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## NEW DATA ON THE MORPHOLOGY AND DISTRIBUTION OF OSWALDOCRUZIA SKRJABINI (NEMATODA, MOLINEIDAE)

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**New Data on the Morphology and Distribution of *Oswaldocruzia skrjabini* (Nematoda, Molineidae).** Svitin, R. S. — Sixteen specimens of *Oswaldocruzia* (Nematoda, Molineidae) were found in the material from *Zootoca vivipara* Lichtenstein, 1823 collected in Ukraine. The nematodes were identified as *O. skrjabini* Travassos, 1937 due to the presence of well-developed cervical alae and the host species. Based on the specimens examined, an amended description of the species, with new morphological characters and metrical data, was composed; its distribution in Ukraine was outlined. *Oswaldocruzia skrjabini* differs from other species of the genus by the presence of extra branches on spicular fork and shoe.

Key words: *Oswaldocruzia*, *O. skrjabini*, *Zootoca (Lacerta) vivipara*, synlophe, spicules.

**Новые данные о морфологии и распространении *Oswaldocruzia skrjabini* (Nematoda, Molineidae).** Свитин Р. С. — Шестнадцать экземпляров *Oswaldocruzia* (Nematoda, Molineidae) были обнаружены в материале от *Zootoca vivipara* Lichtenstein, 1823 собранном на территории Украины. Нематоды были определены как *O. skrjabini* Travassos, 1937 на основании наличия развитых латеральных крыльев и вида хозяина. Представлено дополненное описание вида с новыми морфологическими признаками, морфометрией и распространением в Украине. *Oswaldocruzia skrjabini* отличается от других видов рода наличием дополнительных отростков на ветках fork и shoe спикул.

Ключевые слова: *Oswaldocruzia*, *O. skrjabini*, *Zootoca (Lacerta) vivipara*, синлоф, спикулы.

### Introduction

Nematodes of the genus *Oswaldocruzia* Travassos, 1917 are a group of bursate nematodes (Strongylida) inhabiting the digestive tract of amphibians and reptiles. The first species described in Palaearctic — *O. filiformis* Goeze, 1782 was recognised as a parasite of amphibians from the genera *Bufo* and *Rana*. Since the first description was very brief and without significant characters illustrated, many authors thereafter assigned various forms found in amphibian and reptilian hosts to *O. filiformis*. As a result, by the end of the XX century the host list of *O. filiformis* included amphibians and reptiles from the genera *Rana*, *Bufo*, *Hyla*, *Pelobates*, *Anguis*, *Lacerta*, *Natrix*, *Ophisaurus*, *Vipera* (Skrjabin et al., 1954; Ryzhikov et al., 1980; Baker, 1981; Sanchis et al., 2000; Anderson, 2000). However, Molin (1860) found some specimens differing from *O. filiformis* by the presence of wide cervical alae and described them as *O. bialata* Molin, 1860. Travassos (1937) distinguished another form in the material labelled as *O. filiformis* from *Zootoca vivipara* and described a new species — *O. skrjabini* Travassos, 1937; he also supposed that more species could be revealed among the specimens identified as *O. filiformis*. Contrary to that opinion, Sharpilo (1976) proposed to synonymise all species from European reptiles with one species, *O. filiformis* (= *O. goezei*), and to consider differences described by Travassos and other authors as intraspecific variations. In the review of the genus *Oswaldocruzia* provided by Ben Slimane et al. (1996), *O. skrjabini* was considered as a valid species and was included into the identification key of Palaearctic species. However, morphology of the caudal bursa and spicules of this species were taken from the first description where these structures had been poorly illustrated (folded bursa and not dissected spicules).

During the studies on the genus *Oswaldocruzia* we examined the specimens collected from *Z. vivipara* in Ukraine and stored in the collection of the Department of Parasitology of Schmalhausen Institute of Zoology, NAS of Ukraine. Based on particular morphological characters and the host species, we assigned the specimens to *O. skrjabini*. Morphological examination of the nematodes allowed to update and amend the description of the species by adding new information to it. The amended description of *O. skrjabini* is presented herein.

### Material and methods

Totally 16 specimens, previously identified as *O. filiformis*, were studied; 10 of them, 3 males and 7 females, were measured (details of the genital system morphology were measured in 5 females). Standard parasitological indices (prevalence, intensity of infection and abundance) were calculated based on the collection records. All specimens were initially fixed and stored in 4 % solution of formalin in saline. Prior to examination, nematodes were cleared in lactophenol. After the studies, all nematodes were transferred to 70 % alcohol for further storage.

Morphology of the nematodes was studied using the light microscope AmScope T690B (AmScope, China) equipped with digital imaging system. In the description of measured characters, mean value is given and followed by range in parentheses. All measurements in the text are given in micrometers, all scale bars on the figures equal 0.1 mm, unless otherwise indicated.

The nomenclature of the synophe in the oesophageal region follows that of Ben Slimane et al. (1993). The nomenclature of the caudal bursa follows Durette-Desset and Chabaud (1981).

### *Oswaldocruzia skrjabini* Travassos, 1937

Host. *Zootoca (Lacerta) vivipara* (Lichtenstein, 1823).

Site. Intestine.

Prevalence — 22 %, intensity — 2.2 (1–6), abundance — 0.5.

Deposited specimens: collection of the Department of Parasitology of Schmalhausen Institute of Zoology, NAS of Ukraine.

Localities in Ukraine: Kyiv Region (1 locality), Lviv Region (2 localities), Sumu Region (1 locality), Zhitomyr Region (1 locality), Zakarpattia Region (1 locality) (fig.1).

### Description

General. Body thin, elongated, females generally larger than males, maximum width near midlength. Cuticle without visible transverse striations and with longitudinal ridges irregularly interrupted along body. Anterior extremity with well developed cephalic vesicle consisting of two parts: wider and rounded anterior part, and narrower posterior part, sometimes folded transversally (fig. 2, 1). Triangular oral opening surrounded by 6 externo-labial papillae, 4 cephalic papillae, and 2 amphids; dorsal oesophageal tooth absent. (fig. 2, 4). Oesophagus thin, club-shaped, almost cylindrical in anterior half, with oval bulb in posterior half. Excretory glands well-developed, dissimilar in size, their posterior ends located posterior to oesophago-intestinal junction; both glands opening through jointed

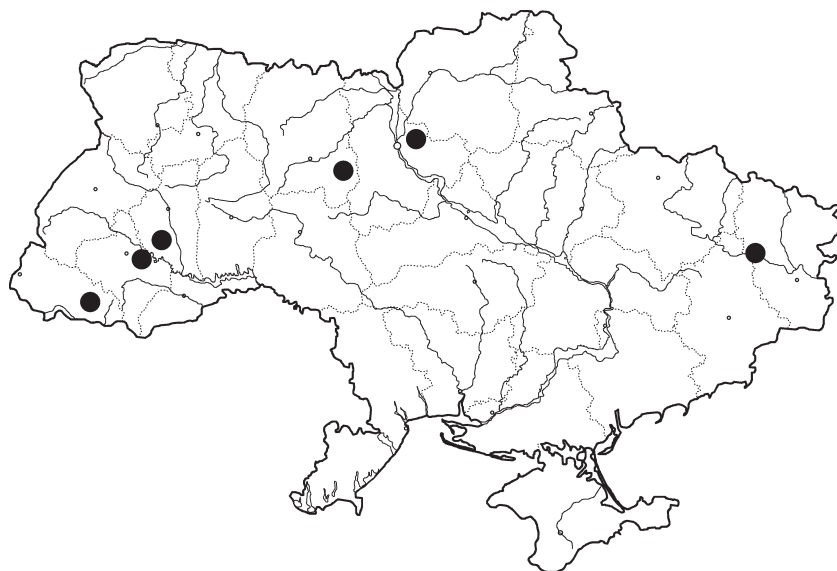


Fig. 1. Distribution of *O. skrjabini* in Ukraine.

excretory duct and excretory pore at level of posterior third of oesophagus. Nerve ring position varying near midlength of oesophagus or somewhat closer to its posterior third. Deirids comparatively large, at level of posterior quarter of oesophagus (fig. 2, 1).

Structure of synlophe studied on transverse sections in 7 specimens (fig. 2, 5–7; 3, 3). Synlophe symmetrical. Well-developed cervical alae located along anterior 2/3 of oesophagus, visible in lateral view, becoming narrow at end of oesophagus. On transverse sections, crests absent along anterior part of oesophagus on ventral side, 10–15 simple crests present on dorsal side; triangular cervical alae with rounded tops. On sections at level of posterior end of oesophagus and anterior part of intestine, crests present on dorsal (17–19) and ventral (10–15) sides, cervical alae small, triangular.

Males (based on 3 specimens, morphometry in table 1). Each cervical ala beginning at 114 (108–120) from anterior end and transformed into simple crest at 540 (460–620) from its beginning, at about midlength of longer excretory gland. Caudal bursa symmetrical, 3-lobed; rays arranged in type 2–1–2 pattern, type II (classification of Durette-Desset, 1985). Rays 2 and 3 parallel, slightly separated from each other, reaching edge of bursal membrane; ray 4 with common origin not reaching bursal margin, separated from rays 5 and 6; rays 5 and 6 parallel, slightly separated, reaching bursal membrane margin; ray 8 with independent origin, parallel at origin, overlapping ray 6 in midlength and distancing from it in distal third, not reaching bursal margin. Dorsal ray of bursa formed by rays 9 and 10. Each ray 10 with small extra branch on its tip. Reduced rays 1 present on each side of genital cone. Genital cone well developed, with two papillae. Gubernaculum absent (fig. 2, 8; 3, 1, 2). Spicules equal, surrounded by thin membrane, consisting of three branches: blade, fork and shoe. Blade distally divided in 4 tips, fork bifurcated in its distal

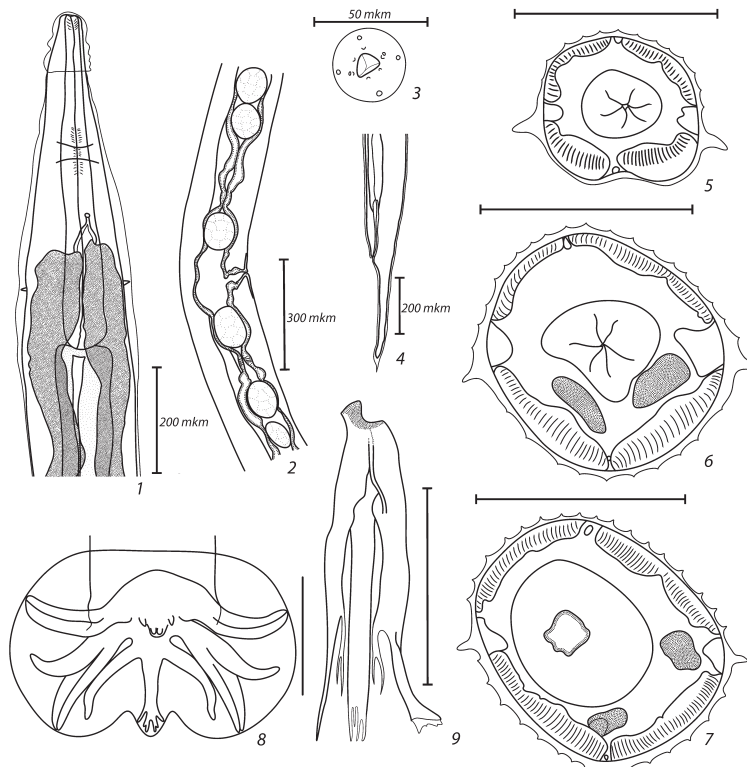


Fig. 2. *Oswaldocruzia skrjabini*: 1 — anterior part of body, female, ventral view; 2 — part of female genital system near vulva; 3 — posterior end, female, lateral view; 4 — anterior end, apical view; 5 — transverse section at mid-oesophagus level; 6 — transverse section at posterior part of oesophagus; 7 — transverse section at level of intestine anterior part; 8 — male caudal bursa; 9 — left spicule, dissected.

third with extra process on its interior branch, shoe distally banded with short bifurcated process on its distal third (33 % of the whole spicule length) (fig. 2, 9; 3, 4).

**Females** (based on 7 females, morphometry in table 2). Each cervical ala beginning at 99 (85–125) from anterior end and transformed into simple crest at 417 (335–523) from its beginning, at about midlength of longer excretory gland. Vulva wide, postequatorial in position. Anterior ovary beginning near posterior end of excretory glands, posterior ovary slightly anterior to vulva. Number of eggs varying from 4 to 49 depending on female age (size). Size of eggs 75–95 × 53–55. All eggs observed on morula stage, in uteri, ovejectors and in vulva (fig. 2, 2). Vagina vera 37 (25–45) long, 20 (14–25) in diameter. Anterior oviduct beginning posterior to excretory glands, forming 1–4 bends, 3,942 (2,070–5,580) long. Posterior one beginning slightly anterior to vulva, 3,790 (1,940–6,580) long. Distance from cephalic end of body to anterior oviduct and from end of tail to posterior one 913 (320–1,200) and 608 (460–800), respectively. Anterior uterus 1,262 (1,000–1,640) long, posterior 1,368 (1,040–1,820) long. Length of anterior infundibulum 104 (68–163), maximum width closer to uteri 57 (30–75), minimum width closer to sphincter 32 (23–48). Length of posterior infundibulum 101 (73–133), maximum width closer to uteri 46 (30–53), minimum width closer to sphincter 29 (23–35). Anterior sphincter 32 (25–40) long, 37 (28–50) wide; posterior one 38 (35–43) long and 36 (25–43) wide. Length of anterior ovejector 114 (75–150), maximum width 76 (73–83), minimum width 60 (50–75). Length of posterior ovejector 112 (75–163), maximum width 69 (65–75), minimum width 58 (43–75). Tail tapering, with sharp cuticular process on tip (fig. 2, 3).

## Discussion

After examination of totally extended bursa and dissected spicules we found that *O. skrjabini* differed from *O. filiformis* in presence of extra branches on papillae 10 of caudal bursa, presence of extra branches on spicular fork and shoe, and division of spicular blade in 4 tips on its end; while *O. filiformis* possesses spicules with blade distally divided on 3 process and without extra branches on fork and shoe.

*Oswaldocruzia skrjabini* may be easily differentiated from all other Palaearctic species by structure of synlophe and male genital system. *Oswaldocruzia bialata* has the most similar synlophe structure (wide cervical alae and increased deirids), however it may be differentiated from *O. skrjabini* by the absence of extra branches on spicular fork and shoe, absence of extra branches on rays 10 of caudal bursa and absence of reduced papilla 1

**Table 1. Morphometry of *O. skrjabini* males (3 specimens)**

Characters	mean	min.	max.
Length of body	6140	5490	6710
Width of body	110	100	120
Length of cephalic vesicle	73	68	80
Width of cephalic vesicle	40	35	50
Length of oesophagus	377	345	418
Length of oesophagus, in % of body length	6.15	5.55	6.69
Width of anterior end of oesophagus	23	22	25
Width of oesophagus at midlength	26	23	28
Width of oesophageal bulb	44	38	53
Distance to nerve ring from anterior end of oesophagus	202	183	238
Distance to nerve ring, in % of oesophagus length	53.39	49.66	56.89
Distance to excretory pore from anterior end of oesophagus	275	270	280
Distance to excretory pore, in % of esophagus length	73.50	65.87	81.16
Distance to deirids	283	270	295
Length of tail	117	108	128
Length of spicules	173	170	175

Table 2. Morphometry of *O. skrjabini* females (7 specimens)

Characters	mean	min.	max.
Length of body	8841	7240	10130
Width of body at midlength	129	100	180
Length of cephalic vesicle	77	55	108
Width of cephalic vesicle	39	35	43
Length of oesophagus	305	286	316
Length of oesophagus, in % of body length	3.48	4.34	3.02
Width of anterior end of oesophagus	23	20	25
Width of oesophagus at midlength	24	23	28
Width of oesophageal bulb	47	40	55
Distance to nerve ring from anterior end of oesophagus	180	145	208
Distance to nerve ring, in % of oesophagus length	59.11	46.18	68.71
Distance to excretory pore from anterior end of oesophagus	278	243	328
Distance to excretory pore, in % of oesophagus length	91.25	77.23	107.03
Distance to deirids from anterior end of body	292	263	315
Distance to deirids from anterior end of body, in % of body length	3.32	2.59	3.90
Distance from anterior end to vulva	5265	4070	6250
Distance to vulva, in % of body length	59.50	50.25	63.67
Length of tail	195	165	243
Length of tail, in % of body length	2.22	1.80	2.70

aside from genital cone. Another species with wide cervical alae, *O. problematica*, is easily differentiated from *O. skrjabini* by the presence of numerous crests on the ventral side of the body at the beginning of oesophagus level, and by spicule structure (absence of extra branches on fork and shoe and undivided blade). The presence of extra branches on spi-

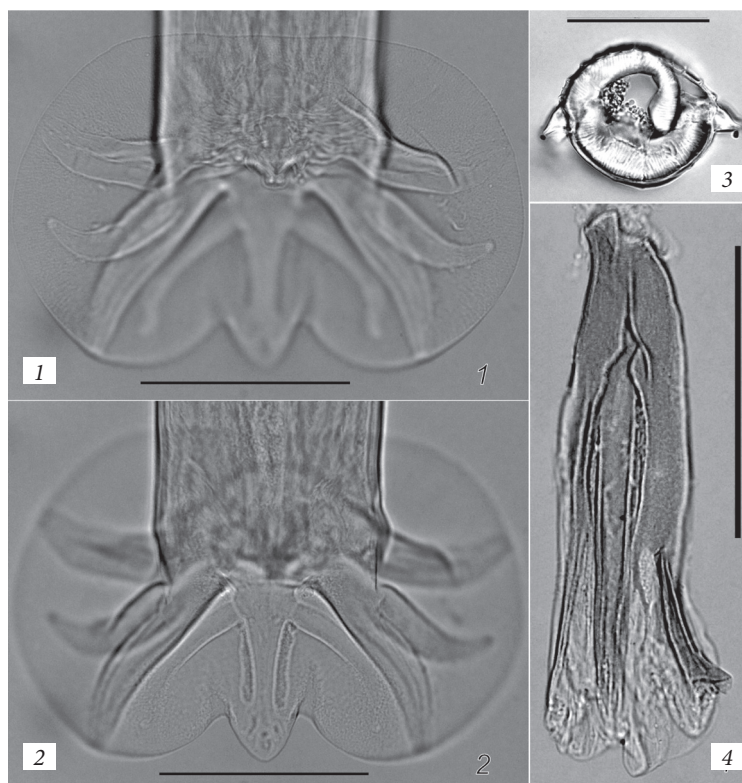


Fig. 3. *Oswaldocruzia skrjabini*, photomicrographs: 1, 2 — male caudal bursa; 3 — transverse section at mid-oesophagus level; 4 — left spicule, dissected.



cules was previously reported for the Palaearctic species *O. guyetanti* described by Durette-Desset et al. (1993). That species is characterised by very similar spicular structure (blade ending in 4 processes, extra branches on fork and shoe), but the shoe process is short and divided into 3 tips in *O. guyetanti* different for what we observed in *O. skrjabini* (the process is longer and bifurcated). The cervical alae of *O. guyetanti* in oesophageal region are narrower than those in *O. skrjabini*, though deirids look similarly enlarged in both species. In our opinion, the two species may be closely related despite they parasitise distantly related hosts (*Rana* sp. vs. *Z. vivipara*). Apparently, this fact should be confirmed by investigation of more specimens of both species, experimental infection and molecular studies.

In the present study, *O. skrjabini* was found only in the material from *Z. vivipara*. We also examined the material collected from other reptilians (*Vipera berus*, *Natrix natrix*, *Coronella austriaca*, *Anquis fragilis*, *Lacerta agilis*, *L. viridis*) and amphibians (*Rana* spp., *Pelophylax* spp., *Bufo* spp., *Pelobates fuscus*, *Hyla arborea*, *Triturus cristatus*, *Lissotriton vulgaris*, *L. montadoni*, *Mesotriton alpestris*) and found no specimens of *O. skrjabini* in it. Moreover, all samples from *Z. vivipara* contained only *O. skrjabini*, with rather high abundance. Since the species was described and identified only from *Z. vivipara*, we consider *O. skrjabini* as a specific parasite of the viviparous lizard.

We found *O. skrjabini* in 6 localities in northern and western regions of Ukraine, within the distribution area of *Z. vivipara* in the country (Shcherbak, Shcherban, 1980). Besides Ukraine the species was also reported in northern Italy (Travassos, 1937). In our opinion, real distribution of *O. skrjabini* is wider and may be outlined by further studies of parasites of the viviparous lizard.

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