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BIOEFFICACY OF PLANT EXTRACTS AGAINST *ALTERNARIA ALTERNATA*, LEAF BLIGHT PATHOGEN OF SENNA (*CASSIA ANGUSTIFOLIA*)

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ABSTRACT

Alternaria leaf light is an endemic disease of senna affecting at all growth stages with significant reduction in leaf yield. As senna is a low value medicinal crop *invitro* study was taken up with the objective of identifying the effective botanical for the leaf blight disease management, which will be cost effective and without pesticide residues. Among the 10 % aqueous extracts of plants *viz*., *Piper betle* leaves, *Allium sativum* bulbs, *Acorus calamus* rhizomes, *Coleus forskohlii* tubers, *Tinospora cordifolia* stem that were tested, *A. sativum* was found highly effective with 57.4% inhibition in radial growth over check. *A. calamus* second in order of its efficacy in reducing the fungal growth by 43.3%, while *Piper betle* least effective. Copper oxychloride (2500 ppm) was considered as standard check and distilled water as check.

Key words: *Allium sativum, Tinospora cordifolia, Acorus calamus, Piper betle, Coleus forskohlii* Plant extracts, senna, leaf blight pathogen, *Alternaria alternata*.

Introduction:

Senna (*Cassia angustifolia*) is a small shrub native to India belonging to the family Caesalpiniaceae, cultivated over 10,000 ha in semi-arid lands as annual crop can be maintained as perennial for 2-3 years. India is the main producer and exporter of senna leaves, pods for its sennosides (A and B) concentrate to world market. Seeds are used for propagation and normally cultivated as post *kharif* crop. It suffers from *viz*., leaf spot, root rot, damping off, die back and root knot etc. *Alternaria cassiae* was identified as causal organism of foliar blight of several *Casssia* spp. in India and USA (Boyette, 1998) and serious seedling blight of *C. obtusifolia* (sickle pod) and *C. occidentalis* (coffee senna) in the USA (Boyette, 1998). *A. alternata* and *A. tenuissima* were also found to cause foliar blight of *C. fistula* and *C. tora* in India and Pakistan (Lenne, M.J., 1990), while *A. alternata* observed as most

common pathogen causing defoliation with severe yield losses (Patel and Pillai, 1979). Seedling blight is described as severe leaf lesions resulting in defoliation, severe stem lesions developing into cankers, stunting and plant death (Walker, 1982).

Although chemical management is successful because of economic, environmental or health concerns and due to the development of resistant strains, the botanicals are now emerging as safer and more compatible alternatives for the control of phytopathogens (Kumbhar *et al*., 2000). Hence initially the laboratory experiment was conducted to find out the abundantly available common plants with antifungal properties during 2011-12 for further utilisation in disease management.

Materials and Methods:

Isolation of Pathogen:

Alternaria alternata was isolated from infected leaves of senna plants by using potato dextrose agar (PDA) medium during 2011-12. The pathogen was purified by single spore isolation technique and identified based on the cultural and morphological characters reported by earlier authors (Keissler, 1912). Koch's postulates were established through pathogenicity test and the culture was maintained on PDA.

Plant Extract Preparation:

Different plants *viz.*, *Piper betle* leaves, *Allium sativum* bulbs, *Acorus calamus* rhizomes, *Tinospora cordifolia* stem and *Coleus forskohlii* tubers were collected, thoroughly washed with tap water, later using sterilized distilled water. The material was weighed, cut into small pieces and aqueous extracts were prepared with sterilized distilled water using electric grinder @ 50 gms/250 ml. The extract was centrifuged at 1500 rpm for 10 minutes and the supernatant was filtered through sterile whatman filter paper No. 40, which was considered as 20% and diluted to get 10% solution. Standard check solution (2500 ppm) was prepared by dissolving copper oxychloride @ 2.5 gms/1000 ml.

The efficacy of the extracts was tested by poisoned food technique in completely randomised block design. Fifty ml of each solution was added to the equal quantity of molten potato dextrose agar, mixed thoroughly, dispensed in sterilized petri plates and allowed to solidify. Each plate was inoculated with 5 mm mycelial disc taken from the periphery of 7 days old culture of *A. alternata* growing on PDA. The inoculated petridishes were then incubated at $25+1^0$C. For each treatment four replications were

maintained. Petridishes without plant extract as control, while the plates with copper oxychloride (2500 ppm) fungicide as standard check. Colony diameter was measured after 7 days of incubation, the data was statistically analysed and per cent inhibition was calculated with the following formula.

Per cent inhibition =

$$\frac{\text{Colony diameter in check - Colony diameter in amended medium}}{\text{Colony diameter in check}} \times 100$$

Results and Discussion:

All the plant extracts tested showed antifungal fungicidal properties against the test pathogen, *A. alternata* with significant variation in inhibition. The fungicide which was taken as standard check at 2500 ppm concentration was significantly superior over all the plant extracts evaluated. The colony growth was 1.0 cm in treatment with copper oxychloride which was highly effective with maximum inhibition of 72.3%. Among the plant extracts, *A. sativum* bulb extract was found effective recorded colony growth of 1.5 cm with 57.4% reduction in its growth followed by *A. calamus* rhizome extract with 43.3% inhibition in colony diameter (2.0 cm). The extracts of *Tinospora cordifolia* stem and *Piper betle* leaves were least effective with a colony diameter of 2.8 and 3.0 cm respectively (Table 1).

The results of the present study are in conformity with the finding of Chakraborthy *et al*. (2012) who concluded that *A. sativum* bulb extract inhibited the radial growth of *Phoma lingum*, fruit rotting pathogen of custard apple, he attributed it to the presence of volatile forms allicin and ajoene in the extracts are responsible for damaging the fungal cell walls (Singh and Divedi, 1990 and Augusti, 1996). Azaron or 1,2,4 trimethoxy -5-(1-propenyl) benzene isolated from the rhizome extracts of *A. calamus* exhibited antifungal activity against *Macrophomina phaseolina*, *Curvularia lunata* and *A. alternata* as reported by Begum *et al*. (2004).

Table 1: Effect of plant extracts on growth of *A. alternata in vitro*

S.No	Name of the Plants	Parts used	Colony growth in cm	% reduction over control
1.	*Piper betle*	leaves	3.08	12.8
2.	*Acorus calamus*	rhizome	2.00	43.3
3.	*Coleus forskohlii*	tuber	2.38	32.6
4.	*Allium sativum*	bulb	1.50	57.4
5.	*Tinospora cordifolia*	stem	2.80	20.6
6.	COC 2500 ppm (standard check)		0.98	72.3
7.	Check		3.53	
	SEm ±	0.061		
	CD (P≤0.05)	0.18		
	CV%	5.23		

Singh *et al*., (2010) also reported that crude extract of *A. calamus* (4000 µg/ml) was highly effective against *A. solani*, while *T. cordifolia* (5000 µg/ml) against Helminthosporium. HPLC analysis of crude extracts indicated that the increase in production of phenolics *i.e* gallic acid (1432 µg/g) in *A. calamus* and tannic acid (5852 µg/g) in *T. cordifolia* can be correlated with the induction of resistance in treated plants against the pathogenic fungi. Contrary to the present study *Piper betle* leaf extract is very effective against food spoilage fungi *viz*., *Aspergillus niger*, *A. oryzae* and *Penicillium* spp. (Wanchaitanawong *et al.*, 2005) and inhibited the mycelial growth and sclerotial formation of *Rhizoctonia solani* from tobacco at 50% concentration (Seema *et al*., 2011) which might be due to the presence of hydrochavicol in the extract (Ali *et al*., 2010).

Further studies with the screened plant extracts are to be conducted to find out the effective botanical pesticides for the disease management *in vivo* as these are easily available, cost effective, non phytotoxic and ecofriendly.

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