ORIGINAL ARTICLE

In vitro antifungal potency of some plant extracts against *Fusarium oxysporum*

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In an approach towards the development of ecofriendly antifungal compounds for controlling plant diseases caused by *Fusarium oxysporum*, different extracts of three weed plants, namely, *Capparis decidua*, *Lantana camara* and *Tridax procumbens*, were tested for their antifungal potential. The spore germination/spore counting technique was followed for the evaluation of the antibiotic properties of the extracts at three different concentrations. Results revealed that the free flavonoids and sterols of *T. procumbens* (flower) and bound flavonoids of *C. decidua* (fruit and stem) totally inhibited spore germination of the fungi (100%). The antifungal components from these plants could be used in developing novel fungicides (biopesticides) for the diseases caused by *F. oxysporum* (plant pathogen).

Key words: *Capparis decidua*, *Fusarium oxysporum*, *Lantana camara*, percentage spore inhibition, *Tridax procumbens*

INTRODUCTION

Fusarium oxysporum also referred to as panama disease or agent green, is a plant pathogenic fungus that causes '*Fusarium* wilt' in more than a hundred species of plants such as tomato, potato, sugarcane, cowpea, *Musa spp*., pea, ginger, etc. It colonizes the xylem of the host plant, and as a result, blockage and breakdown of the xylem leads to wilt disease symptoms such as, leaf wilting, yellowing and eventually the death of the plant.[1] Management of *F. oxysporum* is required, as this pathogen and its many special forms affect a wide variety of hosts of economic value.

The development of resistance to common fungicides and increasing restrictions on the use of toxic material in the environment has given an impetus to the search for novel plant protectants that interfere with the fungal pathogenicity factors. Use of natural products for the control of fungal diseases in plants is considered as an alternative to synthetic fungicides, due to their lower negative impacts on the environment. Besides being harmless and nonphytotoxic, it has been proved that plant extracts exhibit effects on germination and on the viability of fungal spores as well. Several higher plants and their constituents have been successful in plant disease control and have proved to be harmless and nonphytotoxic, unlike chemical fungicides.[2-4] Three weed plants, namely, *Lantana camara* L. (Verbenaceae), *Tridax procumbens* L. (Asteraceae) and *Capparis decidua* Forsk (Edgew) (Capparaceae) were selected in the present study, for evaluation of their antifungal activities. The selected plants were well adapted to harsh (xerophytic) climatic conditions and were well known, among local natives, for their medicinal properties.

MATERIALS AND METHODS

Different parts of *L. camara* (root, stem, leaf and flowers), *T. procumbens* (root, stem, leaf and flowers) and *C. decidua* (root, stem and fruits) were collected from different localities of Jaipur and its nearby areas. The selected plant parts were separately shade dried, finely powdered and subjected to flavonoid and alkaloid extraction, following the method of Subramanian and Nagarajan[5] and Harborne,[6] respectively. The flowers of *T. procumbens* were taken for sterol extraction,[7] while the leaves of *L. camara* were Soxhlet extracted in 80% ethanol for 24 hours, and the ethanolic extract thus obtained was further used for bioassay.

The plant pathogenic microorganism *F. oxysporum* (MTCC 7678) was procured from the Microbial Type Culture Collection (MTCC), in Chandigarh. The fungal culture was grown and maintained on a Potato Dextrose Agar medium. The antifungal activity of plant extracts (2.5 mg/ml, 5 mg/ml and 10 mg/ml) was investigated by using the method of spore counting.[8] Spore suspension was prepared from a 15-day-old culture of the fungus in sterile distilled water, and 100 µl fungal suspension was added to 100 µl plant extracts, of concentration 2.5 mg/ml, 5.0 mg/ml and

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10 mg/ml (prepared in acetone), in glass vials and incubated at 25 ± 2°C for 24 hours. The control vials contained acetone in place of plant extracts. After incubation, the content of the vials was stained with cotton blue and mounted in lactophenol. The spores were observed under a microscope for their germination status. Percentage inhibition was calculated by using the established formula.

$$\% \text{ Spore inhibition} = \frac{A-B}{A} \times 100$$

A: Spore inhibition in control; B: Spore inhibition in treatment

RESULTS

The effect of different extracts of selected plants was observed on spore germination of *F. oxysporum* [Figures 1-3]. A total of 33 extracts were screened for their antifungal properties at three different concentrations (2.5 mg/ml, 5.0 mg/ml and 10 mg/ml). Except for two, all the other plant extracts were found to be significantly active against the selected pathogen, at the three tested concentrations. Twelve extracts showed >80% inhibition in spore germination at 10 mg/ml concentration, while 12 extracts inhibited spore germination >70% at 5 mg/ml concentration, thus showing significant antifungal potential against the test pathogen. Free flavonoids and sterols of *T. procumbens* (flower) and bound flavonoids of *C. decidua* (fruit and stem) totally inhibited spore germination of the fungi (100%) at the concentration of 10 mg/ml, while >95% inhibition and >85% inhibition was reported at 5 mg/ml and 2.5 mg/ml concentrations, respectively. Free flavonoids of *L. camara* (flower), *C. decidua* (fruit), *T. procumbens* (stem, leaf), bound flavonoids of *T. procumbens* (leaf, flower) and alkaloids of *T. procumbens* (flower) were found with excellent inhibitory potential against the test pathogen. Observations revealed that the free flavonoids of selected plants were more effective than the bound flavonoids and alkaloids of the plants.

DISCUSSION

In the present investigation the results are quite encouraging, as all the extracts, except two, are found to be active against test plant pathogens and most of the extracts totally inhibited spore germination. For pathogenic fungi, spore germination is a determining factor at the onset of host colonization, and many of the tested extracts have a definite potential, which can be used as a new effective fungicide.

Extracts of *T. procumbens* were found to have enormous antifungal potential and the plant was observed to be the most potent in the present study followed by *C. decidua* and *L. camara.* The selected plants were well known for their antimicrobial properties, but most of the study was carried out with human pathogens.[9-14]

Application of chemical fungicides was a conventional method to control diseases caused by fungal pathogens, but tremendous health hazards have been reported from time to time during the application of chemical fungicides, in the field conditions.[15] The present investigation has

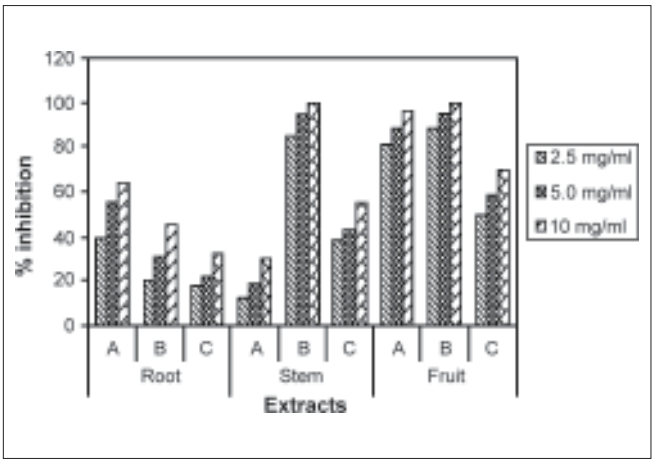

Figure 2: Antifungal activity of *C. decidua*

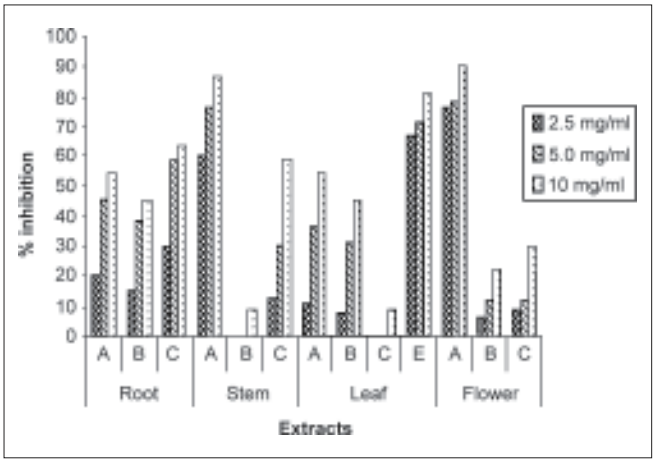

Figure 1: Antifungal activity of *L. camara*

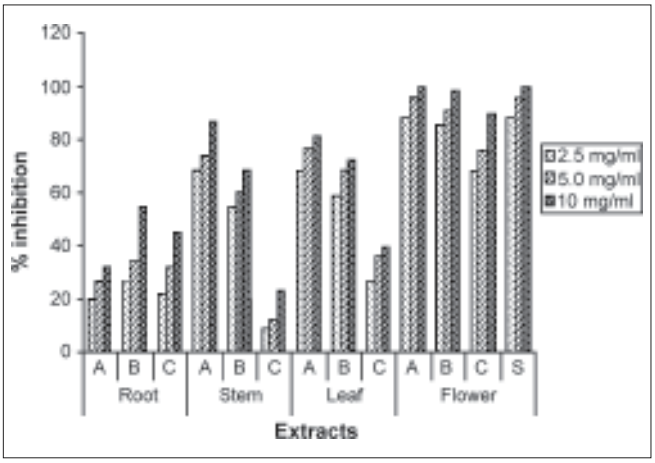

Figure 3: Antifungal activity of *T. procumbens*

been carried out to explore the hidden antifungal potential of weed plants. Many of the tested plant extracts showed an excellent antifungal efficacy, which may be used for formulating new, safer and ecofriendly fungicides.

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