

CHARACTERIZATION OF A MEXICAN POPULATION OF *HOPLOTYLUS FEMINA* S'JACOB, 1960 ASSOCIATED WITH *QUERCUS CRASSIPES* HUMB. & BONPL.

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ABSTRACT

Franco-Navarro, F. and I. Cid del Prado-Vera. 2006. Characterization of a Mexican population of *Hoplotylus femina* s'Jacob, 1960 associated with *Quercus crassipes* Humb. & Bonpl. *Nematropica* 36:173-180.

A population of *Hoplotylus* from Mexico State, Mexico, was identified as *Hoplotylus femina* s'Jacob, 1960 based on similarities in morphological characters with those of this species, including: the female head pattern, the consistent lack of a functional spermatheca, the areolated lateral field with four incisures, the undifferentiated postvulval uterine branch, and the size and shape of the female and male tails. The female head pattern of this Mexican population showed fused submedian lip sectors lacking the pronounced notch on their outer margins unlike those reported for this genus, which have a deep distinct notch. Although most of the females had empty spermathecae, like those of other *H. femina* populations, a specimen with a full spermatheca was observed. This is the first report of a species of *Hoplotylus* from Mexico.

Key words: Forest, *Hoplotylus femina*, Mexico, morphology, natural habitats, oak trees, Pratylenchidae.

RESUMEN

Franco-Navarro, F. y I. Cid del Prado-Vera. 2006. Descripción de una población mexicana de *Hoplotylus femina* s'Jacob, 1960 asociada a *Quercus crassipes* Humb. & Bonpl. *Nematropica* 36:173-180.

Una población del género *Hoplotylus* proveniente del Estado de México, México, fue identificada como *Hoplotylus femina* s'Jacob, 1960 con base en algunos caracteres morfológicos similares a los que presenta esta especie y entre los que se incluyen: la región labial de la hembra, la ausencia consistente de una espermateca funcional, el campo lateral areolado con cuatro incisuras, la presencia de un saco postuterino poco diferenciado, así como el tamaño y forma de la cola de hembras y machos. El patrón de la región labial de las hembras de esta población mexicana presentó los sectores labiales submedios fusionados, aunque sin la presencia de la muesca pronunciada en los márgenes exteriores, característica del género. Aunque la mayoría de las hembras presentaron su espermateca vacía, tal y como es típico en *H. femina*, se observó un espécimen con la espermateca llena. Este es el primer reporte de una especie del género *Hoplotylus* presente en México.

Palabras clave: bosque, encino, *Hoplotylus femina*, México, nematodos parásitos de plantas, Pratylenchidae.

INTRODUCTION

According to Bernard and Niblack (1982), the genus *Hoplotylus* s'Jacob is among the least known of plant-parasitic nematode genera. There are a few reports about species of this genus from forests in The Netherlands, USA, New Zealand,

Poland and Japan. These nematodes have been reported from the rhizosphere of timber, ornamental and forest trees including *Quercus robur* L., *Q. prinus* L., *Chamaecyparis lawsoniana* Parl., *Castanea dentata* (Marsh.) Borkh., *Thelypteris noveboracensis* (L.) Nieuwl., *Tsuga canadensis* (L.) Carr., *Ulmus davidiana* Planchon var. *japonica* (Rehder)

Nakai, *Podocarpus nagi* Zoll and Moritzi, *Ilex maximowicziana* var. *mutchagara* Hatusima, *Stylax japonica* Sieb. and Zucc., *Alnus hirsuta* Turcz., *Coprosina* sp., *Blechnum* sp., *Carpodetus* sp., *Prunus virginiana* L., *Betula lenta* L. and *B. platyphylla* Sukatchev var. *japonica* (Miq) Hara (Bernard and Niblack, 1982; Minagawa, 1988; s'Jacob, 1959).

The type species, *Hoplotylus femina* s'Jacob, 1960, was initially thought to be comprised only of females; hence the specific name provided in the original description (s'Jacob, 1959). Later, however, a male specimen was found (s'Jacob, 1979), and males have since been found in a Japanese population (Minagawa, 1988).

Hoplotylus femina females and males were observed in soil samples from a forest of associated pine (*Pinus* sp.) and oak (*Quercus crassipes* Hump. & Bonpl.) trees in Juchitepec, Mexico State, Mexico, during a nematode survey in undisturbed areas from the Central Valley of Mexico. The objective of this study was to provide biological, morphological and morphometric data of a *H. femina* population from Mexico, due to the lack of information on *H. femina* from the Americas (Bernard and Niblack, 1982). Morphological details observed with a scanning electron microscope (SEM) were also included.

MATERIALS AND METHODS

Nematodes were extracted by centrifugal-flotation (Hooper, 1986) from soil around roots of *Q. crassipes*. Nematodes were killed and fixed in cold 4% formalin according to Stone (1971), then processed to glycerine by Seinhorst's method (Seinhorst, 1959) and mounted on permanent slides with wax rings, using a modified Maeseneer and d'Herde (1963) technique. Specimens for SEM were cold-fixed in 2% sodium phosphate-buffered glutaraldehyde at 4°C (0.1 M, pH 7.2), and

post-fixed in 2% osmium tetroxide overnight. They were then dehydrated in a graded series of ethanol (from 5% to 100%) and critical point dried with CO₂ (Eisenback, 1991). After coating with gold, specimens were observed with a JEOL 35-C scanning electron microscope at 10 kV accelerating voltage.

Hoplotylus femina s'Jacob, 1960
(Figs. 1 and 2).

Measurements of females and males from Juchitepec, Mexico State, Mexico are given in Tables 1 and 2, respectively.

Description

Female: Body stout, and tapering toward the anterior end (Fig. 1A). Lip region rounded, high and slightly set off. Lip annuli three or occasionally four (Fig. 1C). SEM *en face* view showing a non-elevated oral disk fused with both subventral and subdorsal lip sectors forming a smooth, dumb-bell shaped headcap. Outer margins of the headcap smooth and lacking a pronounced central notch. Lateral lip sectors almost circular and surrounding the oval amphidial apertures (Fig. 2A). Cephalic framework heavily sclerotized, extending into the body two or three annuli. Stylet well developed. Outer margins of knobs tulip-shaped, parallel in profile and projecting anteriorly. Hemizonid 1-2 annuli anterior to excretory pore. Median bulb rounded with conspicuous valve. Oesophageal gland lobe overlapping intestine dorsally (Fig. 1C). Lateral field aerolated and marked by four incisures at mid body (Fig. 2C). Inner pair of incisures close together. Lateral field at the level of tail region marked by three incisures ending seven annuli before tail tip (Fig. 2D). Reproductive system well developed. Ovary outstretched, with a single row of oocytes. Spermatheca oval, generally with-

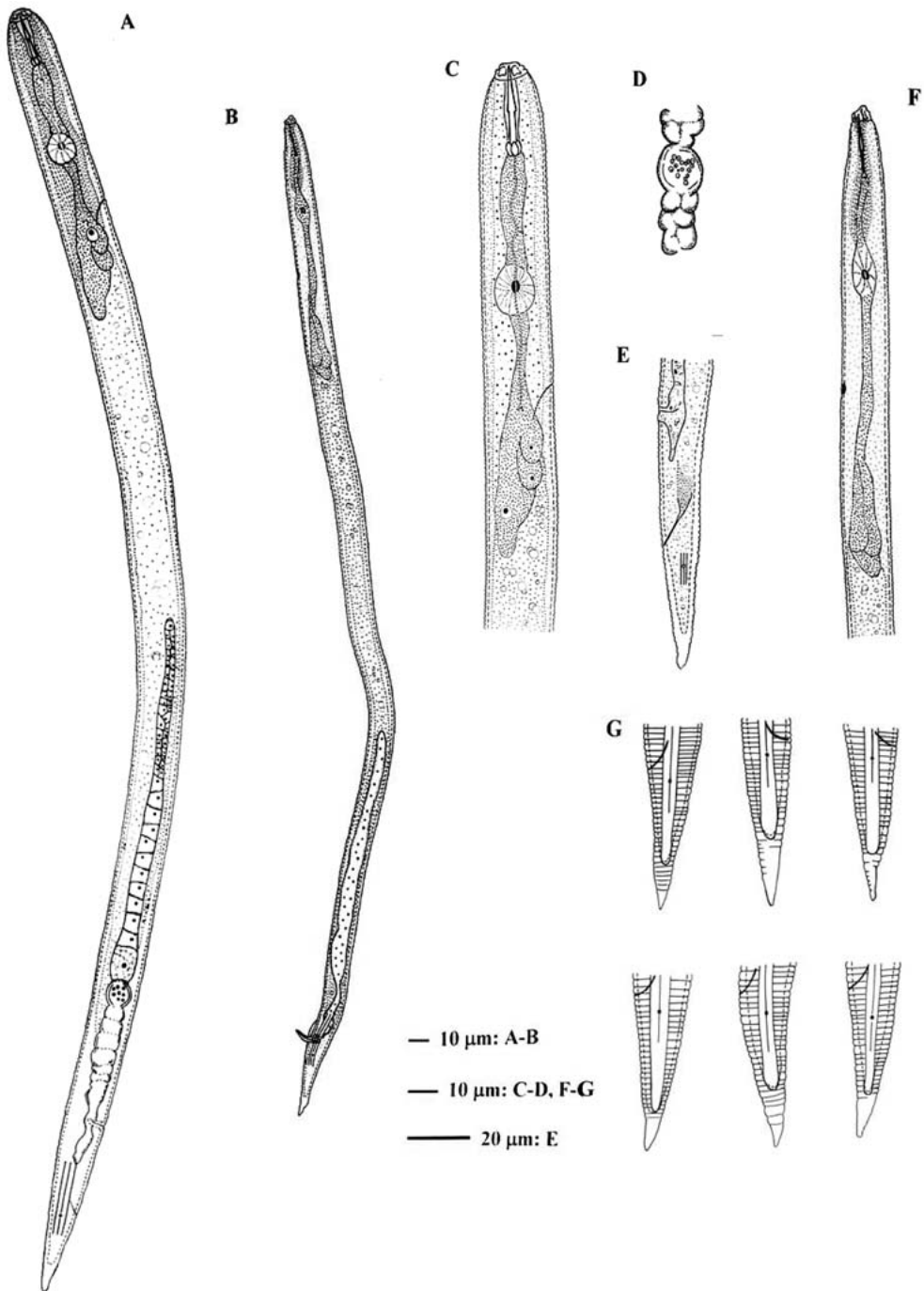


Fig. 1. *Hoplotylus femina* s'Jacob 1960 from Juchitepec, Mexico. A, C-E, G) Female. B, F) Male. A) Entire body. B) Entire body. C) Anterior body region. D) Spermatheca filled with sperm. E) Posterior body region. F) Anterior body region. G) Tail shape variations.

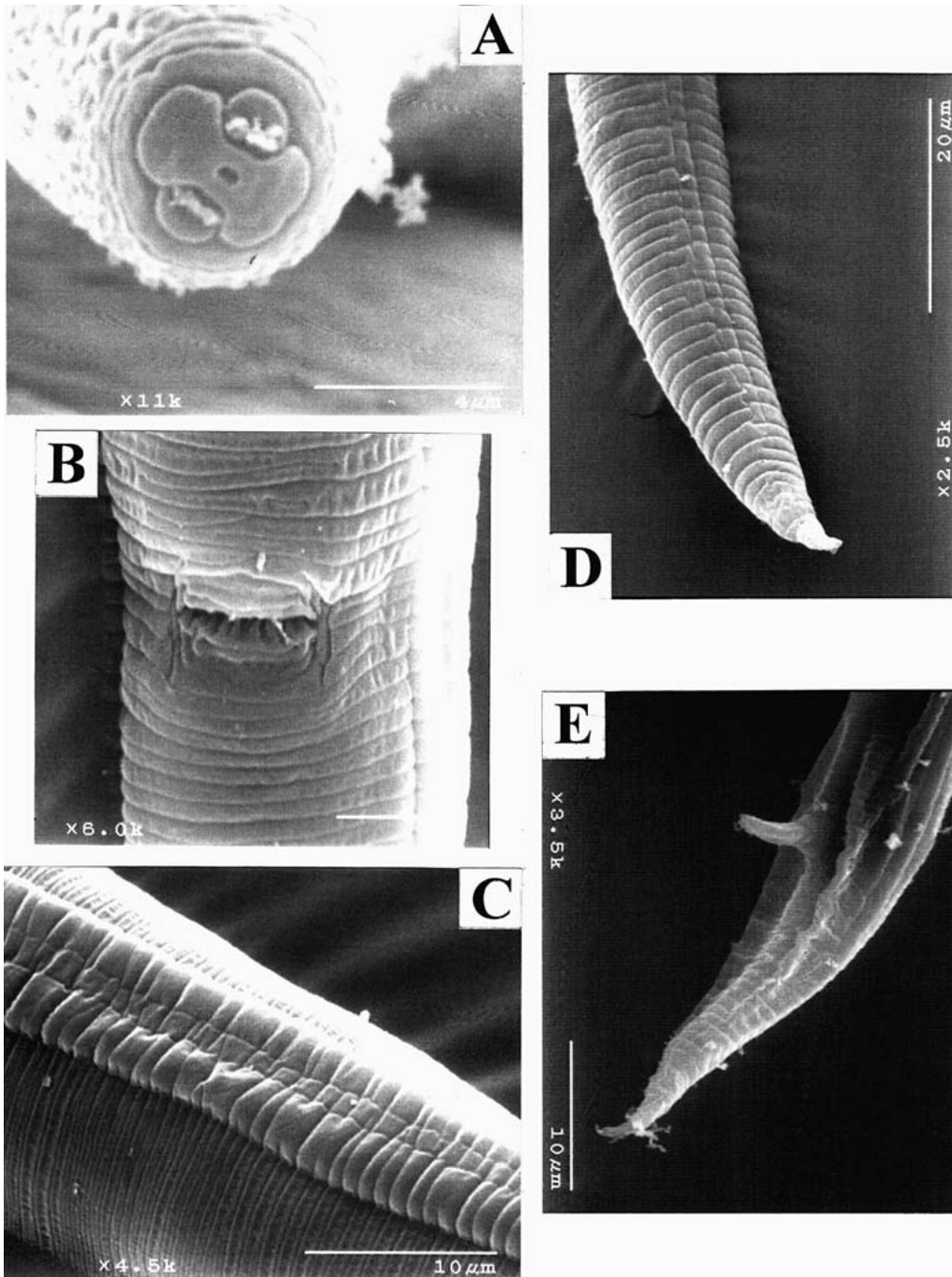


Fig. 2. SEM micrographs of *Hoplolytus femina* s' Jacob 1960 from Juchitepec, Mexico. A-D) Female. E) Male. A) Face view pattern. Note the submedian lip sectors fused together and with the oral disc, and lacking the notch on the outer margins. B) En face view of vulva. C) Areolated lateral field. D) Pointed tail terminus. E) Tail.

Table 1. Selected morphometric values of three populations of *Hoplotylus femina* females from different localities (all measurements in μm).

Measurement or ratio	Juchitepec, Mexico State, Mexico	Wageningen, The Netherlands*	Kunigami, Okinawa, Japan*
N	45	29	25
Body length	375.2-618.0 (467.1 \pm 14.5)	450-656 (536)	409-602 (520 \pm 43.0)
Head diam.	7.6-10.0 (8.7 \pm 0.2)		
Head height	2.4-6.8 (4.0 \pm 0.2)		
Stylet length	17.2-27.6 (22.3 \pm 0.7)	21-26 (25)	22.3-26.0 (23.5 \pm 0.8)
Stylet knob height	2.8-5.2 (3.9 \pm 0.1)		3.3-4.7 (4.1 \pm 0.3)
Stylet knob width	3.2-6.0 (4.9 \pm 0.2)		4.0-5.7 (4.8 \pm 0.5)
DGO to stylet base	6.2-7.6 (7.1 \pm 0.4) (n = 8)		5.3-9.3 (6.8 \pm 1.0)
Anterior end to vulva	318-536 (401.1 \pm 13.0)		
Vulva to anus	24.8-41.6 (33.2 \pm 1.1)		
Postvulval uterine sac length	12.0-20.4 (17.7 \pm 4.3) (n = 5)		10.0-40.0 (24.0 \pm 6.9)
Hyaline part of tail	8.4-18.8 (11.4 \pm 0.6)		
Lip annuli	3 (n = 29), 4 (n = 16)		3 (n = 1), 4 (n = 22), 5 (n = 2)
a	19.3-29.4 (24.4 \pm 0.8)	23.1-30.6 (26.2)	22.8-29.4 (25.7 \pm 1.7)
b'	2.7-4.3 (3.5 \pm 0.3)		2.7-4.1 (3.3 \pm 0.4)
c	10.5-17.0 (13.9 \pm 0.4)	14.2-19.2 (16.1)	12.7-21.5 (15.6 \pm 1.7)
c'	2.2-3.4 (2.8 \pm 0.1)	2.8-3.1	1.8-3.5 (2.7 \pm 0.5)
Excretory pore (%) [†]	14.4-21.4 (17.9 \pm 0.5)		17.1-21.9 (19.0 \pm 1.2)
V (%) [‡]	82.2-88.0 (85.8 \pm 0.3)	84.0-87.3 (85.9)	83.2-87.8 (85.8 \pm 1.1)

*From s'Jacob (1959). Specimens mounted in permanent slides.

†From Minagawa (1988).

‡Head to excretory pore as percentage of body length.

§Head to vulva as percentage of body length.

out sperm (Fig. 1D). Only one specimen found with sperm in the spermatheca. Vulva transverse, with vulval lips protruding slightly (Fig. 2B). Postvulval uterine branch small or undifferentiated (Fig. 1E). Tail elongate, conical, narrowing at the base of the hyaline part. Distal region of the tail with irregular or scattered annulations. Tail terminus pointed or slightly rounded. Phasmids pore-like, located four annuli after the anus (1.2 μm) (Fig. 1G).

Male: Evident sexual dimorphism in the lip region, stylet and body width. Body shorter and more slender than that of female (Fig. 1B). Lip region slightly set off and higher dorsally with three asymmetrical annuli. Cephalic framework weak. Stylet thin, with small rounded knobs (Fig. 1F). Lateral field with three incisures. Procorpus cylindrical. Median bulb oval with less developed valves than in female. Oesophageal gland lobe overlapping the

Table 2. Selected morphometric values of three populations of *Hoplotylus femina* males from different localities (all measurements in μm).

Measurement or ratio	Juchitepec, Mexico State, Mexico	Wageningen, The Netherlands*	Kunigami, Okinawa, Japan ^x
N	14	1	5
Body length	320.8-433.6 (386.1 \pm 18.5)	580	365-443 (391)
Maximum body diam.	10.4-15.0 (12.4 \pm 0.7)		
Body diam. at excretory pore	10.2-13.6 (12.3 \pm 0.6)		
Body diam. at anus	8.4-11.2 (9.6 \pm 0.5)		
Lip region height	3.3-4.8 (3.9 \pm 0.2)	3.5	3.3-3.7 (3.4)
Lip region width	4.8-7.0 (5.6 \pm 0.3)	5.0	4.0-6.0 (5.6)
Stylet length	9.6-15.6 (12.7 \pm 0.8)	18	14.7-16.3 (15.5)
Stylet knob height	0.8-1.2 (1.1 \pm 0.1)	1	1.3-1.7 (1.4)
Stylet knob width	1.6-2.4 (2.0 \pm 0.1)		2.0-3.0 (2.5)
DGO to stylet base	6.60 (n = 1)		5.0-8.7 (6.4)
Anterior end to excretory pore	55.6-70.0 (63.8 \pm 2.5)		
Spicules length	10.4-13.6 (12.3 \pm 0.4)	17	13.3-14.0 (13.7)
Tail length	24.8-36.0 (32.6 \pm 2.0)	49	33.0-36.7 (34.6)
Lip annuli	3	3	3
a	27.3-39.3 (31.4 \pm 1.8)	44	27.9-36.5 (32.1)
b'	3.7 (n = 1)		3.2-4.0 (3.6)
c	10.2-14.0 (11.9 \pm 0.6)	11.8 ^y	10.5-12.5 (11.3)
c'	2.8-4.0 (3.4 \pm 0.3)	3.6	3.1-3.8 (3.5)
Excretory pore (%) ^z	15.4-18.6 (16.6 \pm 0.5)	16.2	17.6-20.4 (18.8)

*From s'Jacob (1979).

^xFrom Minagawa (1988).

^yCorrect value after Minagawa (1988).

^zHead to excretory pore as percentage of body length.

oesophago-intestinal junction (Fig. 1F). Excretory pore situated slightly posterior to base of isthmus. Testis single, out-stretched. Spicules slightly curved, pointed; gubernaculum minute. Bursa moderately developed, not enveloping the tail. Tail elongate, conical, with a pointed terminus (Fig. 2E). Hyaline portion of tail irregularly annulated, ventrally curved.

DISCUSSION

According to the keys elaborated by Bernard and Niblack (1982) and Minagawa (1988), the specimens from Mexico differ from *H. sjacobi* Bernard and Niblack, 1982 mainly in the shape of stylet knobs and smaller c' ratio values. The specimens from Mexico differ from *H. silvaticus* Ber-

nard and Niblack, 1982 in having an empty spermatheca, irregularly annulated tail and greater *c'* ratio values. Finally, the Mexican population differs from *H. montanus* Minagawa, 1984 in having greater values of body and stylet length. The morphometric parameters of *H. femina* females from Mexico are similar to those reported for Dutch and Japanese populations of this species. The aerolated lateral field, an empty spermatheca and distal region of the tail smooth or coarsely and irregularly annulated observed in the Mexican specimens are specific characters reported for *H. femina* (Minagawa, 1988).

Despite the males from the Mexican population showing smaller length values of body, stylet, spicule and tail, than those of a male from The Netherlands (s'Jacob, 1979), their morphological and morphometric characters were similar to those reported for a Japanese population by Minagawa (1988).

On the other hand, the female head pattern of the Mexican population of *H. femina* showed the median lip sectors fused together and with the oral disc, but lacking the pronounced notch on their outer margins, as reported in diagrams of the head patterns for the genus *Hoplotylus* (Sher and Bell, 1975; Luc, 1987; Geraert, 1997). These findings indicate that the presence of the notch on the outer margins of the fused submedian lip sectors is not a stable character in the species of this genus, and may be specific of the Mexican population. Most females of the Mexican population had empty spermathecae confirming that this species is probably parthenogenetic as suggested by Luc (1987); however, the presence of sperm in one specimen indicates that amphimixis may occur.

The results of the morphological and morphometrical comparison of the Mexican *H. femina* population with those from different geographical areas (s'Jacob,

1959, 1979; Bernard and Niblack, 1982; Minagawa, 1988) provide a good description of the relationship among these populations; however, molecular analyses of these populations are necessary for a better understanding and interpretation of this relationship.

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