

Paecilomyces lilacinus an efficient bionematicide

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ABSTRACT

In natural soils a great number of microorganisms live together and compete with one another for space and nutrients. Some of the microbes are pathogenic, some live on waste material and don't harm the plants, Others are even beneficial to plants by working against pathogens or by supporting plant health. Plant diseases need to be controlled to maintain the quality and abundance of food, feed, and fiber produced by growers around the world. Different approaches may be used to prevent, mitigate or control plant diseases. Beyond good agronomic and horticultural practices, growers often rely heavily on chemical fertilizers and pesticides. Such inputs to agriculture have contributed significantly to the spectacular improvements in crop productivity and quality over the past 100 years. However, the environmental pollution caused by excessive use and misuse of agrochemicals has led to considerable changes in people's attitudes towards the use of pesticides in agriculture. Among these alternatives are those referred to as biological controls. The biological control of some plant diseases has been found effective and is gaining importance day by day as one of the cheapest control measures. Paecilomyces lilacinus is a common soil fungus that has been isolated from many different habitats around the world occurring most frequently in warmer climates (1,2). It is well known as a facultative egg pathogen of sedentary nematodes. The commercial strain 251 (PL251) is available in several countries and has demonstrated efficacy in reducing root-knot, cyst and free-living nematodes on a range of crops. It has been reported to be very effective in controlling root-knot nematodes viz., M. incognita, M. javanica, M. arenaria and M. hapla in different plants.

I.INTRODUCTION

Plants are means for the human survival and comforts starting from food, home to several other requirements. A wide range of microorganisms including fungi, bacteria and viruses are exploiting plants as a source of food and shelter, as in case of all living forms on the earth. Some of these can act as pathogens, which cause a variety of diseases that result in significant yield reduction leading to heavy economic loss in many of the agricultural and horticultural species. Nematodes are the most abundant and ubiquitous multicellular organisms on earth. They are found in almost every type of habitat, from the bottom of the deepest ocean to near the tops of the highest mountains, from the tropics to the polar regions, and from every conceivable habitat (3). Most of the nematodes are beneficial because of their free-living and saprophytic nature and play a major role in decomposition of organic matter and nutrient recycling. Nematodes can feed on bacteria, fungi, algae, plants and they can also parasitize insects, animals and humans.

Plant parasitic nematodes have been recognized as one of the limiting factors in the normal production of agricultural and horticultural crops including ornamental plantation all over the world. Extent of damages, however, varies depending upon the nematode, crop and its cultivars, agro climatic conditions and other biotic and abiotic factors. Among the plant parasitic nematodes the root-knot nematodes, *Meloidogyne* spp. have been of interest to nematologists worldwide probably due to their widespread distribution and being most serious agricultural pests which are responsible for heavy losses both in quantity as well as quality (4). The genus *Meloidogyne* comprises of about 97 described species and almost every kind of cultivated and wild plants are parasitized by one or the other species of root-knot nematodes (5). The accurate information on the extent of crop losses caused by plant parasitic nematode is difficult to assess. However, many workers have expressed approximate losses. Crop losses due to root-knot nematode attack range from slightly less than one percent to total destruction (6). Hussey and Janssen (7) estimated approximately 5% of global crop loss due to infection of *Meloidogyne* spp. Sasser and Freckman (8) reported 11.1% loss in ornamental plantation throughout the world due to plant parasitic nematodes. In India the loss is predicted at about 14.6% and could go as high as 50-80% in some crops (9).

There are also some reports of crop losses in terms of money. The estimated annual loss due to nematodes in USA was of the order of \$ 10,383,743,00 in 16 field crops, \$ 225,145,900 in fruits and nut crops, \$ 266,989,100 in vegetable crops and \$ 59,817,634 in ornamental crops (10). The losses in ornamentals due to nematodes were also estimated to the tune of \$ 60 million in U.S.A. (11). Sasser and Freckman (8) have indicated annual crop losses due to plant parasitic nematodes on worldwide basis to the tune of \$ 100 billion.

II.PAECILOMYCES LILACINUS

Paecilomyces lilacinus is a common saprobic, filamentous fungus. It has been isolated from a wide range of habitats including cultivated and uncultivated soils, forests, grassland, deserts, estuarine sediments and sewage sludge. It has also been found in nematode eggs, and occasionally from females of root-knot and cyst nematodes. In addition, it has frequently been detected in the rhizosphere of many crops. The species can grow at a wide range of temperatures – from 8°C to 38°C for a few isolates, with optimal growth in the range 26°C to 30°C. It also has a wide pH tolerance and can grow on a variety of substrates (12; 13). *P. lilacinus* has shown promising results for use as a biocontrol agent to control the growth of destructive root-knot nematodes. *Paecilomyces lilacinus* has been reported to be very effective in controlling root-knot nematodes viz., *M. incognita* (14, 15), *M. javanica* (16, 17), *M. arenaria* (18), *M. hapla* (19, 20) in different plants.

III.DESCRPTION

P. lilacinus used to be classified with the fungi imperfecti or Deuteromycetes, fungi for which perfect (sexually reproducing) states have rarely been found. Many isolates of *P. lilacinus* have been identified from around the world and it is accepted that variation exists within the species. *P. lilacinus* forms a dense mycelium which gives rise to conidiophores. These bear phialides from the ends of which spores are formed in long chains. Spores germinate when suitable moisture and nutrients are available. Colonies on malt agar grow rather fast, attaining a diameter of 5–7 cm within 14 days at 25 °C (77 °F), consisting of a basal felt with a floccose

overgrowth of aerial mycelium; at first white, but when sporulating changing to various shades of vinaceous. The reverse side is sometimes uncolored but usually in vinaceous shades. The vegetative hyphae are smooth-walled, hyaline, and 2.5–4.0 µm wide. Conidiophores arising from submerged hyphae, 400–600 µm in length, or arising from aerial hyphae and half as long. Phialides consisting of a swollen basal part, tapering into a thin distinct neck. Conidia are in divergent chains, ellipsoid to fusiform in shape, and smooth walled to slightly roughened chlamydospores are absent (12).

IV.HOW PAECILOMYCES LILACINUS WORKS

Lysek first reported the association of the fungus *P. lilacinus* with the eggs of *Meloidogyne* spp (21). The *P. lilacinus* is highly adaptable in its life strategy, depending on the availability of nutrients in the surrounding environments it may be entomopathogenic (22), mycoparasitic (23), saprophytic (24), as well as nematophagous.. It has been isolated from many cyst and root-knot nematodes and from soil in many locations (25,26). Several successful field trials using *P. lilacinus* against pest nematodes were conducted in Peru. Many enzymes produced by *P. lilacinus* have been studied. A basic serine protease with biological activity against *Meloidogyne hapla* eggs has been identified (27). One strain of *P. lilacinus* has been shown to produce proteases and a chitinase, enzymes that could weaken a nematode egg shell so as to enable a narrow infection peg to push through (28).

Before infecting a nematode egg, *P. lilacinus* flattens against the egg surface and becomes closely appressed to it. *P. lilacinus* produces simple appressoria anywhere on the nematode egg shell either after a few hyphae grow along the egg surface, or after a network of hyphae form on the egg. The presence of appressoria appears to indicate that the egg is, or is about to be, infected. In either case, the appressorium appears the same, as a simple swelling at the end of a hypha, closely appressed to the eggshell. Adhesion between the appressorium and nematode egg surface must be strong enough to withstand the opposing force produced by the extending tip of a penetration hypha. When the hypha has penetrated the egg, it rapidly destroys the juvenile within, before growing out of the now empty egg shell to produce conidiophores and to grow towards adjacent eggs (29).

V.WHY PAECILOMYCES LILACINUS AS BIONEMATICIDE

- Pathogens do not develop resistance against a biocontrol product.
- They act against a wide range of pathogenic fungi and nematodes.
- They use various modes of action.
- They perpetuate themselves by producing ample spores.
- They grow extremely rapidly and quickly colonise the soil.
- They can promote nutrient uptake and enhance plant growth.
- They are harmless to humans and livestock.

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