

# Scanning electron microscopy of the rare nematode species *Pterygodermatites bovieri* (Nematoda: Rictatuliriidae), a parasite of bats

Vasilij V. Tkach<sup>1</sup> and Zdzislaw P. Swiderski<sup>2</sup>

<sup>1</sup>Institute of Zoology, Ukrainian Academy of Sciences, 15 Bogdan Khmelnitsky street, Kiev-30, MSP, 252601, Ukraine

<sup>2</sup>Institute of Parasitology, Polish Academy of Sciences, 3 Pasteur street, P.O. Box 153, 00-973, Warsaw, Poland

Key words: Nematoda, *Pterygodermatites bovieri*, SEM, external morphology

**Abstract.** External morphology of the nematode *Pterygodermatites bovieri* (Blanchard, 1886), a very rare parasite of bats in the Palaearctic region, was studied by scanning electron microscopy. Special attention was paid to the cephalic end structure and cuticular armament, which are of great systematic importance in this group of nematodes. The mouth opening of *P. bovieri* is subterminal and oriented dorsally. Numerous sclerotized denticles, arranged in two rows, are situated in the buccal cavity around the mouth opening. They are better developed in its ventral part. In females there are 12–14 ventral denticles. Cephalic papillae are arranged in two rows: internal (six papillae – two dorsal, two lateral and two ventral) and external (four papillae). Amphids are small, situated close to lateral cephalic papillae of the internal row. Males possess 40–41 cuticular combs in each ventro-lateral plate row, and, in addition, a short row of four ventral, unpaired precloacal fans. Females in our material possessed 68 cuticular elements represented by combs and spines, in each row. Changes of the cuticular elements shape along the nematode body length are described. Results of SEM observations are compared with previous descriptions of *P. bovieri* based on the light microscopical observations.

Rictulariid nematodes are mainly parasites of rodents and carnivorous mammals and comparatively few species of rictulariids were described so far from bats (Quentin 1969). Morphology of majority of them was studied insufficiently. All literary data concerning the rictulariid nematodes from bats are based on light microscopical observations. The aim of the present study is to describe the external morphology of the extremely rare and less-known species *Pterygodermatites bovieri* (Blanchard, 1886), a parasite of vespertilionid and miniopterid bats in the Palaearctic region. The work is based on SEM observations of *P. bovieri* and the emphasis is made on the structure of the cephalic end and cuticular elements (combs and spines), which are of taxonomic importance within this group of nematodes. Internal structure of the species is not considered in the present paper as these data are available in the literature (Baruš and Tenora 1967, Tkach 1991).

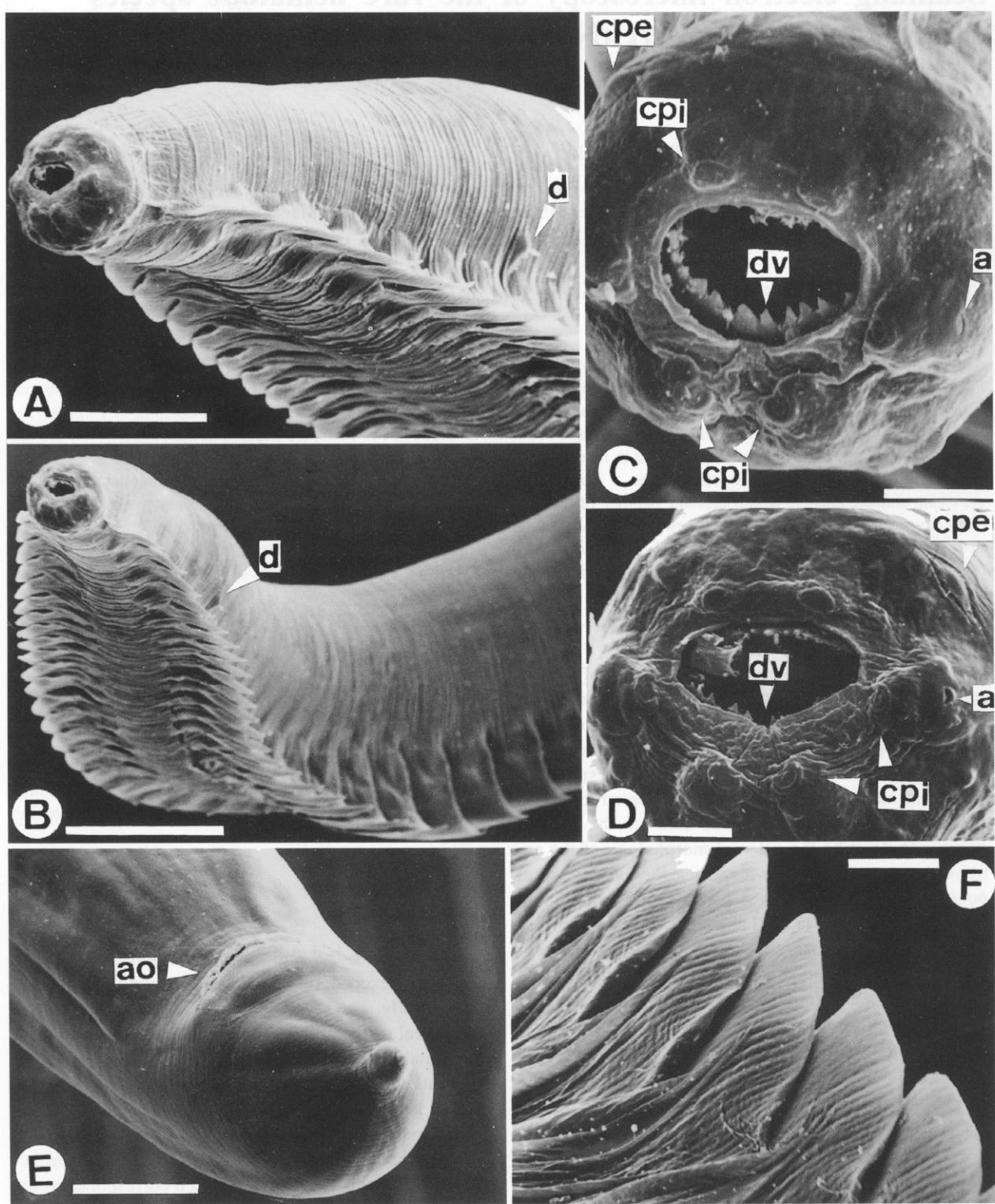
## MATERIALS AND METHODS

The material used in this study was obtained from three bat species belonging to the family Vespertilionidae: *Vesptilio murinus* L., *Eptesicus serotinus* (Schreber) and *Myotis mystacinus* (Kuhl) collected in different regions of Ukraine. The whole material consisted of 24 females and 3 males, some of them fragmented and not suitable for investigation. One male and three females were examined by means of scanning

electron microscopy (SEM). Adult specimens of *Pterygodermatites bovieri* were fixed in 4 % formalin. For SEM study the nematodes were postfixed in ethanol, dehydrated in a graded series of ethanol and acetone, and critical point dried with CO<sub>2</sub> as the transition fluid. The specimens were finally mounted on stubs, coated with gold and examined with a JSM-35CF scanning electron microscope at an accelerating voltage of 15 kV.

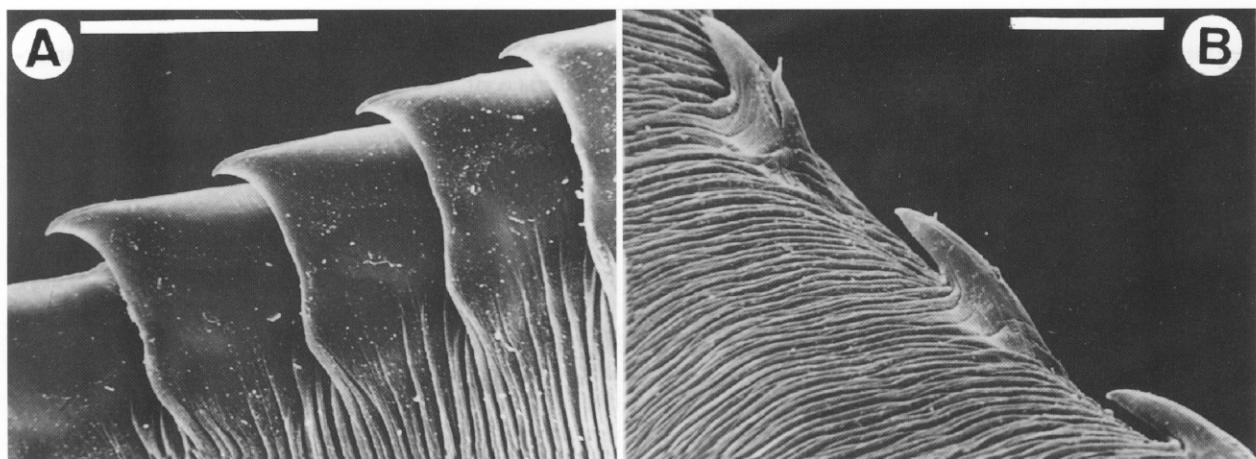
## RESULTS

Males are 1.6–2.0 mm long, while females are much longer and exceed 10 mm. The body cuticle is striated transversally. The striation is especially well-defined on the ventral surface of the body (Fig. 1A, B). Both males and females possess two ventro-lateral rows of cuticular elements consisting of combs in males and of combs and spines in females. The rows begin immediately posterior to the buccal capsule and are situated symmetrically on both sides of the body. There is no distinct annulation of the body surface which corresponds to the position of the cuticular plates. Caudal end of the female is usually nearly straight and smooth, with small rounded process on the tip (Fig. 1E). In males the caudal end is strongly curved ventrally in all three specimens examined, including one used for SEM. The above condition did not allow us to study the male caudal end by SEM, but light microscopy has revealed



**Fig. 1.** External morphology of *Pterygodermatites bovieri*. **A, B** – anterior part of the male body, lateral and ventro-lateral views; **C** – head morphology of the female, apical view; **D** – head morphology of the male, apical view; **E** – caudal end of the female; **F** – cuticular combs in the anterior part of the male body.

**Abbreviations:** a – amphids; ao – anal opening of the female; cpe – external ring of cephalic papillae; cpi – internal ring of cephalic papillae; d – deirid; dv – denticles on the ventral side of mouth opening. Scale bars: A, C-F – 0.05 mm; B – 0.1 mm.



**Fig. 2.** Cuticular armament of *Pterygodermatites bovieri*. **A** – combs in the middle part of male; **B** – postvulvar spines of female. Scale bars: A, B – 0.05 mm.

presence of eight pairs of caudal papillae of sessile type: four pairs of bigger papillae (two precloacal and two immediately postcloacal) and four pairs of smaller papillae situated close to the end of the tail.

#### Cephalic end structure

The buccal capsule is rounded, distinctly separated from the body (Fig. 1C, D). Its anterior surface is slightly oblique. Mouth opening is subterminal and opens dorsally. It is large, oval, elongated transversally. Lips are not well-defined, although six lip-like structures, divided by the small grooves, were observed. There are numerous sclerotized tooth-like denticles arranged in two rows, situated in the buccal cavity around the mouth opening. The denticles are better developed on the ventral side of the mouth (Fig. 1C, D). In females there are 13–14 ventral denticles. Edges of the mouth opening seem to be somewhat sclerotized (or pseudochitinized, according to Baruš and Tenora 1967).

Two rings of cephalic papillae were observed: the internal ring, consisting of 6 papillae and external ring consisting of 4 papillae. Papillae of internal ring are situated around the mouth opening. They are sessile, bulky, rounded in shape, somewhat elevated upon the surface of the head cuticle and possess on their tops round ring-like structures, surrounded by a circular groove (Fig. 1C, D). There are two dorsal, two ventral and two lateral papillae in the internal ring, all are similar in shape and size. Papillae of the external ring (two dorso-lateral and two ventro-lateral) are subapical, sessile, transversally elongated, surrounded by a shallow groove.

Amphids are small, possessing a well-defined opening (Fig. 1C, D). They are situated on opposite sides of

the buccal capsule, close to the lateral cephalic papillae of the inner ring. Deirids are situated laterally on both sides of the body, in males at about 0.20–0.25 mm from the anterior end. They are sessile, with a hair-like process on the top.

#### Cuticular elements structure

Like other rictulariid nematodes, *P. bovieri* possesses two rows of cuticular elements along the body. The rows begin immediately posterior to the buccal capsule and situated ventro-laterally. In the anterior part of the body they form a common nearly flat surface with the ventral side of the nematode (Fig. 1A, B). Males have 40 cuticular combs in each row. All examined females in our material had 68–69 plates in each row, although in the literature, from 67 to 71 combs and spines in a row were reported for the females of *P. bovieri* (Baruš and Tenora 1967, Erkulov and Moldopiyazova 1986). In addition, the males possess a short row of four unpaired, ventral, precloacal plates, oval in shape. Cuticular combs in the anterior part of the body are similar in both sexes. They are leaf-shaped, slightly overlapping one another (Fig. 1A, B, F). Thereafter, however, the shape of the cuticular elements changes in different way in males and females. In males, the combs in the middle and posterior part of the body still overlap one another. They are more or less rectangular in shape, with pointed posterior ends of their upper edges (Fig. 2A). In females, the combs gradually acquire the spine-like shape so that it is difficult to indicate the strict border between combs and spines. Just anterior to the vulvar opening they are already completely transformed into thick, but sharply pointed spines, not overlapping one another (Fig. 2B). More posteriorly, they are diminishing and disappear approximately at a level of border between

the third and fourth quarters of the body length. Prevulvar cuticular elements are 34 in number and represented by combs and few spines. Postvulvar spines are 34 in number.

## DISCUSSION

The species *Pterygodermatites bovieri* was described more than a century ago from *Vespertilio murinus* in France (Blanchard 1886). Since that time it was reported only three times: from *Miniopterus schreibersi* (Kuhl) in Afghanistan (Baruš and Tenora 1967), from *Myotis blythi* Tomes in Kirghizia (Erkulov and Moldopiyazova 1986) and from *V. murinus*, *Eptesicus serotinus*, and *M. blythi* in Ukraine (Tkach 1991). In the paper of Baruš and Tenora (1967) the female morphology of *P. bovieri*, including the number of cuticular elements, teeth, etc., was precisely described and figured for the first time. Quentin (1969) in his revision of the family Rictulariidae allocated the considered species into the new sub-genus *Neopaucipectines* of the genus *Pterygodermatites*. Skvortsov (1971) reported the finding of a single sexually immature female determined as *Rictularia bovieri*, from *M. blythi* in Moldavia. But, in our opinion, the specimen, described by Skvortsov (1971), belongs to another species of rictulariids, because it has only 58 pairs of cuticular elements against 67–71 pairs in *P. bovieri* and it also differs from the latter species by the female caudal end structure. Erkulov and Moldopiyazova (1986) provided only very short data about their material. Tkach (1991) first described the male morphology of *P. bovieri*. There are, however, some inaccuracies in the latter description. It concerns the position of the cuticular comb rows described as lateral, while, as the present study has shown, they are ventro-lateral. Second, more important point, is that the mouth opening in the considered species is oriented

dorsally, whereas Tkach (1991) indicated that the anterior surface of cephalic end is oblique and the mouth opens ventrally.

In previous descriptions of *P. bovieri* only 6 cephalic papillae belonging to internal ring were described whereas papillae of an external ring were not mentioned, as they are not well visible in the light microscope. It also concerns amphids which were observed for the first time in the present study.

As stated above, the males and females of *P. bovieri*, like in other rictulariids species so far studied, are very different in the body length, number of cuticular elements in ventro-lateral rows, presence of an additional precloacal fans row in males and other characters. In spite of the above differences, the head morphology is very similar in both sexes (Fig. 1C, D), moreover, the size of buccal capsule of males and females from our material is nearly equal (0.024–0.028 mm).

The fact that in the anterior part of the nematode body the cuticular comb rows form nearly flat ventral surface may suggest that these plates are not only attachment structures, but they also may be involved in the worm movement. This suggestion is difficult to verify, however, our observations of the living specimens of *P. bovieri* have shown that on the flat surface in the Petri dish and on the moistened paper the nematodes moved on one of the lateral sides of the body, like other nematodes.

We believe that further SEM investigations of other rictulariids species from bats and other hosts (rodents, carnivores) will provide material for more adequate and fruitful comparisons.

**Acknowledgment.** The authors are thankful to Dr. Stanislav Gorb, Institute of Zoology, Kiev, for his assistance with SEM examination of our material. Preparation of this paper for publishing was supported for one of the authors (V. V. T.) by a fellowship from the Josef Mianowski Foundation, Warsaw, Poland.

## REFERENCES

BARUŠ V., TENORA F. 1967: Three interesting nematode species in *Miniopterus schreibersi* (Chiroptera) from Afghanistan. *Sb. VŠZ Brno, řada A*, 15: 95–101.

BLANCHARD R. 1886: Notices helminthologiques (première série). *Bull. Soc. Zool. France*, 11: 994–304.

ERKULOV K. E., MOLDOPIYAZOVA T. M. 1986: New and less-known helminth species from mammals in Southern Kirghizia. In: Free-living and parasitic scolecids of the fauna of Kirghizia. Ilim, Frunze, pp. 112–131. (In Russian.)

QUENTIN J.-C. 1969: Essai de classification des Nématodes Rictulaires. *Mém. Mus. nat. Hist. Nat.*, n. s., 54: 57–115.

SKVORTSOV V. G. 1971: Nematodes of bats in Moldavia (2nd communication). In: Parasites of animals and plants. 7-th issue. Shtiintsa, Kishinev, pp. 75–93. (In Russian.)

TKACH V. V. 1991: First finding of males of *Pterygodermatites bovieri* (Nematoda, Rictulariidae) parasitizing bats. *Zool. zh.* 70: 125–127. (In Russian.)