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ANTIFUNGAL ASSAY OF CRUDE EXTRACTS OF SOME COMMON HERBS AGAINST *Fusarium lycopersici* Sacc.

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ABSTRACT

Tomato wilt disease caused by *Fusarium lycopersici* is considered as one of the most important disease of tomato both in field and greenhouse grown worldwide. Chemical fungicides are commonly used for management of plant diseases. Seed treatment with synthetic fungicides considerably reduce wilt incidence in tomato, however their use is costly as well as environmentally undesirable. Plant based pesticides appear to be one of the better alternatives as they have minimal environmental impact and danger to consumer in comparison to synthetic pesticides. This study investigated the antifungal properties of aqueous extracts obtained from different parts of common herbaceous plants. The result showed that the aqueous extract of whole plant of *Oxalis corniculata* belonging to the family Oxalidaceae was found to be highly effective (100 % inhibition of mycelial growth) against the test pathogen *Fusarium lycopersici*. The next maximum mycelial inhibition 81% was recorded in *Amaranthus gracillis* leaf of the family Amaranthaceae.

KEYWORDS: Herbaceous Plants, Antifungal Activity, *Fusarium lycopersici*

Tomato *(Lycopersicon esculentum)* belonging to the family Solanaceae is one of the world's most important vegetable. India ranks second in the area as well as in production of tomato. In India it is being grown in about 7.67 lakh hectares with an annual production of 163.85 lakh metric tons (Horticultural Statistics at a Glance 2017). Yield loss due to wilt disease is 25.14 – 47.94% in Uttar Pradesh has been recorded (Enespa and Dwivedi, 2014). Tomato wilt disease caused by *Fusarium lycopersici* is considered as one of the most important disease of tomato both in field and greenhouse grown worldwide (Abdel Monaim, 2012). *Fusarium* produces three types of asexual spores, microconidia, macroconidia and chlamydospores. Chemical fungicides are commonly used for management of plant diseases. Seed treatment with synthetic fungicides considerably reduce wilt incidence in tomato, however their use is costly as well as environmentally undesirable. Chemical control measures create imbalances in the microbial community, which may be unfavourable to the activities of the beneficial organisms and may also lead to the development of resistant strains of pathogens.

Most of the synthetic compounds used as fungicides have been found to exhibit teratogenecity, mutagenecity, carcinogenecity, phytotoxicity and residual effect (Bajaj and Ghosh, 1975). Most of the fungicides are toxic and directly affect the Central Nervous System (CNS) of mammals including human being. Consumptions of grains treated with organomercurials have resulted in many deaths and permanent neurological disability in human in Pakistan, Iraq and other countries (Haq, 1963). In India the first report of poisoning due to pesticides was reported from Kerala in 1958, where, over 100 people died after consuming wheat flour contaminated with parathion (Karunakaran, 1958). Though many research efforts have been carried out to find alternatives and environmentally safe methods to control plant diseases (Agbenin et al. 2004). The use of plant products for the control of *Fusarium* wilt in crop is limited (Agbenin and Marley 2006). The demand of plant based therapeutics is increasing in developing countries as they are natural products easily available and having no harmful effects.

From the above account it is apparent that there is need to investigate new fungitoxicants, which are easily biodegradable and provide inexhaustible resources (Beye, 1978). The area of Azamgarh, a district of eastern U.P. has a rich flora and knowledge of indigenous medicinal plants is well documented (Srivastava, 1986; Chandra 1984; Khanna *et al.* 1994; Maheshwari *et al.* 1986; Beg *et al.* 2006). Therefore, the present study was designed to explore the *in vitro* potential antifungal activity of some herbaceous plants against the *Fusarium lycopersici* Sacc., the causal organism of wilt of tomato.

MATERIALS AND METHODS

The fresh aerial parts of selected herbaceous plants were collected from various areas of Azamgarh district of Eastern Uttar Pradesh. The plant specimens were identified in the department of Botany Shibli National P.G. College Azamgarh with the help of flora of Duthie (1903-1929).Twenty grams of plant parts were

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taken from each samples and surface sterilized with 70% alcohol and finally with sterilized distilled water. Then they were crushed by pestle and mortar and extracted with 20 ml of sterilized distilled water and filtered aseptically through double layered cheese cloth. The poisoned food technique was used in the screening of aqueous extracts for their antifungal properties evaluation (Grover and Moore, 1962). Five ml aqueous extract of each plant parts were mixed with 10 ml of molten Czapeck's Dox Agar medium in a pre-sterilized petriplates separately and swirled properly. In control set the medium was supplemented with the same amount of sterilized distilled water. A mycelial disc (4 mm diameter) cut from the periphery of 7 days old culture of *Fusarium lycopersici* was aseptically inoculated in the centre of each petriplate. For each treatment and control three replicates were maintained. Finally, the antifungal activity of each extract was calculated in terms of inhibition percentage of mycelia growth by using the following formula (Mohana and Raveesha, 2007).

$$\text{Percent inhibition of mycelial growth} = \frac{C-T}{C} \text{x} 100$$

Where C = Average increase in mycelial growth in control plate,

T = Average increase in mycelial growth in treatment plate

RESULTS AND DISCUSSION

A total of 30 aqueous extracts of 25 different herbaceous plants belonging to 21 families were screened for their antifungal activities against *Fusarium lycopersici* Sacc. Result shows the impact of various treatments on fungal mycelial growth in comparison with non-treated control. A marked variability of the extract was observed. All plants showed more or less inhibitory tendency towards mycelial growth. The aqueous extract of whole plant of *Oxalis corniculata* belonging to the family Oxalidaceae was found to be highly effective (100 % inhibition of mycelial growth) against the test pathogen *Fusarium lycopersici*. The next maximum inhibition 81% was recorded in *Amaranthus gracillis* leaf of the family Amaranthaceae. The leaf of *Amaranthus spinosus*, *Adhatoda vesica* and *Lindenbergia indica* also showed significant mycelial inhibition 76.40, 75.60 and 71.42 percent, respectively. The *Oxalis corniculata* is an important weed having several medicinal uses and evaluated for first time for its antifungal activity against *Fusarium lycopersici*. Different plant parts such as stem, leaves, fruits and whole plant of *Oxalis corniculata* were assayed against the test pathogen which showed strong fungitoxicity (100% mycelial inhibition) except root which showed less fungitoxicity and inhibited only 39% mycelial growth. The mycelium inhibition varies from family to family and species to species. The variation of fungitoxicity from family to family has been observed by Hajek (1961) who reported the legumes (Fabaceae) to be more active than grasses (Gramineae). The antifungal effect of aqueous extract of these plants can be attributed to the presence of different phytochemicals that can act alone or in combination as proven by other studies (Field *et al*., 2006, Giordani *et al*., 2008). We must not overlook the fact that practically all natural antimicrobial compounds are completely biodegradable without leaving any residue and thus limit pesticidal pollution.

Table 1: Screening of different parts of herbaceous plant extracts on mycelial inhibition (%) of *Fusarium lycopersici* Sacc.

Name of the Plants	Family	Part Used	Mycelial inhibition (%)
Acalypha indica Linn.	Euphorbiaceae	Stem	42.00
Acalypha indica Linn.	Euphorbiaceae	Leaf	64.00
Adhatoda Vasica Nees.	Acanthaceae	Leaf	75.60
Adhatoda vasica Nees.	Acanthaceae	Flower	68.00
Ageratum conizoids Linn.	Asteraceae	Leaf	23.07
Amaranthus gracilis Desf.	Amaranthaceae	Leaf	81.00
Amaranthus spinosus Linn.	Amaranthaceae	Leaf	76.40
Andrographis paniculata (Burm.f.) Wall. ex Nees.	Acanthaceae	Leaf	63.69
Boerahaavia diffusa Linn.	Nyctaginaceae	Leaf	62.20
Boerahaavia diffusa Linn.	Nyctaginaceae	Root	28.90
Clitoria ternatia Linn.	Fabaceae	Leaf	39.50
Cannabis sativa Linn.	Canabiaceae	Stem	52.32
Cannabis sativa Linn.	Canabiaceae	Leaf	65.45
Coccinia cardifolia (Linn.) Cong.	Cucurbitaceae	Leaf	20.03

Cocculus hirsuta (Linn.) Diels	Menispermaceae	Leaf	68.40
Convolvulus arvensis (Linn.) Diels.	Convolvulaceaea	Leaf	19.04
Cynodon dactylon (Linn.) Pers.	Poaceae	Whole plant	49.00
Cyperus compressus Linn.	Cyperaceae	Leaf	49.20
Datura metel Linn.	Solanaceae	Fruit	45.76
Euphorbia hirta Linn.	Euphorbiaceae	Leaf	52.00
Ipomoea reptans (Linn.) Poir	Convolvulaceae	Leaf	47.61
Lantena camara Linn.	Verbinaceae	Leaf	31.61
Lindenbergia indica (Linn.) Kuntz.	Scrophulariaceae	Leaf	71.42
Nepeta hindostana (Roth.) Haines.	Lamiaceae	Leaf	43.20
Ocimum sanctum Linn.	Lamiaceae	Leaf	39.20
Oxalis corniculata Linn.	Oxalidaceae	Whole plant	100.00
Phalaris minor Retz.	Poaceae	Leaf	38.20
Rumex dentatus Linn.	Polygonaceae	Leaf	61.61
Sida veronicifolia Linn.	Malvaceae	Leaf	26.40
Vernonia cinerea (Linn.) Less.	Asteraceae	Leaf	42.00

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