

NOTES ON MORPHOLOGY, DISTRIBUTION AND ECOLOGY OF *HOPLOTYLUS FEMINA* (TYLENCHIDA, PRATYLENCHIDAE)

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Summary. *Hoplotylus femina* s'Jacob, 1960 is reported from one site in the territory of the Slovak Republic for the first time and from 41 sites in the northern parts of Germany. All records are from a wide variety of woodland ranging from pure deciduous to pure coniferous forests and from different soil types. Data on morphology of females and males and details on geographical distribution and ecology are presented. Males with functional testis were commonly found and females generally had a spermatheca filled with sperm.

Key words: Forest soil, Germany, new record, Slovak Republic.

Five *Hoplotylus* species have been described so far: *H. femina* s'Jacob, 1960 from Europe (with type locality in the Netherlands), *H. silvaticus* Bernard *et* Niblack, 1982 from North Carolina, USA, *H. sjacobi* Bernard *et* Niblack, 1982 from New Zealand, *H. montanus* Minagawa, 1984 and *H. triversus* (Minagawa, 1984) Siddiqi, 1986 both from Japan. *Hoplotylus femina* has been reported from several other European countries (Belgium, Germany, Poland, Czech Republic, Romania: cf. Bongers, 2007), from the USA and Japan; *H. silvaticus* also has been reported from Japan. On the whole, however, the genus and its species are still among the least well known tylenchid taxa.

During faunistic studies in Germany (with more than 4,000 soil sites sampled throughout the country, including more than 1,000 from various forest biotopes), *H. femina* was found at many sites. During a nematological survey in forest ecosystem conducted throughout the Slovak Republic, with more than 1,500 localities of various ecosystems studied, the species was found once. Data on morphology, geographical distribution and ecology based on these findings are given in the present paper.

MATERIALS AND METHODS

The nematodes were isolated from soil samples by a decanting-sieving method or the Seinhorst elutriator with final extraction using a Baermann funnel or by a centrifugation-flotation method with MgSO₄. The nematodes were fixed in TAF or FAA, transferred to dehydrated glycerine and mounted permanently on microscope slides. These were used for the subsequent mi-

croscopy studies. Slides and other fixed voucher material are deposited in the German Nematode Collection (DNST) at the Biologische Bundesanstalt, Münster, Germany, and in the nematode collection at the Parasitological Institute, SAS, Košice, Slovak Republic.

RESULTS AND DISCUSSION

Morphology and biology

The original description of *H. femina* by s'Jacob (1960) based on numerous females had been completed by the description of a single male from the Netherlands (s'Jacob, 1979). Subsequently, Minagawa (1988) described in detail females and five males of a population from Okinawa, Japan. Brzeski (1998) added morphological details of females from Poland, Bernard and Niblack (1982) of a single female considered to be *H. femina* from the USA.

Morphometrics of females and males of the Slovak population from Mičakovce and the summarised data of specimens originating from several localities in Germany are given in Table I. All measurements are well within the range of data already known for this species or slightly extend the previously reported ranges. Also, other morphological characters closely agree with previous descriptions. However, a spherical to slightly oblong spermatheca in the female genital tract, ranging from 9 × 9 µm to 13 × 19 µm and densely packed with round to slightly elongated sperm, was commonly observed, even in populations with apparent absence of males (Fig. 1). The tail terminus in both sexes was generally more variable than previously reported. The phasmids are quite distinct but not lens-like. Males have a basic number of four incisures in each lateral field along most of the body, but the inner incisures are mostly indistinct. Deirids said to be present in the male (s'Jacob,

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1979) are definitely lacking.

In Germany, males were present in 23 of a total of 41 samples positive for *H. femina*. In two of the samples with *H. femina* only juveniles were found and in the remaining samples almost all females showed a spermatheca filled with sperm. Males were found during all sampling months from March to October; females were recovered also in samples collected in November and January. The frequent occurrence of males, which showed a functional testis, and the common observation of filled spermathecae in the females suggest that *H. femina* – in contrast to previous assumptions – is an amphimictic species. The previously reported absence or rareness of males in *H. femina* could perhaps be explained by reduced longevity or temporary absence of males, or their higher sensitivity in the extraction process; alternatively, the highly dimorphic males may just have been overlooked in nematode suspensions.

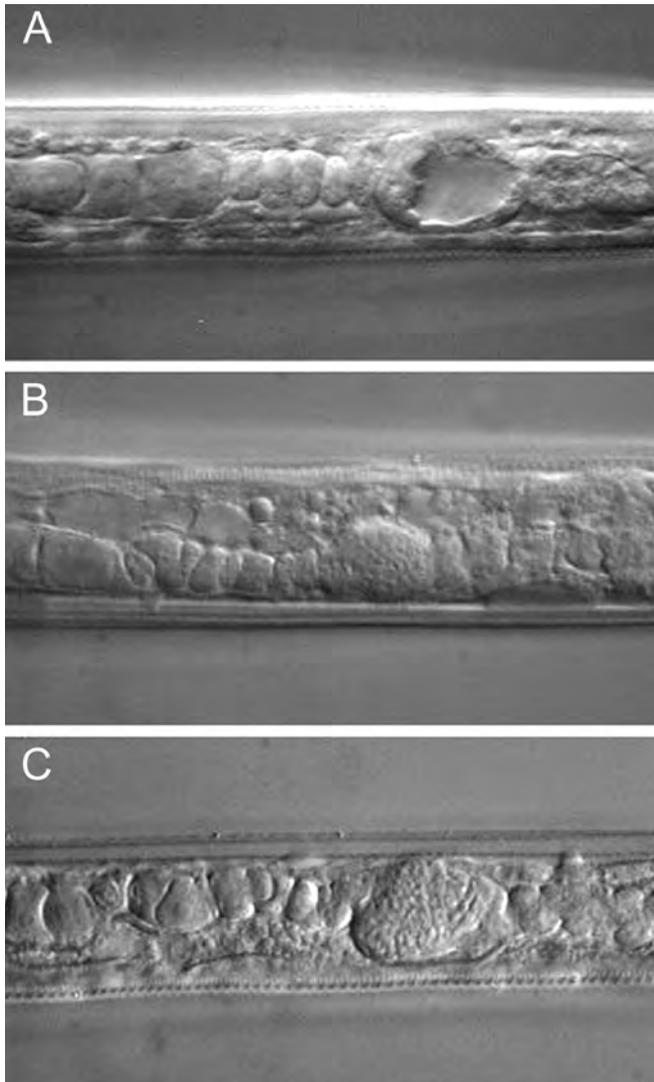


Fig. 1. Spermatheca in genital tract of *Hoplotylus femina* females from Germany. A: Empty spermatheca. B: Small spermatheca filled with sperm. C: Enlarged spermatheca with sperm.

Geographic distribution

In the Slovak Republic *H. femina* appears to be a rare nematode species, recovered at only one site (Mičakovce) in the north-eastern region of the country in the orographic unit Ondavská vrchovina upland, at an altitude of about 200 m, with average rainfalls of 700-800 mm and an average temperature of 7 °C. In Germany, *H. femina* was recovered in 1968 for the first time (Sturhan, 1969); since then the number of records has increased to the present total of 41. The distribution of the sites of occurrence is shown in Fig. 2, with the most northern record from a place near Eckernförde (Schleswig-Holstein), and the most southern near Pössneck (Thüringen), most of the records being from the northern lowlands and a few from medium elevations more in the south of the country. Despite intensive sampling in the more central and in the southern regions of the country, no *H. femina* could be found here. This interesting distribution can hardly be explained by differences in climatic or edaphic factors, or presence or absence of preferred biotopes or putative hosts. The most plausible interpretation appears to be that an invasion or post-glacial recolonisation of the more central parts of Europe took place, starting from south-east Europe through Romania, Slovak Republic, Czech Republic, Poland, eastern and northern Germany and extending to the Netherlands and Belgium in the west. Further records from other regions in Europe may support or



Fig. 2. Records of *Hoplotylus femina* in Germany.

Table I. Morphometrics of females and males of *Hoplotylus femina* populations from Germany and the Slovak Republic (all measurements in μm).

Character	Germany		Slovak Republic (Mičakovce)	
	15 ♀♀	15 ♂♂	7 ♀♀	2 ♂♂
L	584±57 (437-708)	491±35 (416-563)	603±40 (532-640)	432, 460
a	28.3±2.7 (23.8-33.5)	39.6±3.6 (33.0-46.1)	29.9±2.4 (25.5-32.0)	36.0, 38.3
b	5.7±0.5 (4.9-6.7)	6.2±0.3 (5.6-6.6)	4.0±0.3 (4.0-4.8)	5.5, 5.5
b'	3.8±0.5 (3.1-4.8)	4.0±0.4 (3.2-4.6)	3.4±0.4 (2.8-3.8)	2.9, 3.2
c	17.1±1.7 (13.1-20.4)	13.1±0.9 (11.3-14.9)	17.1±2.0 (16.0-20.2)	13.5, 12.2
c'	2.7±0.3 (2.2-3.4)	3.6±0.4 (2.8-4.2)	2.1±0.5 (2.2-3.3)	3.6, 3.8
V	85.9±1.2 (83.6-90.4)		85.3±2.9 (80.0-88.3)	
Excretory pore (%)*	17.6±0.9 (16.0-19.2)	16.6±0.8 (15.5-18.3)	17.8±0.7 (17.1-18.8)	
Stylet length	25.2±1.0 (22.3-26.7)	15.7±0.9 (12.8-16.3)	22.0±1.9 (19.8-24.0)	16.0, 12.0
Tail length	33.9±3.0 (28.0-41.2)	36.2±4.3 (23.0-40.9)	33.2±3.8 (28.0-36.0)	34.2, 38.7
Spicula		14.2±0.8 (13.1-16.0)		12.0, 12.0
Gubernaculum		5.6±0.5 (4.8-6.5)		

* Distance of excretory pore from anterior end in % of body length.

reject this hypothesis. Urek *et al.* (2003) reported *Hoplotylus* sp. from apple orchard soil in Slovenia, but did not provide data on species identity.

Ecology

Hoplotylus femina is a forest nematode species. Almost all previous records appear to refer to forests and/or trees, both deciduous and coniferous. In the Netherlands and Poland, this nematode was mainly found in oak forests (Bongers, 1988; Brzeski, 1998), and in the Czech Republic Háňel (1996, 2004) reported it from a *Picea* forest and a mixed forest with *Fagus*, *Picea*, *Sorbus* and *Quercus*. In Romania only, *H. femina* has been recorded from mountain grassland (Popovici, 1998).

In the Slovak Republic, the nematode occurred in a Querceto-Carpinetum forest with heavy clay Cambisol soil derived from Carpathian flysch and with pH of 4.5. In Germany, *H. femina* was found in a wide range of forest types; 32 of the total of 41 sites with *H. femina* are deciduous forests (mostly beech and oak forests), five pure coniferous forests and four forests of various deciduous trees mixed with coniferous trees. At most

sites the soil was loamy sand or sandy loam, often with a high humus content, and at one site only the soil was heavy loam. The soil pH ranged from 3.2 to 6.1. The wide range of trees around which *H. femina* was found indicates that the species is polyphagous, which confirms previous observations. The fact that *H. femina* could not be found in soil from hedgerows, under solitary trees etc. may be an indication that ecological factors other than hosts are governing the preference of this nematode for forest soil.

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