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University of Calcutta, Kolkata 700 019, India

Studies on biofungicidal properties of leaf extracts of some medicinal plants for the management of Foot rot disease of rice

SARAT BORKATAKI, FARISHTA YASMIN AND EUSHAH ALI*
Department of Botany, Nowgong College, Nagaon 782001, Assam
**Department of Botany, Gauhati University, Guwahati 781014, Assam*

Leaf extracts of some medicinal plants were taken to study their antifungal properties against Foot rot disease of rice caused by *Fusarium moniliformae* during 2008. The results showed that the maximum inhibition of spore germination of *F. moniliformae* was recorded by the leaf extract of *Azadirachta indica* (97.0%) in 6 hrs of treatment at 100% concentration and the minimum inhibition was showed by *Datura stramonium* (32.0%) at 10% concentration in 2 hrs. of treatment as compared to the control. The results also revealed that the growth of *F. moniliformae* was suppressed by all the plant leaf extracts at different concentrations after 10 days as compared to the control. *Azadirachta indica* inhibited maximum percentage of growth of the pathogen (dry weight 190 mg; 20.65% of growth) and the minimum inhibition was showed by *Datura stramonium* (350 mg and 38.04%). The inhibition percentage of spore germination and growth of the pathogen was gradually increased with increase in concentrations of plant extracts and hours of treatment. The leaf extracts of *A indica, O. sanctum* and *D. stramonium* may have some chemical substances which exhibited greater antifungal properties towards the Foot rot disease of rice caused by *F. moniliformae*.

Key words: Leaf extracts, medicinal plants, biofungicidal properties, Foot rot disease of rice

INTRODUCTION

Foot rot disease of rice caused by *Fusarium moniliformae* Sheld is one of the important diseases throughout the paddy growing areas (Ou, 1985). The disease has been first described from Japan by Hoti (1898). The disease occurs both in the nursery and in the main field. In the nursery, the effected seedlings become chlorotic and pale, thinner than the healthy ones and abnormally elongated. Such seedlings may wilts from the tips downward and finally die. *Fusarium moniliformae* is primarily a seed – borne pathogen of rice which infects the seedlings at the time of germination or at an early growing state (Ou, 1985).

The constant use of fungitoxic chemicals adds to environmental pollution, consequently, efforts are under way for finding alternatives to chemical fungicides. The indiscriminate use of chemical fungicides is posing a serious threat not only to human health but also disturbs nature's control mechanism, leading to the worst possible infestations. Chemical fungicides are non-degradable pollutants that either don't degrade or degrade very slowly, thus they have seriously contaminated the global ecosystem and enter food chain. Growing concern about harmful effect of chemical fungicides on environments and human health and with the advent of progress in biotechnology search for safer, ecofriendly biological control measure is more important in the niche of biodiversity. With the objective of finding alternatives of synthetic chemical fungicides attempts have been made to control different microorganisms with plant extracts by various workers (Gehlot, 1997; Srivastava and Lal, 1997; Nair and Arora, 1996; Singh and Dwivedi, 1990; Upadhyaya and Gupta, 1990; Sharma and Bohra, 2003; Gautam *et al.* 2003; Natarajan and Lalithakumari, 1987; Kamalakannan *et al.*,2001). It has been reported that certain plants contain products such as alkaloids, tannins, quinines, coumarines, phenolic compounds, ipomeamarone in their extracts and exudates and they are known for antifungal activities. The present investigation has been carried out to study the effect of extracts

of three medicinal plants species for their antifungal activity against Foot rot disease of rice caused by *Fusarium moniliformae.*

MATERIALS AND METHODS

The experiment was done in the Microbiological Laborotary, Department of Botany, Nowgong College, Nagaon; Assam during the year 2008. The test pathogen, *Fusarium moniliformae* was isolated and identified according to the keys as proposed by Gilman (1957). Pure culture from single spore was maintained on Potato dextrose agar medium for growth. The fresh leaves extracts were prepared according to the method described by Srivastava and Lal (1997).

The fresh leaves of *Azadirachta indica, Ocimum sanctum and Datura stramonium* were separately washed and crushed in sterile distilled water (at 1 : 1 w/v) in a pestle and mortar and filtered through muslin cloth. This formed 100% plant extract solution. The plants extracts so prepared heated to 40°C for 10 min to avoid contamination and different concentration viz. 10%, 50% and 100% were prepared with sterile distilled water for further studies. In order to study the inhibition percentage of spore germination, spore suspension was prepared in stock solution of selected plants. A drop of spore suspension was placed in cavity slide and observed under a compound microscope for 6 hrs. The inhibition of spore germination was calculated by the following formula as suggested by Srivastava and Lal (1997). Inhibition percentage of spore germination =

$$\frac{\text{Total number of spores} - \text{Number of germinated spores}}{\text{Total number of spores}} \times 100$$

In order to study the growth of the pathogen, modified Czapeck's dox liquid medium was used. Ten days old pure culture of *F. moniliformae* was aseptically inoculated in 100 ml sterilized Czapeck's dox liquid medium in 250 ml conical flacks. Different concentration of plant extracts were maintained along with the medium. The control sets were maintained without the treatment of different concentration of plant extract. All the flasks were incubated at 27±1°C for 10 days. Mycelial mats were harvested by filtering on tared Whatman filter paper No. 41 and dried at 60°C in an oven and weighed.

RESULTS AND DISCUSSION

The inhibition percentage of spore germination of *F. moniliformae* by leaf extracts of different plants are furnished in Table 1. It was observed that all the leaf extracts inhibited the spore germination of the test fungus. It was also observed that the inhibition percentage of spore germination was gradually increased with increase in concentrations of plant extracts and hours of treatment. Amongst the three plant extracts, *Azadirachta indica* inhibited maximum spore germination (97.0%) at 6 hrs. of treatment at 100% concentration followed by *Ocimum sanctum* (78%) and *Datura stramonium* (72%) leaf extracts. The minimum inhibition was showed by *Datura stramonium* (32%) at 10% concentration of extracts in 2 hrs. of treatment followed by *A. indica* (40%) and *Ocimum sanctum* (42%) as compared to the control.

The results on the growth of *F. moniliformae* at the different concentrations of the leaf extracts are furnished in Table 2. The results revealed that all the plant leaf extracts at the different concentrations suppressed the growth of the pathogen after 10 days as compared to the control. It was observed that the inhibition percentage of growth of the pathogen was found maximum at 100% concentration of extract of *Azadirachta india* (dry weight 190 mg; 20.65% of growth) followed by *Ocimum sanctum* (300 mg and 32.60%), while the minimum inhibition was showed by *Datura stramonium* (350 mg and 38.04%). It was also observed that the sporulation of the pathogen was good (+++) at 10% concentration and the poor (+) sporulation was observed at 100% concentration of all the plant leaf extracts. The experimental results showed that the different concentration of leaf extract of *A. indica, O. sanctum* and *D. stramonium* inhibited the spore germination and growth of the pathogen. It was observed from the results that the maximum inhibition of the spore and growth of the pathogen was showed by the leaf extract of *A. indica* followed by *O. sanctum* and *D. stramonium.* Dubey (1998) reported that leaf extract of *Moringa oleifera, A. indica, Glyricidia maculata, O. sanctum, D. stramonium* and *Tegetes erecta* completely inhibited sclerotial formation of *Thanatephorus cucumeris,* causing Banded Blight of rice.

In the present investigation, the leaf extract of *A. indica* at 100% concentration, inhibited maximum spore germination (97%) and growth of the pathogen (190 mg and 20.65%) which may be due to the presence of certain chemicals (phenols and tannin) in the leaf extract. Similar observation were also observed by Dubey (1998), and Srivastava and Lal (1997). Anonymous (1972) reported the presence of essential oils in *O. sanctum* and fixed oils in *D. alba.* Upadhyaya and Gupta (1990) reported that leaf extract of *Datura alba, Ocimum sanctum, Cannabis sativa* and bulb extract of *Allium sativum* suppressed the radial growth of *Curvularia lunata.* In the present investigation it was observed that some variations occurred in the inhibitory effect of the various plant leaf extracts which might be due to quantitative and qualitative differences in the antifungal principles.

The present studies conclude that the leaf extracts of *A. indica, O. sanctum* and *D. stramonium* which have some chemical substances (phenol, tannin, essential and fixed oils) exhibited greater antifungal properties towards the Foot rot of rice disease pathogen. These plant species are widely available whose potential can be effectively used for the management of Food rot disease of rice caused by *Fusarium moniliformae.*

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Table 1: Inhibition percentage of spore generation of *Fusarium moniliformae* by leaf extract of different plants

Name of plants	Concentration (%)	Hours of treatment		
		2	4	6
Azadirachta indica	10	40	48	67
	50	52	65	75
	100	64	79	97
Ocimum sanctum	10	42	49	62
	50	50	60	66
	100	60	72	78
Datura stramonium	10	32	40	50
	50	43	52	61
	100	54	60	72
Control		15	10	8

Table 2 : Effect of some plants leaf extracts on the growth of *Fusarium moniliformae* after 10 days

Name of plants	Concentration	Fungal growth (mg) after 10 days		
		Dry weight	Percentage of inhibition	Sporulation index
Azadirachta indica	10	700	76.08	+++
	50	396	43.04	++
	100	190	20.65	+
Ocimum sanctum	10	790	85.86	+++
	50	420	45.65	++
	100	300	32.60	+
Datura stramonium	10	815	88.58	+++
	50	445	48.36	++
	100	350	38.04	+
Control		920		

Sporulation Index : +++ = Good, ++ = Moderate, + = Poor

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