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Evaluation of Botanicals *In Vitro* against *Rhizoctonia solani* F. sp. *sasakii* Causing Banded Leaf and Sheath Blight of Maize

Reddi Gunasri, V Prasanna Kumari, V Manoj Kumar, K Jayalalitha and V Srinivasa Rao
Department of Plant Pathology, Agricultural College, Bapatla, A. P.

ABSTRACT

Maize (*Zea mays* L.) is one of the most important cereal crops cultivated in the world which is most prone to several biotic and abiotic stresses. Incidence of banded leaf and sheath blight disease was more severe causing up to 100% gain yield loss, particularly in rice fallow maize crop. *In vitro* screenings using five aqueous leaf extracts was tested against *Rhizoctonia solani* f. sp. *sasakii*. Propiconazole @ 0.1% was used as standard fungicides for comparison. Significant, mycelial growth inhibition was observed with Karanj leaf extract @ 15% and 10%, which can be used further in strengthening the plant protection in maize against banded leaf and sheath blight.

Key words: *Banded leaf and sheath blight, Botanicals, Efficacy, Maize*

Maize (*Zea mays* L.) is one of the most important cereal crops cultivated in the world for food, feed and industrial products. This short duration, miracle C4 commercial crop, commonly known as "Queen of Cereals", is being cultivated in tropics, sub-tropics and temperate regions under both irrigated and semi-arid conditions. In India, it is cultivated in almost all the states with an area of 9.38 M ha, 28.753 M t production and 3065 kg ha^{-1} productivity (Indiastat, 2017-18). In India, maize is the third most important cereal crop after rice and wheat.

Maize crop suffers from various diseases such as Turcicum leaf blight, Maydis leaf blight, downy mildews, rust and stalk rots, which result in considerable yield loss of 90 per cent (Lal *et al.*, 1985). Banded leaf and sheath blight (BLSB) disease incited by *Rhizoctonia solani* f.sp. *sasakii,* is gaining economic importance due to direct losses like premature death of plant, stalk breakage or ear rot, while indirect losses due to reduced grain yield and quality.

Management of this disease is difficult as sclerotia, remains viable in the soil for long. Use of synthetic chemicals causes several adverse effects like development of resistance in pathogen, residual toxicity, pollution in the environment, high cost, carcinogenic risk undesirable biological effects on animals and human beings. Tamuli *et al.* (2014) reported antifungal activity of plant extracts to be effective than commercial synthetic fungicides due to presence of naturally occurring anti-microbial property that have been recognized and tested against a wide range of pathogenic microbes.

Therefore, in the present study some locally available plants were tested *in vitro* conditions against *Rhizoctonia solani*.

MATERIAL AND METHODS

The present study was conducted during November, 2018 at Department of Plant Patholgy, Agricultural College, Bapatla. Aqueous leaf extracts of five different plant leaf extracts were evaluated against *Rhizoctonia solani* f.sp. *sasakii* by using poisoned food technique as per Grover and Moore (1962). Fresh leaves were collected and washed thoroughly with distilled water followed by rinsing in sterile distilled water. Leaf extracts were prepared using 100 grams of leaves in 100 ml sterile distilled water followed by filtering through double layered muslin cloth. Collected filtrate was centrifuged at 5000 rpm for 10 minutes at ambient temperature (26 ± 2 ^{o}C). The supernatant was collected to 250 ml conical flask and was filter sterilized using G-3 filter.

Potato dextrose agar (PDA) was prepared and autoclaved at 121 ^{o}C at 15 lbs pressure for 15 minutes. Different concentrations of leaf extracts of calculated amounts were added to lukewarm PDA and transferred to the previously sterilized Petri plates and were solidified. Mycelial discs of 5 mm diameter from five days old culture was inoculated into the centre of poisoned medium and incubated at 27±1 ^{o}C. Radial growth of the test fungus was measured at every 24 hours interval and inhibition per cent was calculated by comparing with check using the formula given by Grover and Moore (1962). Four replications of each treatment were maintained and the analysis was done by using factorial CRD.

Per cent growth inhibition =

$$\frac{\text{Growth of pathogen in control} - \text{Growth of pathogen in treatment}}{\text{Growth of pathogen in control}} \times 100$$

The details of the treatment and concentrations tested against *Rhizoctonia solani* f.sp. *sasakii* were given in Table 1.

Table 1. List of leaf extracts used in *in vitro* experiments

Leaf extracts	Concentrations
Neem leaf extract	5%, 10%, 15%
Nerium leaf extract	5%, 10%, 15%
Calotropis leaf extract	5%, 10%, 15%
Custard apple leaf extract	5%, 10%, 15%
Karanj leaf extract (Pongamia)	5%, 10%, 15%
Propiconazole	0.10%

RESULTS AND DISCUSSION

Efficacy of each aqueous leaf extracts against the *R. solani* f.sp. *sasakii* inciting banded leaf and sheath blight disease of maize is presented in Table 2 and Plate 1. Among all the leaf extracts evaluated

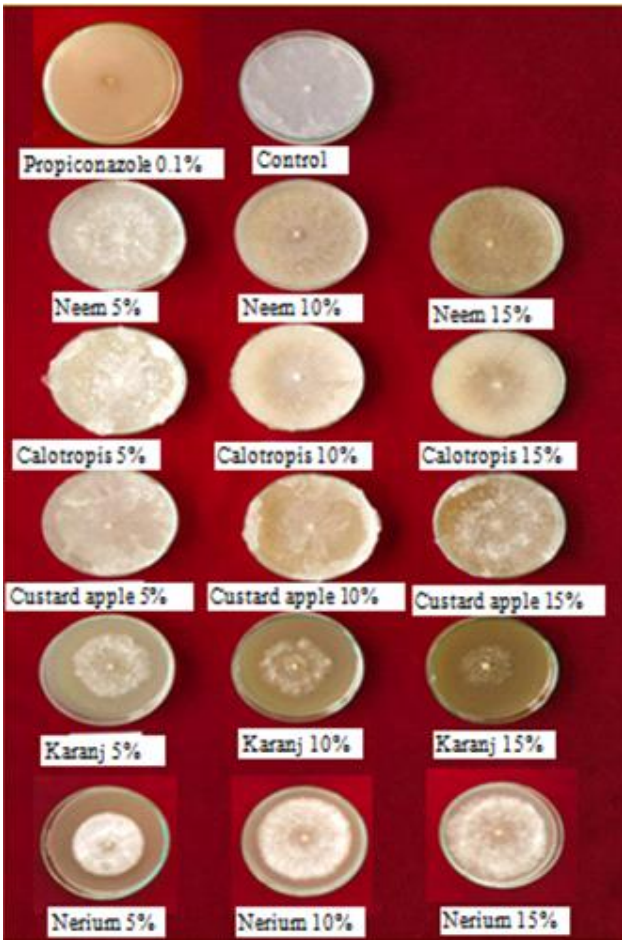

Plate 1. *In vitro* evaluation of leaf extracts at varied concentrations against *Rhizoctonia solani* f. sp. *sasakii*

Table 2. *In vitro* evaluation of aqueous leaf extracts at different concentrations on mycelia inhibition of *Rhizoctonia solani* f.sp. *sasakii*

S. No.	Leaf extracts/ Concentration	Colony Diameter (cm)			Mean	Per cent Inhibition			Mean
		5%	10%	15%		5%	10%	15%	
1	Neem	9.00	9.00	9.00	9.00	0.00	0.00	0.00	0.00
2	Nerium	4.50	6.40	7.39	6.09	50.00	28.88	17.88	32.25
3	Calotropis	9.00	9.00	9.00	9.00	0.00	0.00	0.00	0.00
4	Custard apple	9.00	9.00	9.00	9.00	0.00	0.00	0.00	0.00
5	Karanj	4.96	4.12	3.18	4.08	44.88	54.22	64.66	54.58
	Mean	7.29	6.30	6.31		18.97	16.62	16.50	
	Control	9.00							
	Propiconazole @0.1% check	0.00							
		Leaf extracts (LE)		Concentration (C)	Check vs Others				
	SEm±	0.07		0.06	0.13				
	CD (P ≤ 0.05)	0.21		0.16	0.38				
	CV (%)	3.44							

Karanj leaf extract was found to be most significant with the minimum mycelial growth (4.08 cm) followed by Nerium (6.09 cm). Among different concentrations of the leaf extracts tested, 10% concentration was found superior (6.30 cm) in inhibiting colony diameter, however it was on a par with 15% concentration (6.31 cm).

In the interaction between different leaf extracts and different concentrations Karanj @15% was found significantly superior (3.18 cm) over other leaf extracts and it was found that even at 10 % concentration Karanj leaf extract inhibited the mycelia growth significantly (4.12 cm) over other.

Among five different aqueous leaf extracts karanj resulted in significant per cent inhibition of *R. solani* f.sp. *sasakii* (54.58%). Whereas, the leaf extracts of neem, calotropis and custard apple were found to be significantly ineffective in inhibiting the radial growth of the fungus.

Naik *et al*. (2016) reported Pongamia leaf extracts to be effective against root rot pathogen, *R. solani*. He also stated that maximum inhibition of the fungus was recorded at all concentrations tested (5, 10 and 15 per cent). Reports by Sharma *et al*. (2018) revealed that maximum per cent growth inhibition of *R. solani* occurred with extract of garlic cloves (71.85%) followed by leaf extract of Karanj (38.88%).

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