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RESEARCH ARTICLE

SCREENING OF ISOLATED FUNGAL STRAINS AGAINST SOME WEEDS AS HERBICIDE: A PRELIMINARY EVALUATION

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ABSTRACT

The screening for evaluating herbicidal potential of CFCF (Cell Free Culture Filtrate) of some isolated fungal strains against some problematic weeds of Madhya Pradesh viz. *Parthenium hysterophorus, Lantana camara, Xanthium strumarum, Cassia tora, Hyptis suveolens,* and *Sida actua* was done by employing shoot cut bioassay and seedling bioassay. CFCF obtained from 21 days old fermented broth was used. Results indicated that CFCF (Cell Free Culture Filtrate) from *Fusarium oxysporum* FGCCW#43, *Fusarium moniliforme* FGCCW#16 and *Fusarium roseum* #55 showed excellent results against these weeds, whereas CFCF from *Phoma herbarum* FGCCW#54 showed strong mortality against *Parthenium hysterophorus*. The results from this study revealed potential fungal species that could be used as a novel, lucrative source of natural herbicides in the future.

INTRODUCTION

Weeds are one the most serious causes of economic losses in agricultural production. The exploitation of synthetic herbicides for weed control has been increasing. However their heavy application in crop fields has resulted in environmental and medical problems. Exploitation of secondary metabolites or biorationals of both pathogenic and non-pathogenic fungi in weed management have attracted the attention of scientists in recent years. Several comprehensive reviews have been published on biological, technological and economical feasibility of microbial products as herbicides Pandey *et al.* (2002). (Pandey *et al.*, 2000 Pandey AK, Farkya and Rajak (1992). Saxena and Pandey, 2001; Thapar *et al*., 2002; Vikrant *et al*., 2006). Natural herbicides, which are eco-friendly, biodegradable and less toxic from microorganisms are the best candidates in this category. Fungi are well recognized for their ability to produce diverse biologically active metabolites including herbicides (Pandey, 1999). Therefore, screening for fungal products with herbicidal activity has been one of the most interesting features in weed management research. Some fungal metabolites are toxic to certain weeds e.g., Maculosin produced by *Alternaria alternata*, is host specific to spotted knapweed (Bharti and Rao, 1985).

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Some are toxic to both monocotyledonous and dicotyledous weeds e.g. Cornexistin from *Paceilomyces variotti*. Pearce, J.A., and Robinson (1997). Barua *et al.* (2002). These compounds have been used as candidate in developing eco-friendly herbicides. In this study, the cell free culture filtrates from nine different genera of fungi collected from different places of Madhya Pradesh, India at the time of survey were tested for their phytotoxicity against some problematic, obnoxious weeds of Madhya Pradesh. These weeds are commonly found in many agricultural fields in India. Purvis *et al.* (1964) The activities of the CFCF on selected weeds were measured under control laboratory conditions. The main objective of this paper is to highlight potential broad spectrum fungal species, which could have promising future for their use in weed control.

MATERIALS AND METHODS

Fungi investigated

Seven different genera of nine fungal species, *Alternaria alternata* FGCCW#32; *Colletotrichum dematium* FGCCW# 09; *Curvularia lunata* FGCCW#25; *Fusarium moniliforme* FGCCW#16; *Fusarium oxysporum* FGCCW# 43; *Fusarium roseum* FGCCW# 55; *Phoma herbarum* FGCCW#54; *Myrothecium roridum* FGCCW# 03; and *Sclerotium rolfsii* FGCCW# 08 were obtained from different places during survey and stored in MRL (Mycological Reserach Laboratory), Department of Biological Sciences, R. D. University, Jabalpur.

The cultures were maintained by sub culturing on PDA slants at 28^0C in tightly capped culture tubes.

Cell free Culture Filtrate (CFCF) production

Modified Richards broth was used as basal medium for culturing the fungi. 250 ml Erlenmeyer's flasks containing 100ml broth media were seeded with 5 mm disc of inoculum separated from 7 days old cultures grown on PDA medium. Inoculated flasks were incubated at 28±1°C in a BOD incubator (Remi, India) and the cell free culture filtrate (CFCF) was extracted after 21 days respectively Pandey *et al*. (2003) Pandey *et al*. (2002) Pandey *et al*. 2000.

Extraction procedure

At the end of incubation period, the metabolized broth was passed through a pre-weighed Whatmann filter paper no.1 under aseptic conditions and was centrifuged at 400xg for 15-20 min. The pellet was thrown and the supernatant was again filtered *in vacuo* by microfiltration using sterile microfilters, 0.45 µm pore size, Minisart (Sartorius, Gottingen, Germany) making it cell free (Walker and Templeton, 1978). Thus Cell Free Culture Filtrate was obtained.

Bioassay procedure

In order to determine the herbicidal potential, shoot cut bioassay and seedling bioassay were employed as per Pandey *et al*. (1990) The toxicity was intitally recognized by the appearance of rapid curling, acute necrosis, complete wilting, collapse of leaves, blackening of stem finally leading to death of shoots within 24 hrs (Brosten and Sand (1986).

RESULTS AND DISCUSSION

Data recorded in Table I and II showed that among the filtrates from nine fungal species, *Fusarium oxysporum* FGCCW#43 showed the strongest herbicidal potential (100%) on all selected weeds while *Fusarium moniliforme* FGCCW#16 and *Fusarium roseum* FGCCW#55 were the second and third most effective (about 98% and (60%) inhibition on all selected weeds respectively in shootcut and seedling bioassays. The other fungal culture filtratates having different degrees of mortalilty on all weeds as compared to the control were *Alternaria alternata* FGCCW#32; *Colletotrichum dematium* FGCCW# 09; *Curvularia lunata* FGCCW#25; *Phoma herbarum* FGCCW#54; *Myrothecium roridum* FGCCW# 03; *Sclerotium rolfsii* FGCCW# 08. The CFCF obtained from fermented broth of *Phoma* sp FGCCW #54 had varied degree of toxicity against *Parthenium* but showed weak herbicidal efficacy against other weeds. Metabolites required for fungal growth are normally synthesized during initial phase whereas most of the toxicants are formed during idiophase i.e. stationary phase of the fungus. Phytotoxins often act as the initiator factor for successful pathogenesis.

Several phytotoxins are known to be the determinant factor in pathogenesis. Most of the phytotoxic metabolites acts by modifying the metabolism of the host plants, while some are toxic to the plant tissues once accumulated and poison the plant tissues (Amusa, 2006). Variation in phytotoxicity due to toxin has also been recorded by other workers (Hoagland, 1990; Abbas *et al*., 1992; Saxena and Pandey 2001; Saxena *et al*., 2000, 2001; Joseph *et al*., 2002; Vikrant *et al*., 2006). The above findings clearly indicate that among nine strains screened, CFCF of *Fusarium* spp. have significant broad spectrum herbicidal potential against *Parthenium hysterophorus, Lantana camara, Xanthium strumarium, Cassia tora, Hyptis suaveolens,* and *Sida acuta* weeds. Based on the result of this study, it can be concluded that the secondary metabolites produced by *Fusarium* spp have significant herbicidal potency and impart remarkable weed mortality. Further evaluation of these strains is needed before its large-scale application.

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