.

The field screening for anthracnose and BLS could be done only in *maha* 2015/16 season as the disease were prevailed only in that season. According to Table 5, MI 2 shows a low DSI value for anthracnose among the two check varieties. Compared to MI 2, none of the parental lines showed significant difference in respective DSI value. The parental line MICH PL 18 showed the lowest DSI value for anthracnose among the parental lines, and was significantly different from MICH 3 check variety. MICH PL 08 and MICH PL 09 lines showed significant differences with both the check varieties showing low DSI values for BLS. These two lines were not significantly different from each other for BLS, MICH PL 09 line showed the lowest DSI value.

Table 4. Disease severity index of chilli parent lines against Leaf curl virus.

Parent line	Disease severity index		Reaction
	Yala 2015	*Maha* 2015/16	
MICH PL 08	$7.1^{b,‡}$	$15.3^{b,‡}$	MR
MICH PL 09	$9.2^{b,‡}$	$12.7^{b,‡}$	MR
MICH PL 16	$37.1^{a,†}$	$44.2^{a,†}$	MS
MICH PL 18	$40.0^{b,‡}$	$29.2^{b,†}$	MS
MICH PL 51	$42.5^{b,‡}$	$42.0^{a,†}$	MS
MICH PL 66	$10.4^{b,‡}$	$35.2^{b,†}$	MS
MICH PL 21	$35.0^{a,†}$	$27.8^{b,‡}$	MS
MICH PL 80	$35.8^{a,†}$	$33.8^{b,†}$	MS
MICH PL 75	$39.2^{a,†}$	$51.6^{a,†}$	S
MICH PL 83	$7.5^{b,‡}$	$42.5^{a,†}$	MS
MICH PL 26	$45.8^{b,‡}$	$16.9^{b,‡}$	MS
MICH PL 42	$2.9^{b,‡}$	$1.5^{b,‡}$	R
MICH 3	$27.5^{†}$	$41.4^{†}$	MS
MI 2	29.5^{a}	53.3^{a}	S

Note: Within each column comparison were done with check varieties.
The values followed by different letter or symbol superscript are significantly different ($P<0.05$) where Symbol indicates the comparison with MICH 3 and the letter indicates the comparison with MI 2.

Table5. DSI of chilli parent lines against BLS and anthracnose in 2015/16 *maha* season.

Parent line	BLS		Anthracnose	
	Disease severity index	Reaction	Disease severity index	Reaction
MICH PL 08	$8.3^{b,‡}$	MR	$20.7^{b,†}$	S
MICH PL 09	$6.7^{b,‡}$	MR	$15.9^{a,†}$	MS
MICH PL 16	$20.0^{a,‡}$	MR	$24.0^{b,†}$	S
MICH PL 18	$16.7^{a,‡}$	MR	$8.7^{a,‡}$	MS
MICH PL 51	$31.7^{a,†}$	MS	$20.0^{b,†}$	S
MICH PL 66	$28.3^{a,†}$	MS	$14.8^{a,†}$	MS
MICH PL 21	$53.3^{b,‡}$	S	$12.2^{a,†}$	MS
MICH PL 80	$15.0^{a,‡}$	MR	$16.7^{a,†}$	S
MICH PL 75	$30.0^{a,†}$	MS	$23.4^{a,†}$	S
MICH PL 83	$26.7^{a,‡}$	MS	$20.5^{b,†}$	S
MICH PL 26	$38.3^{a,†}$	MS	$26.0^{b,†}$	S
MICH PL 42	$33.3^{a,†}$	MS	$18.5^{b,†}$	S
MICH 3	$38.3^{†}$	MS	$19.5^{†}$	S
MI 2	23.3^{a}	MR	12.6^{a}	MS

Note: Within each column comparison were done with check varieties.
The values followed by different letter or symbol superscript are significantly different ($P<0.05$) where Symbol indicates the comparison with MICH 3 and the letter indicates the comparison with MI 2.

CONCLUSIONS

MICH PL 08, MICH PL 09 and MICH PL 42 lines are good sources for CLCV resistant breeding programme. MICH PL 08, MICH PL 09MICH PL 16, MICH PL 18 and MICH PL 80 showed tolerant reactions for BLS disease. All the screened lines were moderately susceptible or susceptible for chilli anthracnose.

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