SHORT COMMUNICATION

Screening for Resistance Against Northern Corn Leaf Blight (*Exserohilum turcicum)* in Temperate Maize Lines

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Ten early duration maize lines, namely, CM 128, V 327, V 335, V 13, V 128, V 17, V 336, CM 129, V 53 and V 27, were screened against northern corn leaf blight (*Helminthosporium turcicum* or *Exserohilum turcicum*) under field as well as under artificial epiphytotic conditions. Five inbreds, namely, V 335, V 13, V 336, V 53 and V 27 were identified as resistant while rest five, *viz.*, CM 128, V 128, V 327, V 17 and CM 129 were found susceptible. In the pooled disease scores across the three seasons, the highest mean score of 4.0 was recorded for V 128, indicating high level of susceptibility, whereas, lowest mean score of 1.5 recorded for V 335, showed high level of resistance across the locations. The promising inbreds can be utilized as a resistant donor in breeding programme. These inbreds possessing resistance to northern corn leaf blight can be used successfully in developing high yielding early maturing varieties for the hill region.

Key Words: *Exserohilum turcicum*, Maize, Resistance, *Turcicum* leaf blight

The production of the maize in hilly areas (Kumaoun hills) of India is low as compared to the other areas of the nation. The major cause of low yield is Northern corn leaf blight which causes a wide range (28-91%) of yield losses in maize (Sharma and Aujla, 1968; Pant *et al.,* 2000; Singh *et al.,* 2003).

Success of any crop improvement programme depends on the nature and magnitude of genetic variability present in the crop. The effectiveness of selection largely depends on the amount of heritability for traits under study. Therefore, present study was undertaken to reduce the loss from *Turcicum* leaf blight (*Helminthosporium turcicum* pass or *Exserohilum turcicum*) through selecting early maturing resistant maize materials. An attempt has been made to evaluate the variability in present materials of maize.

Turcicum leaf blight is the most common as well as chronic problem of maize in the hills. Passerini, from Italy was first to describe the turcicum leaf blight in 1876. In India, Butler *et al*. (1920), first observed this disease in maize. It is the most prevalent form in all the major maize growing regions of India during rainy (*kharif*) as well as winter (*rabi*) season (Lal, 1991). The disease can substantially reduce the grain yield of maize over a wide range from 28 to 91% (Ullstrup, 1951; Chenulu and Hora, 1962; Sharma and Aujla, 1968; Pant *et al*., 2000). Severe disease conditions prevailing at the time of ear formation may cause total grain loss.

This disease has also been observed to be the most important in the hills, mainly in Jammu and Kashmir, Himachal Pradesh, Sikkim, West Bengal, Meghalaya, Tripura, Assam and Uttarakhand. The symptoms first develop on lower leaves and successively progress to upper leaves of the plant under favourable conditions. In severe disease condition, the entire foliage generally gets killed, giving the appearance of frosted leaves. The ears and kernels are seldom infected, but some lesions do develop in the outer husk. The typical symptoms seen on a susceptible host are long elliptical (4 to 20 cm long and 1 to 5 cm wide), greyish-green to brown (tan) in colour. Spores are produced in the lesions, which are olive-green to black, and usually produce concentric rings, giving the entire spot a target like appearance. Spores from the primary lesions re-infect the host producing secondary cycle of the disease (Partridge, 1997). The presence and absence of this type of lesions are governed by host-pathogen interaction (Carlos, 1987).

Ten maize inbred lines with different genetic background and origin were evaluated against *Turcicum* leaf blight under artificial epiphytotic condition during *Kharif* 1998 and 1999 at Hawalbagh, Almora and *Rabi* 1998-99 at Amberpet, Hyderabad. Heavily infected leaves with *Turcicum* leaf blight were collected during last season and ground to powder and stored at room temperature. The powdered inoculum was inoculated as per procedure. A pinch of the leaf powder was dropped

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into the whorl of each plant, commencing from 20 days after planting. The inoculation was preferably done late in the afternoon till the pre-tasseling stage 4 times at weekly intervals. Spray of spore suspension with spore concentration of $2.5x10^4$/ ml was done on plants, commencing from 20 days after planting till pre-tasseling stage at 5-7 days interval. The disease severity was recorded at flowering stage and dry silk stage in the terms of intensity following the rating scale of 1.0 to 5.0 with 0.5 intermediate rating (Payak and Sharma, 1982). Intermediate ratings between two numbers (1.25, 1.5, 1.75, 2.25, 2.75, 3.25, 3.5, 3.75, 4.25, 4.5 and 4.75) was also recorded. Row-to-row spacing of 60 cm and plant-to-plant of 25 cm was maintained at both the locations. Fertilizer doses @ of 160 kg N, 60 kg P_2O_5 and 40 kg K_2O were applied to the crop at both the locations.

Mean score for *Turcicum* leaf blight recorded during *Kharif* 1998 and 1999 are presented in the Table 1. Mean score of *Turcicum* leaf blight during *Kharif* 1998 ranged from 1.8 (V 53) to 4.0 (V 17) while, during *Kharif* 1999 it varied from 1.9 (V 13) to 4.5 (V 17). The five inbreds, namely, CM 128, V 327, V 128, CM 129 and V 17 exhibited above 3.0 score and were identified as susceptible while rest of five inbreds, V 335, V 13, V 336, V 53 and V 27 with disease of score of less than 2.5, were found to posses resistance. V 17 recorded the maximum disease score of 4.5 during *Kharif* 1999, was highly susceptible, whereas the minimum disease score of 1.8 was recorded for V 53 during *Kharif* 1998, which indicated high level of resistance for *Turcicum* leaf blight.

The disease mean scores for *Turcicum* leaf blight recorded during *Rabi* 1998-1999 are presented in the Table 2. The highest mean score (3.9) was recorded for V 17, while the lowest (1.5) for V 335. Out of ten inbreds tested during the season, five, namely, V 335, V13, V 336, V 53 and V 27 indicated resistance for *Turcicum* leaf blight, while remaining five (CM 128, V 327, V 128, V 17 and CM 129) showed susceptibility.

The disease reaction for *Turcicum* leaf blight was pooled across three seasons in two environments and is presented in the Table 3. The highest mean score of 4.0 was recorded for V 128, indicating highest level of susceptibility and lowest mean score (1.8) was recorded for V 335 indicating highest level of resistance across the environment. The other susceptible inbred lines on the basis of pooled score were, CM 128 (4.0), V 327 (3.7), V 128 (4.0), V 17 (4.1) and CM 129 (3.3), while inbreds having score of 1.8 (V 335), 2.0 (V 13), 2.1 (V 336), 2.0 (V 53) and 2.3 (V 27) were resistant to turcicum leaf blight.

In a similar study, Singh *et al.* (2003), identified 17, 27, 111 and 10 inbred lines developed at Almora as resistant, moderately resistant, susceptible and highly susceptible to *maydis* leaf blight caused by *Bipolaris maydis* (*Cochliobolus heterostrophus*). Their study, which involved about 65 genotypes, also indicated susceptibility of CM 128, V 327, V 128, V 17 and

Table 1. Mean disease reaction of maize inbreds *Turcicum* leaf blight, *Kharif* 1998 and 1999 at Hawalbagh, Almora

No.	Inbred lines	1998	1999	Mean	Type of reaction
1	CM 128	3.5	3.8	3.7	S
2	V 327	3.8	4.1	3.9	S
3	V 335	2.0	2.0	2.0	R
4	V 13	2.3	1.9	2.1	R
5	V 128	3.8	4.1	3.9	S
6	V 17	4.0	4.5	4.3	S
7	V 336	2.0	2.3	2.1	R
8	CM 129	3.0	3.5	3.3	S
9	V 53	1.8	2.0	1.9	R
10	V 27	2.3	2.5	2.4	R

S-susceptible (2.6 to 5.0), R-resistant (1.0 to 2.5)

Table 2. Mean disease reaction of maize inbreds for *Turcicum* leaf blight, *Rabi* 1998-99 at Amberpet, Hyderabad

No.	Inbred lines	1998-99	Type of Reaction
1	CM 128	3.0	S
2	V 327	3.3	S
3	V 335	1.5	R
4	V 13	1.7	R
5	V 128	4.0	S
6	V 17	3.9	S
7	V 336	2.0	R
8	CM 129	3.5	S
9	V 53	2.2	R
10	V 27	2.0	R

S-susceptible (2.6 to 5.0), R-resistant (1.0 to 2.5)

Table 3. Pooled mean disease reaction of maize inbreds *Turcicum* leaf blight (Hawalbagh and Hyderabad)

No.	Inbred lines	1998 (*Kharif*)	1998-99 (*Rabi*)	1999 (*Kharif*)	Pooled	Type of Reaction
1	CM 128	3.5	3.0	3.8	3.4	S
2	V 327	3.8	3.3	4.1	3.7	S
3	V 335	2.0	1.5	2.0	1.8	R
4	V 13	2.3	1.7	2.0	2.0	R
5	V 128	3.8	4.0	4.1	4.0	S
6	V 17	4.0	3.9	4.5	4.1	S
7	V 336	2.0	2.0	2.3	2.1	R
8	CM 129	3.0	3.5	3.5	3.3	S
9	V 53	1.8	2.1	2.0	2.0	R
10	V 27	2.3	2.0	2.5	2.3	R

S-susceptible (2.6 to 5.0), R-resistant (1.0 to 2.5)

V 27, while V 335, V 13, V 336 and V 53 showed resistance reaction.

Elliott and Jenkins (1946) screened 200 inbred lines, 126 crosses and 184 double crosses against the *Turcicum* leaf blight and found that NC34 was the most resistant while CI123, K715, KY114, MO21A, T49B, T105, BK115, CI15 and TX116 showed traces of infection and the resistant to *Turcicum* leaf blight was transmitted to hybrid progeny. In a similar study, conducted by Gowda and Kaisar (1990) tested 37 maize lines for resistance to *Exserohilum turcicum*. Of these 10 were resistant and 12 were moderately resistant. Rathee *et al.* (1999) reported 8 genotypes having high level of disease resistance.

The inbred lines identified to possess resistance to *Turcicum* leaf blight in the present study, can be used successfully in developing high yielding early maturing varieties for the hill region having high level of resistance to *Turcicum* leaf blight.

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