ASSESSMENT OF SELECTED ORGANOTIN COMPLEXES AGAINST PLANT PATHOGEN FUNGI

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ABSTRACT

Organotin complexes were screened extensively in vitro against a number of plant pathogens, which are responsible for various diseases in plants. Antifungal activity was determined in 2007 by Hanging drop method (in C. glocosporiodes, A. brassicicola and C. capsic) and found to be very much active in this respect. The order of increasing activities is schiff base<Et_3SnL<Bz_3SnL<Ph_3SnL. The results provided evidence that the studied complexes have a potential to be used as drugs and these would further enable us to evaluate their utility in agriculture. The present results will add new information to synthesize antifungal drugs as the synthesized compounds showed promising antifungal activity.

Key Words: ***Organotin (IV) schiff base, Antifungal activity***

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INTRODUCTION

The harvest losses due to fungal disease in crops may amount to 12% or even higher in developing countries. The increasing social and economic implications caused by fungi necessitate a constant striving to produce safer food crops and to develop new antifungal agents (Hadizadeh, *et al.* 2009). Recently considerable attention has been paid to triorganotin derivatives, owning to their high *in vitro* antifungal activities against some medically important fungi (Sander, *et al.* 2004). The present study was designed to investigate the status of fungi associated with plants (Shahzadi, *et al.* 2005). Organotins with three organic groups can be powerful fungicides (Rehman, *et al.* 2004). Mehmood, *et al.* (2003) and Ahamadi, *et al.* (2005) have studied organotin(IV) compounds and its effect as antifungal activities. Fungal infections have become more prevalent during the past two decades and *in vivo* studies of organotin compounds are in progress (Ebdon, *et al*. 1998). According to literature, the emerging resistance of microorganisms to some synthetic antibiotics makes it necessary to continue the search for new antimicrobial substances (Jamil, *et al*. 2009).

Fungal diseases pose a greater threat; hence the need to find cheap and effective antifungal agents is necessary. Diseases caused by fungi are common and carry significant treatment costs and mortality (Yamada, *et al.* 1993). The uses of natural and synthetic compounds are important in the control of plant diseases (Cho, *et al*. 2006). Compounds like $C_{17}H_{16}N_2O_3$ (1), $C_{29}H_{44}N_2O_3Sn_2$ (2), $C_{53}H_{44}N_20_3Sn_2$ (3) and $C_{56}H_{54}N_20_3Sn_2$ (4) with the general formulae R_3SnL {L: Schiff base (1) and R: Ethyl, Phenyl and Benzyl} were used in the present study to screen for antifungal activity against *Colletotrichum gloeosporioides, Colletotrichum capsici and Alternaria brassicicola*. These fungi are the most economically important plant pathogens and continue to be the focus of extensive research with a wide variety of methodologies. C. gloeosporioides causes anthracnose disease in fruit crops (Dodd *et al.* 1991), *C. capsici* causes blight leaf disease (Nair and Ramakrishnan, 1973) and *A. brassicicola* causes black spot disease which finally causes death (Muto *et al*. 2005) in virtually every important cultivated brassica species including broccoli, cabbage, canola, and mustard respectively (Jevons, 1961). In the last decades, considerable success has been attained in the use of organotin compounds to control economically important plant diseases (Echevarria, *et al*. 1999). Fungi have become resistant to many commonly used antibiotics (Irgens, 2002). It has long been recognized that more effective durable forms of disease control might be devised if we had a better knowledge of both the dynamics of the pathogen populations and the factors that determine host resistance or susceptibility (Adejumo, 2005).

Keeping in view the damages caused by fungi in crop plants the present study was designed to investigate the status of fungi associated with plants (Shahzadi *et al.* 2005).

MATERIALS AND METHODS

All glasswares were sterilized by thoroughly washing and drying at 105°C (Singh, *et al.* 2000). All chemicals used in the study were obtained from Fluka chemicals and Aldrich chemicals. This experiment was conducted at COMSAT Institute (CIIT), Abbotabad-Pakistan in 2007. Hanging drop method as developed by Singh, *et al.* (2000) has been used for the antifungal activity of Schiff base ligand and complexes. Test synthetic compounds were a) $C_{17}H_{16}N_2O_3$, b) $C_{29}H_{44}N_2O_3Sn_2$, c) $C_{53}H_{44}N_20_3Sn_2$ and d) $C_{56}H_{54}N_20_3Sn_2$ with the general formulae R_3SnL {L: Schiff base, R: Ethyl, Phenyl and Benzyl respectively. In the text, these compounds are written as (1) (2) (3) (4). The concentration (250ppm) of the test compounds were used to study the effect on germination of fungi. Spores germination was observed under microscope after 8 hours of incubation at 30°C for incubation period of 5-8 days. The percent inhibition of spore germination was calculated as follows,

$$\text{Percent inhibition of spore germination} = \frac{\text{Total number of ungerminated spore x 100}}{\text{Total number of spore}}$$

RESULTS AND DISCUSSION

The present communication describes the antifungal activity of schiff bases (1) and their organotin derivatives (2) (3) (4). The antifungal effect of the tested compounds against *C. glocosporiodes*, *A. brassicicola and C. capsici* were close to the standard drug (Ketoconazole). The results are presented in Table I

Table I ***Fungi toxicity of compounds (250ppm inhibition dose)***

	Compounds				Ketoconazole
Pathogen	**(1)**	**(2)**	**(3)**	**(4)**	
C. glocosporiodes	+	+	+++	+	+++++
A. brassicicola	+	+	+++	+	+++++
C. capsici	+	+	+++	+	+++++

+ = low, ++ = significant, +++ = good, +++++ = excellent.
(1) $C_{17}H_{16}N_2O_3$, (2) $C_{29}H_{44}N_2O_3Sn_2$, (3) $C_{53}H_{44}N_20_3Sn_2$ and (4) $C_{56}H_{54}N_20_3Sn_2$

The screening results show that all the compounds exhibited antifungal activities. This activity was found to be quite significant, Compound (1), Compound (2) and Compound (4) were found to be less effective against all the species of tested fungi and there was low inhibition of spore germination at 250 ppm. Compound (3) exhibited good inhibition of *C. glocosporiodes A. brassicicola and C. capsici* at 250 ppm. The antifungal activities of organotin compounds are in the following order (1)<(2)<(4)<(3). The assessment of the fungal toxicity of the synthesized compounds is based on %age inhibition. Biological screening data of all the organotin compounds depict low to moderate activity against the fungi used with better physical properties. Further, it has been concluded that the organotin compounds are more active than the free ligands, which indicate that metallation increases antifungal activity which is in accordance with earlier reports (Masood, *et al.* 2002). The mode of biological action of organotin(IV) complexes, or even the parent organotin (IV) compounds has not yet been completely clarified and may vary from one compound to another (Zahid, *et al.* 2006). Finally, more and more experiments are needed to be conducted in order to understand the biological (including antifungal) activity of organotin (IV) complexes (Lorenzo, *et al.* 2002). However, it can be noted that compounds with phenyl groups showed the greatest inhibitory effect against one or more types of fungi as compared to alkyl groups (Raman *et al.* 2001). According to Horsfall the hydrogen of phenolic group is so reactive that it enables the toxicants to combine with constituents of the living tissues, thus the toxicity of the schiff base is due alcoholic group and the presence of phenyl groups in compounds (3) (4) bonded with tin atom is responsible for the rise of toxicity (Jamil, *et al.* 2009). The novel synthesized compounds are cost effective and are easy to synthesize and their antifungal activities have never been reported previously (Alam, *et al.* 1981). It is likely that the new complexes (2) (3) (4) might be more environments friendly. The antifungal activity of compounds has even more potency with respect to the inhibition of microbes. The antimicrobial properties of volatile aromatic

oils from medicinal as well as other edible plants have been recognized since antiquity (Manohar *et al.* 2001). In modern agriculture microbes, schiff base and its copper(II), zinc(II), cobalt(II) and nickel(II) complexes have been used extensively to control different plant pathogenic fungi (Srivastava and Shalini 2008). Like wise in the present study compounds (1) (2) (3) (4) show similar antifungal activities and the results provided evidence that the studied complexes might indeed be potential sources of antimicrobial agents (Zhonget, *et al.* 1994).

CONCLUSION

The present study evaluated the synthesized compounds like a): $C_{17}H_{16}N_2O_3$, b): $C_{29}H_{44}N_2O_3Sn_2$, c): $C_{53}H_{44}N_20_3Sn_2$ and d): $C_{56}H_{54}N_20_3Sn_2$ for their antifungal activities and the results provided evidence that the studied complexes might indeed be potential sources of antifungal agents.

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