Parasiting ability of *Pasteuria penetrans* on phytonematodes

R. Sharmila, S. Kumar and S. Ramakrishnan

ABSTRACT

A survey was made in Coimbatore district of Tamil Nadu on *Pasteuria penetrans* spore attachment on different phytonematodes and laboratory condition during kharif season of 2010. The study revealed that the nematodes *Meloidogyne incognita*, *Heterodera cajani*, *Radopholus similis*, *Helicotylenchus multicinctus*, *Pratylenchus coffeae* and *Hoplolaimus* spp.were encumbered with *P. penetrans* spores ranging from 26 to 35. The spore attachment was higher on *M. incognita* compared to *H. cajani*, *R. similis*, *H. multicinctus*, *P. coffeae* and *Hoplolaimus* spp. Hence it is inferred that the rate of parasitism by *P. penetrans* differs significantly among phytonematodes.

Key words: Encumbered, Parasitism, *Pasteuria penetrans*, Phytonematodes

INTRODUCTION

Plant parasitic nematodes are parasitized by obligatory nematode antagonistic bacterium *Pasteuria*. The *Pasteuria* spp. differ in their host range and pathogenicity to nematodes (Prabhu *et al.*, 2008). It is reported that *P. penetrans* is parasitic on *Meloidogyne* spp. (Sayre and Starr, 1985); *P. thornei* parasitizes *Pratylenchus brachyurus* (Sayre *et al.*, 1988); *P. nishizawae* is parasitic on cyst nematodes (Sayre *et al.*, 1991); *P. usage* is parasitic on the sting nematodes, *Belonolaimus logicaudatus* (Giblin-Davies *et al*., 2003); and *P. hartismes* is parasitic on *Meloidogyne ardenensis* (Bishop *et al*., 2007). The biochemical composition of nematode cuticle, soil moisture and temperature are responsible for the attachment of *P. penetrans* spores to the juveniles of *Meloidogyne* spp.

Although *P. penetrans* has the attributes of being a successful biocontrol agent against plant parasitic nematodes, information on its adherence ability on different phytonematodes and its natural selection to infect other nematodes is lacking. Hence, the present study was carried out with the objective to study the adherence ability of *P. penetrans* on different phytonematodes.

MATERIALS AND METHODS

A survey was conducted to study the distribution of *P. penetrans* in Thondamuthur, Pudhur, Madhampatti, Theethipalayam, Thannerpanthal, Chellappakoundanpudur and Alandurai, Coimbatore district. The root samples were collected from each place at random at 15-20 cm depth. A total 101 samples were collected from different crops and processed for nematodes *viz.*, *R. similis*, *H. multicinctus*, *Hoplolaimus*. Mature females of root knot nematode were recovered from the infected roots and the presence of *P. penetrans* spores was observed by dissecting 25-50 females.The female nematodes were placed in a drop of distilled water on 25 x 75 mm micro slide punctured with a needle, covered with 18mm round cover glass and gently pressed for release of the body contents. The slides were then examined under a research microscope for the presence of the bacterial spores.

Soil samples were drawn from the rhizosphere of different plants in Botanic Garden, Tamil Nadu Agriculture University, Coimbatore and washed using Cobb's decanting and sieving method. Different nematode populations *H. cajani*, *M. incognita*, *Radopholus similis*, *Hoplolaimus* sp., *P. coffeae* and *H. multicinctus* were extracted from the soil samples and used for the experiments. Nematode suspensions were prepared by squashing with fine forceps in 1ml of suspension in a small eppendorf tube. Root powder preparation of *P. penetrans* (crushed tomato roots infested with *M. incognita*, that were parasitized with *P. penetrans*) was introduced at the rate of 1g per tube. After agitation for 5-10 min, this was equally distributed to six Petri dishes. The nematodes were observed under research microscope for the encumbrance of the spores. Spore attachment was monitored hourly until 90% of juveniles were encumbered with *P. penetrans* spores.

RESULTS AND DISCUSSION

A total of 101 samples were collected from different location in 7 villages of Coimbatore district were examined for the presence of *P. penetrans* in soil and root samples. This hyperparasite was not foumd on the other species of nematode from others

Table 1. Parasitization of phytonematodes by *Pasteuria penetrans* in Coimbatore districts

Locality	Number of samples collected	Plant parasitic nematode genera observed	Host on which spores are isolated	Number of sample with *Pasteuria penetrans*	Mean number of spore load/J_2
Thondamuthur	18	*Meloidogyne* sp. *Pratylenchus* sp. *Xiphinema* sp. *Helicotylenchus* sp. *Dorylaimus* sp	*M. incognita*	3	35
Pudhur	16	*Meloidogyne* sp. *Pratylenchus* sp. *Xiphinema* sp.	*M. incognita*	1	20
Madhampatti	14	*Meloidogyne* sp. *Pratylenchus* sp. *Xiphinema* sp. Criconemoides sp.	*M. incognita*	1	28
Theethipalayam	12	*Meloidogyne* sp. *Pratylenchus* sp. *Xiphinema* sp.	*M. incognita*	-	-
Thannerpanthal	16	*Meloidogyne* sp. *Pratylenchus* sp. *Xiphinema* sp. *Hoplolaimus* sp. *Longidorus* sp.	*M. incognita*	-	-
Chellappa koundan pudhur	12	*Meloidogyne* sp. *Pratylenchus* sp. *Xiphinema* sp.	*M. incognita*	-	-
Alandurai	13	*Meloidogyne* sp. *Pratylenchus* sp. *Xiphinema* sp. *Heterodera* sp.	*M. incognita*	1	26

location, *viz*., *Criconemoides* sp, *Dorylaimus* sp, *Helicotylenchus* sp, *Hoplolaimus* sp, *Longidorus* sp, *Pratylenchus* sp, *Radopholus* sp, *Xiphinema* sp were free of infection (Table 1). The adult females of and J_2 of *M. incognita* obtained from Thondamuthur, Pudhur, Madhampatti and Alandurai were found parasitized by *P. penetrans*. The highest spore load was recorded in Thondamuthur (35 spores per J_2) followed by Madhampatti (28 spores per J_2 and the lowest in Pudhur (20 spore per J_2). Samples from Theethipalayam, Thannerpanthal and Chellappa Koundan Pudhur were free from *P. penetrans*.

The spore attachment study on different phytonematodes was carried out by using spores from different areas. The percentage of parasitized J_2 and the mean number of spore encumbered J_2 were recorded. The highest number of spore were encumbered on *M. incognita* from Madhampatti followed by Pudhur, Alandurai and Thondamuthur. The maximum number of spores were encumbered on *H. cajani* from Thondamuthur and minimum from Alandurai. The nematodes *R. similis* recorded maximum spores encumbered from Thondamuthur and minimum number from Pudhur. There was no spores attachment from Madhampatti and Alandurai. The spores encumbered in *H. multicinctus* was high from Thondamuthur followed by Alandurai and low from Pudhur and Madhampatti (2.81%). The maximum number of spore attachment on *P. coffeae* from Pudhur (4.41%) and minimum

from Thondamuthur (3.21%). Samples collected from Thondamuthur recorded the highest number of spores encumbered on *Hoplolaimus* sp. (1.56%) and the lowest from Pudhur (1.36%) and no attachment was reported from Madhampatti and Alandurai.

Stirling (1991) and Chen and Dickson (1998) reported the occurrence of *P. penetrans* throughout the world, but its occurrence and abundance seemed to be variable. Mani (1996) also reported the wide prevalence of the hyperparasite on grapevine grown areas of Dharmapuri and Madurai Districts. Natural suppressive effect of *P. penetrans* on the root knot nematodes population had been reported from Australia on grapevine (Stirling and White, 1982) tobacco, winter vetch and soybean (Brown *et al*., 1985) and in USA on vegetables in west Africa (Mankau, 1980).

Bhattacharya and Swarup (1989) repored that an isolate of *P. penetrans* parasitizing five species of *Heterodera* viz., *H. avenae*, *H. cajani*, *H. graminis*, *H. zeae* and *H. sorghi*. The bacterium can easily be multiplied on *M. incognita*. The host range of each isolate is specific and limited, but some isolates have a broad spectrum (Walia *et al*., 1990).

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R. Sharmila, S. Kumar and S. Ramakrishnan
Department of Nematology, Centre for Plant Protection Studies, Tamil Nadu Agricultural University, Coimbatore - 641003, TamilNadu, India.

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