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Antifungal activity of extracts of *Millettia pinnata* L. and *Cassia tora* L. against plant fungal pathogen *Alternaria solani*

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Abstract- *Alternaria solani*, plant pathogenic fungus causes Early blight of Potato, main reason of significant economical losses of potato. Present research focus on antifungal activity of seed, bark, leaf and stem extracts of *Millettia pinnata* L. and *Cassia tora* L. against plant fungal pathogen *Alternaria solani* (ITCC No. 4632). Extracts were prepared in organic solvents such as acetone, ethanol, chloroform and petroleum ether. Mycelial growth of *Alternaria solani* was recorded in all prepared extracts. Minimum mycelial growth of *Alternaria solani* was recorded in acetone extract of *Millettia pinnata* L. seed with 2.7 mm. Ethanol extract of Karanj seed also exhibited less growth of mycelium that was 3.3 mm. In compare to Ethanol, Chloroform and Petroleum ether, Acetone solvent is more effective in controlling the Mycelial growth of *Alternaria solani*. All other treatments are effective than check.

Key words: Antifungal activity, *Millettia pinnata* L. (Karanj), *Cassia tora* and *Alternaria solani*

INTRODUCTION

A plant pathogenic fungus *Alternaria solani* causes significant economic losses of potato crop.^{1,2} Use of chemical fungicides are harmful for health and also pollute the environment. Plant extracts may be used for the management of different plant diseases. Some scientists are involved to search more environmentally friendly natural compounds for the control of plant diseases using plant extracts from different plants.³⁻⁶ Present research focus on antifungal activity of extracts of *Millettia pinnata* L. and *Cassia tora* L.

Millettia pinnata L. belongs to family Fabaceae, mostly found in tropical and temperate Asia. It is also commonly known as Indian beech, Pongam oil tree, karanj, honge, pungai, karach and naktamala. Various parts of

Millettia pinnata L. have their medicinal value.^{7,8} *Millettia pinnata* L. is used for the treatment of head pains, leucoderma, skin diseases, wounds, piles, liver pain, leprosy and chronic fever. It is used for anti-inflammatory, antidiarrhoeal, anti-ulcer, anti-hyperammonic and antioxidant activity. Different parts of plant contain alkaloids demethoxy-kanugin, gamatay, glabrin, kaempferol, kankone, kanugin, karangin, pinnatin, pongamol, pongapin, quercitin, saponin, β -sitosterol and tannin.

Cassia tora L. belongs to family of Fabaceae, is mostly found in South-East Asia and the South West Pacific. In India it is distributed in tropical parts. It is a dicot legume, commonly known as sickle senna, sickle pod, tora, coffee pod, chakvad and thakara. The whole plant parts have been widely used to control different diseases, especially in Satpura region of Madhya Pradesh,

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India. *Cassia tora* L. is used for anti-inflammatory, antiperiodic, anthelmintic, ophthalmic, liver tonic and cardiogenic. The leaves and seeds of *Cassia tora* contain several anthraquinone glycosides, cinnamaldehyde, gum, tannins, mannitol, coumarins and essential oils which are useful in leprosy, ringworm, colic, dyspepsia, constipation, cough, bronchitis, cardiac disorders.

Antifungal activity of *Millettia pinnata* L. and *Cassia tora* L. against few bacteria was evaluated by some scientist.^{9,10} In present research, it was observed that acetone extract of selected plants showed maximum inhibitory activity against plant fungal pathogen *Alternaria solani*, which is due to the presence of some secondary metabolites.

MATERIALS & METHODS

Preparation of the Extract

Collection of plant material

Cassia tora leaves were collected from Chalisgaon, Dist. Leaves, stems, bark and seeds of *Millettia pinnata* L. and *Cassia tora* L. were collected from different locations of Ranchi district of Jharkhand, India. Selected plant parts were cleaned with water followed by shade-dried. The different parts of the selected plants were powdered, stored and used for extraction. 10 g of powder was mixed to 100 mL of different solvents such as acetone, ethanol, petroleum ether and chloroform for 72 hr. The crude extract was filtered through Whatman No. 1 filter paper which was considered as a standard solution.¹¹

Test pathogen

Test fungal pathogen *Alternaria solani* (ITCC No.-4632) was obtained from Department of Mycology and Plant Pathology, ICAR-Indian Agricultural Research Institute, New Delhi. The test pathogen was cultured and maintained on Potato dextrose agar medium (PDA) at 28°C for further use.

Antifungal Activity

Poison food technique was used for the examining the antifungal activity of *Millettia pinnata* L. and *Cassia tora* L. against *Alternaria solani*.¹² At different concentration of selected plants extracts like 1.0 %, 2.5 %, 5.0% and 10.0%, diameter of mycelial growth was measured. The experiments were replicated three times and average of diameter of mycelial growth was measured. Percentage of inhibition was calculated by the following formula of Vincent (1947).¹³⁻¹⁷

$$\% \text{ of Mycelial inhibition} = \frac{\text{Radial growth in check} - \text{Radial growth in treatment}}{\text{Radial growth in check}} \times 100$$

RESULT & OBSERVATIONS

Results of antifungal activity of extracts of selected plants – *Millettia pinnata* L. and *Cassia tora* L. using different solvents - acetone, ethanol, petroleum ether and chloroform were given in Table 1, Table 2, Table 3 and Table 4. Selected plants extract significantly inhibited the mycelial growth of test pathogen *Alternaria solani*.

Table 1 showed the antifungal activity of acetone extracts of *Millettia pinnata* L. and *Cassia tora* L. Minimum mycelial growth of *Alternaria solani* was recorded in acetone extract of *Millettia pinnata* L. seed with 2.7 mm followed by Karanj bark or *Cassia tora* seed that was 4.3 mm at 10% concentration. Karanj seed extracts using acetone showed maximum percentage of inhibition against *Alternaria solani* with 97%. Karanj bark or *Cassia tora* seed extracts showed 95.2% of inhibition at 10% concentration. Leaf extract of *Cassia tora* or Karanj was also effective to control *Alternaria*, exhibited 94.4% and 93.7% of inhibition respectively in acetone as a solvent. Other extracts were moderately effective to control *Alternaria solani*.

The ethanol extract of Karanj seed showed minimum mycelial growth of *Alternaria solani* with 3.3 mm. Karanj bark extract showed mycelial growth with 3.7 mm and in *Cassia tora* seed, it was observed growth with 4.3 mm. It was recorded that Karanj leaf or *Cassia tora* bark extract also effective to control test pathogen, in which average diameter of growth was 5.7 mm at 10% concentration (Table 2). Maximum percentage of inhibition of mycelia growth of *Alternaria solani* was recorded in case of Karanj seed that was 96.3%, followed by Karanj bark with 95.9% or *Cassia tora* seed with 95.2%. Leaf extract of Karanj or Bark extract of *Cassia tora* with 93.7 % of inhibition, was also effective to control *Alternaria solani*,

Effect of chloroform extracts are depicted in Table-3. Minimum mycelial growth of *Alternaria solani* was recorded in chloroform extract of Karanj seed with 3.7 mm followed by Karanj bark with 4.0 mm, Karanj leaf with 4.7 mm, *Cassia tora* seed with 5.3 mm and *Cassia tora* bark with 5.7 mm at 10% concentration. Karanj seed extract in chloroform showed maximum percentage of inhibition against *Alternaria solani* which was 95.9%.

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Karanj bark showed 95.6% of inhibition, Karanj leaf extract with 94.8%. *Cassia tora* seed and bark exhibited 94.1% and 93.7% of inhibition. Other extracts using chloroform were also effective than check.

Results of antifungal activity of Petroleum ether extracts were given in Table 4. Minimum mycelial growth of *Alternaria solani* was also recorded in Petroleum ether extract of Karanj seed with 4.3 mm followed by Karanj

bark with 4.7 mm, *Cassia tora* seed with 6.0 mm and Karanj leaf or stem with 11.3 mm and 14.7 mm respectively at 10% concentration. Maximum percentage of inhibition 95.2% was recorded in Karanj seed extract followed by Karanj bark with 94.8% or *Cassia tora* seed with 93.3%. Leaf or stem extract of Karanj was moderately effective to control test pathogen.

Table 1- Effect of different concentration of acetone extracts of different parts of *Milletia pinnata* L. and *Cassia tora* L on mycelial growth and Percentage of inhibition of *Alternaria solani*.

Plant Extracts	1%		2.5%		5%		10%	
	mm	% of inhibition	mm	% of inhibition	mm	% of inhibition	mm	% of inhibition
<i>Milletia pinnata</i> L.								
a) Seed	27.7	69.2	22	75.6	9.3	89.7	2.7	97
b) Bark	40.3	55.2	27.7	69.2	12.3	86.3	4.3	95.2
c) Leaf	44.7	50.3	33.3	63	17.3	80.8	5.7	93.7
d) Stem	55.3	38.6	47.3	47.4	20.7	77	15.3	83
<i>Cassia tora</i> L.								
a) Seed	39.3	56.3	31.3	65.2	14.3	84.1	4.3	95.2
b) Bark	45	50	38.3	57.4	19.3	78.6	5.3	94.1
c) Leaf	52	42.2	42	53.3	24.7	72.6	5	94.4
d) Stem	63	30	51.3	43	33	63.3	14.7	83.7
Check	90	0	90	0	90	0	90	0

Table 2- Effect of different concentration of ethanol extracts of different parts of *Milletia pinnata* L. and *Cassia tora* L on mycelial growth and Percentage of inhibition of *Alternaria solani*.

Plant Extracts	1%		2.5%		5%		10%	
	mm	% of inhibition	mm	% of inhibition	mm	% of inhibition	mm	% of inhibition
<i>Milletia pinnata</i> L.								
a) Seed	43.3	51.9	32	64.4	14.7	83.7	3.3	96.3
b) Bark	50.7	43.7	39.3	56.3	20	77.8	3.7	95.9
c) Leaf	59.7	33.7	44	51.1	25	72.2	5.7	93.7
d) Stem	69.3	23	46.7	48.1	31.7	64.8	17.7	80.3
<i>Cassia tora</i> L.								
a) Seed	43.7	51.4	40	55.6	22	75.6	4.3	95.2
b) Bark	55.3	38.6	43.3	51.9	23.7	73.7	5.7	93.7
c) Leaf	65	27.8	51.3	43	32	64.4	7.3	91.9
d) Stem	73	18.9	61.3	31.9	39	56.7	20	77.8
Check	90	0	90	0	90	0	90	0

Table 3- Effect of different concentration of chloroform extracts of different parts of *Milletia pinnata* L. and *Cassia tora* L on mycelial growth and Percentage of inhibition of *Alternaria solani*.

Plant Extracts	1%		2.5%		5%		10%	
	mm	% of inhibition	mm	% of inhibition	mm	% of inhibition	mm	% of inhibition
<i>Milletia pinnata</i> L.								
a) Seed	45.7	49.2	37.3	58.6	21.7	75.9	3.7	95.9
b) Bark	50	44.4	44.7	50.3	32	64.4	4	95.6
c) Leaf	64.3	28.6	47.3	47.4	34.7	61.4	4.7	94.8
d) Stem	69.3	23	52	42.2	40	55.6	16	82.2
<i>Cassia tora</i> L.								
a) Seed	48.3	46.3	41.3	54.1	30.7	65.9	5.3	94.1
b) Bark	55.7	38.1	46.7	48.1	34.7	61.4	5.7	93.7
c) Leaf	65.3	27.4	52.3	41.9	46.3	48.6	6.3	93
d) Stem	64.3	28.6	57	36.7	52.7	41.4	17.3	80.8
Check	90	0	90	0	90	0	90	0

Table 4- Effect of different concentration of Petroleum ether extracts of different parts of *Millettia pinnata* L. and *Cassia tora* L on mycelial growth and Percentage of inhibition of *Alternaria solani*.

Plant Extracts	1%		2.5%		5%		10%	
	mm	% of inhibition	mm	% of inhibition	mm	% of inhibition	mm	% of inhibition
<i>Millettia pinnata</i> L.								
a) Seed	47.3	47.4	41.3	54.1	26	71.1	4.3	95.2
b) Bark	52	42.2	50	44.4	36	60	4.7	94.8
c) Leaf	70.7	21.4	50	44.4	40	55.6	11.3	87.4
d) Stem	75.3	16.3	52.7	41.4	43.7	51.4	14.7	83.7
<i>Cassia tora</i> L.								
a) Seed	51.7	42.6	45.3	49.7	29.7	67	6	93.3
b) Bark	62.7	30.3	54.3	39.7	40.7	54.8	36	60
c) Leaf	70	22.2	54.3	39.7	46.3	48.6	36.7	59.2
d) Stem	77.3	14.1	59.7	33.7	53.3	40.8	43	52.2
Check	90	0	90	0	90	0	90	0

CONCLUSION

Overall, Extracts of selected plants- *Millettia pinnata* L. and *Cassia tora* L. using different solvents such as acetone, ethanol, petroleum ether and chloroform are significantly the most effective and reduced the mycelial growth of the *Alternaria solani*. Result showed selected plant extract using acetone was most effective against test pathogen. Acetone extract of Karanj seed exhibited maximum inhibition against *Alternaria solani* which was 97%, followed by ethanol extract of Karanj seed which showed inhibition percent of 96.3 at 10 % concentration. Other selected plant extracts in different solvents like chloroform and petroleum ether were also effective to control *Alternaria solani*.

From the present research work, it may be concluded that *Millettia pinnata* L. and *Cassia tora* L. can be utilized for the control of fungal diseases caused by *Alternaria solani*.

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