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OCCURRENCE OF *PASTEURIA* BACTERIA AS PARASITES OF PLANT-PARASITIC NEMATODES IN THE EAST MEDITERRANEAN REGION OF TURKEY

by
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Summary. In a survey of plant parasitic nematodes in East Mediterranean region of Turkey 14 nematode species were found infected by bacteria of the *Pasteuria penetrans* group, from which *Tylenchulus semipenetrans*, *Meloidogyne incognita*, *M. javanica*, *M. arenaria*, *Pratylenchus penetrans* and *P. thornei* are important plant parasites. This is a first report on the occurrence of the *Pasteuria penetrans* group from Turkey.

The East Mediterranean region is a very important agricultural area in Turkey. Citrus, cotton, grapevine, maize, soybean, vegetables and wheat are the most cultivated plants in this region. There is very little knowledge about plant parasitic nematodes in the East Mediterranean region. The only comprehensive studies on occurrence of plant parasitic nematodes were done by Ağdaci (1978), Elekçioğlu (1992), Vovlas *et al.* (1993), Elekçioğlu *et al.* (1994), and Lamberti *et al.* (1994). However, there is no information on biology, ecology and control of nematodes as yet. Because chemical control of plant parasitic nematodes is often un-economic and may cause environmental problems, there is a need to develop alternative methods, such as biological control.

Bacteria of the *Pasteuria penetrans* group are obligate parasites of plant parasitic nematodes and important potential agents for biological control (Mankau and Prasad, 1977; Sayre, 1980). According to Ciancio *et al.* (1994) their host range reaches to 102 genera and 236 species. The ability of *P. penetrans* and other *Pasteuria* species to prevent reproduction and eventually kill root-knot and many other plant

parasitic nematodes may prove useful in biological control programmes for major nematode pests (Starr and Sayre, 1988).

Because there is no information about the *P. penetrans* group in the East Mediterranean region, this work aimed to determine the occurrence and host range of this parasite.

Material and methods

In a survey of plant parasitic nematodes soil and root samples were collected since 1992 from various crop plants. Nematodes were obtained from soil by using a modified Baermann funnel technique after Whitehead and Hemming (1965) and the centrifugal flotation technique. Adult females of *Meloidogyne* spp. and *Tylenchulus semipenetrans* were dissected directly from roots. In addition, monthly samples were taken from wheat and citrus from October 1993 to September 1994 to estimate the parasitic potential of *Pasteuria* in crops. Nematodes bearing endospores of *P. penetrans* group were separated, counted, mounted and identified to species, where possible.

Results and discussion

Pasteuria bacteria were observed in nematode samples associated with different crop plants. The plant parasitic nematodes encumbered with endospores of these parasites are listed in Table I. Most of the nematode species were observed to have a single or few endospores, whereas the second stage and females of *Meloidogyne* spp. were heavily infected. *Pasteuria* spores were only observed on second-stage juveniles of the citrus nematodes. However, since attachment of spores may not always lead to infection only the three root-knot nematode species, *Meloidogyne arenaria*, *M. incognita* and *M. javanica*, can be considered as parasitized. Parasitism by *Pasteuria* was not observed in some economically important nematode species such as *Ditylenchus dipsaci* (Kuehn) Filipjev, *Heterodera avenae* Woll., *Xiphinema index* Thorne et Allen and *X. pachtaicum* (Tulaganov) Kirjanova.

The natural infection rate of *Pasteuria* in a

citrus orchard on *T. semipenetrans* and in a wheat field on *Pratylenchus thornei* was very low and ranged between 0.5-2%. The citrus orchard investigated was 17 years old and had been planted with a mixture of grapefruit, lemon, mandarin and orange grafted on sour orange. About 95% of all citrus root samples were infected by *T. semipenetrans* but its population density varied strongly from tree to tree.

The nematodes infected by *Pasteuria* such as *Pratylenchus* spp., *Meloidogyne* spp. and *T. semipenetrans* are widespread and important pests in the East Mediterranean region. Especially root-knot nematodes are very important in greenhouse cultures. Some juveniles and females of root-knot nematodes were heavily infected by this parasite. The spores of *P. penetrans* are resistant to environmental factors such as heat, desiccation and nematicides (Dutky and Sayre, 1978; Stirling, 1984). This is a great advantage for its use in greenhouses since farmers in Turkey apply nematicides and soil solarization to control root knot nematodes.

TABLE I - Plant parasitic nematodes infected by *Pasteuria* in Turkey.

| Nematode species | Nematode stage | Part of the body infected | Location |
|--|------------------|---------------------------|-------------|
| <i>Merlinius brevidens</i> (Allen) Siddiqi | juvenile | cuticle | Adana |
| <i>Rotylenchulus macrosomus</i> Dasgupta, Raski et Sher | premature female | cuticle | Adana |
| <i>R. parvus</i> (Williams) Sher | premature female | cuticle | Adana |
| <i>Pratylenchus penetrans</i> (Cobb) Filipjev et Schuurmans Stekhoven | juvenile | cuticle | Adana |
| <i>P. thornei</i> Sher et Allen | juvenile | cuticle | Adana |
| <i>Meloidogyne arenaria</i> (Neal) Chitw. | juvenile, female | cuticle, pseudocoelom | Adana |
| <i>M. incognita</i> (Kofoid et White) Chitw. | juvenile, female | cuticle, pseudocoelom | Adana, Içel |
| <i>M. javanica</i> (Treub) Chitw. | juvenile, female | cuticle, pseudocoelom | Adana, Içel |
| <i>Tylenchulus semipenetrans</i> Cobb | juvenile | cuticle | Adana |
| <i>Aphelenchus avenae</i> Bastian | juvenile | cuticle | Adana |
| <i>Helicotylenchus</i> sp. | juvenile | cuticle | Adana |
| <i>Paratylenchus</i> sp. | female | cuticle | Içel |
| <i>Tylenchus</i> sp. | juvenile | cuticle | Adana |
| <i>Aphelenchoides</i> sp. | juvenile | cuticle | Adana |

Pasteuria could not be detected in all species of plant parasitic nematodes identified in this region. This could be due to low natural infection rate of these species by the *P. penetrans* group.

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