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Short Communication

Efficacy of Copxykil Against Some Pathogenic and Non-Pathogenic Microorganisms

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Abstract. Efficacy of copxykil – with copper oxychloride as active ingredient – as fungicide and bactericide was evaluated against *Alternaria alternata, Fusarium oxysporum, F. solani, Aspergillus flavus, A. fumigatus, A. niger* and *Pencillium expansum* as well as against *Escherichia coli, Shigella dysentriae* and compared with a standard imported commercial product 'COBOX'. The test fungicide proved to be more effective than the commercial one.

Keywords: copxykil, fungicidal effect, bactericidal effect, copper oxychloride

Copper oxychloride is a fungicide and has been effective in controlling a number of plant diseases such as early and late blight caused by *Alternaria solani and Phytophthora infestants*, respectively, potato diseases in different parts of India (Paharia, 1961a, b; Chowdhury, 1954; Chattopadhya, 1953), fusarium root rot caused by *Fusarium solani* (Crop Profile for Dry Beans in Kansas, 2003), altenaria brown spot due to *Alternaria alternata* on citrus fruits etc. (Rangaswami and Madhawan, 2005). Swart *et al*. (2008) stated that higher percentage of export quality fruits was obtained by the use of copper oxychloride as compared to that of other fungicides, specially Mancozeb.

Copper products showed longer residual activity and higher rain fastness than did the brands Mancozeb, Difenoconazole, Iprodione, Famoxadone and Pyraclostrobin. Cuprous oxide and copper oxychloride provided satisfactory control of fruit diseases through 28 days and withstood 71 mm of rain fall in the orchard. Thus these chemicals saved the numbers of sprays by approx. half per season for fruit protection (Vincent *et al*., 2007).

In Pakistan about 25-30% of the crop yield is damaged due to diseases. Keeping in view the agricultural importance of copper oxychloride as a fungicide and its extensive use for protecting plants from fungal diseases, this fungicide was synthesized in the laboratory as wettable powder following a new economical method and the product was registered as 'Copxykil'. In the present communication, preparation and efficacy of this fungicide has been discussed as compared to that of the imported fungicide, 'Cobox' and against some pathogenic and non-pathogenic fungi as well as some water borne pathogenic bacteria *viz. Escherichia coli* and *Shigella dysentriae* (Todar, 2008).

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Copper oxychloride was prepared employing a modified method by the action of air on scrap copper in hydrochloric acid and sodium chloride salt solution (Qaimkhani *et al*., 2008). The product has copper content of 56-58% and apparent density of 420-520 g/litre. It is a bluish green powder, insoluble in water, but soluble in ammonium hydroxide solution. Its composition varies according to the conditions of manufacture but generally approaches the formula $CuCl_2.3Cu(OH)_2$. The product is in the form of wettable powder having approx. 80% active ingredients and 20% inert material. Its fungicidal efficacy has been tested versus that of the commercial fungicide Cobox BASF (Brasileria S.A. Industries Quimicas, Sao Paulo-Brasil) which is a wettable powder having approx. 84% copper oxychloride as active ingredient and 16% inert material.

As copper oxychloride is insoluble in water, therefore, its emulsification was made using the emulsifier polyethylene glycol which has no fungicidal activity of its own (Leven *et al*., 1979). A series of different concentrations of both fungicides were made as 0.1%, 0.5%, 1%, 5% and 10% with the above emulsifier.

Eight fungi were taken as test organism; four of them were plant pathogens *viz.*, *Alternia alternata, Fusarium solani, F. oxysporum and Helminthosporium sp*. and four were saprophytes viz. *Aspergillus niger*, *A. flavus*, *A. fumigatus* and *Pencillium expansum*. These fungi were isolated from infected fruits. The fungi were grown and maintained on Czapek's Dox agar and the bacteria were cultivated on nutrient agar.

Bactericidial activity of Copxykil was also tested against water borne human pathogenic bacteria *viz*., *Escherecia coli* and *Shigella dysentriae*. Results are tabulated in Table 1.

Table 1. Fungicidal effect of Copxykil on plant pathogenic and non-pathogenic fungi and pathogenic bacteria at different concentrations

Microbial species	Test fungicide (Copxykil) Concentration					Standard fungicide (Cobox) Concentration				
	0.1 %	0.5%	1%	5%	10%	0.1%	0.5%	1%	5%	10%
	Zone of inhibition (dia. in cm)					Zone of inhibition (dia. in cm.)				
Pathogenic fungi										
Alternaria alternata	–	1.0	1.5	2.7	3.0	–	–	1.3	2.2	2.7
Fusarium oxysporum	1.0	1.5	1.8	2.5	3.2	–	1.1	1.5	2.3	2.8
F. solani	–	1.5	2.0	2.5	3	–	–	1.5	2.0	2.5
Helminthosporium sp.	–	1.0	2.5	2.8	3.5	–	1.0	1.5	2.2	2.9
Non-pathogenic fungi										
Aspergillus flavus	–	–	1.0	1.1	1.3	–	–	–	1.1	1.2
A. fumigatus	–	–	1.0	1.1	1.3	–	–	–	1.1	1.3
A. niger	–	1.5	2.0	2.5	3.0	–	1.5	2.0	2.4	2.8
Penicillium expansum	–	–	1.1	1.5	1.7	–	–	1.0	1.5	1.7
Pathogenic bacteria										
E. coli	--	1	1.5	2.5	3	1	1.5	2.5	3	3.5
Shigella dysentriae	--	1	1.6	2	2.5	1	1.5	2	2.8	3

For testing fungicidal activities diffusion plate method (Reddish, 1950) was used for the product as well as the standard commercial fungicide 'Cobox' whereas agar diffusion method was used for testing antimicrobial activity. All these experiments were performed in duplicate. The culture plates were examined for zone of inhibition for a period of 2 weeks. Same technique was used for the control.

The zones of inhibition of microorganisms (Table 1) indicate that the efficacy of the formulation 'Copxykil' as fungicide is equivalent to that of the standard one i.e. 'Cobox'. The lowest inhibition concentration of 'Copxykil' was generally 0.5%, whereas that of 'Cobox' was 1.0%.

Comparatively, pathogenic fungi displayed more sensitivity to the formulated fungicide than the non-pathogenic fungi. Maximum activity was shown by *Helminthosporium* sp. This confirms the findings of Gupta *et al.* (1980) relating to *H. oryzae*. Also *A. alternata* showed results approximately close to *Helminthosporium* sp. The next pathogenic fungal species which showed sensitivity to this fungicide were *F. oxysporum* and *F. solani*. Upadhyay and Roy (1987) reported earlier that *F. moniliform* was checked completely by 10 ppm concentration of six fungicides, including copper oxychloride.

Least inhibition was exhibited by *A. flavus* and *A. fumigatus*. This reaction could be due to the presence of toxin in the fungus clashing with the fungicidal power of copper oxychloride. Other saprophytic fungi showed high sensitivity to this fungicide. *Penicillium expansum* showed less activity than *A. niger*.

Bactericidal efficacy of 'Copxykil' was found to be comparable with that of 'Cobox' against the bacteria, *E. coli* and *S. dysenteriae*.

From these studies, it is clear that Copxykil can be used as a fungicide as well as a bactericide at the pre- and post- harvest stages for protection of plants against fungal and bacterial pathogens.

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