INTERNATIONAL JOURNAL OF PLANT PROTECTION / VOLUME 6 | ISSUE 1 | APRIL, 2013 | 139-141

IJPP

RESEARCH ARTICLE

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

■ M. S. LOKESH*[1], S. V. PATIL[2], S.B. GURUMURTHY [2], M.G. PALAKSHAPPA[3] AND M. ANANDARAJ[4]

[1]AICRP on Spices, Horticulture Research Station (U.H.S.) Sirsi, UTTARA KANNADA (KARNATAKA) INDIA
[2]College of Horticulture (U.H.S.) Sirsi, UTTARA KANNADA (KARNATAKA) INDIA
[3]AICRP on Sesame and Niger, University of Agricutural Sciences, DHARWAD (KARNATAKA) INDIA
[4]Indian Institute of Spices Research, CALICUT (KERALA) INDIA

ARITCLE INFO

Received : 09.11.2012
Accepted : 30.03.2013

Key Words :
Black pepper, *Trichoderma viride, T. harzianum, Laetiseria arvalis, Bacillus subtilis,* Foot rot

*Corresponding author:
lokeshsirsi@rediffmail.com

ABSTRACT

Phytophthora foot rot (*Phytophthora capsici)* of black pepper (*Piper nigrum* L.) is most devastating disease in Uttara Kannada district of Karnataka which is situated in Central Western Ghats. The antagonistic organisms *viz., Trichoderma viride, T. harzianum, Laetiseria arvalis,* and *Bacillus subtilis* were tested against *P.capsici* in pot culture by adding infected material to healthy vine. Among the four bioagents tried, *Trichoderam viride* and *T. harzianum* were effective in reducing the incidence of the disease as compared to *Laetiseria arvalis,* and *Bacillus subtilis.* The disease incidence was maximum in untreated vines.

How to view point the article : Lokesh, M.S., Patil, S.V., Gurmurthy, S.B., Palakshappa, M.G. and Anandaraj, M. (2013). Biological control of phytophthora foot rot (*Phytophthora capsici*) of black pepper (*Piper nigrum* L.) in Central-Western ghats . *Internat. J. Plant Protec.*, **6**(1) : 139-141.

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* Leonion) 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 losting 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 and annual rainfall of 2500 mm with 110 rainy days. The temperature ranges from 16 ^{0}C to 36 ^{0}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 (*Capcicum 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 (500kg) suppressed *Phytophthora capsici* in spice crops (Joe *et al.,* 2000). Treatment with *T. harzianum* under green house 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.

Acknowledgement :

Authors are thankful to the Indian Council of Agricultural Research, New Delhi which supported the work financially under the All India Co-ordinated Research Project on Spices.

REFERENCES

Ahmed, Sid Ahmed, Perez, Sanchez C. and Emilia Candela, M. (2000). Evaluation of induction of systemic resistance in pepper plants (*Capsicum annuum*) to *Phytophthora capsici* using *Trichoderma harzianum* and its relation with capsidiol accumulation. *European J. Pl. Pathol.,* **106**: 817-824.

Cristinzio, G. (1987). Studies on biological control of *Phytophthora capsici* on pepper. *Capsicum Newsletter*, **6**: 65.

Cruz, A.M. and Cisterna, O.V. (1998). Integrated control of *Phytophthora capsici* in pepper. I. Effect of antagonist fungi on plant growth. *Agricultura Tecnica Santiago,* **58**: 81-92.

Jebakumar, R.S.,Anandaraj, M.and Sarma, Y.R. (2000). Compatibility of phorate and chlorpyriphos with *Trichoderma harzianum* (Rifai.) applied for integrated disease management in black pepper (*Piper nigrum* L.). *J. Spices & Aromatic Crops*, **9**: 111-115.

Joe, Y., Alfoldi, T. Lockeretz, W. and Niggli, U. (2000). *Trichoderma* as a potential and inexpensive biofungicide for organic agriculture. In : Alfoldi, T. and Lockeretz, W. (Eds.) *The world grows organic* (pp. 117) Switzerland. Marygreen Agrotech (P.) Ltd., 5/302, Santhosh Nagar (CHENNAI) INDIA.

Samraj, J. and Jose, P.C. (1966). A Phytophthora wilt of pepper *Piper nigrum. Sci. & Cul.,* **32** : 90-92.

Sarma, Y. R., Ramachandran, N. and Anandaraj, M. (1988). Black pepper disease in India. In: Sarma,Y.R. and Premakumar, T. (Eds.) *Control of black pepper diseases* (pp.55-101). National Research Centre for Spices, Calicut (KERALA) INDIA.

Sastry, M.N.L. and Hegde,R.K. (1980). The distribution of *Phytophthora palmivora* (Butler) Butler in North Kanara soils and its role in wilt of pepper. In: Narmbiar, K.K.N. (Ed.) Workshop on Phytophthora diseases of tropical cultivated plants (pp.237-241). Central Plantation Crops Research Institute, Kasargod, (KERALA) INDIA.

****