

REACTION OF MULTIPLE DISEASE RESISTANT I & II FULE—SIB FAMILIES TO THREE DISEASES AT KALIMPONG, WEST BENGAL

BY

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Eighty full-sib families of maize originated from multiple disease resistance stocks I & II at Hyderabad were tested against three diseases, namely turcicum leaf blight, common rust and banded leaf & sheath blight at Kalimpong under field condition in the *kharif* season (summer/monsoon). Thirtyseven families were found resistant to all the three diseases whereas thirtyfour families were resistant to moderately resistant to these disease. The remaining nine families although showed intermediate reaction (moderately susceptible) to either of the three diseases they were, otherwise, resistant to moderately resistant to the remaining ones. These resistant families may be further tested for resistance to maydis leaf blight and charcoal rot in the plains of West Bengal for the development of multiple disease resistant stocks for West Bengal.

INTRODUCTION

Maize (*Zea mays* L.) is subject to attack by as many as sixtyone individual diseases under Indian conditions (Payak and Sharma, 1980). Among them, sixteen are considered to be of major importance as they are widely spread throughout the country and may cause considerable damage to this crop resulting significant loss in yield under favourable condition. These includes four foliar diseases, five stalk rots, four downy mildews, two that affect leaf, sheath ear and one nematode disease. Accordingly, All India Coordinate Maize Improvement Project has given consideration to the above major diseases with an emphasis to develop multiple disease resistant varieties for the different agroclimatic zones of India out of different multiple disease resistant stocks obtained from various sources of indigenous and exotic origins. The present study was, therefore, undertaken to evaluate eighty full-sib families out of multiple disease resistant stocks I & II (MDR I & II) against three major diseases, namely turcicum leaf blight (*Exserohilum turcicum*), common rust (*Puccinia sorghi*) and banded leaf & sheath blight (*Rhizoctonia*

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soloni f. *sasakii*) at the Maize Research Station, Kalimpong with an object to develop multiple disease resistant varieties for the sub-Himalayan region of West Bengal.

MATERIALS AND METHODS

About two hundred full-sib families originated from multiple disease resistant stocks I & II were planted during 1982-83 rabi season (winter season) at Hyderabad for assessing their reaction to turicum leaf blight, common rust, late wilt (*Cophalosporium maydis*) and charcoal rot (*Macrophomina phaseolina*). Eighty full-sib families were selected on the basis of resistance to all the four diseases. During the 1983 *kharif* season (summer, monsoon) these eighty families were further evaluated for resistance to turicum leaf blight, common rust and banded leaf & sheath blight at Kalimpong. The germplasm was obtained from the Project Coordinator, All India Coordinated Maize Improvement Project, IARI, New Delhi-12. The seeds were planted in randomised block design in two rows plot each of five meter length containing twenty plants with two replications. Normal agronomic practice was followed and no plant protection measure was undertaken during the entire crop season.

Evaluation was done under the natural field condition, as per instruction from the coordinating unit unless otherwise mentioned, for the unique geographical position and optimum climatic condition of this location for the high incidence and regular occurrence of these maize diseases in the growing season. The incidence of turicum leaf blight and common rust was recorded after the flowering on the basis of 1 (very slight to slight infection) to 5 (very heavy infection) scale and that for the banded leaf & sheath blight was recorded at the pre-flowering stage on the basis of a separate 1 (mild infection) to 5 (very heavy infection) scale as described by Payak and Sharma (1982). Both the scales consisted of five broad categories designated by different disease index from 1 to 5. Thus all the plants in a particular set were affixed with a particular disease index and the average disease index per plant was calculated. Finally the type of disease reaction in a family was determined on the basis of average disease index as described elsewhere in details (Kaiser, 1983).

RESULTS AND DISCUSSION

Less variation in respect of reaction to these three diseases was observed in the tested full-sib families of MDRI and MDRII with the average grade ranging from resistant to moderately resistant in most of the cases as presented in Table 1. Among the families tested thirtyseven families, namely MDRI F. S. - 6, 12, 43, 47, 50, 52, 55, 64, 65, 77, 81, 99, 105, 112, 118, 126, 132, 144, 157, 183, and 184;

Table 1. Reaction of MDR I & II full-sib families to three diseases

Disease	Reaction	Family
Turcicum Leaf blight	Resistant	MDRI F.S.— 6, 12, 19, 28, 41, 43, 45, 47, 49, 50, 52, 55, 64, 65, 76, 77, 81, 87, 88, 89, 91, 92, 93, 98, 99, 105, 112, 118, 121, 124, 126, 138, 140, 144, 153, 157, 183, 184, MDRII F.S.— 1, 4, 9, 10, 19, 26, 40, 48, 50, 54, 55, 63, 71, 85, 92, 102, 111, 112, 120, 131 & 136.
	Moderately resistant	MDRI F.S.— 3, 4, 5, 13, 14, 42, 44, 51, 66, 82, 84, 85, 86, MDRII F.S.— 32, 37, 39, 96, 97 & 128.
	Moderately susceptible	MDRI F.S.— 71.
Common rust	Resistant	MDRI F.S.— 5, 6, 12, 13, 14, 19, 28, 41, 42, 43, 44, 47, 50, 51, 52, 55, 64, 65, 66, 77, 81, 82, 84, 85, 86, 87, 99, 105, 112, 118, 121, 124, 126, 132, 138, 140, 144, 157, 183, 184, MDRII F.S.— 1, 4, 9, 10, 26, 32, 37, 39, 40, 48, 50, 54, 55, 63, 71, 96, 97, 102, 112, 120, 128, 131 & 136.
	Moderately resistant	MDRI F.S.— 3, 4, 49, 71, 76, 88, 89, 91, 92, 93, 98, MDRII F.S.— 19, 35, 92 & 111.
	Moderately susceptible	MDRI F.S.— 45 & 153.
Banded leaf & sheath blight	Resistant	MDRI F.S.— 4, 5, 6, 12, 13, 14, 42, 43, 47, 49, 50, 51, 52, 55, 64, 65, 66, 71, 76, 77, 81, 82, 84, 85, 89, 93, 98, 99, 105, 112, 111, 126, 132, 144, 153, 157, 183, 184, MDRII F.S.— 1, 4, 9, 10, 19, 37, 39, 40, 48, 50, 54, 55, 63, 71, 85, 92, 96, 97, 102, 111, 112, 120, 128, 131 & 136.
	Moderately resistant	MDRI F.S.— 44, 45, 86, 87, 88, 121, 124, 138, 140, MDRII F.S.— 26 & 32.
	Moderately susceptible	MDRI F.S.— 3, 19, 28, 41, 91 & 92.

M.D.R. = Multiple disease resistant; F.S. = Full Sib.

MDRII F. S. - 1, 4, 9, 10, 40, 48, 50, 54, 55, 63, 71, 102, 120, 131 and 136 were resistant to all the three diseases, while thirtyfour families, namely MDRI F. S.—4,

5, 13, 14, 42, 44, 49, 51, 66, 76, 82, 84, 85, 86, 87, 88, 89, 93, 98, 121, 124, 128 and 140; MDRII F. S.—19, 26, 32, 37, 39, 85, 92, 96, 97, 111 and 128 were either resistant or moderately resistant to these diseases. The remaining nine families although showed intermediate reaction (moderately susceptible) to either of the three diseases they were, otherwise, resistant to moderately resistant to the remaining ones. This inter-mediate type of disease reaction of the nine families, namely MDRI F. S.—71 to turcicum leaf blight, MDRI F. S.—45 and 153 to common rust and MDRI F. S.—3, 19, 28, 41, 91, and 92 to banded leaf and sheath blight at Kalimpong condition may be attributed due to the change of environment or the different races of the pathogens used in the screening. Further, in most of the tested families little variation in respect of disease reaction to turcicum leaf blight and common rust indicates that the resistance to those two diseases in these families was polygenic i. e., controlled by many genes some of which had produced major effects. The polygenic resistance to turcicum leaf blight and common rust in most corn genotypes has been well established (Jenkins and Robert, 1952; Pate and Harvey, 1954; Handoo, 1969). Although a similar type of disease reaction was observed in case of banded leaf & sheath blight, the nature of resistance to this disease is not yet fully understood. These resistant families may be further tested for resistance against maydis leaf blight (*H. limnospodium maydis*) and charcoal rot posing major problems in the plains of West Bengal. Some other characters such as yield potential, plant height, susceptibility to lodging and insect-pest may also be studied in order to develop desirable multiple resistant varieties for West Bengal including other places similar to the climatic condition of West Bengal.

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REFERENCE

- Handoo, M. I. (1969) Genetic resistance to *Helminthosporium maydis* Nisikado and Miyake in maize (*Zea mays* L.). Thesis submitted for Ph. D. at IARI, New Delhi.
- Jenkins, M. T. and Robert, A. L. (1952). Inheritance of resistance to leaf blight of corn caused by *Helminthosporium turcicum* Agron. J., 44 : 136-140.
- Kaiser, S. A. K. M. (1983). Field inoculation techniques and disease rating scale in maize. *Indian J. Mycol. Res.*, 21 : 75-85.
- Pate, J. B. and Harvey, P. H. (1954). Studies on inheritance of resistance in corn to *Helminthosporium maydis*. *Agron. J.* 46 : 442-445.
- Payak M. M. and Sharma, R. C. (1960). An inventory and bibliography of maize disease in India, 44 pp. Division of Mycology and Plant Pathology, IARI, New Delhi.
- and — (1982). Disease rating scales in maize in India. Techniques of scoring for resistance to disease of maize in India (Notes used for the training course held at A. P. Agricultural University, Hyderabad), AICMIP, IARI, New Delhi, pp. 1-5.