Biological control of phytophthora foot rot (Phytophthora capsici) of black pepper (Piper nigrum L.) in Central-Western ghats

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INTRODUCTION

Black pepper (Piper nigrum L.) spice native to Western Ghats is cultivated in arecanut gardens under multistoried cropping system in Uttara Kannada district of Karnataka which is situated in Central Western ghats. The vines are trained on the trunks of arecanut as standards to generate additional income and effective utilization of natural resources like soil, water, sunlight, nutrients etc. Black pepper is one of the heritage spice crops used in culinary and preparation of Ayurvedic medicines.

The Phytophthora foot rot of black pepper (Phytophthora capsici) was first reported in India as Phytophthora palmivora (Butler) Butler in pepper gardens of Kerala by Sam Raj and Jose (1966). In the years 1978 to 1979 the disease appeared in epiphytotic form and resulted in huge loss in the form of destruction of vines in the pepper belt of Uttara Kannada (Sastry and Hegde, 1980). The soil borne pathogen, P. capsici infects all parts of vine viz., leaves, stem, collar, inflorescence, spike, roots and results in leaf rotting, yellowing, defoliation, wilting and finally leads to death of the vines. The disease starts with the onset of South West monsoon (June) with symptoms on lower leaves of the vine as brown circular with fimbriate margins. Disease becomes severe during middle of the monsoon (July to October) with leaf rotting, inflorescence and spike dropping, rotting of collar region which result in sudden wilting of the vine. During end of the monsoon (November and December) root rot results in yellowing, drooping of leaves, defoliation, followed by wilting and death of the vine.

As the pathogen is soil borne, it is very difficulty to manage the disease with fungicide alone. As the produce is export oriented in recent years, clean produce is preferred to fetch high price in the international market. It is possible with the use of effective biocontrol agents with longer lasting effect.
Unlike fungicides in combating the disease. As there is meagre literature on the use of biological control against the disease, an investigation was made to explore the effective biocontrol agents against *P. capsici*.

**MATERIALS AND METHODS**

The experiment was conducted at Horticulture Research Station, Sirsi, Uttara Kannada, Karnataka during 2008 to 2012 for five years. The centre is situated at an altitude of 516 mts MSL with an annual rainfall of 2500 mm with 110 rainy days. The temperature ranges from 16°C to 36°C.

The experiment was laid out in pots with seven treatments, three replications and ten vines in each treatments. The antagonistic organisms *viz.*, *Trichoderma viride*, *T. harzianum*, *Laetiseria arvalis* and *Bacillus subtilis* were applied (@ 10g with 10^8 cfu) to black pepper vines along with neem cake (@ 100g/pot containing 5 kg of nursery mixture. The infected material was added to the pots. For chemical check, Bordeaux mixture (@ 1 per cent) and copper oxychloride (@ 0.2 per cent) were applied to the vines as spraying (0.5 l/vine) and drenching (2 l/vine), respectively. The treatments were imposed twice in the season *i.e.*, once before the onset of monsoon (June) and in the mid of monsoon (August). Untreated vines served as control. The observation was made for the disease incidence in percentage based on the symptoms on the vines after two months of application of treatments.

**RESULTS AND DISCUSSION**

The results in Table 1 showed that disease incidence was least (24.18 per cent) in the vines treated with *T. viride*. This was on par with *T. harzianum* (24.98 per cent). However, *L. arvalis* (35.39%) was better in checking the disease as compared to *B. subitis* (38.93 per cent). When compared the bio agents with fungicides Bordeaux mixture was most effective in reducing the disease (15.81 per cent). There was slight reduction of disease with the neem cake application alone (50.30 per cent) as compared to untreated check (62.16 per cent).

In recent years biological control of plant pathogens in gaining a momentum to manage the soil borne diseases. In Central Western Ghats soils showed suppressiveness for *P. capsici* even though the presence of pathogen in the forest areas but there was no infection of vines under natural condition. Incorporation of oil cakes to pepper wilt sick soils suppressed the pathogen population (Sarma *et al.*, 1988). *Trichoderma* sp. of isolates of 1-30 were effective in reduction of *P. capsici* (Cristinzio, 1987). Jebakumar *et al.* (2000) which indicated that phorate and chlorpyriphos could be safely applied with *T. harzianum* for the management of Phytophthora foot rot, nematodes and mealybugs on black pepper. *T.
harzianum, introduced into the subterranean part of the pepper (Capsicum annuum) plant, induces a systemic defense response against P. capsici in the upper part of the plant (Ahmed et al., 2000). Trichoderma (10 and 5 kg/ha at pre- and post-monsoon, respectively) mixed with compost (500 kg) suppressed Phytophthora capsici in spice crops (Joe et al., 2000). Treatment with T. harzianum under greenhouse conditions significantly increased root length, root dry weight, plant height, leaf number, leaf dry weight, leaf area, stem diameter and flower number per plant in Capsicum annuum and also suppressed Phytophthora capsici as compared to non-inoculated treatment (Cruz, 1998). The results were inconformity with the findings of the above workers.

The present study indicated that T. viride and T. harzianum along with organic amendment like neem cake could be effectively utilized in management of soil borne P. capsici in black pepper with clean production.

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REFERENCES


