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Short Note

Evaluation of maize hybrids against major diseases in Himachal Pradesh

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Abstract

Thirty maize hybrids were evaluated against various diseases viz. banded leaf and sheath blight (BLSB), Erwinia stalk rot (ESR), Turcicum leaf blight (TLB), Maydis leaf blight (MLB) and brown stripe downy mildew (BSDM) under artificial inoculation field conditions at three hot spot locations to identify multiple disease resistant hybrids. All the hybrids showed moderately susceptible to highly susceptible disease reaction to BLSB, whereas they showed resistant to moderately susceptible disease reaction to both MLB and TLB. Hybrids like PG 2465, P 3420, DKC 9106, HiShell, PSC 3322, PG 2408, 900 M Gold, F_1 Corn Hybrid, DMH 1107, KHB 63 and DKC 7074 were observed resistant to BSDM, whereas two hybrids HiShell and KHB 52 showed resistance to ESR. Two maize hybrids namely HiShell and KHB 52 were found resistant to ESR, BSDM, MLB, TLB and were moderately susceptible to BLSB.

Key words: Maize, diseases, blight, resistant, susceptible.

Maize (*Zea mays* L.) is one of the most important *kharif* cereal crops of Himachal Pradesh. It is mainly used as food, feed and fodder in the state and is grown over a wide range of agro-climatic conditions. Diseases are an important constraint for maize production in the state. Among the various diseases of maize, banded leaf and sheath blight (BLSB) caused by *Rhizoctonia solani* f. sp. *sasakii* Exner, Erwinia stalk rot (ESR) by *Erwinia chrysanthemi* pv *zeae* Sabet, Turcicum leaf blight (TLB) by *Exserohilum turcicum* (Pass)Leonard and Suggs, Maydis leaf blight (MLB) by *Bipolaris maydis* (Nisikado)Shoemaker and brown stripe downy mildew (BSDM) caused by *Sclerophthora rayssiae* var. *zeae* Payak and Renfro are widely prevalent in different maize growing areas of Himachal Pradesh (Basandrai *et al.*, 2005). During the recent past, the spread of different maize hybrids in the state has increased the incidence of different diseases. Cultivation of resistant genotypes is the most economical and safer option to manage these diseases. During *kharif* 2010, thirty maize hybrids from private companies and public sectors were evaluated against these diseases under artificial inoculations in field in order to identify disease resistant hybrids.

Field trials were conduced during *kharif* season of 2010 at three hot spot locations viz., Kangra for BLSB, Dhaulakuan for ESR and BSDM and Bajaura for MLB and TLB. Thirty maize hybrids were planted during second fortnight of June in paired rows of 3 m length in two replications at each location by adopting recommended package of practices. Plants were artificially inoculated with the pathogens using standard procedures (Laxminarayan, 1980). For banded leaf and sheath blight, the method of Ahuja and Payak (1978) was used. The inoculations were made on 40 days old plants with grain cultures inserted between stalk and sheath at second or third internode level from soil. The observations on disease were made two

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weeks after flowering on 1-5 scale as described by Sharma (2005). The hybrids with disease rating 1 and 2 were categorized as highly resistant and resistant; whereas hybrids with disease ratings of 3, 4, and 5 were rated as moderately susceptible, susceptible and highly susceptible, respectively. Hybrids were artificially screened against Turcicum and Maydis leaf blight by dropping a pinch of inoculum consisting of ground powder made from infected leaves of the previous season's crop in the whorl in one month old plants followed by spray of water after inoculation in order to maintain the high humidity (Laxminarayan, 1980).The disease severity on different hybrids was scored on 1-5 disease rating scale as given by Payak and Sharma (1983).

Hypodermic syringe inoculation method (Shekhar, 2005) was used for screening against Erwinia stalk rot. To inoculate the plants, a diagonal hole was made in the middle of second internode from ground to the pith and one milliliter of bacterial suspension was injected in to the plant through the hole. Percent disease incidence was calculated by counting wilted and healthy plants after 15 days of inoculation. Hybrids with disease incidence of 0-10 per cent (disease rating 1) were categorized as highly resistant, 10-20 per cent (disease rating 2) as resistant, 20-30 per cent (disease rating 3) as moderately susceptible, 30-70 per cent(disease rating 4) as susceptible and 70-100 per cent (disease rating 5) as highly susceptible. For screening of hybrids against brown stripe downy mildew, 2-3cm pieces of freshly infected leaves containing sporangia of pathogen were placed in the whorl of plants at seedling stage (Laxminarayan, 1980). The observations on disease were made two weeks after flowering on 1-5 scale as given by Payak and Sharma (1983).

The reaction of various hybrids to different diseases has been presented in Table 1. None of the hybrid was found resistant to banded leaf and sheath blight at Kangra. Garg *et al.* (2007) also evaluated a set of 29 tropical maize inbred lines under artificial inoculations in field at three hot spot locations viz. Udaipur, Pantnagar and New Delhi. Most of the lines were also found to be susceptible by them except inbred CA 00106 which revealed moderate resistance to all the three isolates. Comprehensive efforts involving a wide range of germplasm are still required to find naturally occurring resistant gene sources against this disease.

At Bajaura, out of the thirty hybrids evaluated against Maydis leaf blight, none of the hybrid proved highly resistant. Twenty three hybrids were observed as resistant and seven hybrids showed moderately susceptible disease reaction. Earlier workers have also evaluated maize germplasm against MLB and reported none of the genotypes to possess complete resistance to the disease (Kumar and Saxena, 2008; Kaur *et al.*, 2010).Variation in host reaction to the pathogen appear to be controlled by nuclear genes (Rathore *et al.*, 2005). Nineteen hybrids showed resistant reaction and eleven hybrids showed moderately susceptible disease reaction to TLB. Dutta *et al.* (2005) reported that three lines namely CM 104, CM 105 and CM 118 possessed resistance to three races of the Turcicum leaf blight pathogen out of 26 elite maize inbred lines tested by them. Harlapur *et al.* (2008) have also reported less incidence of turcicum leaf blight in genotypes like Cargill, 900M, DMH-2, DK 973 and Allrounder. Resistance to TLB is conditioned by a relatively low number of genes, primarily additive in effect (Rathore *et al.*, 2005).

Hybrids like PG 2465, P 3420, DKC 9106, HiShell, PSC 3322, PG 2408, 900 M Gold, F1 Corn hyb. DMH 1107, KHB 63 and DKC 7074 were observed resistant to brown stripe downy mildew at Dhaulakuan. Earlier, Basandrai *et al.* (2000&2002) have reported hybrids like KH 150, XH1174 MY, PRO 312, PRO 316, JH 3189, MMH 69, EH 230792 and X 1123 G to be resistant to BSDM at Dhaulakuan.

None of the tested hybrid was free from Erwinia stalk rot at Dhaulakuan. Hybrids HiShell and KHB 52 showed 10.0 and 12.5% infection and were rated as resistant. Dhillon *et al.* (1995) have reported single cross hybrid Paras as highly resistant to ESR. Resistance to ESR has been reported to be dominant over susceptibility and is governed by one or two major

Table 1. Reaction of different maize hybrids to major diseases in Himachal Pradesh during *kharif* 2010

Sr. No.	Genotype	Kangra	Bajaura			Dhaulakuan	
		BLSB Reaction	MLB Reaction	TLB Reaction	BSDM Reaction	ESR (%)	Reaction
1	KF 105	S	R	MS	MS	50.0	S
2	KHB 52	MS	R	R	MR	12.5	R
3	P 3540	S	R	R	MS	40.0	S
4	PAC 740	S	R	R	MS	100.0	HS
5	VMH 4106	MS	R	R	MS	50.0	S
6	KHB 118	MS	R	MS	MR	62.5	S
7	1018-13371	S	R	MS	MR	75.0	HS
8	VMH 4102	MS	R	R	MR	100.0	HS
9	PG 2465	S	R	R	R	62.5	S
10	P 3420	MS	MS	MS	R	75.0	HS
11	PAC 712	MS	R	MS	MR	87.5	HS
12	DMH 8255	MS	R	R	MR	55.6	S
13	Karan	MS	R	R	MR	28.6	MS
14	DKC 9106	MS	R	R	R	54.5	S
15	PMZ 4	MS	MS	MS	MR	100.0	HS
16	30 V 92	S	R	R	MR	50.0	S
17	PG 2414	S	MS	MS	MR	70.0	S
18	HiShell	MS	R	R	R	10.0	R
19	PSC 3322	S	R	MS	R	62.5	S
20	PG 2408	MS	R	R	R	100.0	HS
21	900 M Gold	MS	R	R	R	50.0	S
22	F1 Corn hyb	S	MS	MS	R	55.6	S
23	DMH 1107	MS	R	R	R	100.0	HS
24	KHB 63	MS	R	R	R	33.3	S
25	DKC 7074	MS	R	R	R	81.8	HS
26	PG 2460	S	MS	MS	MR	90.0	HS
27	PSC 3440	MS	R	R	MR	40.0	S
28	S 641	MS	R	R	MR	88.9	HS
29	S 601	S	MS	R	MR	80.0	HS
30	Vivek 21	HS	MS	MS	MS	100.0	HS
	CD (P=00.05)	-	-	-	-	11.8	-

BLSB – Banded leaf and sheath blight; MLB – M*aydis* leaf blight; TLB-Turcicum leaf blight; ESR- Erwinia stalk rot; BSDM- Brown Stripe Downy Mildew; HR- Highly resistant, R-Resistant, MR- moderately resistant, MS- moderately susceptible, S-susceptible, HS-highly susceptible

genes (Shekhar, 2005). Two maize hybrids namely HiShell and KHB 52 were found resistant to major diseases like Erwinia stalk rot, Turcicum and Maydis leaf blight, brown stripe downy mildew prevailing in Himachal Pradesh and were moderately susceptible to banded leaf and sheath blight.

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