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USE OF CULTURAL FILTRATES OF CERTAIN MICROBIAL ISOLATES FOR POWDERY MILDEW CONTROL IN SQUASH

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Abstract: Powdery mildew induces significant losses in yield and quality of squash. Therefore, culture filtrates of certain microbial isolates, (*Epicoccum nigrum, Epicoccum minitans, Epicoccum* sp., *Trichoderma harzianum, Trichoderma viride* and *Bacillus pumilus*) were used alone, and in combination with the fungicide penconazole to control powdery mildew in squash, under field conditions. Moreover, GC-MS analysis was carried out to identify the chemical components of the most effective culture filtrates against powdery mildew pathogen. The results showed that culture filtrates of different microbial isolates (except for *Trichoderma harzianum*) were more effective against powdery mildew in squash than the tested fungicide alone at the recommended levels, in both tested seasons. The results also showed that mixing different culture filtrates with penconazole improved efficiency against powdery mildew compared to using the fungicide alone, in both tested seasons. The efficacy of the culture filtrates of the tested microbial isolates against powdery mildew were due to the presence of a mixture of known antifungal compounds. The results suggest the possible use of the culture filtrates of the tested microbial isolates as alternative to fungicides, in powdery mildew control. Also, this study suggests the possible mixing of the culture filtrate of the tested biocontrol agents with fungicides to minimize the applied amount of fungicides.

Key words: powdery mildew, bio-control agents, fungicide, disease

INTRODUCTION

Cucurbits play a significant role in human nutrition. Cucurbit crops constitute a major portion of all vegetables and are grown in different regions in Egypt. Squash is a promising export crop which can be readily produced at a low cost during the winter season of Egypt.

Cucurbit powdery mildew, caused by to *Podosphaera* (sect. *Sphaerotheca*) xanthii (Castag.) Pollacci, is a serious disease on cucurbits grown worldwide. Powdery mildew occurs on leaves, stems and fruits. Major epidemics reduce crop yields by causing decreased fruit set, inadequate ripening, fruit cracking and deformation as well as reducing post-harvest storage time.

Control methods currently available under commercial conditions include the use of repeated applications of elemental sulphur (Kimati *et al*. 1980) and other fungicides. The constant use of fungicides, however, can result in environmental contamination and selection of resistant populations of *P. (sect. Sphaerotheca*) *xanthii* (Castag.) (McGrath 1996; McGrath *et al*. 1996). Beneficial microorganisms and insects are also negatively affected by some fungicides used against powdery mildew of cucurbits. Fungicides that contain high doses of sulphur are particularly harmful to beneficial microorganisms and insects (Calvert and Huffaker 1974).

These factors emphasize the need for new methods to control the diseases (Wilson *et al*. 1987) *i.e.* the usage of natural products or biocontrol agents (BCAs), culture filtrates of biocontrol agents, salts, plant extracts, and mineral oils alone or in combination (Horst *et al*. 1992; Falk *et al*. 1995; Belanger and Benyagoub 1997; Daayf *et al*. 1997; El-Kot and Hegazi 2008; Hegazi and El-Kot 2008; Pertot *et al*. 2007).

Also, the reduction of application rates is one of the dominant trends in the horticultural industry. This can be achieved in different ways, by the introduction of new chemicals that are applied at much lower rates, or by the purification of the chemicals, or by the combination of the formulation with an adjuvant or with plant extracts or culture filtrates of biocontrol agents. The adjuvants, plant extracts and culture filtrates of biocontrol agents can be incorporated into the formulation or added to the tank as a tank-mix product. The use of adjuvants, culture filtrates of biocontrol agents and plant extracts have gained more and more acceptance. This is mainly because the cost of the development of new active ingredients is still much higher than the cost of the development of new adjuvants. Bentonit is one of the adjuvants which has been used in combination with fungicides against plant pathogenic fungi. It has been used either alone, or in combination with the fungicides, Fundazol and Bayleton, against *Thielaviopsis basicola* (Berk. and Br.) (Bade 1995). Also El-Naggar (1996) used bentonit either alone, or in combina-

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