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Antifungal potential of dried rhizome/ leaf powder of *Acorus calamus*, *Adhatoda vasica* and *Vitex negundo* against some soil borne fungal pathogens

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Abstract

Antifungal potential of dried rhizome/ leaf powder of *Acorus calamus*, *Adhatoda vasica* and *Vitex negundo* against some soil borne fungal pathogens was evaluated. Dried rhizome powder of *Acorus calamus* was found to possess strong antifungal activity as it completely arrested the growth of *Sclerotium rolfsii* in comparison to *Adhatoda vasica* and *Vitex negundo* dried leaf powders which caused only 4.2 and 11.2 % inhibition of the pathogen at 1.0 % concentration, respectively. Dried rhizome powder of *A. calamus* when further evaluated against different soil borne pathogens, gave complete inhibition in mycelial growth of *S. rolfsii* and *Rhizoctonia solani* at 0.5 % concentration whereas it gave 87.0 and 72.9 % inhibition in mycelial growth of *Fusarium solani* and *Sclerotinia sclerotiorum* at 1.0 % concentration. Different concentrations of dried leaf powder of *V. negundo* and *A. vasica* which were individually less effective against *S. rolfsii* gave better inhibition in mycelial growth when supplemented with 0.25 % dried powder of *A. calamus* rhizomes and caused 52.2 and 59.8 % inhibition, respectively at 1.0 % concentration. The synergistic effect was more pronounced at 1.0 % concentration than at higher concentrations.

Key words: Botanicals, rhizome/ leaf powders, antifungal activity, soil borne fungi.

Introduction

Soil borne fungal pathogens are a serious menace in the crop production causing huge losses which necessitates their effective management with appropriate means. Management through sole treatment of chemicals is not advisable due to their residual toxicity, environmental pollution and health hazards. Hence, adoption of some ecofriendly and comparatively cheaper methods which can be incorporated in integrated disease management programme becomes inevitable. Botanicals have been identified as an important component of IDM and also play a major role in disease management especially in organic farming system. Attempts have been made to study antifungal activity of some plant extracts against soil borne pathogens (Bianchi *et. al.*, 1997; Shivpuri, *et. al.*, 1997; Sindhan *et. al.*, 1999; Begum *et. al.*, 2007). Keeping this in view, three botanicals namely, *Acorus calamus* (Sweet flag), *Adhatoda vasica* (Basooti) and *Vitex negundo* (Banah) widely known for their medicinal / biopesticidal properties as well as their abundance in the native area were evaluated for their antifungal potential that would help to devise a suitable integrated management strategy against some important soil borne fungal pathogens.

Materials and Methods

Leaves of *A. vasica*, *V. negundo* and rhizomes of *A. calamus* were cut into small pieces, dried in shade and were ground to fine powder. The requisite quantity of each botanical powder was weighed to make concentrations of 1.0, 5.0 and 10.0 per cent, supplemented in the potato dextrose agar medium, autoclaved and evaluated against *Sclerotium rolfsii* by poisoned food technique (Falck, 1907). Mycelial bits from actively growing culture of the test pathogen were placed at the center of the plates containing amended medium and incubated at 25±1° C. Observations on the diametric growth of the pathogen were recorded and per cent mycelial growth inhibition of the pathogen was calculated (Vincent, 1947). Dried rhizome powder of *A. calamus* was further evaluated at different concentrations of 0.25, 0.50, 0.75 and 1.00 per cent against *S. rolfsii*, *Rhizoctonia solani*, *Fusarium solani* and *Sclerotinia sclerotiorum* keeping in view its efficacy against the test pathogen, *S. rolfsii*. In a different experiment, to know the synergistic effect of *A. vasica* and *V. negundo* with *A. calamus*, dried leaf powders of *A. vasica* and *V. negundo* were supplemented with 0.25 per cent dried rhizome powder of *A. calamus* to make further concentrations of 1.0, 5.0 and

10.0 per cent (w/w) and bioassayed against *S. rolfsii*.

Results and Discussion

Among three botanicals evaluated against *S. rolfsii* at 1.0, 5.0 and 10.0 per cent concentrations (Table 1), dried powder of *A. calamus* rhizomes was found to possess strong antifungal activity as it caused complete (100%) inhibition in the mycelial growth of *S. rolfsii* even at lowest concentration of 1.0 per cent. However, at this concentration, dried leaf powders of *A. vasica* and *V. negundo* caused only 11.2 and 4.2 per cent inhibition in mycelial growth of the test pathogen, respectively. With this preliminary information, *A. calamus* was further evaluated at lower concentrations of 0.25, 0.50 and 0.75 % (Table 2).

Dried rhizome powder of *A. calamus* completely arrested growth of *S. rolfsii* and *R. solani* at 0. 50 % concentration with 67.0 and 29.2 per cent inhibition in mycelial growth of *F. solani* and *S. sclerotiorum*, respectively.

Table 1. Comparative efficacy of dried rhizome/ leaf powders of *A. calamus*, *A. vasica* and *V. negundo* against *S. rolfsii*

Botanical	Mycelial growth inhibition at concentration (%)			Mean
	1.0	5.0	10.0	
Acorus	100.0	100.0	100.0	100.0
calamus	(90.0)	(90.0)	(90.0)	(90.0)
Adhatoda	11.2	31.4	50.0	30.8
vasica	(19.4)	(34.0)	(45.0)	(32.8)
Vitex	4.2	22.0	43.3	23.1
negundo	(11.8)	(28.0)	(41.1)	(26.9)
Mean	38.4	51.1	64.4	
	(40.4)	(50.6)	(58.6)	
CD (P = 0.05)	3.09			

Figures in parentheses are arc-sine transformed values

Data (Table 2) also indicated that *F. solani* and *S. sclerotiorum* appeared less sensitive to *A. calamus* even at highest test concentration of 1.0% registering 87.0 and 72.9% inhibition in their mycelial growth, respectively.

Table 2. Efficacy of dried rhizome powder of *A. calamus* against some soil borne pathogens at different concentrations

Pathogen	Mycelial growth inhibition at concentration (%)				Mean
	0.25	0.50	0.75	1.00	
Sclerotium rolfsii	84.8	100.0	100.0	100.0	96.2
	(67.0)	(90.0)	(90.0)	(90.0)	(84.2)
Rhizoctonia solani	79.6	100.0	100.0	100.0	94.9
	(63.1)	(90.0)	(90.0)	(90.0)	(83.2)
Fusarium solani	38.5	67.0	84.8	87.0	69.3
	(38.3)	(55.5)	(67.0)	(68.8)	(57.3)
Sclerotinia sclerotiorum	25.5	29.2	70.7	72.9	49.5
	(30.2)	(32.6)	(57.2)	(58.6)	(44.7)
Mean	57.1	74.0	88.8	89.9	
	(49.7)	(66.9)	(76.0)	(76.8)	
CD (P = 0.05)	3.34				

Figures in parentheses are arc-sine transformed values

Different concentrations of dried leaf powders of *A. vasica* and *V. negundo* supplemented with dried powder of *A. calamus* rhizomes (@ 0.25%) were also evaluated to know their synergistic effect on the mycelial growth of *S. rolfsii* (Table 3). It is evident that dried leaf powders of *A. vasica* and *V. negundo* which were less effective individually against *S. rolfsii* (Table 1), gave better inhibition of mycelial growth when supplemented with 0.25 % dried powder (w/w) of *A. calamus* rhizomes (Table 3). However, the synergistic effect was more pronounced at 1.0 % concentration above which it appeared to be diminished.

Various plant species have been reported to exhibit antifungal potential against soil borne fungi (Bianchi *et. al.*, 1997; Sindhan *et. al.*, 1999 and Begum *et. al.*, 2007). Antifungal activity of these plant species may be attributed to presence of some antifungal compounds like phenols, proteins etc. An antifungal compound, azaron isolated from the rhizome extract of *A. calamus* has been found to completely inhibit the growth of *Macrophomina phaseolina*, *Curvularia lunata* and *Alternaria alternata* at 400 ppm (Begum *et.*

al., 2004; Lee, 2007). Ethanol extract of *A. calamus* also showed a strong antifungal activity against six major phytopathogenic fungi at 1000 ppm (Begum *et. al.*, 2007). Ghosh, (2006) reported efficacy of a pathogenesis related protein, haem peroxidase extracted from *A. calamus* leaves against some phytopathogenic fungi. The present studies though provide us preliminary information about strong antifungal potential of *A. calamus* against some important soil borne fungal pathogens, it can be inferred that this botanical can surely prove to be a significant component in devising integrated disease management strategy and also in developing compatible synergistic combinations with other botanicals available in the locality against a wide variety of fungal pathogens.

Table 3. Efficacy of different concentrations of dried leaf powders of *A. vasica* and *V. negundo* supplemented with dried rhizome powder of *A. calamus* rhizomes against *S. rolfsii*

Botanical	Mycelial growth inhibition at concentration (%)			Mean
	1.0	5.0	10.0	
Adhatoda	52.2	48.3	35.7	45.4
vasica	(50.6)	(40.2)	(28.2)	(39.7)
Vitex	59.8	41.8	22.5	41.3
negundo	(46.2)	(44.0)	(36.6)	(42.3)
Mean	56.0	45.0	19.1	
	(48.4)	(42.1)	(32.4)	
CD (P = 0.05)	6.82			

Figures in parentheses are arc-sine transformed values

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