

HOST - RANGE AND SPECIFICITY OF TWO *PASTEURIA* ISOLATES FROM KERALA, INDIA

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ABSTRACT

Pasteuria spp. are natural parasites of nematodes and hence have great potential as bio-control agents. An isolate of *Pasteuria penetrans* was recovered from root-knot nematode, *Meloidogyne incognita* (PPMI) from Vandanmedu, Idukki district in Kerala. Host range and spore morphometrics of this isolate was studied. The endospores of this isolate had a mean diameter of 4.8 μ m. Based on the spore encumbrances on J2 nematode cuticle, *Heterodera oryzicola* was found to be a host. *Hoplolaimus seinhorsti*, *Pratylenchus coffeae*, *Aphelenchus avenae*, *Aphelenchoides aligarhiensis* found as non hosts. Eggs were also found attached with the endospores. Spores were seen throughout the entire female body and the female may either be killed or allowed to attain maturity. However, such females did not produce any eggs. The infective propagules were released when the nematode body decomposed and remained free in the soil until contacted by susceptible nematodes. Host range and spore morphology of another isolate of *Pasteuria* sp. recovered from the rice cyst nematode, *Heterodera oryzicola* (PPHO) from a banana field near Kayangulam, Alapuzha district, Kerala was also studied. Spores of this isolate had a mean diameter of 6 μ m. Based on spore encumbrance on nematode cuticle of *Radopholus similis* (females, males & larvae), *Hoplolaimus seinhorsti* and *Malenchus* sp. were reported as hosts. *M. incognita*, *R. reniformis*, *Xiphinema americanum* and *X. elongatum* were reported as non-hosts. Spores were collected by crushing the infested cysts, crushed cysts mixed with sterile sandy loam soil was used for screening various nematode species. The results suggest that the *Pasteuria* isolates found in Kerala are different in their host-range and spore morphology from species reported elsewhere.

Key words: Biological control, bacteria, cyst nematode, burrowing nematode, root-knot nematode, host range

INTRODUCTION

The burrowing nematode, *Radopholus similis* is the most important nematode problem on coconut, arecanut, banana and black pepper (Koshy *et al.*, 1975). The root-knot nematode *Meloidogyne incognita* Chitwood causes serious problem on most of the component crops involved in the coconut and arecanut based cropping systems. The rice cyst nematode, *Heterodera oryzicola* (Rao & Jayaprakash, 1978) is the predominant pest on rice and on banana var. Nendran in rice fields (Charles & Venkitesan, 1984). *Pasteuria* group of gram-positive, endospore forming bacteria are obligate

nematode hyperparasites. They are natural parasites on nematodes and hence have great potential as bio-control agents (Stirling 1991). The objective of the study was to compare the two *Pasteuria* isolates collected from Kerala (Sosamma and Koshy, 1995; Sosamma, 1999), an isolate recovered from root-knot nematode *M. incognita* (designated as PPMI) with another isolate collected from rice cyst nematode, *H. oryzicola* (designated as PPHO).

MATERIALS AND METHODS

Pasteuria penetrans population was collected from females of *M. incognita* (PPMI) from roots of Cardamom at Vandanmedu, Idukki

District, Kerala. The nematode population was maintained on black pepper, brinjal and *Coleus* in earthen pots in the greenhouse. The *Pasteuria* isolate from *H. oryzae* (PPHO) was collected from a banana field near Kayangulam, Alleppey District, Kerala and is maintained on banana var. Nendran and rice var. Jothi (1285). The spores of *Pasteuria* were obtained by crushing nematode females infected with populations of *Pasteuria* in 0.5 ml water in tubes and the number of spores were determined with Haemocytometer. Host preference was determined by spore attachment assays by treating 20 nematodes each per ml suspension with 104 endospore suspension. These 20 nematodes recovered from watch glasses in a drop of water were placed on glass slides and observed under high magnification (x 1000) with Leitz compound microscope. The number of spores adhering to each nematode was counted. Second stage juveniles of *M. incognita* and *H. oryzae* encumbered with spores of each of the *Pasteuria* population were mounted in water on a glass slide and spores were observed under oil at x 1000 magnification. Measurements of endospore diameter was taken using an eye piece micrometer and mean was calculated.

The ability of spores of PPHO and PPMI to attach to populations of second stage juveniles (J2) of *M. incognita* and *H. oryzae* and to mixtures of different life stages of *Aphelenchoides aligarhiensis*, *Aphelenchus avenae*, *Dolichodorus heterocephalus*, *Helicotylenchus abunaamai*, *Heterorhabditis indicus*, *Hirshmanniella oryzae*, *Hoplolaimus seinhorsti*, *Longidorus saginus*, *Mononchus* sp., *Pratylenchus coffeae*, *Radopholus similis*, *Rhabditis* sp., *Rotylenchulus reniformis*, *Trichodorus* sp., *Xiphinema radicolica* and *X. elongatum* were tested. The mean number of spores adhering to each nematode population was recorded. The frequency distribution of spores on each of different nematode species was constructed according to the following groupings.

- = no spore attachment
- + = 1 - 10 spores per nematode
- ++ = > 10 spores per nematode

RESULTS AND DISCUSSIONS

Based on spore encumbrance of PPHO on nematode cuticle *Heterodera oryzae* (J2), *R. similis* (females, males and larvae) were hosts. This was the first report of *Pasteuria* encumbrance on *R. similis* cuticle on females and larvae in the world. Sharma and Davies (1996) reported that *Pasteuria* spore (PP from *Heterodera cajani*) attachment was found specific only to males and not to females and juveniles. *M. incognita* was non-host to PPHO, whereas with PPMI spore encumbrances to different nematodes, *H. oryzae* (J2), was a host and others were non-hosts (Table 1). Endospores of PPMI had a mean diameter of 4.8 µm and PPHO had a mean diameter of 6 µm. PPMI multiplied and maintained on *M. incognita* infested plants of black pepper, brinjal and *Coleus*. Infested

Table 1. Differences in spore encumbrances on cuticle of two *Pasteuria* isolates recovered from *M. incognita* and *H. oryzae* from Kerala on different populations of nematodes.

Nematode species	PPMI	PPHO
<i>Aphelenchoides aligarhiensis</i>	-	.
<i>Aphelenchus avenae</i>	-	.
<i>Dolichodorus heterocephalus</i>	-	-
<i>Helicotylenchus abunaamai</i>	-	.
<i>Heterodera oryzae</i>	+	++
<i>Heterorhabditis indicus</i>	-	.
<i>Hirshmanniella oryzae</i>	-	.
<i>Hoplolaimus seinhorsti</i>	-	-
<i>Longidorus saginus</i>	-	.
<i>Meloidogyne incognita</i>	++	-
<i>Mononchus</i> sp.	-	-
<i>Pratylenchus coffeae</i>	-	.
<i>Radopholus similis</i>	-	++
<i>Rhabditis</i> sp.	-	.
<i>Rotylenchulus reniformis</i>	-	.
<i>Trichodorus</i> sp.	-	.
<i>Xiphinema radicolica</i>	-	.
<i>X. elongatum</i>	-	.

- ++ = > 10 spores per nematode
- + = 1 - 10 spores per nematode
- = no spore attachment
- .

Host range in *Pasteuria*

roots dried under shade were crushed to release the endospores in the female body in the roots. The root powder obtained were stored in the lab. The spores tolerated dry conditions and remained viable in dry soil up to four years. Spores were found attached to the (J2) juveniles of *M. incognita* throughout the body. Eggs were also found attached with endospores.

PPHO isolate was maintained on *H. oryzae* infested banana var. Nendran and also on rice variety Jothi (1285) in earthen pots. One to several hundred endospores attached per nematode. In *R. similis* the endospores adhered to all body regions and mycelial growth was observed in the females. Endospores were found adhering to the labial annules of (J2) juveniles of *H. oryzae*. The results suggest that *Pasteuria* isolates found in Kerala are different in their host range and spore morphology from species reported elsewhere. The application of nematicides is an uneconomic option for resource poor farmers. The development of a powder made of *P. penetrans* endospores would at least partially replace environmentally damaging chemical nematicides, with the aim of containing rather than eliminating the nematodes. These two isolates from Kerala can be employed as potential bio-control agents in Integrated

Nematode Management (INM) of root-knot, burrowing and rice cyst nematodes.

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