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Evaluation of Mycotoxic Potential of Some Higher Plants against *Fusarium oxysporum* F. Sp. L. causing Wilt in Linseed (*Linum usitatisimum* L.)

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ABSTRACT

Linseed (*Linum usitatisimum* L.) is one of the major oilseed crops of India. The crop badly suffers by *Fusarium oxysporum* f. sp. *L.* pathogen causing wilting. Fifty plant species belonging to different families were collected and evaluated for their mycotoxic potential against the pathogen in *in vitro* condition. All the 50 plant species showed the different level of toxicity. Among them leaf extract of *Xanthium strumanium* (*Kanghi*) and *Tribulus terrestris* (*Gokhru*) exhibited maximum toxicity and inhibited the mycelial growth of fungus upto 81.18% and 77.66%, respectively. Rest of the plant also showed variable per centage of inhibition from 10.55 to 65.74% as compared to untreated check.

Keywords : Mycotoxic, higher plant, *Fusarium oxysporum*, wilt, linseed

INTRODUCTION

Despite of the use of all available means for plant protection, about one third of the yearly harvest of the world is destroyed by the pests. The discovery of the synthetic pesticides and the subsequent development of different groups of synthetic chemicals have contributed greatly to increase of food production indirectly by controlling pests. However, the use of these chemicals raised the number of ecological and medical problems. Most of the pesticides degraded very slowly by atmospheric and biological factors and this lead to the development of resistant strain among the pest, on one hand, to the contamination of environment and food chain on the other thereby causing serious ecological imbalance. Green plants because of their vast diversities contain wide spectrum of plant defense chemical, most of which make a vital contribution to the list of medicine. The use of plant extract for the control of plant diseases caused by fungi did not received proper attention of pathologist / botanist. Only few possessing microbial activity were tried for the control of plant diseases (Dixit *et al.,* 1983, Dube *et al.,* 1983, Singh *et al.,* 1983, Dixit and Dube, 1992, Pande *et al.* 2002). Most of the fungicides commonly used to minimized losses caused by fungal diseases inter the food chain (Majumdar, 1972), resulting in several harmful effect. Therefore, there is constant need for an extensive search for new, effective and harmless fungicides. Plants provide such source of natural product which exhibit strong anti-microbial properties. In present investigation plants belongs to30 families of Angiosperm were screened for their toxicity against *Fusarium oxysporum* f. sp. *lini* .

MATERIALS AND METHODS

Fifty plant species (Table 1) were collected from the N.D. University of Agriculture and Technology, Kumarganj campus and neighboring areas. Leaves and other parts were serially washed thoroughly with fresh water, sterilized water and then 70% ethanol, chopped and the extracted with sterilized distilled water (1:1 w / v) to obtain a stock solution. Mycotoxicity of the extracts against *Fusarium oxysporum* f. sp. *lini* for the inhibition was determined by “Poisoned food technique” (Grover

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Table 1 : Inhibitory effect of different plant extract against test fungus

Scientific Name	Common Name	Family	Radial growth of mycelium (mm)	Per cent inhibition of mycelial growth
Azadirachta indica A. Juss	Neem	Meliaceae	62.50	30.55
Achyranthes aspera L.	Latjeera	Amavanthaceae	69.50	22.77
Allium cepa L.	Onion	Liliaceae	44.00	51.51
Allium sativum L.	Garlic	Liliaceae	45.00	50.00
Anagallis arvensis L.	Krish Neel	Primulaceae	52.66	41.88
Argemone maxicana L.	Satyanasi	Papaveraceae	35.00	61.11
Bassia latifolia	Mahua	Sapotaceae	73.66	18.15
Brassica campestris L.	Mustard	Cruciferae	73.50	18.33
Cajanus cajan (L.) Millsp.	Pigeonpea	Papilonaceae	66.66	25.93
Calotropis procera (Act) R. Br.	Madar	Asclepiadaceae	80.50	10.55
Cannabis sativa L.	Bhang	Canabinaceae	70.50	21.66
Capsicum annum L.	Chilli	Solanaceae	62.83	30.18
Carica papaya L.	Papaya	Caricaceae	69.66	22.66
Carissa carandus L.	Karonda	Apocynaceae	56.00	37.77
Cassia fistula L.	Amaltas	Caesalpinaceae	75.50	16.11
Cestrum diurnum L.	Day jassamine	Solanaceae	67.00	25.55
Chenopodium album L.	Bathua	Chenopodiaceae	74.83	16.85
Citrus limon	Lemon	Rutaceae	63.16	29.82
Clerodendran inerme L.	Clerodendran	Verbenaceae	70.50	21.66
Curcuma longa L.	Turmeric	Zingiberaceae	55.66	38.15
Cynodon dactylon (L.) Pers	Bermuda grass	Poaceae	74.50	17.22
Cyperus rotundus L.	Motha	Cyperaceae	62.83	30.18
Datura alba Nees.	Datura	Solanaceae	32.16	64.26
Delonix regia	Gulmohar	Leguminoceae	72.16	19.82
Eclipta alba Wassk	Bhagara	Ateraceae	72.83	19.09
Emblica officinalis	Aonla	Euphorbiaeae	64.00	28.88
Eucalyptus citriodora Hook	Safeda	Myrtaceae	39.50	56.11
Euphorbia hirta L.	Dudhi	Euphorbiaceae	41.33	54.07
Ginger officinalis	Ginger	Zingiberaceae	60.83	32.41
Lantana camara L.	Tantani	Verbenaceae	49.00	45.55
Lowsonia inermis L.	Mehndi	Lythraceae	34.66	61.48
Lycopersicon esculentum Mil.	Tomato	Solanaceae	69.50	22.77
Mangifera indica L.	Mango	Anacardiaceae	60.33	32.96
Matricaria chamomila L.	Matricaria	Asteraceae	65.33	24.07
Melilotus indica All.	Senji	Papilionaceae	61.16	32.04
Mentha piperita L.	Peppermint	Labiatae	51.33	42.96
Murraya exotica L.	Kamini	Rutaceae	71.16	20.93
Ocimum basilicum L.	Sweet Basil	Labiatae	62.50	30.55
Ocimum canum Sims	Desi Tulsi	Labiatae	61.00	32.22
Ocimum sanctum L.	Holy Basil	Labiatae	58.66	34.83
Parthenium hysterophorus L.	Congressghas	Asteraceae	30.83	65.74
Polyalthia longifolia (Sonner) Thw.	Ashoka	Annonaceae	30.83	65.74
Pongama pinnata	Karanj	Leguminoceae	63.33	29.63
Raphanus sativus L.	Radish	Cruciferae	74.83	16.85
Syzygium cumunii	Jamun	Myrtaceae	55.66	38.15
Tagetes erecta L.	Marigold	Asteraceae	75.16	16.48
Terminalia arjuna	Arjun tree	Combretaceae	74.16	17.62
Thevetica peruviana L.	Kanare	Apocynaceae	64.66	28.15
Tribulus terrestris L.	Gokhru	Zygophyllaceae	20.16	77.66
Xanthium strumarium L.	Kanghi	Asteraceae	17.83	80.18
Check (untreated)			90.00	-
General Mean			60.13	-
SEm±			0.354	-
LSD at 0.05			1.00	-

and More, 1962). Requisite amount of plant extract were added in the medium using sterile pipette to get 10% concentration of the plant extract in medium prior to pouring in Petri dishes. Circular disc of 5 mm circles were cut from 7 days old culture by cork borer. Such disc carrying fungus was placed at centre of each Petri dishes containing solidified medium with plant extract. The disc was placed reversed and one set of such inoculated Petri plate without plant extract serve as control. All the treated and control Petri dishes were incubated for 10 days at 28 ± 2°C in BOD incubator. After incubation for 10 days the diameter of fungal colony was measured in mm in each treatment. The efficacy of the plant extract was determined against the growth of the pathogen in control plates. Mycotoxicity of the plant species was recorded in terms of per cent inhibition of mycelial growth, calculated by using following formula (Eq. 1)given as under:

$$Percent\ mycelial\ inhibition = \frac{dc - dt}{dc} \times 100 \quad \text{(Eq. 1)}$$

dc= average colony diameter in control

dt= average colony diameter in treatment

All the experiments were replicated twice and each had three replications. The data presented are based on their mean values.

RESULTS AND DISSECTIONS

All the 50 plant species belonging to 30 different families screened against *Fusarium oxysporum* f. sp. *lini* causing wilt in linseed, showed different levels of toxicity. Amongst them leaves of *Xanthium strumanium* (*Kanghi*) (Fig. 1a) and *Tribulus terrestris* (*Gokhru*) (Fig. 1b) exhibited maximum toxicity, preventing the mycelial growth of fungus. Rest of the plant showed either moderate or poor toxicity. Maximum per cent inhibition of mycelial growth was recorded with leaf extract *Xanthium strumanium* (80.18%) followed by *Tribulus terrestris* (77.66), respectively. Rest of the plants also showed variable per centage of inhibition in mycelial growth (10.55 to 65.74%) as compared to untreated check (Table 1). The different parts (leaves, stem

Fig 1a: Inhibition of fungal growth with leaf extracts of *Xanthium strumarium*

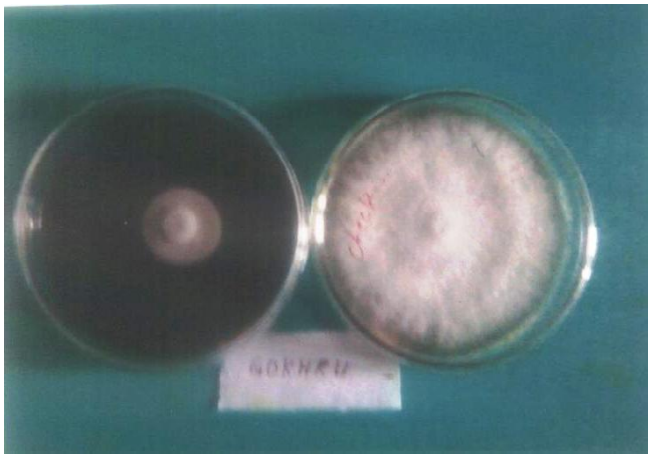

Fig 1b: Inhibition of fungal growth with leaf extracts of *Tribulus terrestris*

Table 2 : Fungitoxicity of different parts of *Tribulus terrestris* and *Xanthium strumarium*

Plant / Plant Parts	Radial growth of mycelium (mm)	Per cent inhibition of mycellial growth
Tribulus terrestris		
Leaf	21.5	76.11
Stem	35.66	60.37
Fruits	54.16	39.82
Xanthium strumarium		
Leaf	17.33	81.11
Stem	20.16	77.6
Fruits	34.66	61.48

and fruits) of the active plants were also tested separately. Out of witch leaf extract was found more effective followed by stem and fruits, respectively (Table 2). Minimum inhibition per cent of 10.55 was noted with leaf extract of *Colotropis procera* (*Mdar*). More than 60% inhibition in growth of test fungus was recorded with *Argimone maxicana*, *Lawsonia inermis* and *Partheninum hysterophones*. Concurrent with present findings Tripathi and Mishra (2000) also reported absolute toxicity of leaf extract of *Xanthium strumanium* against *Fusarium oxysporum* f. sp. *ciceri* causing wilt in chickpea. Chandra (1984) reported family Asteraceae possesses strongly fungitoxic plants. *Xanthium strumanium* in present study also belongs to family Asteraceae and supports the view of Chandra. Effectivity of *Tribulus terrestris* belonging to family Zygophyllaceae is next to *Xanthium strumanium* in inhibiting the mycelial growth of the fungus *Argimone maxicana* (*Satyanasi*), *Lawsonia inermis* (*Mehndi*) and *Parthenium hysterophorus* (Cangress grass) belonging to family Papaveraceae, Lythraceae and Asteraceae, respectively, also inhibit the growth of fungus more than 60% and showed moderate toxicity. These plants were recorded first time for their mycotoxic effect against *Fusarium oxysporum* f. sp. *lini*. Rest of the plants belonging to different families also showed different level of toxicity against the test fungus. The findings of present investigation are in accordance with findings of earlier workers who have reported, fungitoxicity of higher plants varied from family to family, genus to genus and even species to species (Leifertora and Lisa, 1985; Bansal and Gupta, 2000; Singh and Rai, 2000; Singh and Harichand, 2004; Harichnada and Singh, 2005; Mandhare, and Suryawanshi, 2008).

CONCLUSION

Linseed (*Linum usitatisimum* L.) badly suffers by *Fusarium oxysporum* f. sp. *lini.* Fifty plant species were evaluated for their mycotoxic potential against the pathogen in *in vitro* condition. Leaf extract of *Xanthium strumanium* (*Kanghi*) and *Tribulus terrestris* (*Gokhru*) exhibited maximum toxicity and inhibited the mycelial growth.

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