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Additional Sources of Resistance for Southern Corn Leaf Blight in Indian Maize Germplasm

Ram P. SRIVASTAVA[1*] Rajesh SINGH Ved P. MANI[2] Radhey S. KHANDELWAL[2] Mufid ALAM

[1] Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, BHU, Varanasi-221005.
[2] Former Principal Scientist and Research Associate, VPKAS (ICAR), Almora.

[*] Corresponding author e-mail: rpgpbr@gmail.com

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ABSTRACT

Seventy nine maize inbred lines were screened under artificial epiphytotic condition at two locations *viz*, Nagenahalli and Varanasi for continuously for 2 years to identify the additional sources of resistance for 'Southern Corn Leaf Blight (SCLB). *The Southern Corn Leaf Blight* caused by *Bipolaris maydis* is also known as 'Maydis Leaf Blight'. The present study has helped in the identification of 26 resistant inbred lines, 25 moderately resistant, 16 susceptible and 12 highly susceptible maize genotypes. Ten lines viz. V53, V 178, V 190, V 336, V 340, V 341, V 345, V 348, CM 104 and CM 145 by scoring below 1.5 disease score showed high level of resistance, whereas inbred lines *viz*., V 49, CM 126, CM 127, CM 202 and CM 212 showed high level of susceptibility as they scored above 3.5 disease score across the environment. It was also observed that average disease incidence was high in Nagenahalli than Varanasi thus indicating that isolates of *Bipolaris maydis* were more virulent at Nagenahalli than Varanasi.

Keywords: Southern corn leaf blight, *Bipolaris maydis*, *Zea mays*, resistance, susceptible.

Introduction

Maize is prone to a number of biotic stresses like, foliar diseases, ear rot and stalk rot caused by fungi and bacteria, under favorable environmental conditions. These pathogens are capable of causing severe losses and deteriorate the quality of the produce. Maize breeding requires vigorous field and greenhouse testing to determine the kind and level of resistance to different diseases. Southern Corn Leaf Blight is one of the most important maize diseases and caused by the fungus *Bipolaris maydis* Shoemaker, Teleomorph *Cochliobolus heterostrophus* (Drechs.). It is also commonly known as *'Maydis Leaf Blight'* and crops affected by this disease are Corn (*Zea mays*), Sorghum and Teosinte. This disease has great significance in the history of agriculture because of its epidemic propositions in 1970 in US and subsequent devastation of most of the corn crop that year. It tends to be limited by temperature and climate to the warmer part of the US (Hooker *et al.*, 1970) spore production is influenced by temperature (Warren, 1975). Infected tissue is extensively covered with spots and chlorosis rendering them non productive. It is found to have a higher saprophytic ability (Blanco and Nelson, 1972) and hence high primary inoculums level is likely to be found in areas with high disease occurrence. In South East Asia it is reported to cause heavy losses in Pakistan, India, Nepal, Kampuchea, Philippines, Indonesia, Vietnam and China. 'Southern Corn Leaf Blight' is serious disease in India particularly in J & K, Himachal Pradesh, Sikkim, Meghalaya, Punjab, Haryana, Rajasthan, Delhi, UP, Bihar, MP, Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu. The disease is prevalent in warm humid temperate to tropical region, where the temperature ranges from 20-30^{0}C during cropping period. Resistance to this disease is polygenically governed and most of improved cultivars at BHU, Varanasi have a moderate degree of resistance. Ideal maize breeding programme with high

level of SCLB resistance requires to be supported by additional new sources of resistance at regular intervals. The objective of present study is to identify additional sources of resistance for *Southern Corn Leaf Blight* particularly to support breeding programme of Banaras Hindu University, Varanasi, Uttar Pradesh, India.

Material and Methods

The present study was carried out at Agriculture Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi and Zonal Agriculture Research Station, V.C. Farm, Mandya (Nagenahalli), Karnataka during 2010 & 2011. In this experiment 79 entries were included for screening of *'Southern Corn Leaf Blight'* under artificial epiphytotic field condition as well as in glass house conditions. The 79 entries were evaluated in 3-row plot of 3.0 m x 1.8 m each and a local susceptible variety Dhiari Local was planted at regular interval as infector row in RBD with two replications. Further, it was planted in glass house condition with five plants of each of 79 genotypes in pots during *Kharif* (summer season) 2010 & 2011. The data analyzed is the average of the 4 trials in 2 locations for 2 years. The inoculation was applied as suggested by (Meena Shekhar and Sangit Kumar 2012) after inoculation the disease symptoms developed within 1-2 weeks of inoculums and by the time of flowering disease were severe in the infector rows. Disease Score were taken as per (Payak and Sharma 1985) and disease scoring was done as per symptoms mentioned below:

1.0 - Very slight to slight infection, one or two to few scattered lesions on lower leaves.

2.0 - Light infection, moderate number of lesions on lower leaves only

3.0 - Moderate infection, abundant lesions are on lower leaves, few on middle leaves.

4.0 - Heavy infection, lesions are abundant on lower and middle leaves, extending to upper leaves.

5.0 - Very heavy infection, lesions abundant on almost all leaves plants prematurely dry or killed by the disease.

Results and Discussion

A total of 79 maize genotypes were screened to identify additional sources of resistance for *'Southern Corn Leaf Blight'* (Fig. 1).

The results of screening against '*Southern Corn Leaf Blight*' have been presented in Table 1.

The screening led to the identification of 26 sources of resistance *viz.,* V53, V 178, V 190, V 336, V 340, V 341, V 345, V 348, CM 104, CM 145, HKI-586, HUZM-81-1, HUZM-60, CML-192, HKI 1105, HUZM-211-1, HKI-PC-8, CML-150, HKI 193, CML-161, HUZM-53, HKI 323, HKI-164-4-(1-3)-2, HKI-1352-5-8-9, CML-172, HUZM-36. The lines such as CM 104, CM 145 and V 341 have earlier been reported as resistance (Ali and Yan 2012, Durrishahwar *et al* 2008.) where as rest of lines are being reported as resistance for the first time. The maize inbred such as CM-145, V-336 and V-338, was resistance in both the environment and inbred such as NAI-219-J, V-335, V-351, HUZM-121, CM-212, V-25 and CML-395, was susceptible in both the environment. These are the valuable material as it expressed resistance across the environment. Similar screening have been done for Southern Corn of Blight by Ali and Yan (2012) and Durrishahwar *et al*., (2008) where as many studies have been carried out in past for other diseases like *Northern Corn Leaf Blight* (Adipala *et al*., 1993, Muriithi and Mutinda 2001, Singh *et al*., 2004, Chandrashekara *et al*., 2012) and *Grey leaf spot disease* (Maroof *et al*., 1993). Based on susceptible and resistant reactions of maize genotypes, an attempt was made to identify the resistant gene pool sources for the disease. It was observed that Vivekananda Population, CIMMYT Population 31 and Indian public sector genotypes were a very good source for breeding resistant cultivars for SCLB (Table 2).

It may be mentioned here that the Indian public sector material majority coming from Directorate of Maize Research, New Delhi or its network have been generated out of CIMMYT and US, materials. Thus, the CIMMYT and US have contributed tremendously for the development of resistant cultivars for '*Southern Corn Leaf Blight'* in Indian Maize Breeding Programme.

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Figure 1. Plant susceptible to MLB

Table 1. Screening of maize inbreds for identification of Additional Sources of '*Maydis Leaf Blight*' at Naganahalli and Varanasi

Inbred lines
Resistant: V53, V 178, V 190, V 336, V 340, V 341, V 345, V 348, CM 104, CM 145, HKI-586, HUZM-81-1, HUZM-60, CML-192, HKI 1105, HUZM-211-1, HKI-PC-8, CML-150, HKI 193, CML-161, HUZM-53, HKI 323, HKI-164-4-(1-3)-2, HKI-1352-5-8-9, CML-172, HUZM-36
Moderately resistant: V 12, V 13, V 26, V 128, V 241, V 273, V 334, V 335, V 339, V 346, CM 105, CM 118, CM 119, CM 129, CM 141, HUZM-88, HUZM-47, HUZM-97-1-2, CML-451, HKI-287, V-342, CML-140, V-273, HUZM-356, HKI-209
Susceptible: V 17, V 198, V 324, V 350, CM 128, HUZM-457, HUZM-185, HKI-536, V-338, HKI-335, V-386, V-388, HUZM-478, HUZM-509, HUZM-69, CML-152
Highly Susceptible: V 49, CM 126, CM 127, CM 202, CM 212, V-351, V-25, HKI-162, HUZM-80-1, HUZM-121, NAI 219-J, CML-395

Table 2. Reaction of important maize gene pools and populations available at BHU against *Southern Corn Leaf Blight* (*Bipolaris maydis*).

S. No.	**Sources**	**No. of genotypes**			
		Resistant	**Moderate Resistant**	**Susceptible**	**Highly Susceptible**
1	Vivekananda Population	8	12	7	4
2	Indian Public Sector	7	7	3	5
3	CIMMYT Mexico (population-31)	6	2	1	1
4	BHU, Varanasi	5	4	5	2
5	Total	26	25	16	12

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