

Evaluation of Plant Extracts for Management of Maydis Leaf Blight of Maize

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ABSTRACT

Among the extracts tested, garlic clove extract was highly effective in inhibiting the growth of *Helminthosporium maydis* as it produced 66.5, 73.8 and 83.9% growth inhibition at 2, 5 and 10% concentrations, respectively. Neem leaf and tulsi leaf extracts were found effective as growth inhibitions were between 37 to 65 and 39 to 48 %. Bael leaf extract was not at all inhibitory even at 10% concentration. Similarly, onion bulb and mentha leaf extracts were also not very promising as they produced only 38.6 and 25.4% inhibition, respectively at 10 % concentration. The disease was adequately managed by spraying of garlic and neem extract @ 5% in fields.

Key words : *Helminthosporium maydis*, Plant extracts, *Zea mays*

Maydis leaf blight of maize caused by *Helminthosporium maydis* is a serious threat in maize growing areas of Bihar. The potential losses due to maydis leaf blight are reported even up to 60% under severe conditions depending upon susceptibility of variety. The use of chemicals is the only effective way for the management of disease which are not only hazardous for human beings but also increases environmental pollution. Plant extracts have assumed special significance in the present day strategy of developing ecologically safe method of plant disease management. Several plant extracts have been demonstrated to possess excellent fungicidal properties. Inhibition of plant pathogenic fungi by many antifungal compounds of plant origin led to the present study to explore the feasibility of using extract of several plants for the management of maydis leaf blight disease of maize *in vitro* and under field conditions.

Materials and Methods

The test plants such as neem (*Azadirachta indica*), mentha (*Mentha piperata*); tulsi (*Octimum sanctum*); bael (*Aegle marmelos*); garlic (*Allium*

sativum) and onion (*Allium cepa*) were included. Leaves were washed in tap water, crushed in sterile distilled water (1 g leave tissue in 1 litre of water in mortar & pestle) and filtered through 2 layer of muslin cloth to obtain extract. This formed the standard plant extracts and was diluted in water to 2, 5 and 10% concentrations.

Plant extracts were incorporated into melted PDA medium at three different concentrations i.e. 2, 5 and 10% and sterilized at 15 lb pressure/sq. inch for 15 min. The amended PDA medium was poured into sterilized Petri plates @ 20 ml/plates and after solidification, 6 mm disc of 5 days old culture of *H. maydis* was transferred in the centre and incubated at $26\pm 1^{\circ}\text{C}$. PDA not amended with plant extract served as control, replicated thrice. After 168 hrs of incubation, radial growth of test fungus was measured and % inhibition was calculated.

Field trial was laid in R.B.D. using maize cv Kiran in 2006 and 2007 crop seasons at Crop Research Centre, Dholi, Muzaffarpur, Bihar where maydis blight disease was high (46%) in the

previous seasons. Five plant extracts i.e. neem, mentha, tulsi, bael, garlic and onion were evaluated at 5% concentration in plot size of 5 × 4 m with 3 replications. Plant extracts were sprayed on the crop twice at the interval of 10 days after initial appearance of disease symptom. Plot sprayed with plain water only served as control. Observation on disease intensity was recorded at weekly interval using 1-5 scale. The yield data was recorded after harvest of the crop.

Results and Discussion

Among the extracts tested, garlic clove extract was highly effective in inhibiting the growth of *H. maydis* as its produced 66.5, 73.8 and 83.9% growth inhibition of *H. maydis* at 2, 5 and 10% concentrations, respectively. Neem leaf and tulsi leaf extract were effective to some extent as they produced growth inhibition between 37 to 65 and 39 to 48 %, respectively depending upon the concentration of the extract. Bael leaf extract was least effective even at 10% concentration. Simialrly, onion bulb and mentha leaf were also not very promising as they produced only 38.6 and 25.4% inhibition. Foliar spray of garlic clove extract @ 5.0% was found most effective among plant extract showing the minimum disease intensity of 2.8 and 3.0 during 2006 and 2007, respectively (Table 2). Neem leaf extract @ 5.0% ranked second in reducing the disease intensity of 3.2 and 3.3 during both the years. All the treatments differed significantly from check as well as from each others except bael leaf, onion bulb and mentha leaf extracts. Bael leaf extract, onion bulb extract and mentha leaf extract were satically on par to each others as far as disease intensity was concerned. Sahani and Saxena (2008) evaluated 45 plant species against *Fusarium oxysporum* f. sp. *pisi*, 80-97% mycelium inhibition was reported with *A. cepa* and *A. indica*. Singh and Singh (2007) also reported the efficacy of 15 plant extracts against fungal plant diseases and maximum inhibition was recorded with *A. indica* followed by *Lawsonia*

Table 1. Effect of palnt extract on radial growth of *Helminthosporium maydis*.

Plant extracts	Concentration (ppm)	Colony diameter (mm)*		Growth inhibition over check	
		120 hrs	168 hrs	120 hrs	168 hrs
Neem kernel	2	35.0	48.0	41.6 (40.3)	37.2 (37.0)
	5	30.0	33.0	48.5 (44.0)	58.2 (50.4)
	10	25.0	28.3	57.1 (49.2)	64.2 (53.1)
Bael leaf	2	60.0	76.5	0.0 (0.0)	0.0 (0.0)
	5	59.6	75.3	0.0 (0.0)	1.3 (6.3)
	10	58.0	75.0	3.3 (11.5)	1.9 (7.7)
Onion bulb	2	57.0	74.0	5.0 (14.5)	3.2 (10.4)
	5	53.3	70.6	11.3 (20.3)	7.8 (16.2)
	10	38.3	47.3	36.1 (37.4)	38.6 (38.2)
Tulsi leaf	2	32.0	46.3	46.6 (43.4)	39.4 (38.4)
	5	30.3	42.3	49.5 (44.8)	44.7 (41.9)
	10	29.0	40.0	57.6 (45.9)	47.7 (43.8)
Mentha leaf	2	58.0	75.3	3.3 (11.5)	1.9 (7.7)
	5	55.3	70.3	7.8 (16.1)	8.1 (16.9)
	10	40.3	57.0	32.8 (34.6)	25.4 (30.6)
Garlic clove	2	23.0	25.6	61.6 (51.4)	66.5 (54.7)
	5	17.3	20.0	71.1 (58.4)	73.8 (59.6)
	10	10.3	12.3	82.8 (65.5)	83.9 (66.9)
Chek		60.0	76.5		
S.Em (±)				0.45	0.61
CD (P=0.05)				1.36	1.73

* Average of three replications

Table 2. Effect of foliar spraying of plant extracts on disease intensity and yield of maize

Plant extract	Dose (%)	Disease intensity*		Yield (q/ha)*		% increase in yield over check	
		2005	2006	2005	2006	2005	2006
Neem kernel	5	3.2	3.3	16.0	15.3	77.6	59.6
Bael leaf	5	4.2	4.1	10.0	11.6	11.1	14.5
Onion bulb	5	3.9	3.8	12.5	13.0	33.8	35.4
Tulsi leaf	5	3.6	3.5	13.5	14.5	50.0	45.8
Mentha leaf	5	4.0	3.9	15.0	15.9	22.2	23.9
Garlic clove	5	2.8	3.0	17.0	18.0	88.8	87.5
Check		4.7	4.6	9.0	9.6	-	-
S.Em (±)		0.10	0.12	1.25	1.26		
CD (P=0.05)		0.33	0.35	3.72	3.75		

* Average of three replications.

inermis and *Datura metel*. Similar such results were found by Mathur and Gurjar (2002).

The maximum gain yield (17.0 & 18.0 q/ha) was recorded in plot sprayed with garlic clove extract and minimum (9.0 & 9.6 q/ha) in unsprayed plots in both the years. Yield recorded in plot sprayed with garlic clove extract (17.0 & 18.0 q/ha), tulsi leaf extract (13.5 & 14.5 q/ha) and neem leaf extract (16.0 & 15.3 q/ha) were significantly higher than those recorded in unsprayed plots. Yield recorded in plot sprayed with onion bulb extract, bael leaf extract and mentha leaf extract were on par with control. The % increase in yield varied between approximately 11-89 % depending upon disease intensity.

Inhibition of radial growth was good parameters for screening antifungal activity. The fungitoxicity of extracts *Allium sativum*, *Azadirachta indica*, *Aegle marelos*, *Allium cepa* against *H. maydis* was reported earlier by Karande *et al.* (2007). With regards to the disease control, garlic clove extract and neem leaf extract could safely be used in place of fungicides for the management of maydis leaf blight. Kumar *et al.* (2005) also found *A. indica* was quite effective to reduce the *Alternaria* leaf blight under field conditions.

In vitro and *in vivo* studies, some extract like bael, onion and mentha did not gave significant results. It can be hypothesis that either these extracts did not possess any antifungal properties against *H. maydis* or these extracts might break down rapidly

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