

# Occurrence of nematode-parasitic bacteria of the genus *Pasteuria* in the former USSR

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**Summary.** Examination of nematodes mounted on microscope slides and additional specimens collected from several countries of the former USSR revealed the presence of nematode-parasitic bacteria of the genus *Pasteuria*. The bacteria were associated with soil and aquatic nematodes originating from many different biotopes. *Pasteuria* spores were found attached to the cuticle and/or internally in a total of 31 nematode species (24 identified species) belonging to 22 genera, 14 families and 6 orders.

**Key words:** nematodes, parasites, bacteria, *Pasteuria*, hosts, distribution, USSR.

Endospore-forming and mycelial bacteria of the genus *Pasteuria* are presently considered to offer potential for the biological control of plant-parasitic nematodes. It has been shown that these bacteria can effectively regulate nematode population densities (Stirling, 1984; Brown et al., 1985; Bird & Brisbane, 1988). Bacteria of the genus *Pasteuria* occur worldwide in different climatic zones and have been reported from more than 50 countries. The nematode-hosts of *Pasteuria* exceed 200 species from about 100 genera and 10 orders (Sturhan, 1985, 1989; Sayre & Starr, 1988). Three *Pasteuria* species are presently recognised (*P. penetrans*, *P. thornei*, *P. nishizawae*) and each are parasites of phytonematodes.

*Pasteuria* parasitism in nematodes has been reported only once from the territory of the former USSR. *Eudorylaimus monohystera* (= *Ecumenicus monohystera*) from the republic of Moldova was found to be infected by this bacterial parasite (Kozhokaru, 1974). The type species of *Pasteuria*, *P. ramosa* is the only species of the genus having hosts other than nematodes and was described by Metchnikoff (1888) from *Daphnia* species in the Kiev area, Ukraine. Here we present new data on the occurrence of *Pasteuria* bacteria in nematodes in Russia and several other republics of former USSR.

## MATERIALS AND METHODS

Nematodes used for this investigation were available as specimens mounted in glycerin on microscope slides kept in nematological collections of the Institute of Parasitology (Moscow), the Zoological Institute (Saint-Petersburg), the Institute of Inland Waters Biology (Borok) and some private collections. Also, specimens in nematode suspensions recently obtained from soil samples, and fixed in TAF, were checked for the presence of *Pasteuria* (some voucher specimens are deposited in the German Nematode Collection, Münster).

Nematodes were extracted from soil samples using a modified Baermann funnel and a centrifugal flotation method. Photomicrographs of sporangia and endospores were taken with an Axiovert 405 M Opton inverted microscope and a Zeiss Photomicroscope III.

## RESULTS AND DISCUSSION

Examination by light microscopy of permanent slides and specimens recovered from soil samples revealed a total of 31 nematode species (24 identified species) with *Pasteuria* spores present on their cuticle and/or internally (Table 1). The nematode species represented 22 genera, 14 families and 6 orders. A majority of the nematodes were Tylenchida (15

Table 1. Nematode-hosts and distribution of bacteria of the genus *Pasteuria* in the territories of the former USSR.

Nematode	Locality		Nematode stage	Presence of <i>Pasteuria</i>
	Country	Region		
<b>Tylenchida</b>				
Tylenchidae				
<i>Cephalenchus leptus</i> Siddiqi	Russia	Kola Peninsula	juvenile, female	cuticle, pseudocoelom
<i>Coslenchus acceptus</i> Andrassy	Russia	Chukot, r. Jablon	juvenile	cuticle
<i>Filenchus misellus</i> (Andrassy)	Russia	Chukot, s. Lomutskoe	female	cuticle
<i>Filenchus vulgaris</i> (Brzeski)	Russia	St. Petersburg region	female	cuticle
<i>Filenchus</i> sp.	Russia	Moscow region	female	cuticle, pseudocoelom
<i>Malenchus bryophilus</i> (Steiner)	Russia	Moscow region	female, male	cuticle, pseudocoelom
	Russia	Nizhnii Novgorod region	female	cuticle
Hoplolaimidae				
<i>Helicotylenchus digonicus</i> Perry	Estonia	Tartu	female	cuticle, pseudocoelom
	Russia	Leningrad region	juvenile, female	cuticle
	Kyrgystan		juvenile, female	cuticle
<i>Helicotylenchus pseudodigonicus</i>	Russia	Moscow region	female	cuticle, pseudocoelom
Szczygiel				
<i>Helicotylenchus pseudorobustus</i> (Steiner)	Russia	St. Petersburg region	female	cuticle
<i>Helicotylenchus</i> sp.	Russia	Sochi, Krasnodar Territory	juvenile	cuticle
	Kyrgystan		female	cuticle
Tylenchorhynchidae				
<i>Geocenamus rugosus</i> (Siddiqi)	Tadzhikistan	Pendzhksk district	female	cuticle, pseudocoelom
(syn. <i>Tylenchorhynchus cylindricaudatus</i> Ivanova)				
<i>Geocenamus nanus</i> (Allen)	Russia	Chukot, s. Lomutskoe	juvenile, female	cuticle
<i>Geocenamus tartuensis</i> (Krall)	Russia	Voronezh region	juvenile	cuticle
<i>Nagelus leptus</i> (Allen)	Russia	Moscow region	juvenile, female	cuticle
Pratylenchidae				
<i>Pratylenchoides crenicauda</i> Winslow	Russia	St. Petersburg region	female	cuticle, pseudocoelom
	Tadzhikistan	Gorno-Badakhshan region	female	cuticle
	Kyrgystan		juvenile	cuticle
<b>Aphelenchida</b>				
Aphelenchoididae				
<i>Aphelenchoides bicaudatus</i> (Imamura)	Russia	Moscow region	female	cuticle
<i>Aphelenchoides</i> sp.	Russia	Moscow region	female	pseudocoelom
<b>Rhabditida</b>				
Cephalobidae				
<i>Eucephalobus oxyuroides</i> (de Man)	Uzbekistan	Andizhan	female	cuticle, pseudocoelom
<b>Dorylaimida</b>				
Aporcelaimidae				
<i>Aporcelaimellus</i> sp.	Russia	Rostov region	female	pseudocoelom
Qudsianematidae				
<i>Ecumenicus monohystera</i> (de Man)	Moldova*	Kaushansk region	juvenile, female	pseudocoelom
<i>Eudorylaimus</i> sp.	Russia	Gelenzhik, Krasnodar Territory	juvenile	pseudocoelom
<i>Labronemella</i> sp.	Russia	Rostov region	female	pseudocoelom
Belonidiridae				
<i>Dorylaimellus demani</i> Goodey	Russia	Moscow region	female	pseudocoelom
Leptonchidae				
<i>Leptonchus</i> sp.	Russia	Voronezh region	juvenile, female	pseudocoelom
<b>Araeolaimida</b>				
Cylindrolaimidae				
<i>Cylindrolaimus communis</i> de Man	Russia	Amderma, Arkhangelsk region	female	pseudocoelom
Plectidae				
<i>Plectus acuminatus</i> Bastian	Russia	Borok, Jaroslavl region	juvenile	cuticle, pseudocoelom
<i>Plectus parvus</i> Bastian	Russia	Amderma, Arkhangelsk region	juvenile	cuticle, pseudocoelom
<b>Enoplida</b>				
Tobrilidae				
<i>Eutobrilus husmanni</i> (Altherr)	Ukraine	Kiev reservoir	female	pseudocoelom
<i>Semitobrilus gagarini</i> (Ebsary)	Ukraine	Kiev reservoir	male	pseudocoelom
<i>Tobrilus gracilis</i> (Bastian)	Armenia	Sevang lake	juvenile, female	pseudocoelom
Alaimidae				
<i>Paramphidelus hortensis</i> (Andrassy)	Russia	Moscow region	juvenile	pseudocoelom

\* - Kozhokaru (1974)

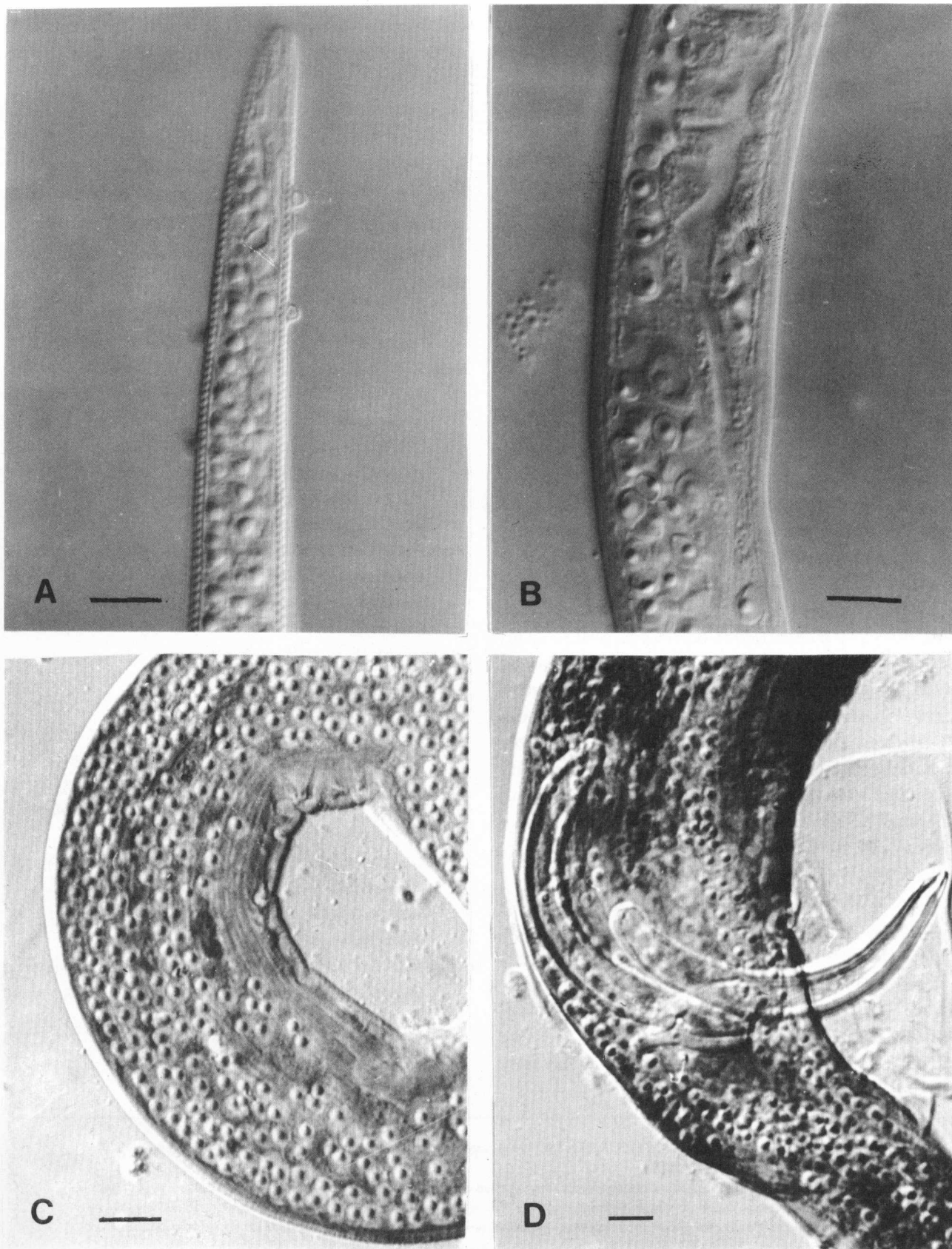


Fig. 1. *Pasteuria* infections in nematodes. A: *Malenchus bryophilus* with endospores attached to the cuticle and sporangia in the pseudocoelom. B: Mid-body region of *Dorylaimellus demani* containing sporangia. C: Mid-Body region of *Plectus acuminatus* containing sporangia. D: Spicule region of *Semitobrilus gagarini* male containing sporangia. Scale bars - 10  $\mu$ m.

species representing 8 genera) and Dorylaimida (6/6) with the nematodes representing the orders Enoplida (4/4), Araeolaimida (3/2), Aphelenchida (2/1), Rhabditida (1/1).

Several of the nematode species listed in Table 1 had previously not been reported as *Pasteuria* hosts. However, observation of bacterial spores on the nematode cuticles does not provide unequivocal evidence that the species are hosts of *Pasteuria*. In members of the Tylenchida spores usually were attached to the cuticle (e.g. up to 25 spores in *Coslenchus acceptus*, up to 8 in *Malenchus bryophilus*), whereas in Dorylaimida and Enoplida species spore attachment was not observed. Sporangia and endospores in most of the nematode taxa resembled, in general morphological characteristics, those described for *Pasteuria penetrans* and for the other two *Pasteuria* species known from nematodes. However, the *Pasteuria* observed in e.g., *Tobrilus gracilis* and *Paramphidelus hortensis* had elongated sporangia with eccentric central body (Fig. 1)

Nematodes with *Pasteuria* spores on their cuticle or with internal infection were found in a wide range of different biotopes. Infected specimens of *Malenchus bryophilus* and *Helicotylenchus pseudodigonicus*, e.g., were recovered from soil samples collected in flooded areas along the rivers Jauza and Mocha in the Moscow region. Specimens from the Tobrilidae family (genera *Eutobrilus*, *Semitobrilus* and *Tobrilus*) with this bacterial pathogen present were obtained from silty sediments from the Kiev reservoir and lake Sevang at a depth of 2.5 m. A single infected juvenile specimen of *Plectus parvus* was recovered from moss samples collected from the roof of old shed.

Our initial studies have shown that nematodes carrying pathogenic bacteria of the genus *Pasteuria* appear to be relatively common in soil and aquatic nematodes present in different regions of the former USSR. With their potential usefulness as biological control agents *Pasteuria* spp. occurring in the territories of the former USSR require to be fully

characterised. Also, further information on the occurrence, hosts and rate of nematode infection in different biotopes and with different nematode species is required.

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Субботин С. А., Штурхан Д., Рысс А. Ю. Распространение нематодопаразитических бактерий рода *Pasteuria* на территории бывшего СССР.

Резюме. В результате анализа постоянных препаратов нематод из нематодических коллекций и нематод, выделенных из образцов почвы из различных республик бывшего СССР, обнаружены нематодопаразитические бактерии рода *Pasteuria*. Бактерии паразитировали на почвенных и пресноводных нематодах в различных биотопах. Споры *Pasteuria* обнаружили на кутикуле и в гемоцеле 31 вида нематод (24 определены до вида), относящихся к 22 родам, 14 семействам и 6 отрядам.

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