

NOTES ON MORPHOLOGY, TAXONOMIC POSITION, DISTRIBUTION AND ECOLOGY OF *PARATROPHURUS BURSIFER* (TYLENCHIDA, BELONOLAIMIDAE)

D. Sturhan¹ and M. Lišková²

¹ Formerly of: Biologische Bundesanstalt für Land- und Forstwirtschaft, Institut für Nematologie und Wirbeltierkunde, Toppheideweg 88, 48181 Münster, Germany

² Parasitological Institute, Slovak Academy of Sciences, Hlinkova 3, 04001 Košice, Slovak Republic

Summary. *Paratrophurus bursifer* (Loof, 1960) is reported from many sites in Germany, several localities in the Slovak Republic and a place in Bulgaria. The species is almost exclusively found in woodland and along river banks with trees; it prefers wet soils, with soil types ranging from sandy to loamy. Specimens from Germany and Slovakia agree in morphology with previous descriptions of the species. The present diagnosis of the genus *Paratrophurus* is considered as imprecise and partially incorrect, and *P. bursifer* is returned to the genus *Tylenchorhynchus* as *Tylenchorhynchus bursifer* Loof, 1960.

Paratrophurus bursifer (Loof, 1960) Siddiqi, 1971 was described as *Tylenchorhynchus bursifer* from The Netherlands. Subsequently, the species has been recorded only a few times and it is mostly considered as "a very rare species" (Andrássy, 1991). The justification of the transfer of *Tylenchorhynchus bursifer* to the genus *Paratrophurus* Arias, 1970 by Siddiqi (1971) has been questioned by some authors. In this paper, information is given on the morphology of the species based on the study of specimens from Germany and Slovakia, the taxonomic position is discussed, and known and new data on geographical distribution and ecology of the species are compiled.

MATERIALS AND METHODS

In the course of nematological surveys, we found *P. bursifer* at many sites in Germany and at several localities in the Slovak Republic. The nematodes were isolated from soil samples by the decanting-sieving method with final extraction using a Baermann funnel equipped with cotton filter or by the flotation-centrifugation method with sugar or MgSO₄. They were killed and fixed with hot TAF and mounted in anhydrous glycerin on permanent mounts for microscopical examination and measurements. Voucher material is deposited in the German Nematode Collection (DNST), Biologische Bundesanstalt für Land- und Forstwirtschaft, Münster, and in the Parasitological Institute of the Slovak Academy of Sciences, Košice.

RESULTS AND DISCUSSION

Morphology

The original description of the species by Loof (1960) is detailed and covers all features of diagnostic

significance. Siddiqi (1971) presented drawings of head end, and of female and male tails, and Andrássy (1991) gave another detailed description based on a few specimens found in Hungary.

The specimens from Germany and Slovakia studied by us agree closely in their morphological characters with the previous descriptions, and thus only a few observations supplementing or confirming these descriptions are given here. The morphometrics of one population from Germany and two populations from the Slovak Republic given in Table I extend the range of known variation.

The rounded, continuous lip region has 5-6 fine but mostly quite distinct annules. The lateral field starts with the two marginal lines, usually at the level of the stylet knobs; it is irregularly areolated along the body with annulation also rarely extending into the central band, which is generally wider than the marginal bands over most of the body. The cuticle annules are 1.0-1.5 µm wide at midbody, growing wider towards the anterior end. The ventral lateral line generally forms the margin of the "bursa" in females and older juvenile stages, but often does not do so in the earliest juvenile stage, which often does not show any bursa-like structure. The stylet base is around 4 µm in diameter, the anterior face of the stylet knobs is flat to slightly sloping. Deirids and post-deirids are lacking. The phasmids are conspicuous in adults and older juvenile stages, less distinct in second-stage juveniles. Lateral canals are generally present in the intestine region; a post-anal intestinal sac is lacking. The spermathecae are spheroid and axial. The gubernaculum is boat-shaped in its distal part.

Taxonomic position

Arias (1970) proposed the genus *Paratrophurus* with the species *P. loofi* Arias, 1970. Subsequently, more species have been described and the genus diagnosis was emended by several authors. The most recent diag-

Table I. Morphometrics of *Paratrophurus bursifer* (all measurements in μm).

Character	Population									
	Type population/NL 13 ♀♀	Hungary (Andrássy, 1991) ♀♀	Achern/D 10 ♀♀	Svätá Mária/SK 10 ♀♀	Kolárovo/SK 7 ♀♀	Type population/NL 7 ♀♀	Hungary (Andrássy, 1991) ♂	Achern/D 10 ♂♂	Svätá Mária/SK 10 ♂♂	Kolárovo/SK 7 ♂♂
Length	557 – 655	610 – 750	576 – 847 (672)	630 – 810 (720)	620 – 830 (710)	484 – 618	690	526 – 620 (571)	660 – 720 (700)	630 – 750 (690)
a	24.8 – 29.9	26 – 28	25.0 – 35.3 (29.2)	26 – 32 (30)	27 – 33 (29)	24.6 – 28.4	30	25.7 – 31.0 (27.8)	29 – 34 (31)	27 – 30 (29)
b	4.3 – 5.1	4.3 – 4.6	5.2 – 6.4 (5.2)	4.5 – 6.5 (5.0)	4.5 – 5.9 (5.3)	4.4 – 5.0	4.7	4.3 – 5.0 (4.7)	4.4 – 5.3 (4.7)	4.4 – 5.3 (4.9)
c	13.0 – 16.9	15 – 16	13.0 – 18.2 (15.0)	13 – 17 (15)	14 – 17 (15)	11.4 – 14.2	16	13.8 – 16.5 (14.7)	12 – 18 (16)	14 – 17 (15)
c ^l		2.7 – 3	2.4 – 3.0 (2.8)				2.3	2.2 – 2.8 (2.5)		
Stylet	22 – 24	22 – 23	23.2 – 24.0 (23.9)	24 – 26 (25)	22 – 25 (24)	22 – 23		22.4 – 24.0 (23.6)	22 – 27 (26)	21 – 25 (23)
Vulva	53.5 – 56.3	53 – 58	53.7 – 57.1 (55.1)	53 – 58 (56)	53 – 58 (55)	-	-	-	-	-
Spicula	-	-	-	-	-	23	28	21.5 – 24.0 (22.8)	23 – 28 (25)	21 – 32 (27)
Gubernaculum	-	-	-	-	-	10	14	11.7 – 13.2 (12.3)	12 – 17 (14)	13 – 16 (14)

nosis is presented by Siddiqi (2000), who lists a total of 13 *Paratrophurus* species, including *P. bursifer* transferred to the genus from *Tylenchorhynchus* earlier (Siddiqi, 1971).

This present genus diagnosis (as well as several previous diagnoses) does not cover the range of morphological variation known among the species currently placed in the genus. Thus, the maximum body length is 2 mm (in *P. kleynsi* Castillo, Siddiqi et Gomez-Barcina, 1989), the phasmids are located posterior to the middle of tail in several species (e.g. *P. acristylus* Siddiqi et Siddiqui, 1983, *P. costarricensis* López, 1986), the vulva position may also be anterior to mid-body (*P. kleynsi*), the lateral field is areolated in *P. bursifer* and the cephalic region annulated not only in *P. striatus*, the terminal cuticle thickening is only about one-fourth of tail length in, e.g., *P. acristylus* and *P. kleynsi*, and males are not “generally present” in all species of the genus.

Castillo et al. (1989) have already written that “the genus *Paratrophurus* is close to *Tylenchorhynchus* Cobb, 1913 from which it differs only in the abnormally thickened cuticle of the tail”, and Siddiqi (2000, p. 456) indicated that *Paratrophurus* may be a junior synonym of *Tylenchorhynchus*. The difference in cuticle thickness on the tail terminus is not considered by us to be diagnostic at the generic level, and the range of variation of this character in *Paratrophurus* with the present species placed in the genus extends into the variation found among *Tylenchorhynchus* species. Moreover, it is a common feature in Tylenchida that species with a narrow tail terminus (comparable to that in *P. bursifer*) have a conspicuous, non-protoplasmic terminal tail portion. Among the *Paratrophurus* species, *P. bursifer* in particular shares most of its morphological characters with *Tylenchorhynchus*. We thus agree with Loof (2001) on return of the species to this genus as *Tylenchorhynchus bursifer*.

Distribution and ecology

Tylenchorhynchus bursifer (= *P. bursifer*) appears to be a rare European species. It was described from soil around roots of *Rosa* sp. at Boskoop, The Netherlands (Loof, 1960) and has subsequently also been mentioned from the southern part of the country (Bongers, 1988). Hooper (1978) reported finding a single female in England; he also mentioned occurrence of the species in Poland, but Brzeski (1998) did not confirm this. Bongers (1988) reported the presence of *T. bursifer* in Switzerland, and Andrassy (1991) found a few specimens in the Bátorliget Nature Reserves in Hungary.

For Germany, *T. bursifer* was recorded for the first time in 1974 (Sturhan, 1975) but is now known from 22 localities from many different areas, exceptions being the most northern and the eastern regions of the country. Almost all records are from woodland, most of them from deciduous forests (among these five wet sites with *Alnus* spp. and/or *Fraxinus excelsior*), two from mixed woodland and one from a spruce forest. Only a single

record is from grassland close to a small river in a forest area. Moreover, the species was isolated from several sediment samples taken close to Münster from a small river with trees growing along the banks. The soils in which it has been found have ranged from humous sand to rather heavy loam and the water content was often high. The highest population density, with several hundred specimens isolated from 300 ml of a sandy-loam soil, was from a *Tilia-Acer*-forest with *Mercurialis*, *Ribes*, *Dryopteris* and *Luzula* as undergrowth at Achern, Baden.

In the Slovak Republic, we found *T. bursifer* at seven localities in various parts of the country (Nižná Myšľa, Dojč, Bánovce, Veľké Leváre, Pod Soroškou, Sväta, Mária and Kolárovo). All localities were characterised by wet, sandy, loamy or clay soils of river banks or floodplain forests, mostly with *Alnus*, *Salix* and *Populus*, with undergrowths of *Urtica dioica* and *Rubus caesius*. We also isolated *T. bursifer* from a soil sample collected close to a forest on the Black Sea coast near Varna-Albena in Bulgaria.

Tylenchorhynchus bursifer is thus known so far from a total of eight European countries (United Kingdom, Spain, The Netherlands, Germany, Switzerland, Slovak Republic, Hungary, Bulgaria). Its occurrence is mainly restricted to woodland, and it shows a preference for wet soils, with the soil type apparently being of minor significance.

LITERATURE CITED

- Andrassy I., 1991. The free-living nematode fauna of the Bátorliget Nature Reserves. Pp. 129-197. In: Mahunka, S. (Red.): The Bátorliget Nature Reserves – after forty years. Akademia-Verlag, Budapest.
- Arias M., 1970. *Paratrophurus loofi* n. gen., n. sp. (Tylenchidae) from Spain. *Nematologica*, 16: 47-50.
- Bongers T., 1988. *De nematoden van Nederland*. Koninklijke Nederlandse Natuurhistorische Vereniging, Utrecht, The Netherlands, 408 pp.
- Brzeski M.W., 1998. *Nematodes of Tylenchina in Poland and temperate Europe*. Muzeum i Instytut Zoologii Polska Akademia Nauk, Warszawa, Poland, 397 pp.
- Castillo P., Siddiqi M.R. and Gomez-Barcina A., 1989. Studies on the genus *Paratrophurus* Arias (Nematoda: Tylenchina) with descriptions of two new species. *Nematologia Mediterranea*, 17: 83-95.
- Hooper D.J., 1978. The Tylenchorhynchidae. The identification of stunt nematodes (Tylenchorhynchinae, Merliniinae and Trophurinae) especially those in Western Europe. In: Spiral and stunt nematodes. A manual prepared for the workshop sponsored by the Nematology Group of the Association of Applied Biologists held at Rothamsted Experimental Station, September 21th, 1978, 75 pp., Harpenden, U.K.
- Loof P.A.A., 1960. Miscellaneous notes on the genus *Tylenchorhynchus* (Tylenchinae: Nematoda). *Nematologica*, 4 (1959): 294-306.

- Loof P.A.A., 2001. *Nematoda: Secernentea (Tylenchida, Aphelenchida)*. *Süßwasserfauna von Mitteleuropa, Band 4/1-1*. Spektrum Akademischer Verlag Heidelberg Berlin, 246 pp.
- Siddiqi M.R., 1971. On the plant-parasitic nematode genera *Histotylenchus* gen. n. and *Telotylenchoides* gen. n. (Telotylenchinae), with observations on the genus *Paratrophurus* Arias (Trophurinae). *Nematologica*, 17: 190-200.
- Siddiqi M.R., 2000. *Tylenchida. Parasites of Plants and Insects*. 2nd edition. CAB International, Wallingford, U.K., XVII + 833 pp.
- Sturhan D., 1975. Untersuchungen über Vorkommen und Verbreitung pflanzenparasitärer Nematoden in Deutschland. *Biologische Bundesanstalt für Land- und Forstwirtschaft in Berlin und Braunschweig, Jahresbericht 1974*, Bonn, Germany, pp. 103-104.

Accepted for publication on 19 July 2004.