Influence of *Pythium oligandrum* on Population of *Fusarium oxysporum* f.sp. *dianthi* and Development of Fusarium Wilt of Carnation

L. B. ORLIKOWSKI[*] *and A. JAWORSKA-MAROSZ*

Research Institute of Pomology & Floriculture, 96-100 Skierniewice, Poland

[*]*Tel.: +48 468 332 041, Fax: +48 468 332 088, E-mail: lorlikow@insad.pl*

Abstract

Relationship between initial oospore number of *Pythium oligandrum*, mode of the mycoparasite application and population dynamics of *Fusarium oxysporum* f.sp. *dianthi* and development of *Fusarium* wilt of carnation was studied. Mixing of oospores with peat 10 days before carnation planting resulted in strong inhibition of the pathogen development. Number of colony forming units of the pathogen decreased at least 3 times. Application of *P. oligandrum* resulted in suppression of *Fusarium* wilt development, especially when the mycoparasite was applied at dose 100 oospore/g of peat.

Keywords: carnation; *Fusarium*; *Pythium oligandrum*; oospores; inhibition; population; healthiness

INTRODUCTION

Fusarium wilt caused by *Fusarium oxysporum* Schlecht. f.sp. *dianthi* (Prill. et Del.) Sny. et Hans. is the most dangerous disease of carnation (*Dianthus caryophyllus* L.) worldwide. Diversity of microbial antagonist, including saprophytic forms of *Fusarium*, some species of *Aspergillus* and *Trichoderma* have been reported to reduce *Fusarium* wilt severity when applied to substratum (GARIBALDI *et al*. 1986; TRAMIER *et al*. 1983). Application of chitosan as substratum drench induced biological control of *Fusarium* wilt (ORLIKOWSKI *et al*. 1997). In 1943 *Pythium oligandrum* was isolated from soil by DRECHSLER (1943). Further studies showed that many of fungi were highly vulnerable to an attack by *P. oligandrum*. At least 2 mechanisms are involved in the process of fungal attack by *P. oligandrum*: mycoparasitism, mediated by intimate hyphal interactions and antibiosis, with alteration of the host hyphae prior to contact with antagonist (BENHAMOU *et al*. 1999). A low-molecular weight protein, termed oligandrin, was described by PICARD *et al*. (2000).The product, applied to decapitated tomato, displayed the ability to induce plant defence reaction that contributed to restrict stem cells invasions by *Phytophthora parasitica*.

The present studies provide a description of the impact of biological control of *Fusarium* wilt of carnation by application of *P. oligandrum*.

MATERIALS AND METHODS

Pythium oligandrum Drechsler. Polyversum, containing 10^6 oospores/g, supplied by Biopreparaty, was used. The product was applied at doses of 0 (control), 50 and 100 oospores/g of peat. Oospores were mixed with substratum 10 days before carnation planting.

Fusarium oxysporum f.sp. *dianthi*. The isolate Gz 274 obtained from invaded vessel of carnation was used. The culture was maintained on potato-dextrose-agar (PDA) at 24°C in the dark. For peat infestation the culture was grown on Quick rolled oats and mixed with peat (pH 5.6).

Estimation of population densities of *Fusarium oxysporum* f.sp. *dianthi* (*Fod*). *Fusarium* selective medium (KOMADA 1975) was used for estimation of colony forming units (cfu) number of *Fod*.

Biological activity of *P. oligandrum* in the control of *Fusarium* wilt of carnation. Plants cv. Master grown in peat artificially infested with *Fod* were cultivated in plastic tunnel. *P. oligandrum* oospores were mixed with substratum 10 days before carnation planting.

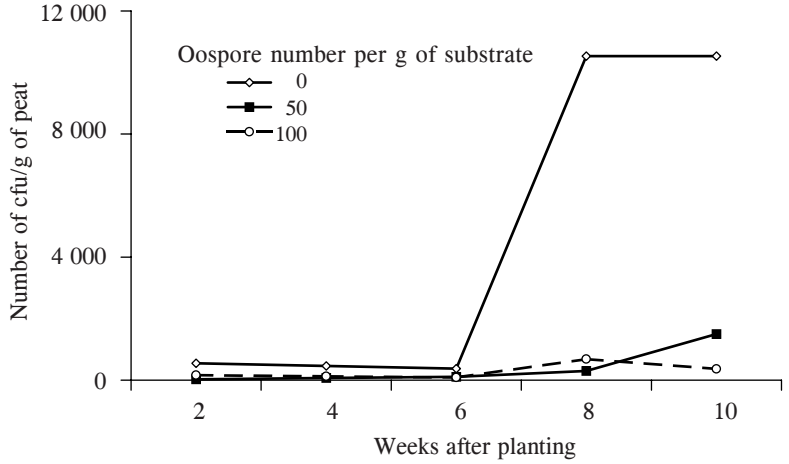

Figure 1. Relationship between oospore number of *Pythium oligandrum* mixed with substratum 10 days before planting, growing period and population dynamic of *Fusarium oxysporum* f.sp. *dianthi*; number of colony forming units (cfu) per g of air dry peat

Number of wilted plants as well as growth of carnation were observed weekly.

Experimental design was completely randomised with 4 replications and 10 plants in each rep. Trials were repeated 3 times.

RESULTS AND DISCUSSION

Estimation of population dynamics of *Fusarium oxysporum* f.sp. *dianthi* in peat. During the first 6 weeks of carnation growth, population density of *Fod* was very low. The number of cfu increased sharply in infested, nontreated peat after 8 week-growth and high population density was noticed within 10-week-cultivation of carnation (Figure 1). After 15 weeks, however, number of cfu decreased at least twice. Mixing of *Pythium oligandrum* oospores with peat 10 days before carnation planting resulted in strong suppression of *Fod* development, especially when 100 oospores/g were applied (Figure 1).

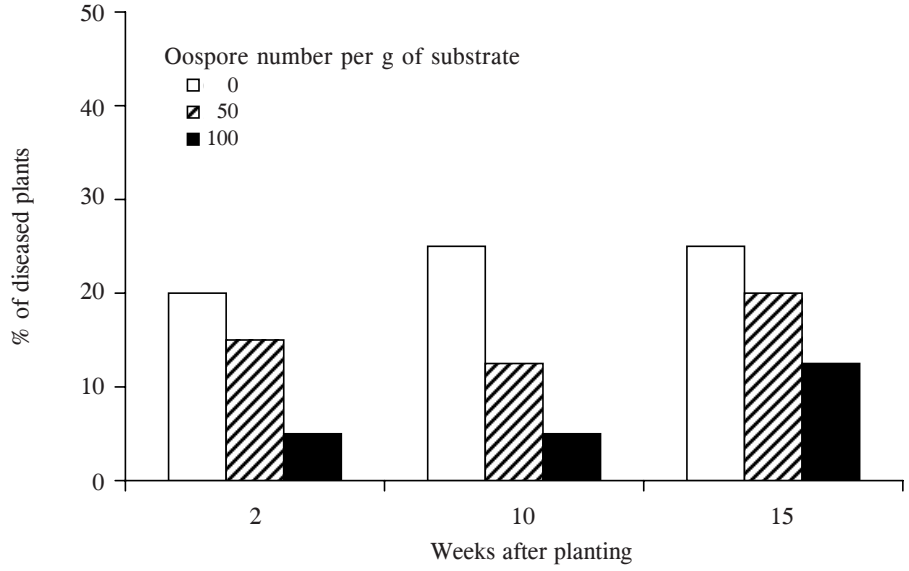

Figure 2. Relationship between oospore number of *Pythium oligandrum*, mixed with substratum 10 days before planting, growing period and development of Fusarium wilt of carnation cv. Master

Biological activity of *Pythium oligandrum* in the control of *Fusarium* wilt of carnation. Development of *Fusarium* wilt symptoms was already strongly suppressed after 6 week-growth of plants in peat mixed with oospores of *P. oligandrum* 10 days before planting of carnation (Figure 2). During the next 9-week-cultivation, *P. oligandrum* inhibited the disease development. The mycoparasite applied at dose 100 oospores per g of peat was more effective than in lower concentration (Figure 2).

In vitro study of JAWORSKA-MAROSZ and ORLIKOWSKI (unpublished data) showed intimate contact of *Fod* and *P. oligandrum* hyphae on PDA. This indicate on *P. oligandrum* as the mycoparasite of *Fusarium* wilt pathogen. Such mode of action of *P. oligandrum* against *Fod* was also observed in peat amended with oospores 10 days before or immediately after carnation planting (unpublished data). Decrease of colony forming units number of *Fod* in the presence of *P. oligandrum* was even 5 times lower than in nontreated substratum. The strong decrease of population density of *Fod* in peat amended with the mycoparasite resulted in the increase of healthy stand of carnations. Such effect was especially evident when 100 oospore/g were mixed or applied as drench to the substratum. It is also possible that presence of the mycoparasite as well as *Fod* in carnation growing site may induce host structural response on the pathogen.

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