NOTE ON *PASTEURIA SP.* PARASITIC IN LONGIDORID NEMATODES

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Accepted:
4.IV.1989
Aceptado:

RESUMEN

Ciancio, A., y R. Mankau. 1989. Nota sobre *Pasteuria* sp. parásito de nematodos longidorides. Nematrópica 19:105–109.

Pasteuria sp. parásito de *Xiphinema* spp. se encontró en *X. brasiliense* en Perú y en *X. bakeri* en California. Las esporas de estos aislamientos mostraron ser más anchas que las descritas en *P. penetrans*, parásito de *Meloidogyne* spp. y otras *Pasteuria* spp. encontradas en *X. americanum*. En Perú, también se encontraron esporas de *Pasteuria* spp. adheridas a *Xiphinema* spp., *Dolichodorus* sp. y *Eudorylaimus* sp. Este es el primer record geográfico de *Pasteuria* sp. en Perú y el primer reporte de parasitismo en *X. brasiliense*.

Palabres claves: biocontrol, parásito, *Pasteuria* sp., *P. penetrans*, Perú, *Xiphinema bakeri*, *X. brasiliense*.

Pasteuria penetrans Sayre & Starr is a widely distributed obligate parasite of soil nematodes with potential as a biological control agent of nematode pests. Attempts to establish in vitro cultures have thus far failed.

Pasteuria sp. has been reported in several nematode species belonging to widely separated taxa, but ultrastructural details have been provided only from a few species of plant-parasitic nematodes of economic importance (4). Races, biotypes, or even species may be present in the *P. penetrans* group, as suggested by the variability observed in spore morphology and host specificity (5). The present note provides additional information on the occurrence and morphometrics of a *Pasteuria* sp. parasitic in some *Xiphinema* spp. from North and South America.

A survey of plant-parasitic, free-living, and predacious nematodes which occur in Peru was conducted from August to October, 1987 in tropical rain forests, highlands, and cultivated fields. Soil samples were collected in the coastal region, highlands, and Amazonian forest areas to a depth of 15 cm from the rhizospheres of edible and native plants. Nematodes were extracted by Cobb's sieving-decanting method, heat relaxed, fixed in 2% formalin, processed by the slow method to glycerol (7); and mounted for light microscopy. During the mounting of longidorid specimens, some *Xiphinema* spp. parasitized by a *Pasteuria* sp.

were oberved. *Pasteuria* spores were observed in the body and adhering externally to the cuticle.

A juvenile of *X. brasiliense* Lordello, collected from rain forest soil at Quistococha (73° 16′ W, 3° 49′ S), Iquitos, Department of Loreto, was parasitized by *Pasteuria* sp. Almost all internal tissue, except for the pharyngeal region which was still recognizable, were digested and occupied by spores of the parasite (Fig. 1 A–D). The average diameter of the resting sporangia, measured by light microscopy, was 5.6 μm ± 0.4 (5.0–6.5), whereas the central endospore averaged 2.0 μm.

Specimens of two *Xiphinema* spp., collected at Tambolodge, (69° 8′ W, 12° 34′ S), Department of Madre de Dios, from rain forest soil, were infected by a few spores which measured 6.7 μm and 4.8 μm, respectively. Spores were attached to the cuticle of individuals of both species, but no germ tubes penetrated into the body of any specimen. The diameter of endospores from both *Xiphinema* species was 1.4 μm. Spores of *Pasteuria* sp. also were found adhering to a *Dolichodorus* sp. during the examination of nematodes collected from a bank of the Amazon River near Tamshiyacu (Loreto) and to a *Eudorylaimus* sp. recovered from the rhizosphere of banana (*Musa* sp.) at Mala, Department of Lima (Fig.

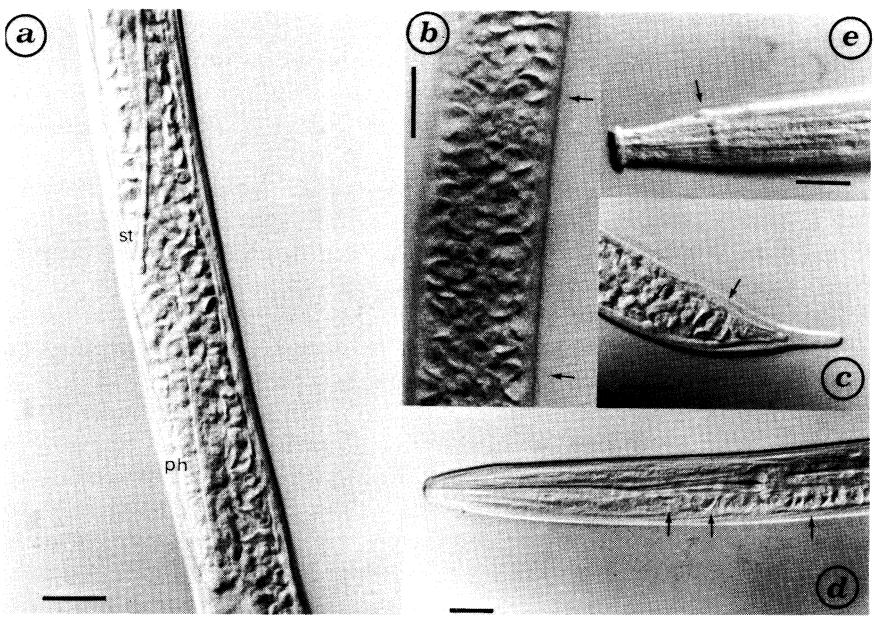
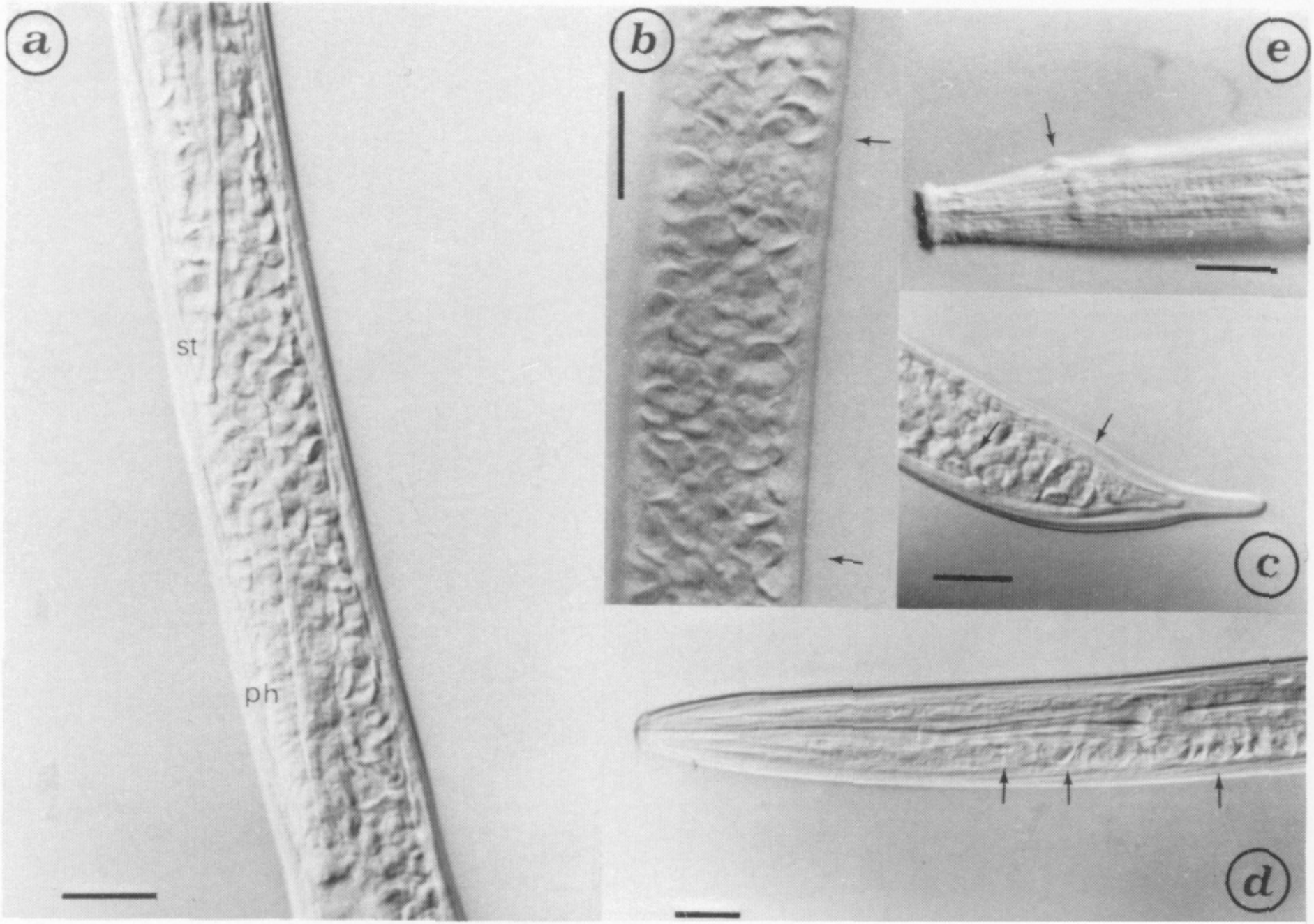


Fig. 1 A–D. Juvenile of *Xiphinema brasiliense* with spores of *Pasteuria* sp. in the anterior (A,D) median (B), and caudal region (C) of the body (arrows). ph = pharynx (esophogeal bulb), st = stylet of next stage; E) *Eudorylaimus* sp. with three adhering *Pasteuria* sp. spores (arrows). Scale bar = 16 μm.



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1E). The average diameter of spores from the latter specimen was 4.9 μm, whereas the endospore measured an average of 1.6 μm.

We also have observed mature spores of *Pasteuria* sp. in several mature females of a population of *Xiphinema bakeri* Williams from grapevines in Temecula, California (Fig. 2 A–C). The spores in these specimens measured an average of 6.8 ± 0.3 μm (5.8–7.7) in diameter, whereas the central endospore measured an average of 2.1 ± 0.2 μm. Sturhan (10) reported spores attached to the cuticle but not within *X. bakeri* from Canada.

All the proliferative stages and spores of *Pasteuria* sp. have been reported in *X. elongatum* Schuurmans Stekhoven & Teunissen from Mauritius (12), and two published lists of parasitic and free-living nematode hosts include some *Xiphinema* species from temperate (10) and tropical climates (3). The latter list indicates some morphometric variation in the size of spores attached to (or within) the *Longidoridae* cited, but in most cases the spores are distinctly larger than those reported from *Meloidogyne* spp. Medium-size spores of the *P. penetrans* group have been found in *X. americanum* Cobb and *X. rivesi* Dalmasso, and our measurements of spores within *X. americanum* from these slides do not differ statistically from the data reported previously (5).

Another exception to the large spore size found in the *Longidoridae* is the 4.5-μm diam listed for *X. elongata* (sic) (3) attributed to Williams (12), but he did not give measurements for spores in *X. elongatum*, stating

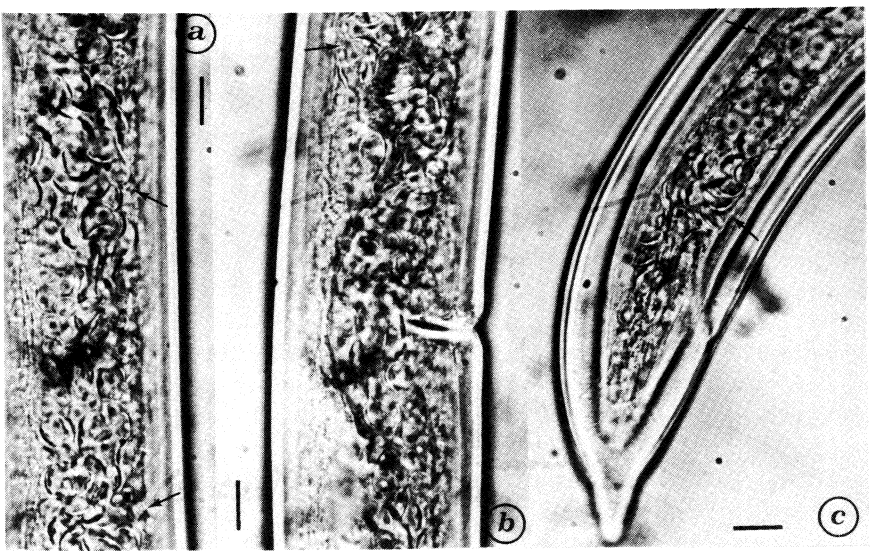
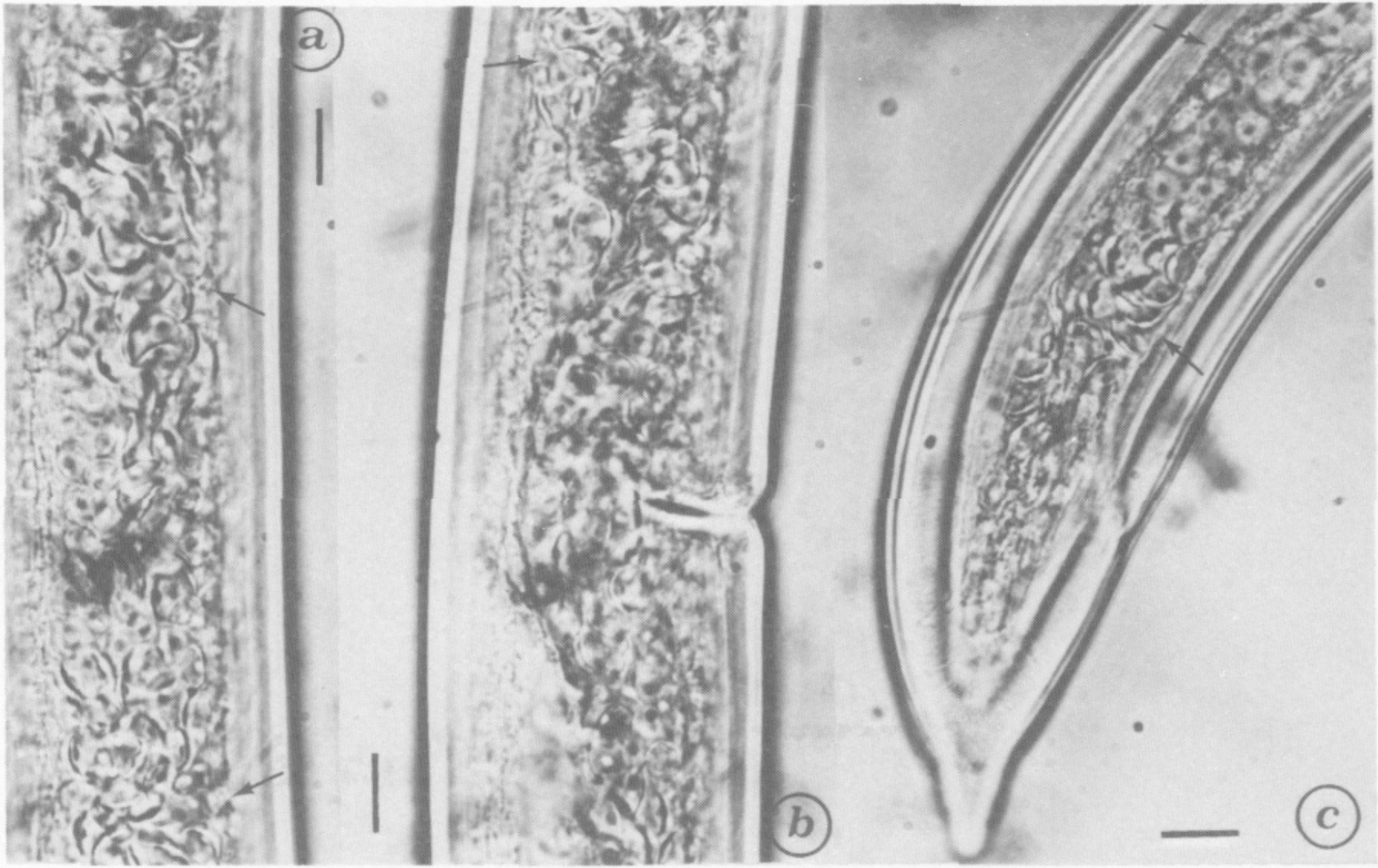


Fig. 2. Spores of *Pasteuria* sp. in female in *Xiphinema bakeri*. A) anterior body. B) vulval region. C) caudal region. Scale bar = 10 μm.



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only that the spores were "identical" to those found in the *Meloidogyne* spp. he studied earlier (11). His text indicated that he was probably referring to morphology rather than size when making the comparison. An examination of his photographs indicated a spore size in relation to the anatomy of the nematode that was clearly similar to the 6.8-µm diam of spores we have observed in *X. bakeri*. Our measurement of spores observed in *Paralongidorus sali* Siddiqi, Hooper & Khan by Siddiqi et al. (6), using the scale given on the figures of this species, indicated that they ranged from 5.5–6.6 µm in diameter.

The variability observed in spore diameters of *Pasteuria* sp. parasites of longidorids could be explained, in part, by differences in nematode processing or aberrations in measuring, but a relationship between variation in spore diameters and host specificity can be assessed only when more living material from different sources is available for comparative studies. If a natural variability in spore diameters occurs in *P. penetrans*, spores larger or smaller than those found thus far in each pathotype should have been observed, but this has not been the case with the isolate attacking *Meloidogyne* spp. That isolate has relatively constant morphometric parameters. The range of variation in spore diameters associated with *Xiphinema* spp. differs greatly from those reported for *P. penetrans* and from the only other nematode-parasitic species described in the genus, *P. thornei* (9). The differences in spore diameters raise questions about the taxonomic meaning of morphometric parameters for these parasites in the absence of additional biochemical, serological, or precise host-range data.

Spores isolated from *Meloidogyne javanica* (Treub) Chitwood failed to parasitize *X. index* Thorne & Allen in in vitro tests (2), whereas an isolate of large spore size was found infecting *X. imitator* Heyns and *Xiphinema* sp. in South Africa but no other plant-parasitic nematodes which were attacked by a different isolate of small spore size (8).

In South America, *P. penetrans* has been reported in Venezuela on *Longidorella morbidus* (Loof) Jairajpuri & Hooper; in Columbia on *M. incognita* affecting coffee; in Bolivia on *Heterodera cacti* Filipjev & Schuurmans Stekhoven; and in Brazil on *M. incognita* (Kofoid & White) Chitwood affecting black pepper; *M. coffeicola* Lordello & Zamith; *M. javanica*; and *Helicotylenchus* sp. (4). Lordello (1) also described a juvenile *X. campinense* (= *X. elongatum*) in Brazil parasitized by a "sporozoan", measuring an average of 5 µm in diameter, which from the author's figure, appeared to be a *Pasteuria* sp.

Xiphinema spp. are serious parasites of many important crops and the occurrence of one or more isolates of the *P. penetrans* group within this genus represents an important possibility for future biocontrol strategies. *Xiphinema* spp. found infected or parasitized by the *P. penetrans* group include: *X. americanum; X. bakeri; X. brasiliense; X. chambersi*

Thorne; *X. coxi* Tarjan; *X. diversicaudatum* (Micoletsky) Thorne; *X. elongatum; X. imitator; X. index; X. pachtaicum* (Tulaganov) Kirjanova; *X. pseudocoxi* Sturhan; and *X. rivesi.*

Our report is the first recored of members of the *Pasteuria penetrans* group occurring in Peru and the first report of development of the parasite within *X. brasiliense* and *X. bakeri.*

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Received for publication:
26.II.1989
Recibido para publicar:

ACKNOWLEDGMENTS

The support provided during the survey in Peru by Prof. E. Carbonell-Torres, Universidad Nacional Agraria, La Molina, Lima, Peru, is gratefully acknowledged.

THANKS TO OUR REVIEWERS—GRACIAS A NUESTROS REVISORES

In addition to our editorial board, other members of OTAN/ONTA and specialists from other disciplines have contributed valuable time in reviewing manuscripts for *Nematrópica*. Publication of their names expresses the Society's deepest appreciation to those who evaluated manuscripts during 1988.

Aparte de nuestra junta editorial, otros miembros de la ONTA/OTAN y especialistas en otras disciplinas también han contribuido con su valioso tiempo en la revisión de manuscritos para *Nematrópica*. A continuación se publican los nombres de aguellos que evaluaron manuscritos in 1988, y a quinenes la sociedad expresa su más hondo aprecio.

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