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Received 10 October 1988

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FOLIA PARASITOLOGICA 36: 371–374, 1989.

SCANNING ELECTRON MICROSCOPIC STUDY ON TOXASCARIS TRANSFUGA (RUDOLPHI, 1819) (NEMATODA)

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Dedicated to Academician Ján Hovorka on the occasion of his 75th birthday anniversary

Abstract. The authors present original observations on the species *Toxascaris transfuga* obtained by means of scanning electron microscopy. Attention was paid to the structure of head end, morphology of papillae of the head and abdominal end, specific morphological traits of cloacae edges and morphology of the egg surface. Presented are morphological criteria which apparently differentiate the species *T. transfuga* from *T. leonina* (Linstow, 1902). *T. transfuga* and *T. multipapillata* Kreis, 1938 seem to be conspecific.

The occurrence of the species *Toxascaris transfuga* (Rud., 1819) in *Ursus arctos* is relatively very frequent in Czechoslovakia, especially in the Slovak Socialist Republic (see Mituch 1966—1970 in litt., 1970, 1972, 1974, 1988; Prokopič and Jaroš 1961). Mituch and Hovorka (1988) published data on the infestation of *Ursus arctos* population in the High Tatras National Park; in the case of *T. transfuga*, the prevalence and the intensity of invasion were 14.5 % and 4—96 individuals, respectively.

Although the species *T. transfuga* has been referred to as a parasite in a number of species belonging to the family Ursidae in different zoogeographic regions, its descriptions are rather simple and infrequent (compare Mozgovoj 1953, Mituch and Hovorka 1988). *T. transfuga* has not been investigated using scanning electron microscopy (SEM) method.

MATERIALS AND METHODS

Nematode specimens used for SEM originated from the collection of the Institute of Helminthology, Slovak Academy of Sciences, Košice. The material was obtained by dissections of *Ursus arctos* from the High Tatras National Park. Nematodes occurred in the small intestine. Before processing for SEM studies, the identity of all specimens (1 male, 6 females) was determined by light microscopy. They corresponded with descriptions presented by Mozgovoj (1953). The specimens for the SEM studies were fixed in 10 % formaldehyde and dehydrated through an ethanol series. Then they were critical point dried, mounted on a double side tape, coated with gold and examined in a TESLA BS — 300 electron microscope at 25 kV.

RESULTS

The body surface is transversely grooved (Pl. II, Fig. 4). The lips are of the same size, averaging 0.37—0.42 mm (Pl. I, Fig. 1). They have a prominent lateral projection of length 0.048—0.050 mm (Pl. I, Fig. 2). The dorsal lip has two lateral papillae (Pl. II, Fig. 1). The lateroventral lips bear only one papilla which is situated on the

ventral side of lip, near its middle (Pl. I, Fig. 2). Papillae situated on the dorsal lip and on the lateroventral lips are of the same character but of different size (Pl. I, Fig. 3 and Pl. II, Fig. 2) ranging from 0.06 to 0.1 mm on average. They have two parts: the oval one is smooth, 0.03—0.04 mm long, the other is grooved and its size is 0.04—0.05 mm (Pl. II, Fig. 3). Approximately 0.006 mm from the upper end of the lip there are openings with transverse incisions. These openings are demarcated with oval grooves (Pl. I, Fig. 4). The lips are furnished with denticles arranged in a line near the inner margin of all three lips (Pl. III, Fig. 1). There are 70—76 denticles on one lip. Some of them are single, while others doubled (Pl. III, Fig. 2). The detailed size and shape of denticles are variable and considerably dependent on the age of individuals. We have observed not only small and oval denticles but also those of normal size and even some with evident signs of abrasion (Pl. III, Figs. 3, 4, 5).

The cuticular rim on the body surface is relatively narrow. It begins 0.4—0.5 mm below the head end (Pl. V, Figs. 3, 4). The width of the abdominal part of the male's body at the level of the cloaca is 0.4—0.5 mm. The cloaca is slot-shaped and its size is 0.15—0.17 × 0.05—0.06 mm. It has ornamentation on both the dorsal and ventral sides (Pl. IV, Figs. 1, 2). This ornamentation consists of structures of different shape and size and is probably of chitinous nature (Pl. IV, Fig. 4). A papilla is situated in the middle of the dorsal ornamentation (Pl. IV, Fig. 3) and one flat papilla in the angles of the cloaca (Pl. IV, Figs. 1, 2). The abdominal part of the male's body is furnished with a variable number of papillae (Pl. IV, Fig. 1; Pl. V, Figs. 1, 2). Of these, the postcloacal papillae seem to be constant (6 pairs). Precloacal papillae are numerous (30—51 pairs). Some of them are doubled (Pl. V, Figs. 1, 4). Mostly, however, only 1 pair is situated on 1 segment (Pl. V, Fig. 2). The average size of papillae is 0.007 mm and they have an independent wall (Pl. V, Fig. 5).

In females, the vulva is situated in the first third of the body. It is oval (Pl. VI, Fig. 1). The oviduct is coated with the lobular epithelium (Pl. VI, Fig. 2). The size of eggs is 0.07—0.09 mm and their surface is without any reticulum (Pl. VI, Figs. 3—6).

DISCUSSION

As far as the genus *Toxascaris* is concerned, only 4 species are presently known, viz. *T. leonina* (Linstow, 1902), *T. multipapillata* Kreis, 1938, *T. melursus* Khera, 1951 and *T. transfuga* (Rudolphi, 1819). *T. multipapillata*, *T. melursus* and *T. transfuga* are parasites of Ursidae while *T. leonina* is a parasite only in Felidae and Canidae. The differential diagnosis of these species is not explicitly elaborated. Our SEM studies on *T. transfuga* demonstrated some unknown traits of this species and supplemented or defined others more precisely.

Elton (1927) et Mozgovoj (1953) mentioned that each lip was furnished with two papillae. In our study, 2 papillae were found only on the dorsal lip.

Mozgovoy (1953) mentioned that the species *T. multipapillata* and *T. transfuga* were probably identical. We agree. We have found that criteria differentiating these two species are very variable. This concerns not only the number of abdominal papillae in males, but also the so-called "deformed" denticles in lips. In our material, different deformations of denticles were demonstrated so that the earlier statements about the growth and or abrasion of denticles were substantiated (Madden and Tromba 1976, Baruš et al. 1979).

As far as SEM studies are concerned, it is possible to compare our results with those obtained in *T. leonina* (see Baruš et al. 1979, Tenora and Staněk 1979, Tenora et al. 1983, Tenora and Staněk, in press). In comparison with *T. leonina*, the morphology of denticles of *T. transfuga* is more variable but their numbers are nearly the same: 70—76.

In *T. leonina*, the number of precloacal papillae is always lower than 30 while in *T. transfuga* it is 30 or more. Furthermore the papillae are not the same in both species (compare Tenora and Staněk, in press).

The demarcation of cloaca in males represents an important morphological trait because in *T. transfuga* there is a marked ornamentation in this region while in *T. leonina* it is completely absent. The validity of *Baylisascaris* Sprent, 1968 seems to be veritable.

Attention should be paid also to the structure of the egg surface. Both in *T. leonina* and in *T. transfuga* the egg surface is without any reticulum. Eggs of both species are markedly different from those of the genus *Toxocara* and *Ascaris* because they have a reticulated surface.

Our observations also corroborated a hypothesis about the number of denticles in one lip (Baruš et al. 1979). It was demonstrated in another species of the genus *Toxascaris* that there are about 72 denticles in one lip; this is very low as compared with species of the genus Toxocara.

Acknowledgements. The authors express their thanks to Mr. J. Lhotecký from the laboratory of electron microscopy, Faculty of Agronomy, University of Agriculture, Brno, for technical assistence as well as to Dr. D. Hejlková from the Department of Zoology, Fur Animal Breeding and Bee-Keeping, Faculty of Agronomy, University of Agriculture, Brno.

СКАНИРУЮЩАЯ ЭЛЕКТРОННАЯ МИКРОСКОПИЯ ВИДА *TOXASCARIS TRANSFUGA* (RUDOLPHI, 1819) (NEMATODA)

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Резюме. Предложенная работа охватывает вполне оригинальные результаты полученные при помощи сканирующей электронной микроскопии вида *T. transfuga*. По сравнению с известным описанием Элтона (1927), сделанного при изучении упомянутого вида оптическим микроскопом, была на субвентральных губах определена только 1 папилла, а не 2. Из морфологических приоритетов работа включает в себя 1. данные о морфологии, числе и изменчивости губных зубов, 2. описание структуры папилл головы и брюха, 3. определение характера поверхностной структуры тела, 4. обнаружение орнаментации в окружности клоаки, 5. данные о характере вульвы, 6. данные о ширине каймы тела, 7. открытие вполне специфичной морфологии внутри яйцевода. В соответствии с взглядом Мозговой (1953) вида *T. multipapillata* Kreis, 1938, является потенциальным синонимом вида *T. transfuga* (Rudolphi, 1819).

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Received 16 June 1988

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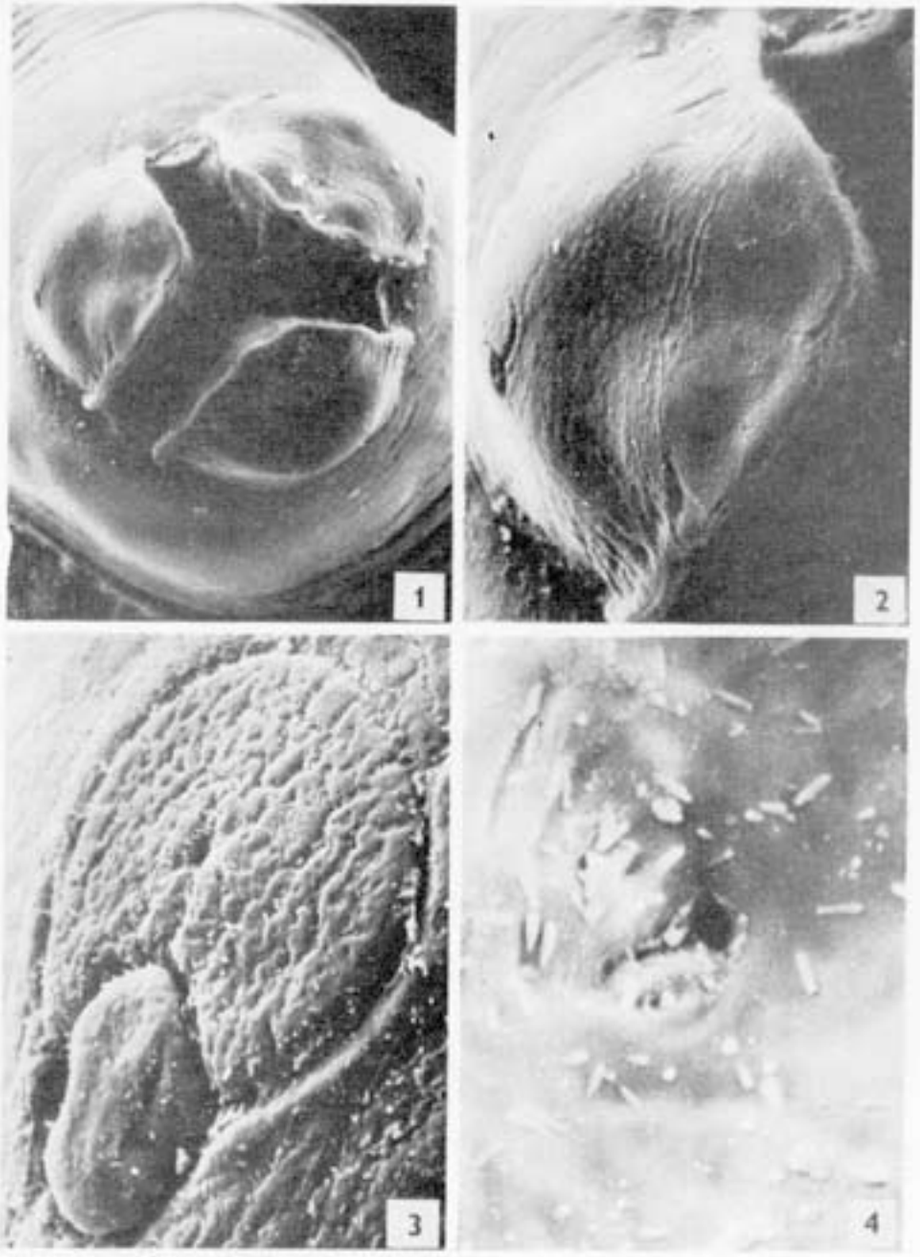
FOLIA PARASITOLOGICA 36: 374, 1989.

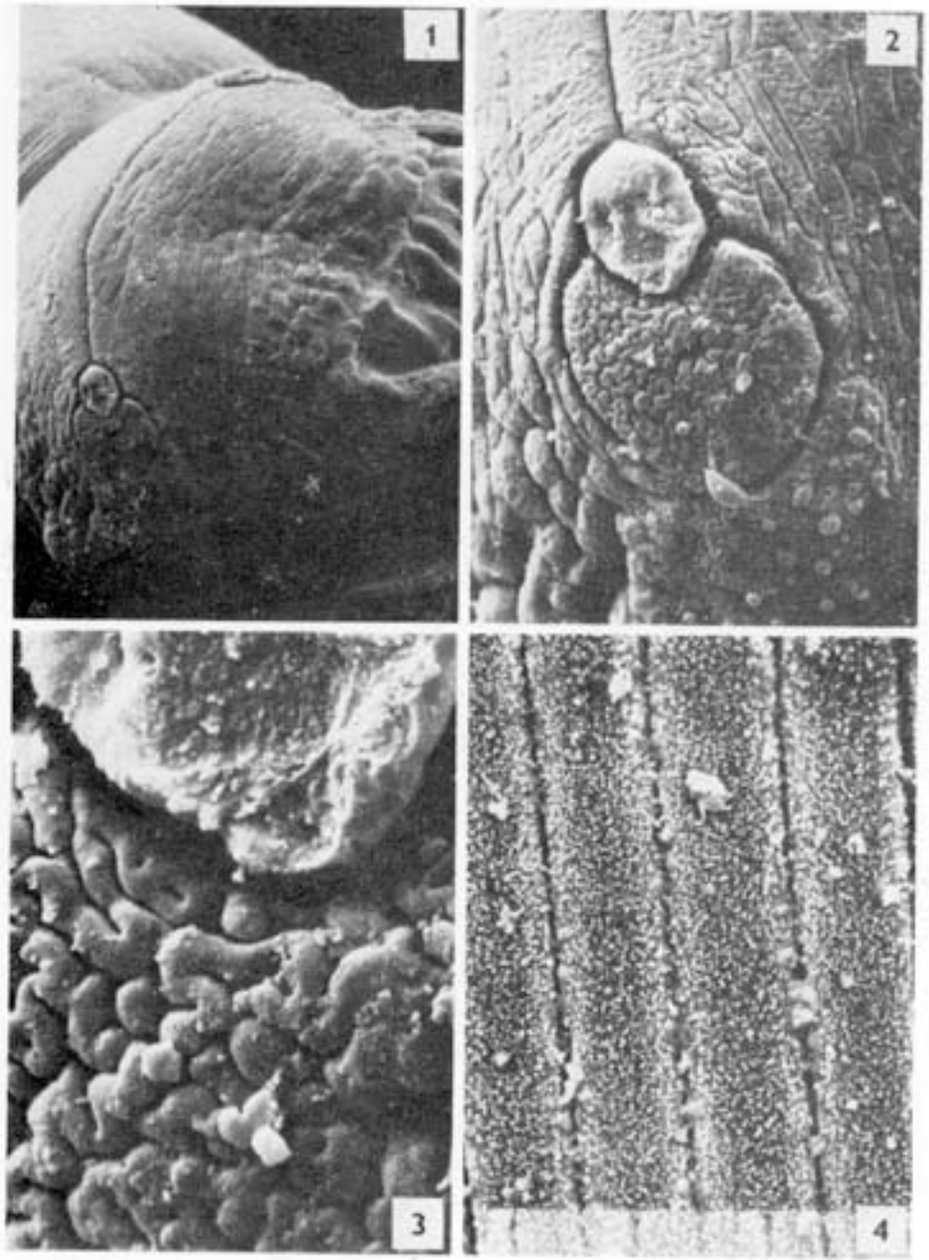
I. G. Uspenskaya: Iksodovye kleshchi Dnestrovsko-prutskogo mezhdurechiva. (Ixodid ticks of the territory between the rivers Dniester and Prut). *Publ. House Shtiintsa, Kishinev 1987, 144 pp., 13 Figs., 27 Tables. Price 1.40 Rb.*

This publication represents another one of a series of works dealing with the tick fauna of a certain region of the USSR. It has been written on the basis of 20-year author's investigations. The book is divided into 5 chapters and final conclusions. Chapter I gives a short characteristic of the territory under study. Chapter II brings an ecologic-faunistic characteristic of ixodid ticks occurring here. They belong to 5 genera and 22 species, 5 of them being abundant in corresponding biotopes. The subgenus *Euhyalomma*, erected by Filippova in 1984, is erroneously mentioned as subgen. nov. (pp. 13 and 35). An incorrect spelling *Allocerea* is used on pp. 13 and 30. A curious inaccuracy appeared on p. 68. Erythema chronicum migrans has been translated as "chronic erythematous megrim"! Chapter III deals with the anthropogenous transformation of local tick fauna which is rather strong. Chapter IV brings data on spatial structure of the tick fauna and on typification of (so called) tick foci. The main categories primary natural or transformed foci and secondary foci, and the subcategories stabile, pulsating, augmenting and waning foci are used. The last chapter concerns the ticks as vectors of transmissive diseases. Four medically important viruses were isolated from ticks in the territory under study until now: TBE, CCHF, West Nile and Bhanja. The publication is closed by a list of papers, with many errors in names and references of foreign authors. In the whole, it is a useful work whose data may serve also for tick students from neighbouring countries.

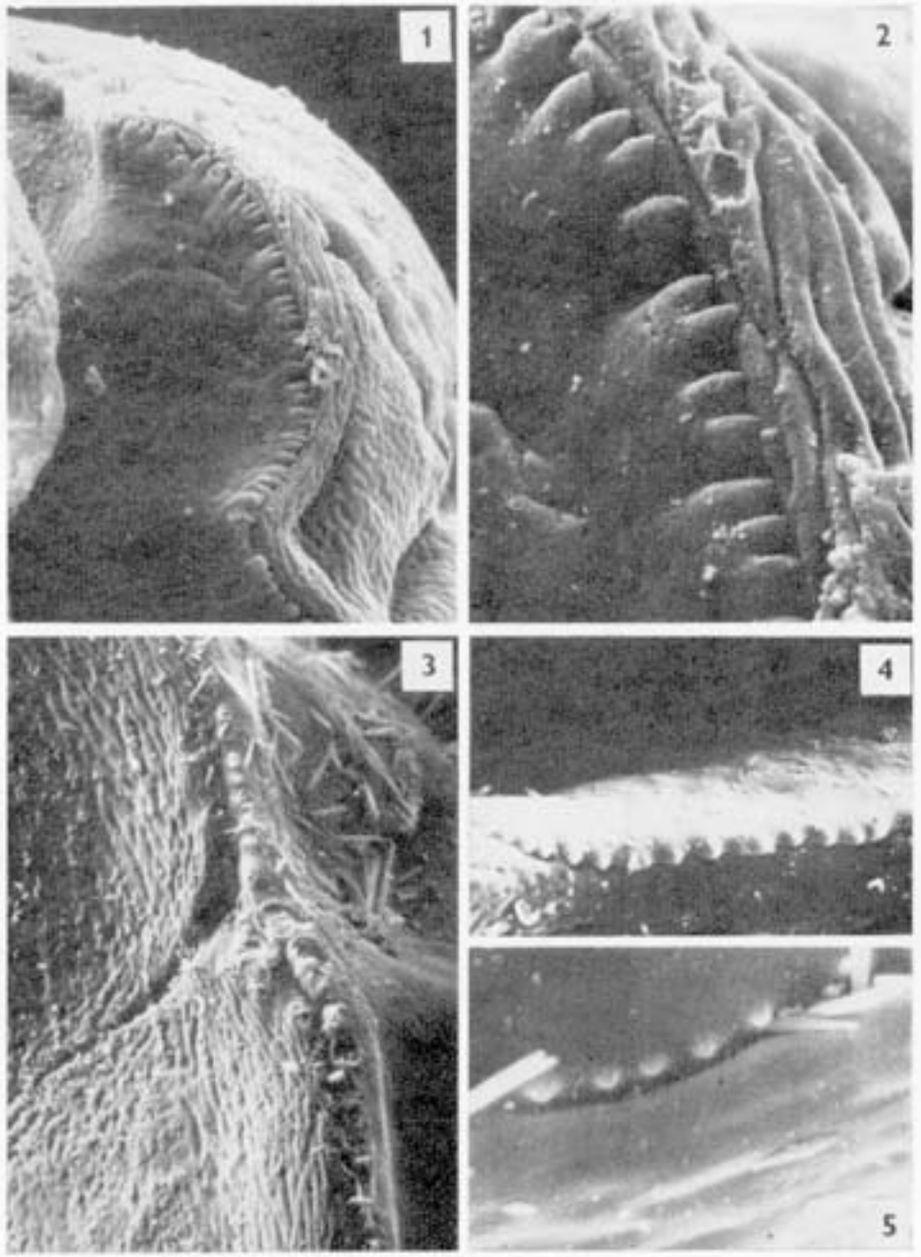
Dr. V. Černý, Ph.D.



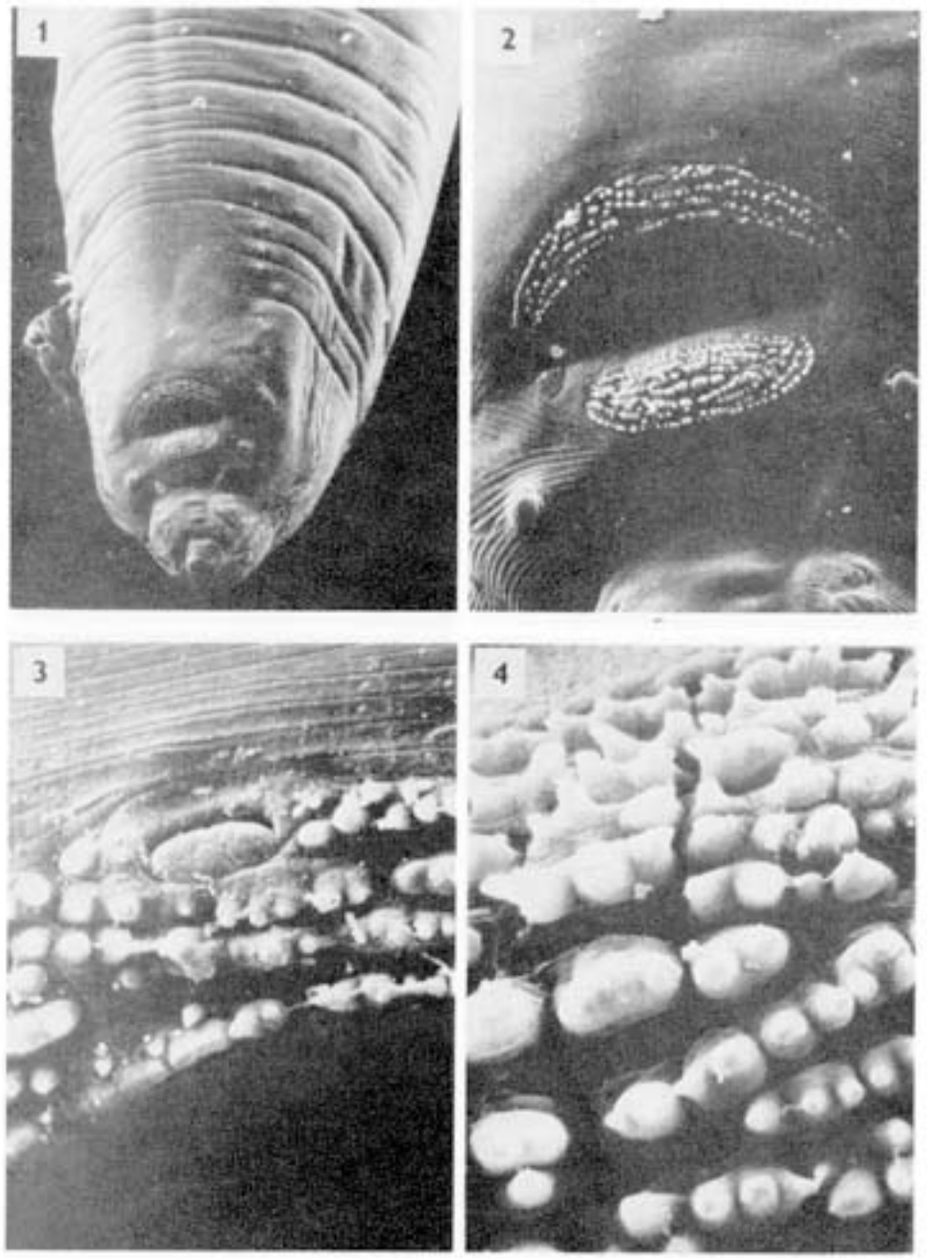
Figs. 1—4. *Toxascaris transfuga*. **Fig. 1.** Three lips, × 140. **Fig. 2.** Lateroventral lip, × 330. **Fig. 3.** Papilla on lateroventral lip, × 1,800. **Fig. 4.** One of the double chink on the lips, × 6,000.



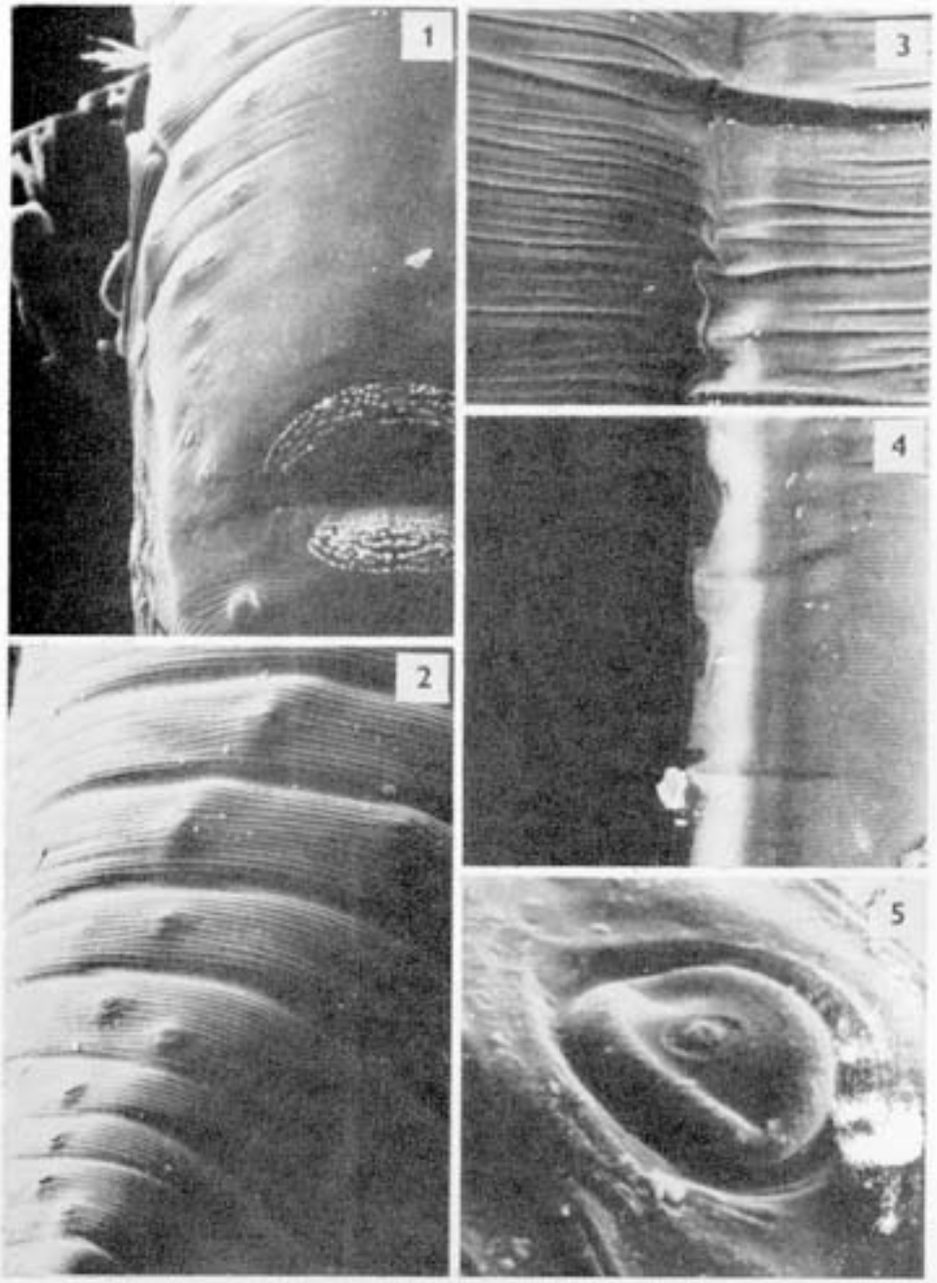
Figs. 1—4. *Toxascaris transfuga*. **Fig. 1.** Dorsal lip, × 240. **Fig. 2.** Papilla, detail, × 420. **Fig. 3.** Structure of the papilla, detail, × 3,000. **Fig. 4.** Surface of the body, × 3,600.



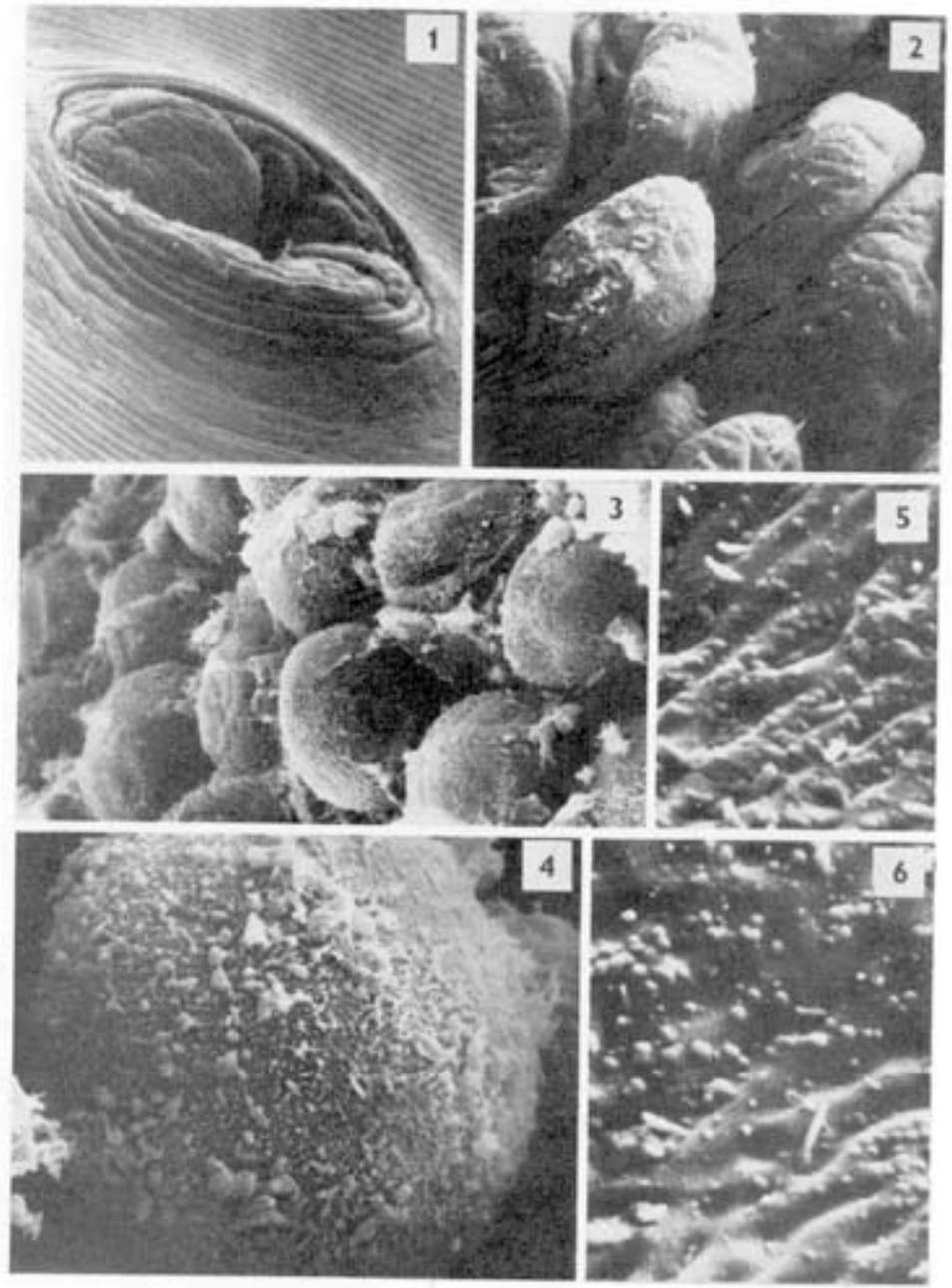
Figs. 1—5. *Toxascaris transfuga*. **Fig. 1.** The dorsal lip with the denticles, × 600. **Fig. 2.** Denticles on the lip, detail, × 2,400. **Figs. 3, 4, 5.** Denticles of different age, **Fig. 3.** × 1,500, **Fig. 4.** ×3,600 **Fig. 5.** — × 4,800.



Figs. 1—4. *Toxascaris transfuga*. **Fig. 1.** Abdominal end of male, × 120. **Fig. 2.** Cloaca, × 420. **Fig. 3.** Ornamentation with the papilla, × 1,800. **Fig. 4.** Ornamentation, detail, × 2,000.



Figs. 1—5. *Turnacaris translugo*. **Fig. 1.** The part of precloacal and postcloacal papillae, × 300. **Fig. 2.** Doubled and single precloacal papillae, × 150. **Fig. 3.** The beginning of the lateral rim, × 150. **Fig. 4.** The lateral rim, × 150. **Fig. 5.** The precloacal papilla, detail, × 6,000.



Figs. 1—6. *Turnacaris translugo*. **Fig. 1.** Vulva, × 600. **Fig. 2.** Epithelium of the uterus, × 1200. **Fig. 3.** Eggs, × 600. **Fig. 4.** Egg, detail, × 1,800. **Figs. 5, 6.** Surface of the egg, detail, × 4,800.