

EVALUATION OF SOME SINGLE CROSS HYBRIDS OF MAIZE FOR RESISTANCE TO TURCICUM LEAF BLIGHT

BY

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Thirtynine single cross hybrids of maize were developed by using ten inbreds in different disease reaction combination to Turcicum leaf blight (*Exserohilum turcicum*=*Setosphaeria turcica*) were evaluated during the Rabi season of 1985-'86 at the Maize Research Station, Kalyani against this disease. Among the hybrids tested, four hybrids, namely CM 104xCM 105, CM 104xCM 115, CM 105xCM 115, CM 120xCM 105 and CM 120xCM 115 were resistant, while twenty-six hybrids were moderately resistant. The remaining eight hybrids were either moderately susceptible in disease reaction. In general, resistance was dominant over susceptibility in most of the cross combinations. The present study further indicates that the inbreds CM 104, CM 105, CM 115, CM 120, CM 206 and RN₆ may be utilised in the breeding programme for the development of synthetic variety resistant to *E. turcicum*.

INTRODUCTION

Turcicum leaf blight (TLB) of maize (*Zea mays* Linn.) caused by *Exserohilum turcicum* (Pass.) Leonard & Suggs. (= *Setosphaeria turcica* (Luttrell) Leonard & Suggs.) poses problem on maize production as it is widely prevalent over different states of India and causes significant loss in grain yield (27.6 to 90.7%) under favourable climatic conditions (Payak and Sharma, 1978; Rai, 1987). Among the various approaches of management practices against TLB highest importance has been accorded to resistance breeding. Although a number of released varieties (hybrids and composites) in India are resistant to one disease, or one set of diseases, most turn out to be susceptible to another set of diseases (Payak and Sharma, 1985). For example, virulent strains of *E. turcicum* appeared in 1974 on hybrid Ganga 5, Deccan, Pio x 104, Pio x 114 and Kisan (Payak and Sharma, 1985). Some of the recommended cultivars like A-de-Cuba, Kisan and Vijay are also showing progressive susceptible reaction to this disease under Kalimpong condition (Kaiser, 1986). The present study was, therefore, undertaken to evaluate some single cross F₁ hybrids for resistance to this disease.

MATERIALS AND METHODS

A total number of thirtynine single cross F₁ hybrids were evaluated to TLB at

the Maize Research Station of All India Coordinated Maize Improvement Project (AICMIP), Kalyani, during the *rabi* season (winter/spring) of 1985-'86.

In the growing season at Kalyani the disease appears during first week of February and continues to manifest itself on the host upto third week of February. In the maize growing belt of Indogangetic plains of Kalyani the average daily maximum temperature during this period ranges from 25° to 28°C and the minimum from 13° to 16°C, the relative humidity remains more or less around 60%. During the night the temperature drops and the maize leaves receive enough dews. Hence from ecological point of view, the existing weather conditions in the Indogangetic plains at Kalyani may be considered to be conducive for the development of TLB disease.

A total number of ten inbreds with different level of resistance as already established (Payak and Sharma; 1979 ; Raj, 1987) were used to make the following cross combinations of AICMIP :

Resistant (R) x Resistant (R)

Resistant (R) x Moderately resistant (MR)

Resistant (R) x Susceptible (S)

Moderately resistant (MR) x Moderately susceptible (MS)

Moderately resistant (MR) x Susceptible (S)

Susceptible (S) x Susceptible (S)

The seeds of F_1 hybrids thus obtained were planted during the last week of November in two rows plots each of which was five meters in length and contained twenty plants with two replications. Normal agronomic practices were followed and no plant protection measure was undertaken during the entire growing season.

The plants of F_1 hybrids were observed for reaction to TLB following the whorl inoculation method by using infected leaf powder to inoculate the standing plants of about 45 cm high as described by Sharma (1982). Adequate controls/checks were kept by inoculating resistant cultivars grown at regular intervals after nine entries. The disease was rated visually on the basis of 1 to 5 scale which consisted of five broad categories and was designated by different disease index (Payak and Sharma, 1982). from 1 (very slight infection) to 5 (very heavy infection) Finally on the basis of average disease index, the type of disease reaction in a genotype was determined (Kaiser, 1983).

RESULTS AND DISCUSSION

The results on the reaction of different single cross combinations/hybrids including their parents/inbreds are presented in Table 1. The parents showing different types of reaction were CM 104, CM 105 and CM 115 (R) ; CM 120, CM 206 and RN6 (MR) ; CM 119 and CM 300 (MS) and CM 200 and CM 500 (S). Variation

Table 1. Reaction of F_1 hybrids (Single crosses) and their parents (inbreds) to *E. turcicum*

Genotype	Reaction
1. Parent/Inbred	
CM 104, CM 105, CM 115	Resistant
CM 120, CM 206, RN ₆	Moderately resistant
CM 119, CM 300	Moderately susceptible
CM 202, CM 500	Susceptible
2. Hybrid/Single cross	
CM 104 x CM 105, CM 104 x CM 115	Resistant
CM 105 x CM 115, CM 120 x CM 105,	
CM 120 x CM 115	
CM 119 x CM 120, CM 119 x CM 104,	Moderately resistant
CM 119 x CM 105, CM 119 x RN ₆ ,	
CM 104 x CM 120, CM 120 x CM 300,	
CM 10 x RN ₆ , CM 120 x CM 202,	
CM 120 x CM 206, CM 104 x CM 300,	
CM 104 x RN ₆ , CM 104 x CM 202,	
CM 104 x CM 500, CM 104 x CM 206,	
CM 105 x CM 300, CM 105 x CM 206,	
CM 105 x RN ₆ , CM 300 x CM 115,	
CM 300 x RN ₆ , CM 300 x CM 206,	
CM 115 x RN ₆ , CM 115 x CM 500,	
CM 115 x CM 206, RN ₆ x CM 500,	
RN ₆ x CM 202, CM 500 x CM 206	
CM 105 x CM 202, CM 105 x CM 500,	Moderately susceptible
CM 202 x CM 206, CM 120 x CM 500,	
CM 119 x CM 500, CM 300 x CM 202,	Susceptible
CM 500 x CM 300, CM 202 x CM 500	
3. Control/Checks	
EVAMDR II	Resistant
Ganga 5, Deccan 103, Ganga Safed 2	Moderately resistant

in the disease reaction from R to S were also observed among the tested hybrids. Among the hybrids tested five hybrids, namely CM 104xCM 105, CM 104xCM 115, CM 105xCM 115, CM 120xCM 105 and CM 120xCM 115 were R, while twenty-six hybrids were MR. Among the remaining eight hybrids four were MS and

other four were S. This wide range in the level of resistance expressed by different hybrids indicates the polygenic type of resistance to TLB as already indicated by previous workers. (Jenkins and Robert, 1952 ; Pate and Harvey, 1954 ; Rai, 1987). Using some of these parents Raj (1987) also reported resistance to TLB in different hybrids, namely DHM (CM 104xCM 105), DHM -101 (CM 202xCM-206), DHM - 103 (CM 120xCM 118) and EH 401075 SS IIIxRN6). The present study clearly indicates that the inbreds CM 104, CM 105, CM 120, CM 206 and RN6 may be effectively utilized as parents for the development of synthetic varieties R to TLB. The general combining ability of the parents showing partial dominance of resistance over susceptibility indicates that resistance to TLB is mainly due to additive genes as reported by different workers (Jha and Dhawan, 1970 ; Ramamurthy *et al.*, 1980 ; Das and Chaudhuri, 1986).

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PRESENT STATUS OF KNOWLEDGE ON COMMON RUST OF MAIZE IN INDIA

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Common rust of maize (*Puccinia sorghi* Schw. = *P. maydis* Bereng.) is an economically important disease. Virulent strains of the pathogen appeared from 1973 onward on released hybrids Ganga Safed 2 and Hi-starch in Bihar.

At least five races of the pathogen are present in India, two of which are capable of attacking monogenic resistant sources. Two types of resistance in maize to *P. sorghi* are so far known- (1) specific and (2) non-specific or generalised. However, non-specific or generalised resistance which is polygenic and found in adult plants, is available in many inbred lines and other cultivars of maize and this can be effectively used against the Indian pathotypes (races) of *P. sorghi* in a breeding programme. But specific resistance can be used if needed as a supplement to mature plant resistance or non-specific resistance.

Chemically, the disease can be effectively controlled by spraying with Dithane Z-78 (Zineb) @ 1.8 to 2.6 kg/ha in 910 to 1320 litres of water or Dithane M-45 (Maneb) @ 2.0 kg/ha in 1100 to 1200 litres of water. However, the best way to control the disease would be the development of resistant varieties which have been already released. These include Ganga 5, Ganga 101, Deccan and Himalayan 123 (hybrids), Jawahar and Kisan (composites) and CM 103, CM 104, CM 105, CM 106 and Cuzco (inbreds) showing acceptable level of resistance to *P. sorghi*.

INTRODUCTION

Maize (*Zea mays* Linn.) is infected by three rust diseases, namely (1) Common rust (*Puccinia sorghi* Schw.), (2) Southern rust (*P. polyspora* Underw.) and (3) Tropical rust (*Physopella zeae* Cumm. & Rama which occur in different parts of the world. Out of these common rust is found to be prevalent wherever maize is grown. In India, only common rust caused by *P. sorghi* Schw. II & III stages only (= *P. maydis* Bereng.) is known to occur for a pretty long time (Butler, 1918). Subsequently it has been reported from various regions of the country, particularly from the hilly areas, such as the Nilgiri hills (Ramakrishnan *et al.* 1953), Kalimpong hills (Chattopadhyay and Sen Gupta, 1955), New Delhi (Vasudeva, 1960), Simla (Misra and Sharma, 1964) and Mysore (Kushalappa and Hegde, 1970). At present, the disease is widely prevalent over different states of India including Jammu & Kashmir (J&K), Himachal Pradesh (HP), Sikkim, West Bengal (WB), Meghalay, Punjab, Haryana, Rajasthan, Delhi,