

# Revision of the species *Psyllotylenchus pawlowskyi* (Kurochkin, 1960) Poinar & Nelson, 1973.

## I. Redescription of *Spilotylenchus pawlowskyi* (*sensu stricto*) comb. n. (Tylenchida: Allantonematidae)

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**Summary.** The diagnosis and taxonomic status of the species *Psyllotylenchus pawlowskyi* Kurochkin, 1960 were investigated. The nematodes were originally described from two species of fleas, *Coptosylla lamellifer* and *Nosopsyllus laeviceps*, but the type specimens have been destroyed or lost. New specimens were obtained from fleas collected at the type locality and were used to prepare a redescription of the species. *Psyllotylenchus pawlowskyi sensu* Kurochkin, 1960 was found to be a complex of three species: *Spilotylenchus pawlowskyi (sensu stricto)* comb. n. a parasite of the flea *C. lamellifer*, and two nematode species which parasitize the flea *N. laeviceps*. A neotype of *S. pawlowskyi (s. str.)* comb. n. is designated and the species is distinguished from all other *Spilotylenchus* species by the body length of the parasitic female, shape of stylet and position of the excretory pore.

**Key words:** *Psyllotylenchus pawlowskyi (sensu lato)*, *Spilotylenchus pawlowskyi (sensu stricto)* comb. n., neotype, biology, flea parasites.

Kurochkin (1960) described *Heterotylenchus pawlowskyi*, a tylenchid nematode found parasitizing the flea species *Coptosylla lamellifer* Wagn. and *Nosopsyllus laeviceps* Wagn., collected from around the Astrakhan Station of Plague Control in the Kharabali and Krasnyi Yar districts of the Astrakhan region in the Lower Volga. The life cycle of this nematode is characterized by an alternation in the host coelom of heterosexual and parthenogenetic generations. Poinar & Nelson (1973) established a new genus *Psyllotylenchus* (Bovien, 1937) and transferred *H. pawlowskyi* to this genus. The author visited the type locality of this species and collected parasitic tylenchid nematodes associated with *C. lamellifer* and *N. laeviceps* fleas. Investigation of these nematodes revealed that Kurochkin's description included representatives of three sphaerulariid parasitic nematode species parasitizing these two species of fleas. The results of this investigation are reported here and a re-evaluation of the morphology, biology and taxonomic status of *P. pawlowskyi sensu stricto* are provided to assist with resolving the taxonomic problem associated with the original description of *P. pawlowskyi sensu lato*.

## MATERIAL AND METHODS

Specimens of the two flea species *Coptosylla lamellifer* and *Nosopsyllus laeviceps* were collected from the fur and nests of the midday gerbil *Meriones meridianus* and the tamarisk gerbil *M. tamariscinus* during September–November 1985 in the Kharabali district of the Astrakhan region. The same flea species were collected for comparative purposes in the Guriev region of Kazakhstan in 1985. Additional *N. laeviceps* fleas were also collected in the Stavropol region and in the Dagestan republic of Russia during 1983, in the Uralsk region of Kazakhstan during 1986 and 1987, and in Azerbaijan during December, 1990. Adult and developing stages of parasitic tylenchids were collected from dissected imaginal stages of the fleas. Juvenile nematodes which emerged from naturally infested fleas were reared in hanging drops of physiological saline or in wet sterile sand, where they can survive up to the 2 months. Nematodes were fixed in 4% formaldehyde, dehydrated in an ethanol series and mounted in glycerin. Temporary mounts of nematodes stained with Polychromous Blue and acetic Orceine were also used.

The pharynx measurement includes the protruding pharyngeal glands.

## DESCRIPTION

### *Spilotylenchus pawlowskyi* (Kurochkin, 1960, *sensu stricto*) comb. n. (Figs. 1-3).

#### Synonymy:

*Heterotylenchus pawlowskyi* Kurochkin, 1960 *ex parte*: p. 1281-1282, Fig. 1A ("mature female of sexual generation");

*Psylotylenchus pawlowskyi* (Kurochkin, 1960) Poinar & Nelson, 1973 *ex parte*.

Morphometrics of parasitic females, free-living juveniles and juveniles from the host coelom are presented in the Tables 1-3.

**Neotype parasitic female:** L = 3590  $\mu\text{m}$ ; a = 19.9; c = 63.0; V = 96.5%; vulva-anus distance = 68  $\mu\text{m}$ ; distance between anterior end and excretory pore = 80  $\mu\text{m}$ ; distance between anterior end and uterus = 1230  $\mu\text{m}$ ; stylet length = 25  $\mu\text{m}$ .

**Free-living juvenile, moulting to female (n=1):** L = 485  $\mu\text{m}$ , a = 35.2; b = 2.8; c = 20.2; V = 91.3%; distance between anterior end and excretory pore = 34  $\mu\text{m}$ ; distance between head end and anterior tip of ovary = 292  $\mu\text{m}$ ; vulva-anus distance = 18  $\mu\text{m}$ .

**Free-living juvenile, moulting to male (n=1):** L = 457  $\mu\text{m}$ ; a = 25.3; b = 4.0; c = 19.0; distance between anterior end and excretory pore = 37  $\mu\text{m}$ ; distance between head end and anterior tip of testis = 247  $\mu\text{m}$ .

**Parasitic female.** Long and thick vermiform body curved dorsally when relaxed after fixation. A bright yellow colouration develops in aging females, young adults colourless. Colouration disappears after formalin fixation. Anterior end rounded, posterior end narrows abruptly after the vulva (Fig. 1A & E). Maximum body diameter 105-340  $\mu\text{m}$  at mid-body or in posterior third of body; at vulva level 45-72  $\mu\text{m}$ . Cephalic end not offset from body contour, tail conically tapered with rounded terminus, rarely pointed or with minute spike. (Fig. 1A & E). Body walls thick with prominent transverse folds, especially in the posterior body region. Cephalic or labial papillae not present. Stylet prominent, usually deeply embedded in body tissue with its tip 2-24  $\mu\text{m}$  below apical margin of the anterior end. Stylet divided into two parts: a strongly sclerotized, posteriorly broadening conical blade and a less sclerotized shaft ending with slightly thickened and asymmetrical base (Fig. 1C & F). Total stylet length 22-28  $\mu\text{m}$ , conus length 6-7  $\mu\text{m}$ , stylet diameter at base of conus 1.5-2  $\mu\text{m}$ ,

shaft diameter 2-2.5  $\mu\text{m}$ , basal thickening diameter 3-4  $\mu\text{m}$ . Contours of stylet shaft poorly distinguishable in some specimens. Stylet lumen narrow, with opening on dorsal side of stylet. Pharynx almost cylindrical, widening at level of subventral gland orifices, without isthmus (Fig. 1A & B). Pharyngeal lumen narrow, with lightly sclerotized lining. Dorsal gland orifice 3-6  $\mu\text{m}$  behind basal thickening of stylet, orifices of subventral glands about 2 stylet lengths behind. Nerve ring usually indiscernible. Excretory duct narrow, meandering not visible between gonadal tube loops because of light sclerotization. Excretory cell body indiscernible. Intestine wide, without lumen. Rectum thin-walled. Ovary and oviduct forming from 2 to 11 flexures in anterior body region. Orientation of these flexures differs between specimens. Spermatheca rounded or oval 70-180  $\mu\text{m}$  x 55-120  $\mu\text{m}$ , filled with numerous tiny spermatozoa and overlaps the sac-like uterus which occupies about two thirds of body length. Up to several thousand eggs and juveniles in uterus. Thin-walled eggs in uterus, extremely small in relation to female size; eggs 31-63 x 18-32  $\mu\text{m}$ , with smallest eggs present in anterior part of uterus and egg size increasing posteriad with juveniles developing inside. Juveniles inside female uterus 135-189  $\mu\text{m}$  long and 5-7  $\mu\text{m}$  dia. Uterus wall thickened near vagina. Vulval lips not protruding (Fig. 1D). Vagina directed obliquely to body surface. Ovoviviparous.

**Juveniles from host coelom prior to moulting.** Freshly hatched juveniles with short, thin body - 202-212  $\mu\text{m}$  long x 10-12  $\mu\text{m}$  maximum dia., slightly swollen behind nerve ring (Fig. 2A). Stylet indistinct. Protractors underdeveloped, and stylet appearing as if embedded in a transparent capsule. Thin, short excretory duct with pore located just anterior to nerve ring. Excretory cell indiscernible. Short, nearly cylindrical pharynx, slightly widened in basal part. Pharyngeal glands poorly developed, their orifices were not observed. Intestine without lumen. Rectum thin; anus located at bottom of a furrow, appearing submerged in lateral view. Short, bluntly rounded tail. Gonad primordium ovoid, two-celled, located at mid-body. Body swelling especially prominent in region of pharyngeal glands before moult (Fig. 2B). Stylet differentiation on short conus, thread-like shaft and tiny basal knobs becoming more obvious in developed juveniles (Fig. 2C). Tail end of these juveniles slightly curved dorsally when relaxed (Fig. 2D).

**Juveniles from host coelom during and after the moulting.** In moulting juveniles the swelling in the region of the pharyngeal glands disappears and the body becomes cylindrical. The juvenile body curves

**Table 1.** Morphometrics ( $\mu\text{m}$ ) of *Spilotylenchus pawlowskyi* (*sensu stricto*) comb. n. parasitic females and *Psyllotylenchus pawlowskyi* (*sensu lato*) females of heterosexual generation.

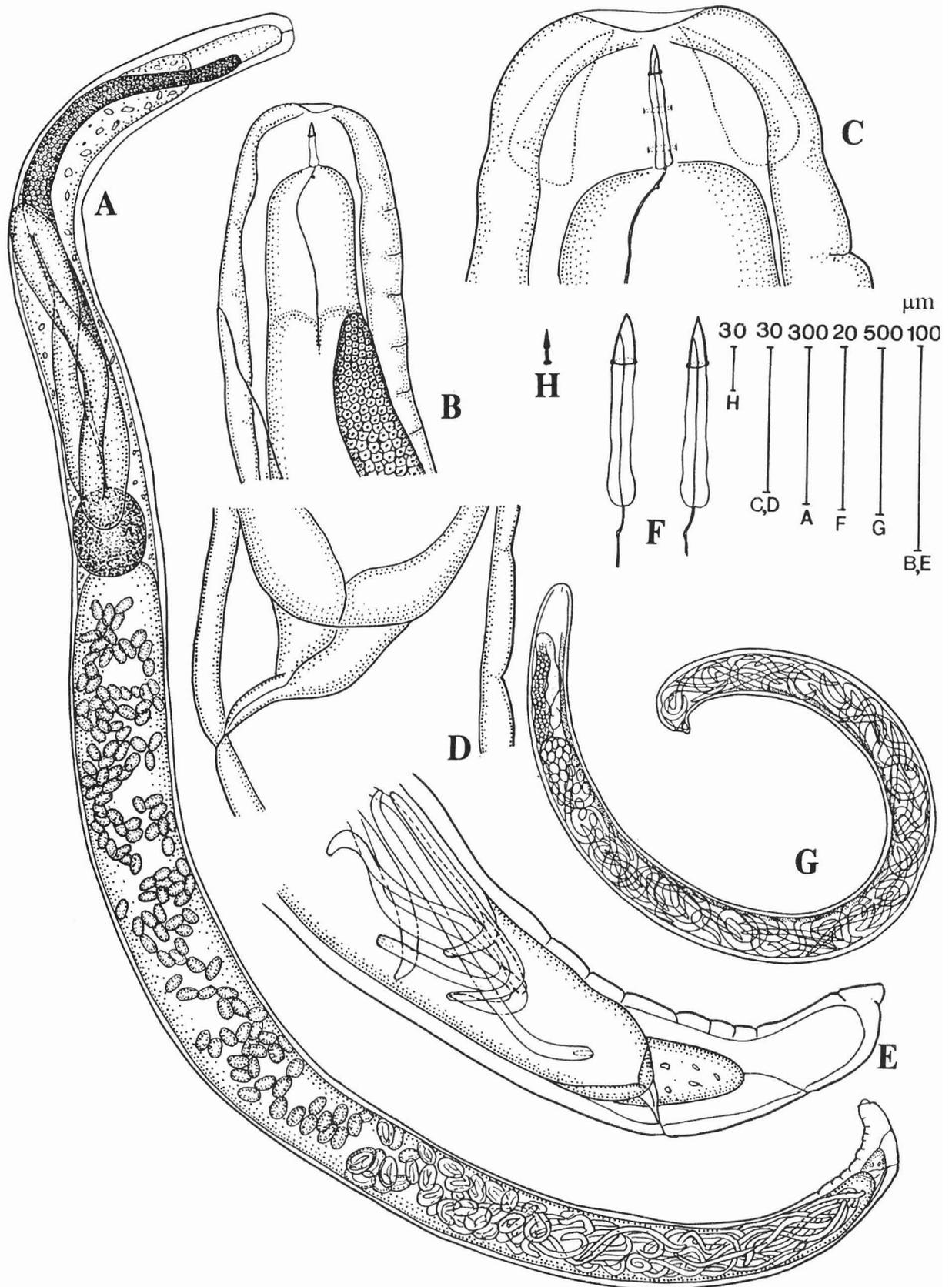
Character	<i>Spilotylenchus pawlowskyi</i> ( <i>sensu stricto</i> ) comb. n. original data	<i>Psyllotylenchus pawlowskyi</i> ( <i>sensu lato</i> ) (Kurochkin, 1960)
n	32	–
L	2863 $\pm$ 89.6 (1890-3690)	2000-3100
a	16.9 $\pm$ 0.8 (9.7-29.4)	–
c	91 $\pm$ 4.9 (50.9-138.1)	–
D	180 $\pm$ 9.0 (105-340)	110-200
Cd	33 $\pm$ 1.4 (20-52)	30-50
V%	96.7 $\pm$ 0.1 (95.2-98.5)	–
Vulva-anus distance	53 $\pm$ 2.0 (30-77)	–
Anterior to excretory pore	86 $\pm$ 1.5 (68-102)	78-100
Anterior to ovary	150 $\pm$ 13.1 (55-256)	–
Anterior to uterus	837 $\pm$ 37.5 (420-1230)	–
Vulva to tail tip	90 $\pm$ 5.0 (43-127)	110-130
Ratio uterus length/body length	0.67 $\pm$ 0.001 (0.58-0.75)	approx. 0.75
Egg length	43 $\pm$ 1.7 (31-63)	47-60
Egg width	25 $\pm$ 0.8 (18-32)	30
Stylet length	24 $\pm$ 0.1 (22-28)	22

**Table 2.** Morphometrics ( $\mu\text{m}$ ) of *Spilotylenchus pawlowskyi* (*sensu stricto*) comb. n. juveniles from host coelom.

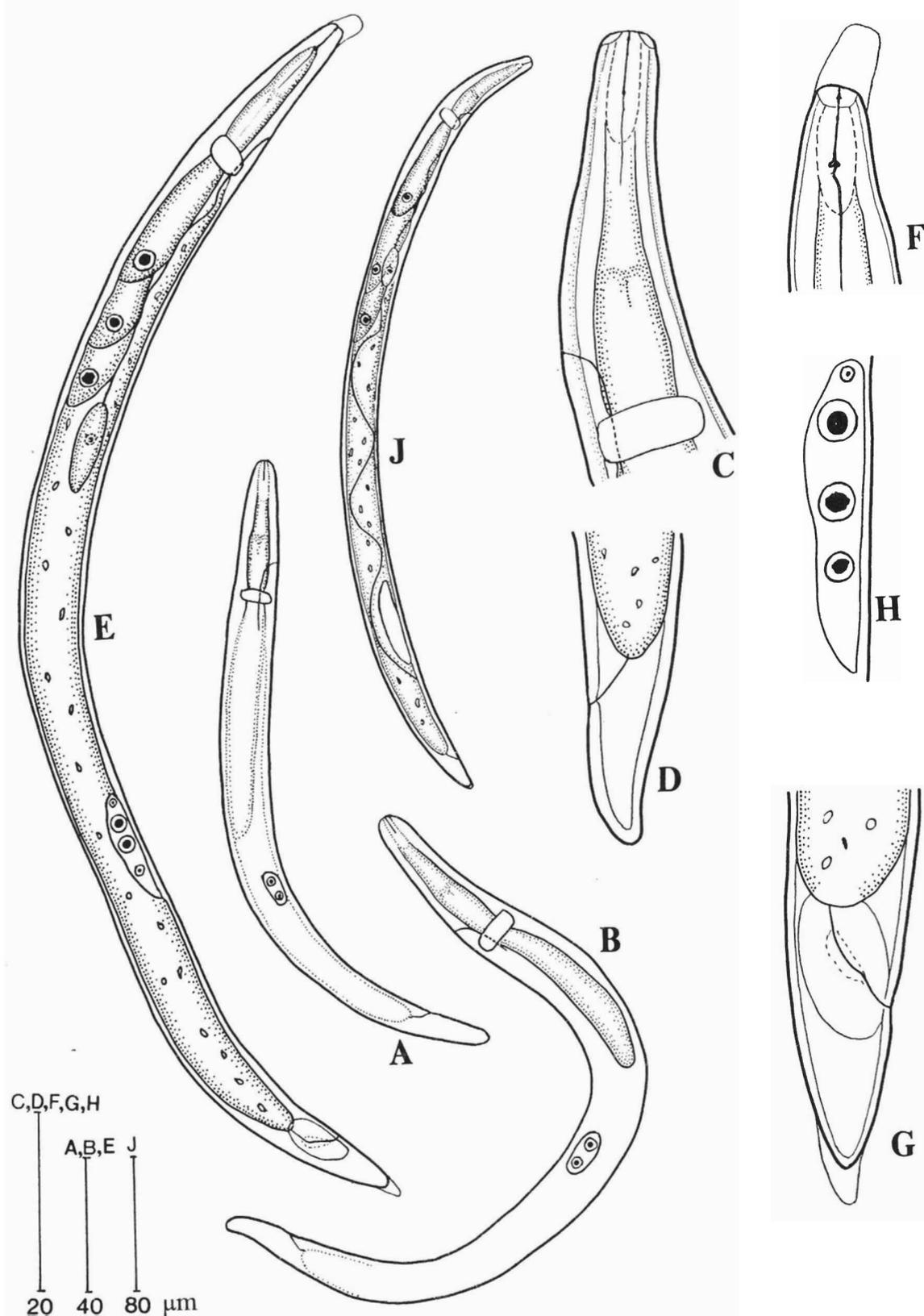
Character	Juveniles before moulting	Molting juveniles	Juveniles after moulting
n	30	9	52
L	267 $\pm$ 9.0 (202-345)	397 $\pm$ 6.1 (378-422)	435 $\pm$ 5.7 (360-498)
a	17.1 $\pm$ 0.5 (12.5-21.6)	21 $\pm$ 0.5 (18.4-22.5)	22 $\pm$ 0.3 (18.0-25.9)
b	3.1 $\pm$ 0.14 (2.1-4.9)	3.5 $\pm$ 0.2 (2.9-4.1)	3.6 $\pm$ 0.01 (2.7-4.6)
c	14.2 $\pm$ 0.4 (10.9-17.3)	17.6 $\pm$ 0.5 (14.7-19.5)	19.1 $\pm$ 0.2 (16.4-23.4)
D	16.1 $\pm$ 0.8 (11-21)	19.3 $\pm$ 0.4 (18-21)	19.9 $\pm$ 0.1 (18-20)
Oes	89 $\pm$ 2.1 (70-110)	116 $\pm$ 5.4 (88-120)	122 $\pm$ 2.4 (95-144)
Cd	18.8 $\pm$ 0.2 (17-21)	23 $\pm$ 0.5 (20-25)	23 $\pm$ 0.3 (20-26)
Anterior to excretory pore	29 $\pm$ 0.6 (24-33)	37 $\pm$ 0.98 (35-41)	38 $\pm$ 0.5 (34-45)
Anterior to nerve ring	37 $\pm$ 0.2 (34-39)	43 $\pm$ 1.9 (36-47)	44 $\pm$ 0.6 (38-53)
Anterior to genital primordium	136 $\pm$ 3.6 (115-165)	244 $\pm$ 13.7 (196-297)	287 $\pm$ 4.9 (218-345)
Genital primordium	16.5 $\pm$ 0.5 (12-20)	34 $\pm$ 1.6 (27-42)	55 $\pm$ 2.3 (27-98)
Stylet length	6.8 $\pm$ 0.01 (6-7)	9.1 $\pm$ 0.01 (9-10)	9.0 $\pm$ 0.003 (9-10)

**Table 3.** Morphometrics ( $\mu\text{m}$ ) of *Spilotylenchus pawlowskyi* (*sensu stricto*) comb. n. juveniles after migration to environment.

Character	Juveniles after 1 day	Juveniles after 31 days	Juveniles after 39 days	Juveniles after 43 days
n	10	12	10	55
L	528 $\pm$ 18.3 (462-574)	452 $\pm$ 5.9 (415-485)	443 $\pm$ 6.6 (400-462)	416.7 $\pm$ 3.0 (358-500)
a	28.5 $\pm$ 2.2 (21.0-33.8)	27.2 $\pm$ 1.0 (24.4-37.3)	24.8 $\pm$ 1.0 (21.8-30.8)	27.2 $\pm$ 0.3 (21.1-33.5)
b	4.6 $\pm$ 0.2 (4.2-5.1)	3.8 $\pm$ 0.01 (3.3-4.2)	4.2 $\pm$ 0.01 (3.7-4.6)	3.5 $\pm$ 0.003 (3.1-4.6)
c	18.6 $\pm$ 0.7 (16.2-21.0)	20.0 $\pm$ 0.3 (18.3-21.4)	17.6 $\pm$ 0.4 (15.4-20.1)	18.5 $\pm$ 0.2 (16.5-22.1)
D	18.8 $\pm$ 0.9 (17-22)	16.8 $\pm$ 0.4 (13-18)	18.1 $\pm$ 0.6 (15-20)	15.4 $\pm$ 0.1 (13-19)
Oes	114.5 $\pm$ 5.1 (99-134)	119 $\pm$ 2.1 (107-137)	107.2 $\pm$ 2.0 (100-120)	118 $\pm$ 1.1 (102-142)
Cd	28.5 $\pm$ 1.3 (22-30)	22.6 $\pm$ 0.3 (22-24)	25.3 $\pm$ 0.5 (23-27)	22.6 $\pm$ 0.2 (19-25)
Anterior to excretory pore	45.0 $\pm$ 0.9 (42-48)	37.4 $\pm$ 0.5 (34-39)	40.6 $\pm$ 0.5 (39-43)	37.7 $\pm$ 0.3 (33-45)
Anterior end to nerve ring	53.8 $\pm$ 2.0 (50-62)	54.8 $\pm$ 0.6 (50-58)	48.0 $\pm$ 1.1 (43-55)	49.2 $\pm$ 0.5 (40-57)
Anterior end to hemizonid	71.7 $\pm$ 0.8 (70-75)	72.3 $\pm$ 0.5 (70-75)	73.8 $\pm$ 0.4 (72-75)	68.6 $\pm$ 0.4 (62-75)
Anterior end to genital primordium	350 $\pm$ 14.9 (307-399)	295 $\pm$ 6.9 (247-322)	303 $\pm$ 11.6 (248-337)	272 $\pm$ 4.3 (199-377)
Genital primordium	53.8 $\pm$ 4.2 (42-67)	63.0 $\pm$ 4.1 (42-100)	74.5 $\pm$ 6.4 (33-100)	85.8 $\pm$ 3.1 (45-128)
Stylet length	10	9.3 $\pm$ 0.1 (9-10)	9.1 $\pm$ 0.1 (9-10)	9.0 $\pm$ 0.003 (9-10)



**Fig. 1.** *Spilotylenchus pawlowskyi* (s. str.) comb. n. parasitic females. A & G: Female, lateral view; B & C: Anterior end; D: Vulval region; E: Posterior end; F & H: Stylet (A - F, original; G & H, redrawn from Kurochkin, 1960).



**Fig. 2.** *Spilotylenchus pawlowskyi* (*s. str.*) comb. n. juveniles from host coelom. Juveniles pre-moult: A: Immediately after leaving the maternal uterus; B: Shortly before moulting (total view); C & D: Anterior and posterior ends of the same juvenile as B. Moulting juveniles: E: Juvenile (total view); F & G: Anterior and posterior ends of the same juvenile as E; H: Genital primordium. J: Juvenile after moulting, just before migration to environment.

ventrally when relaxed (Fig. 2E). A more robust stylet with three distinct basal knobs develops, but the protractors are still weak (Fig. 2F). Excretory duct narrow, strongly sclerotized, clearly visible throughout its length. Oval excretory cell situated behind the pharynx glands. Contours of oesophagus more marked. Dorsal gland orifice can be distinguished on this stage at less than 2  $\mu\text{m}$  behind stylet base; orifices of subventral glands at about 2 stylet lengths behind dorsal gland orifice. Intestine morphology similar to that in younger juveniles but anus not submerged. Tail terminus more slender than in pre-moult juveniles, not curved dorsally. Gonad primordium orientated posteriad in juveniles of both sexes (Fig. 2H). Juveniles of males distinguished by developing spicular apparatus (Fig. 2G). Development of gonad primordium initiated after moulting. Shed cuticle can be seen on the tail in juveniles before migration to environment as an additional sheath (Fig. 2J).

**Free-living juveniles.** Cuticle with characteristically thin annulation. Lateral field with 6 lines (Fig. 3B). Hemizonid located well posterior of the nerve ring. Excretory pore less prominent than in juveniles from coelom; excretory canal indistinct; excretory cell indiscernible. One day after emerging from the host the increase of juvenile body length, tail length, distance from anterior end to excretory pore and further development and differentiation of gonad primordium are observed (Fig. 3C), however, after one month the body length and width have obviously decreased (Table 3). Sexual dimorphism more prominent in the structure of gonad primordium (Fig. 3A, D, & E) which is situated in posterior third of body in both sexes. Additional sheath of cuticle still discernible on tail (Fig. 3A).

**Moulting free-living juvenile of female.** Slender short body slightly curved ventrally. Body shape mainly cylindrical, tapering slightly anteriorly and more pronounced posteriorly (Fig. 3F, G & H). Cephalic end not off-set, without lips. Tail broadly rounded. Stylet still not fully formed: only the robust, strongly sclerotized 6  $\mu\text{m}$  long conus assumes the final shape which is characteristic for parasitic females of this species. Posterior parts of stylet still developing. Pharynx as in earlier juvenile stages but more swollen in region of pharyngeal gland orifices. Gonads still rudimentary, represented by oval ovary primordium and undifferentiated tubular oviduct and uterus. Vagina not formed completely, vulva present.

**Moulting free-living juvenile of male.** Body shorter than moulting female juvenile (Fig. 3I & J). Cephalic end not off-set, with slightly developed lips. Conically tapering tail with rounded terminus. Stylet

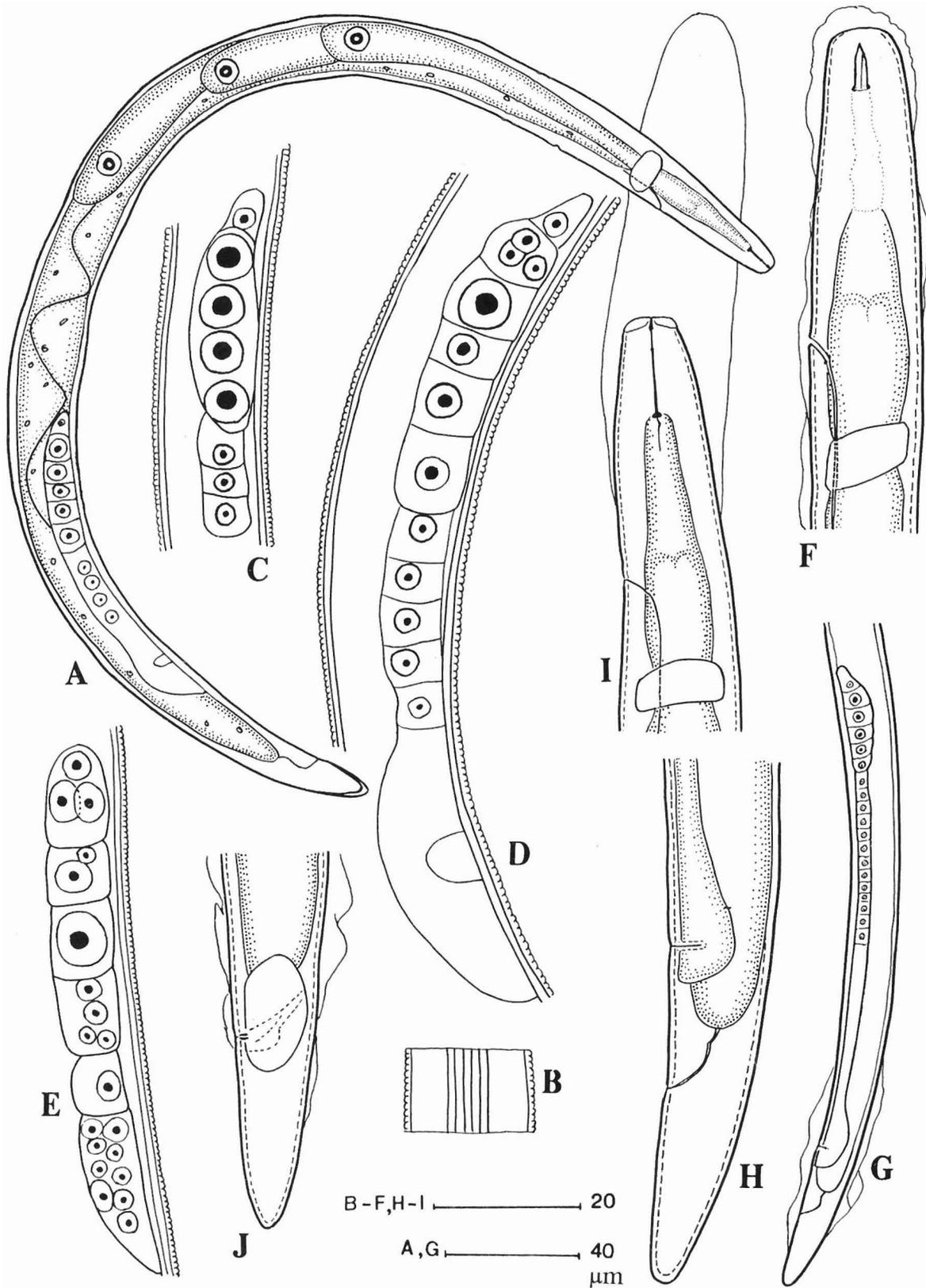
very thin, as in free-living juveniles. Excretory duct and pharynx narrower than in female juvenile. Testis tip located just before mid-body. Spicules not yet fully formed, only distal ends sclerotized.

**Biology.** From a total of 110 dissected *Coptosylla lamellifer*, 54 (49%) were found to be infected with *S. pawlowskyi* (*s. str.*) comb. n., the latter being encountered not only in type locality, but also in Guriev region of Kazakhstan.

Up to 8 immobile parasitic females were recovered per flea (mean=2.2), producing numerous small, very active juveniles. Parasitic females in physiological saline solution produced about 600 juveniles during three hours and their uteri were still tightly filled with eggs and juveniles. Up to 18000 juveniles of differing size were extracted from the coelom of individual infected fleas. Frequently the longest juveniles were present in the femur muscles of the host.

The moult of juveniles was not observed in the female uterus and only one moult was observed in a host coelom. Pre- and post moulting juveniles were readily distinguished by differences in their stylet length and genital primordium size. However, it appears that all the juveniles which emerge from the host coelom are JIII's and they carry the unshed cuticle from the previous stage. It was observed that after their development in the host, *S. pawlowskyi* (*s. str.*) comb. n. juveniles do not leave the coelom through the alimentary tract of the host (as commonly occurs with most flea tylenchids) but instead exit through the genital opening. The genital organs of both males and females of infected *C. lamellifer* fleas are seriously damaged, the ovaries and oviduct in females and phallosome with aedeagus in males always absent. Observations of infected insects reared in tubes filled with wet, sterile sand revealed that numbers of nematode juveniles emerging into the environment varied from 1-50 up to 1500 juveniles per day and that this process invariably resulted in the death of the host. Numerous juveniles were discovered in the coelomic cavity of fleas shortly after death of the host. After the completion a coelomic phase of their development, the juveniles can survive for several days inside the dead host, finally emerging from the host cadaver through the genital opening and the decaying body walls.

Free-living juveniles were reared for two months. An initial increase in body size was followed by shrinkage of the body, but usually no moult occurred. The development of the gonad primordium was also studied and moulting was observed in only two juveniles on the 31st day after emergence into the wet sand. Observation of the formation of the female stylet during juvenile moulting is considered evidence



**Fig. 3.** *Spilotylenchus pawlowskyi* (s. str.) comb. n. free-living juveniles. A: Free-living juvenile female; B: Lateral field of the same juvenile as A; C-E: Genital primordia with different development; F-H: Anterior and posterior ends of juvenile females during moult; J & I: Posterior and anterior ends of juvenile male during the moult.

**Table 4.** Comparative diagnostic taxonomic features of parasitic females of *Spilotylenchus pawlowskyi* (*sensu stricto*) comb. n. with other *Spilotylenchus* species.

Character	<i>S. pawlowskyi</i> (original data)	<i>S. arthuri</i> (Launay <i>et al.</i> , 1983)	<i>S. beaucournui</i> (Launay & Deunff, 1984)	<i>S. laplandicus</i> * (Rubtsov, 1981)	<i>S. megabothridis</i> Laumond & Beau- cournu, 1978)	<i>S. maisonabei</i> (Launay & Deunff, 1990)	<i>S. ussuriensis</i> (Litvinova, 1995)
Stylet length ( $\mu\text{m}$ )	24 (22-28)	24-26	12 (11-14)	19-22	21-24	9-10	21 (20-23)
Stylet distal blade	conical	conical	conical	?	conical	conical	with oblique ventral cut
Stylet shaft width	equal or wider than blade base width	equal or wider than blade base width	much narrower than blade basal width	?	much narrower than blade basal width	much narrower than blade basal width	equal or slightly narrower than blade width
Stylet basal thickening	present, asymmetrical	absent	present, symmetrical	?	present, asymmetrical	present, symmetrical	present, symmetrical
Ex ( $\mu\text{m}$ )	86 (68-102)	31 (19-47)	23 (14-32)	?	?	20-28	19 (8-38)
L ( $\mu\text{m}$ )	2863 (1890-3690)	1127 (905-1280)	1266 (935-1835)	1320-1550	1119 (936-1131)	1200-1320	1455 (1050-2100)
D ( $\mu\text{m}$ )	180 (105-340)	92 (75-116)	93 (61-164)	75-80	136 (114-156)	107-160	144 (91-210)
Insect-host	<i>Coptosylla lamellifer</i>	<i>Spillopsyllus cuniculi</i>	<i>Spillopsyllus cuniculi</i>	<i>Megabothris rectangulatus</i>	<i>Megabothris turbidus</i>	<i>Spillopsyllus cuniculi</i>	<i>Neopsylla bidentatiformis</i>

\* The description and diagnosis of *S. laplandicus* by Rubtsov (1981) do not allow this species to be distinguished from other *Spilotylenchus* species. This species has to be considered a *species dubium*.

that an alternation of parasitic and free-living generations does not occur in the life cycle of *S. pawlowskyi* (*s. str.*) comb. n. Presumably, as with other species of the genus *Spilotylenchus*, females of *S. pawlowskyi* (*s. str.*) comb. n. invade the host after fertilization by free-living males and the males die after copulation.

**Type material.** Neotype parasitic female deposited in the collection of parasites in the Institute of Parasitology, Russian Academy of Sciences, Moscow, Russia, (slide n° 833).

**Type host and locality.** Shortly before his death the late Prof. Yu. V. Kurochkin confirmed that slides containing mounted specimens used for the original description of *Heterotylenchus pawlowskyi* (= *Psyllo-tylenchus pawlowskyi*) had been lost or destroyed. The parasitic female designated here as neotype was collected from the coelomic cavity of a male *Coptosylla lamellifer* flea, collected from a tamarisk gerbil *Meriones tamariscinus* on November 11th, 1985, captured in bushes at the village of Tchachachi in the Kharabali district of the Astrakhan region (leg. O.V. Slobodyanyuk).

**Diagnosis and relationships.** The morphometrics of parasitic females of *S. pawlowskyi* (*s. str.*) comb. n. (Table 1) agree with those published by Kurochkin (1960) for parasitic females of a heterosexual generation of *P. pawlowskyi*. The body length and width of *S. pawlowskyi* (*s. str.*) comb. n. are substantially different from all other *Spilotylenchus* species and

also from all other tylenchids parasites of fleas. The dorsal curvature of the body in relaxation and the long anterior end to excretory pore distance described for *P. pawlowskyi*, also occurred in our specimens (Fig. 1A & G). Therefore, it can be presumed that the nematodes reported here which were collected in the Kharabali district are representatives of the species described by Kurochkin (1960) from females of the parasitic heterosexual generation. However, differences in stylet morphology between our specimens and those of the original description cannot be overlooked (Fig. 1F & H). These differences can be explained by assuming an underestimation of the taxonomic value of stylet morphology by the Kurochkin (1960) who described the stylet of *P. pawlowskyi* as "lanceiform with prominent basal thickening" but not with the basal knobs as shown in his drawings.

*Spilotylenchus pawlowskyi* (*s. str.*) comb. n. was the only tylenchid species found associated with *Coptosylla lamellifer* fleas in the Guriev region of Kazakhstan. The same nematode species was the only parasite recovered from *C. lamellifer* specimens collected in Turkmenistan by the Alma-Ata Anti-Plague Institute, and from specimens from the Uralsk and Djambul regions of Kazakhstan, stored in the Zoological Institute of the Russian Academy of Sciences, St. Petersburg (Slobodyanyuk, 1997). Thus, it can be concluded that *S. pawlowskyi* (*s. str.*) comb. n. is probably the only tylenchid nematode species which parasitizes *C. lamellifer* fleas.

*Spilotylenchus pawlowskyi* (*s. str.*) comb. n. can be distinguished from other species of the genus *Spilo-*

*tylenchus* by the structure and shape of its stylet (Table 4). The stylet length of *S. pawlowskyi* (*s. str.*) comb. n. is close to that of *S. arthuri*, *S. megabothridis*, *S. ussuriensis* and *S. laplandicus*, but, in *S. pawlowskyi* (*s. str.*) comb. n. the stylet distal blade is symmetrically tapered, the stylet shaft diameter equals or exceeds the width of blade base, and an asymmetrical basal thickening is present. The stylet of *S. arthuri* has no basal thickening and the stylet shaft of *S. megabothridis* is much narrower than its blade. In *S. ussuriensis* the distal tip of the blade ends with oblique ventral cut. The stylet morphology is unknown for *S. laplandicus*. Also, *S. pawlowskyi* (*s. str.*) comb. n. is distinguished from these species by its larger parasitic females, longer distance from the excretory pore to anterior end, and by its host species. Sphaerulariid nematodes are characterized by their variable body shape, however, features such as the body narrowing behind the vulva and the rounded dorsally directed projection on the tail appear to have value for the diagnosis *S. pawlowskyi* (*s. str.*) comb. n.

In the original description by Kurochkin (1960) two morphological forms of females were described for the nematodes recovered from flea host coeloms and these two forms differed substantially in their respective body shapes and size of both the gravid females and young individuals. Kurochkin (1960) considered parasitic females characterized by having 2-3.1 mm long cylindrical bodies, body diameter 110-130  $\mu\text{m}$ , 22  $\mu\text{m}$  and long lanceiform stylet with prominent basal thickening as representing the heterosexual generation, whereas females with 600-820  $\mu\text{m}$  long bodies, swollen mid-bodies of 56-120  $\mu\text{m}$  dia., and a very thin, poorly discernible stylet represented the parthenogenetic generation. The author reported the length of juveniles hatched from heterosexual females as being 300-430  $\mu\text{m}$ , and those from parthenogenetic females as being 300-800  $\mu\text{m}$ . He also reported that all drawings and measurements were made of living material. Professor Kurochkin, shortly before his death, confirmed to the present author that type specimens and slides were not designated or deposited in any collection and that the temporary slides used for the original description were destroyed or lost.

A new investigation of nematodes parasitizing *C. lamellifer* and *N. laeviceps* fleas was made on the basis of material collected at the type locality of Kurochkin species. It was identified that three species of tylenchid nematodes were associated with these two flea species. One of these species is a specific parasite of *C. lamellifer* fleas and belongs to the genus *Spilotylenchus* Launay, Deunff & Bain, 1983. Parasitic females of this species resemble the females of the heterosexual generation described by Kurochkin

(Fig. 1A & G). The maximum length of juveniles produced by these *Spilotylenchus* females did not exceed 500  $\mu\text{m}$ . The two other tylenchid species are specific parasites of the species *N. laeviceps*, with one of these belonging to the genus *Spilotylenchus*. However, this tylenchid species can be distinguished from the species parasitic in *C. lamellifer* by the smaller size of the parasitic females (960-1880  $\mu\text{m}$ , 50-189  $\mu\text{m}$  dia., stylet 17-20  $\mu\text{m}$ ) and several morphological differences. Also the maximum length of the juveniles is about 830  $\mu\text{m}$ . The second tylenchid species associated with *N. laeviceps* fleas represents an undescribed genus which is characterized by an alternation of two heterosexual generations in the host coelom. Also, parasitic males and females of this species have similar morphology to the free-living males and parthenogenetic females of Kurochkin's *P. pawlowskyi*. The maximum length of juveniles of this undescribed species is less than 400  $\mu\text{m}$ .

It may be concluded that data for parasitic females of two separate species were included in Kurochkin's description of *P. pawlowskyi* (= *H. pawlowskyi*). Also, the morphometrics for juveniles of three separate species probably were used in the original description.

To resolve the taxonomic uncertainties concerning the original description we propose the transfer of the specific parasites of *C. lamellifer* fleas to the genus *Spilotylenchus*, and redescribe this species here as *S. pawlowskyi* (Kurochkin, 1960). As a result of the absence of type specimens and loss of all original slides a neotype is designated for this species. The two parasitic species of *N. laeviceps* fleas will be described as new taxa in a subsequent paper.

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**Слободянюк О. В.** Ревизия *Psyllopylenchus pawlowskyi* (Kurochkin, 1960) Poinar & Nelson, 1973. I. Переописание *Spilotylenchus pawlowskyi* (sensu stricto) comb. n. (Tylenchida: Allantonematidae).

**Резюме.** Проведен анализ диагноза и таксономического статуса вида *Psyllopylenchus pawlowskyi* Kurochkin, 1960. Нематоды были первоначально описаны от двух видов блох: *Coptopsylla lamellifer* и *Nosopsyllus laeviceps*, однако типовые экземпляры были утеряны. Новые экземпляры этих нематод были получены из типового места обитания и использованы для переописания. Было показано, что *Psyllopylenchus pawlowskyi* sensu Kurochkin, 1960 представляет собой комплекс из трех видов: *Spilotylenchus pawlowskyi* (sensu stricto) comb. n., паразита блохи *C. lamellifer*, и двух видов нематод, паразитирующих в блохе *N. laeviceps*. Обозначен неотип *S. pawlowskyi* (s. str.) comb. n. Этот вид отличается от других видов рода *Spilotylenchus* по длине тела паразитических самок, форме стилета и положению экскреторной поры.

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