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A SCANNING ELECTRON MICROSCOPIC STUDY OF SPICULAR SHEATH OF SOME TRICHURIDS (NEMATODA)

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Abstract. The surface structure of spicular sheath of four *Trichocephalus* species (*T. skrjabini*, *T. suis*, *T. cervicaprae* and *T. globulosus*) was studied using scanning electron microscopy. The shape and size of spines are described in detail and documented. It was found that the armament of spicular sheath is characteristic of individual species examined.

The morphology and biometry of copulatory organs of nematode males have usually the value of important diagnostic and systematic characters. Also with nematodes of the genus *Trichocephalus* Schrank, 1788 the shape of spicular sheath has been used in taxonomy in spite of its considerable variability noted by several authors, e.g., Schwartz (1926), Chandler (1930) and Sondak (1948). In our recent paper (Baruš et al. 1975) we have stressed the importance of the ultrastructure of spicular sheath surface of these nematodes studied by scanning electron microscopy. A detailed knowledge of the morphology and topography of spines on spicular sheath might help to solve some taxonomic problems in this nematode group. We are therefore presenting the results of first observations on the ultrastructure of spicular sheath surface of four *Trichocephalus* species.

MATERIAL AND METHODS

For our scanning electron microscopic studies we have used four nematode species of the genus *Trichocephalus: T. skrjabini* from *Ovis aries* L. and *Gazella subgutturosa* Güldenstaedt from Afghanistan; *T. suis* from *Sus scrofa* f. *domestica* from Czechoslovakia; *T. cervicaprae* from *Hippotragus niger* Harr. and *Giraffa camelopardalis* L. from Prague Zoological Garden and *T. globulosus* from *Ovis aries* L. from Czechoslovakia and *Camelus dromedarius* L. from Afghanistan. Ten males of each species were studied and measured for scanning electron microscopy. The method was described in the paper by Baruš et al. (1975). The preparations were examined in the ASID—1 scanning device used with the JEM 100B electron microscope at an operating and accelerating voltage of 40 kV. Magnifications of micrographs are specified in each case.

RESULTS

1. *Trichocephalus skrjabini* (Baskakov, 1924)

The posterior end of the male body is rounded. The cloacal aperture is situated on the ventral side of body, a small distance from the end. There is a small paracloacal papilla (0.014 mm high) on each lateral side of cloaca. The evaginated spicule sheath is tubular to cylindrical (Plate I, Fig. 1) and reaches the length of 0.10—0.15 mm. The width

of spicule sheath is 0.057—0.071 mm at the site of emergence from cloaca, 0.055—0.059 mm in the middle part and 0.067—0.072 mm in the distal part. The whole spicular sheath is densely covered with small spines (Plate I, Figs. 2, 3) arranged in 48—54 longitudinal rows. The spines are distinctly longer than wide (Plate II, Fig. 1) and with rounded tips (Plate I, Figs. 5, 6). They measure 0.0032—0.0038 mm in legth and 0.0015—0.002 mm in width at base. In apical wiev it may be seen that the spines have oval to circular base (Plate I, Fig. 4). The spicule is 0.94—1.47 mm long, slightly widened at proximal end and 0.014—0.016 mm wide. In the middle and distal parts it is 0.008 mm wide. Its distal end is distinctly rounded. The spicule is always fully covered with the spicule sheath which is characteristic of this species. (During the studies of male of this species the spicule has never been found to protrude from the spicular sheath by the distal end.)

2. *Trichocephalus suis* Schrank, 1788

The posterior end of male body is rounded. The cloaca is situated on the ventral side of body and its lower margin is 0.058—0.080 mm from the posterior end. Paracloacal papillae have not been observed. The spicular sheat is evaginated up to 0.20—0.27 mm. Its proximal part near cloacal aperture measures 0.077—0.085 mm, middle part 0.070—0.082 mm and distal part 0.077—0.088 mm in width. The whole spicular sheath is covered with spines arranged in 60—70 longitudinal rows. The spines have a characteristic shape (Plate II, Figs. 2, 3). They are distinctly triangular and with a wide base measuring 0.005—0.007 mm in width. The spines are tapering towards the tip. Approximately at two thirds of their height they form a conspicuous tip projection. The tips of spines are rounded and directed towards the posterior end of the body. The total height of the spines is 0.003—0.004 mm. In apical (Plate II, Fig 2) or lateral view (Plate II, Figs. 1, 2) the spines are distinctly flat (in all their height including base). The spicule is massive and its tip protrudes from the spicular sheath. It is 1.80—2.15 mm long and has a widened, funnel-shaped proximal part measuring 0.059—0.074 mm in width. The width of the spicule is 0.033—0.038 mm in the middle and distal parts. The distal end of the spicule is slightly bent ventrally. At the distance of 0.080—0.088 mm from the end, the spicule is gradually tapering. The tip of the spicule is not pointed but rather rounded.

3. *Trichocephalus cervicaprae* (Kreis, 1935)

The posterior end of the male body is blunt. The cloaca is situated on the ventral side of body and its lower margin is 0.035—0.040 mm from the end. The spicular sheath is evaginated up to 1.33—2.56 mm. It has a tubular shape and its width is 0.034—0.047 mm close to cloaca, 0.034—0.038 mm in the middle part and 0.030—0.040 mm in the distal part. The spicular sheath is covered with spines arranged in 35—40 rows, except for the distal end (0.130—0.152 mm in length). In the distal part, the spines are thinly distributed, but the proximal part is densely covered with them. The spines have a distinctly elongated shape and they are markedly longer than wide (Plate II, Figs. 4, 5, 6), measuring 0.007—0.009 mm in length and 0.0015—0.0025 mm in width at base. The tips of spines are rounded and directed towards the cloaca. The spicule is 4.96—5.80 mm long, its proximal end is funnel-shaped and measures 0.083—0.097 mm in width. At the distance of 0.070—0.080 mm from proximal end the spicule measures 0.014 mm in width and this width is maintained throughout the length of spicule. The distal end of the spicule is sharply pointed.

4. *Trichocephalus globulosus* Linstow, 1901

The posterior end of the male body is rounded. The cloaca is almost terminal. The lateral margin of the cloaca is salient, but we assume that this formation is not identical with the paracloacal papilla (Plate IV, Figs. 1, 2). The evaginated spicular sheath measures 0.98—1.25 mm in length. Its distal part is spherical and measures 0.29—0.30 mm in diameter. The width of the tubular part of spicular sheath is 0.068—0.12 mm near the cloaca and 0.058—0.093 mm in the middle part. The spicule sheath is covered with three different groups of spines. The spines on the tubular part are arranged in 36—40 longitudinal rows and measure 0.007—0.008 mm in length and 0.003—0.004 mm in width at base. They are of regular, triangular shape (Plate III, Figs. 3, 4, 5) and their rounded tips are usually directed towards the cloaca. The spines on the distal part of the spherical widening of spicular sheath are smaller and relatively scarce, measuring only 0.004 mm in length (Plate III, Figs. 6, 7). On the proximal part of spherical widening the spines are larger (0.014 mm long) and densely distributed. In lateral view the spines have a relatively wide base (Plate IV, Fig. 3) and are slightly bent. The spicule is massive and 3.70—4.88 mm long. Its proximal part is markedly widened (0.11—0.13 mm), the middle part measures 0.022—0.037 mm in width. In the distal part, the spicule distinctly widens up to 0.076 mm and then gradually tapers and terminates in a sharp point.

DISCUSSION

The basic shape of spines on the spicular sheath is triangular (with rounded tip) in all four species of the genus *Trichocephalus* examined. In three species (*T. skrjabini*, *T. cervicaprae* and *T. globulosus*) the spines were always longer than wide. A similar shape was observed also with spines of *T. myocastoris* studied by Baruš et al. (1975). The differences between the spines of these species are in the ratio of the total length to the width of their bases. The spines of *T. cervicaprae* are the narrowest and longest (it should be stressed that they have the same shape throughout the length of the spicule). The spines of *T. skrjabini* have also a constant shape but they are by one half shorter. The spicule sheath of *T. globulosus* is covered with three types of spines differing both in the size and shape (Baylis 1932, Sarwar 1960 and others). Similar differences in the shape and distribution of spines were also encountered with the species *T. myocastoris* (see Baruš et al. 1975). The spines of *T. suis* markedly differ from those of the above-mentioned species. They are also of triangular shape but markedly wider than long or at most as wide as long and identical in the morphology and measurements throughout the length of the spicule sheath. We suppose that a detailed comparative study of this character might contribute to the solution of problems of taxonomic position of the species *T. trichiurus*, *T. suis* and other forms from monkeys (Schwartz 1926, Chandler 1930, Skryabin et al. 1957, Pavlovsky and Sondak 1951, Sondak 1948, Sarwar 1960 and others). The four *Trichocephalus* species examined during our studies can be differentiated on the basis of the morphology, distribution and size of spines on the spicular sheath revealed by the scanning electron microscopy.

ИЗУЧЕНИЕ СПИКУЛЯРНОГО ВЛАГАЛИЩА НЕКОТОРЫХ ТРИХУРИД (NEMATODA) МЕТОДОМ СКАНИРУЮЩЕЙ ЭЛЕКТРОННОЙ МИКРОСКОПИИ

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Резюме. Структуру поверхности спикулярного влагалища четырех видов рода *Trichocephalus* (*T. skrjabini*, *T. suis*, *T. cervicaprae* и *T. globulosus*) изучали методом сканирующей электронной микроскопии. Форма и размер шипов подробно описаны и документированы. Было обнаружено, что вооружение спикулярного влагалища характерно для отдельных изучаемых видов.

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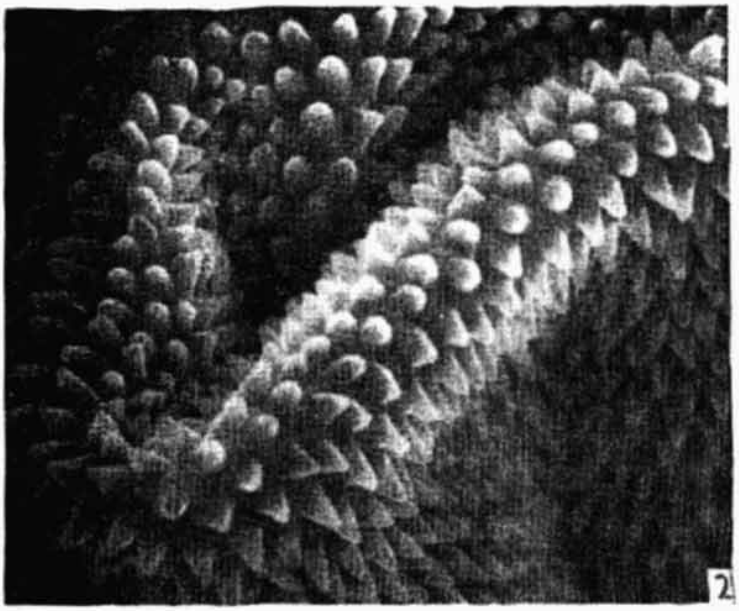
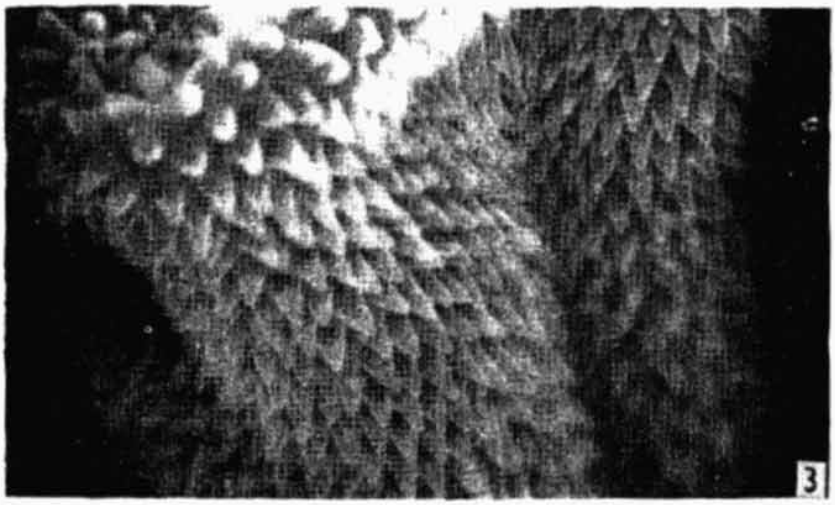
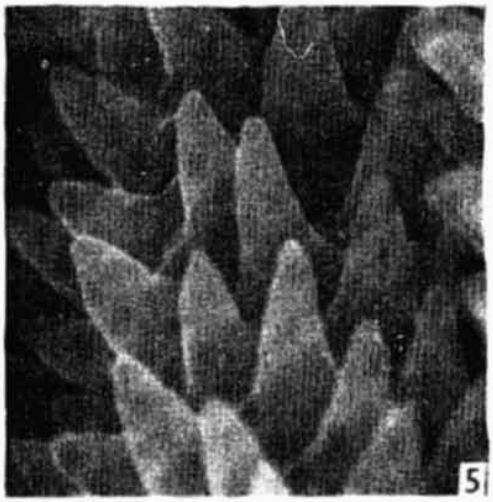
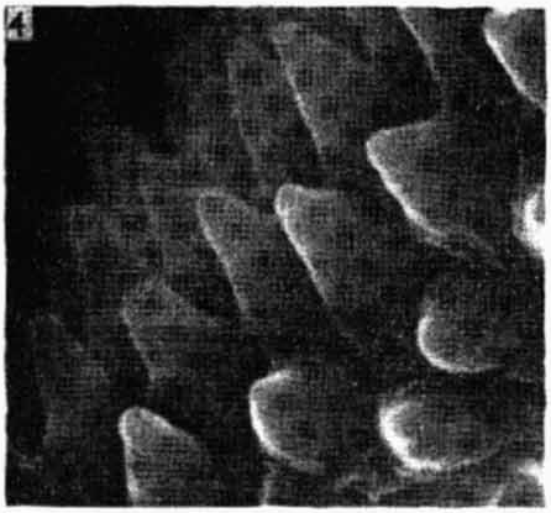
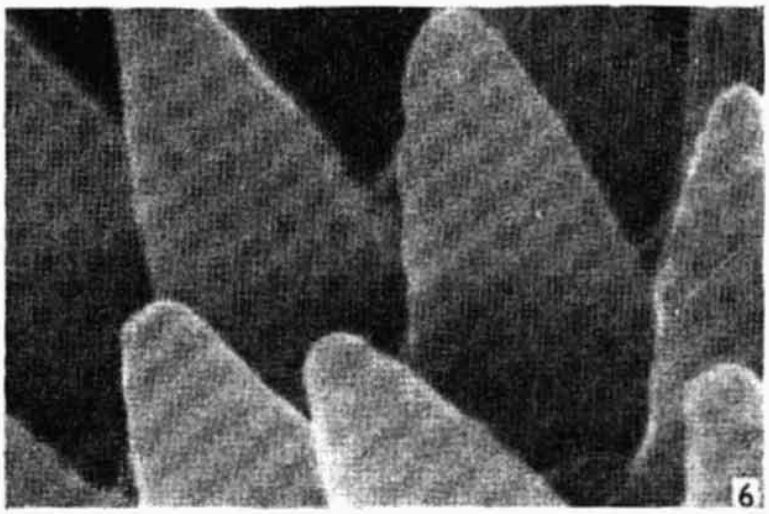


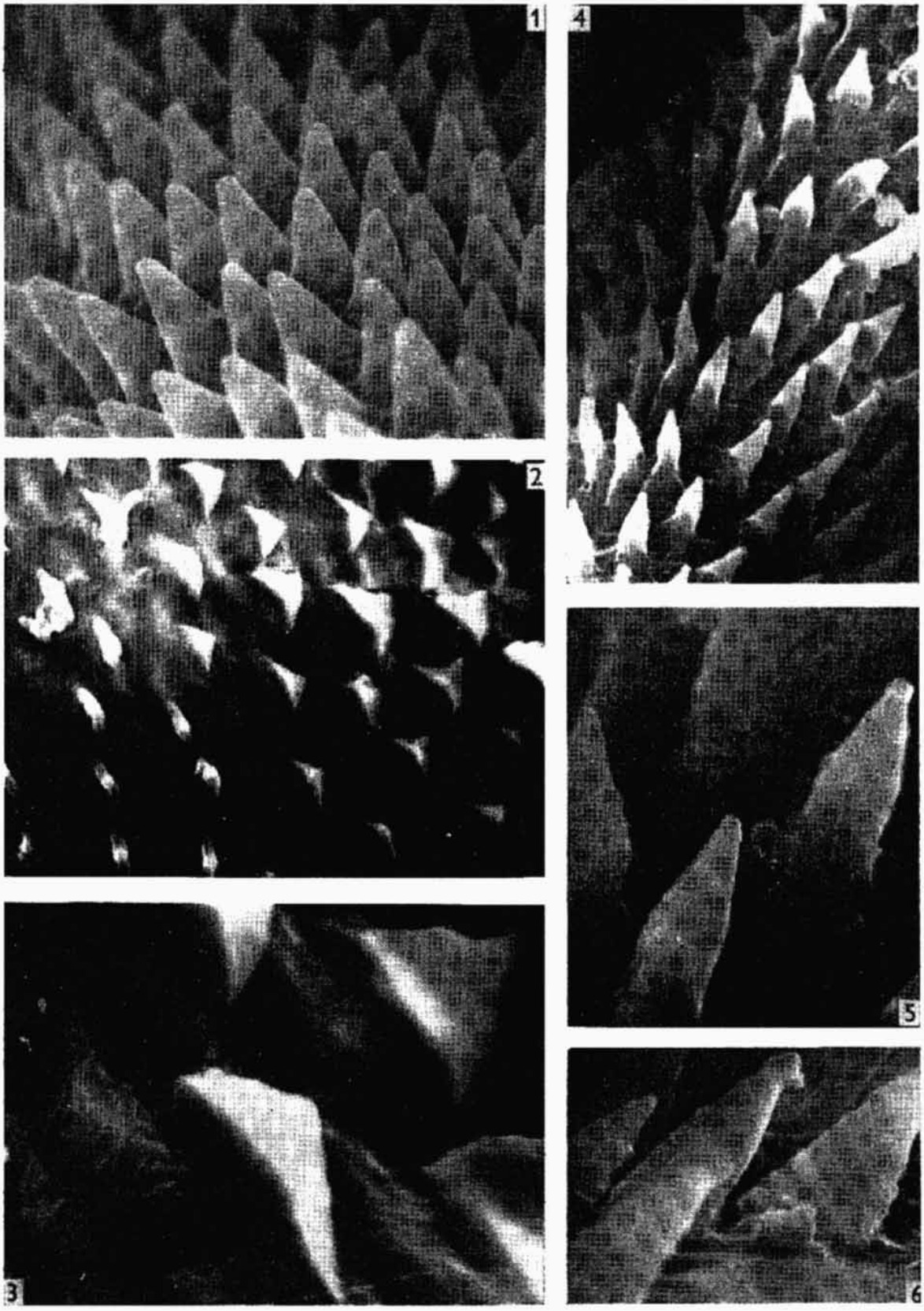




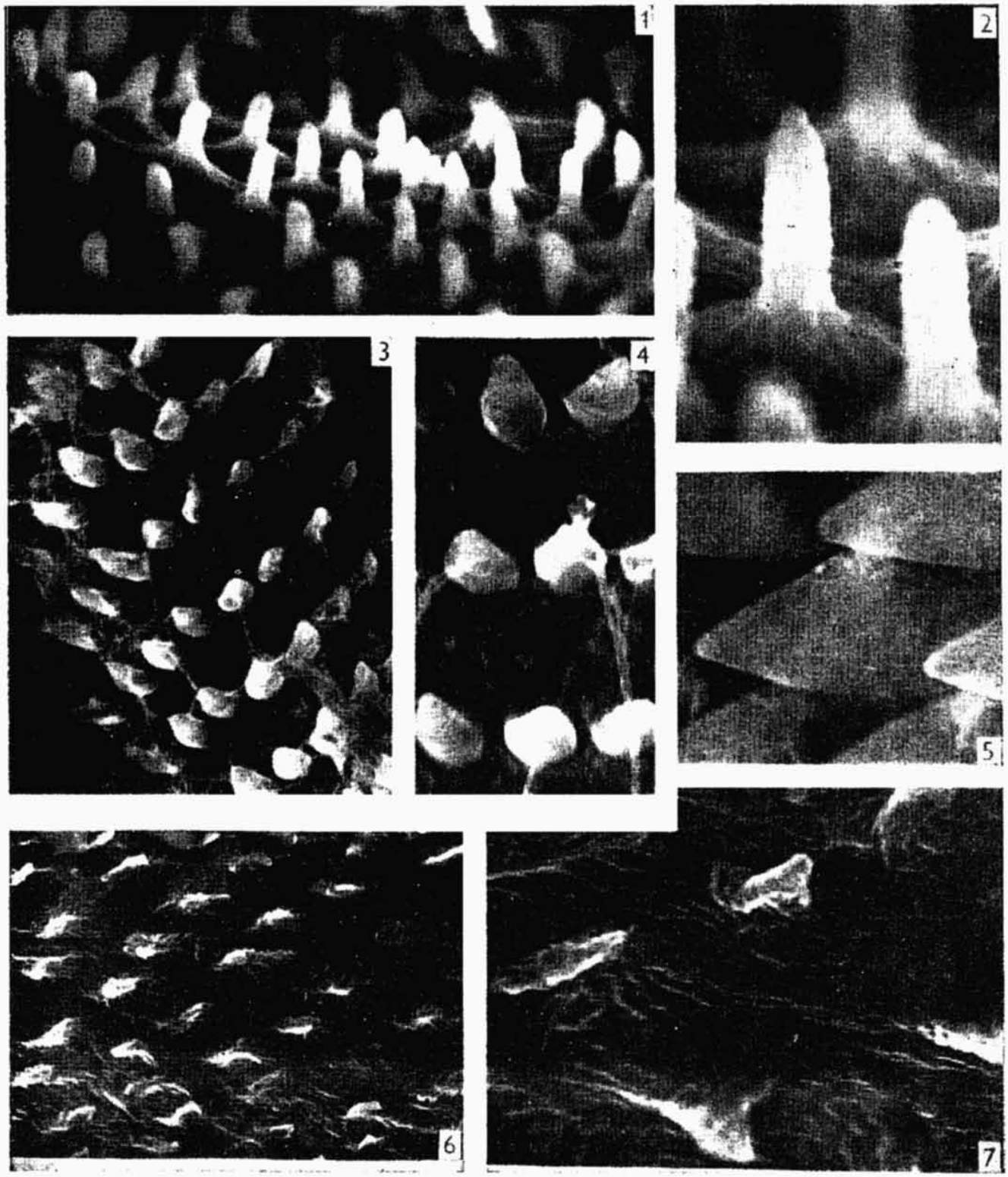




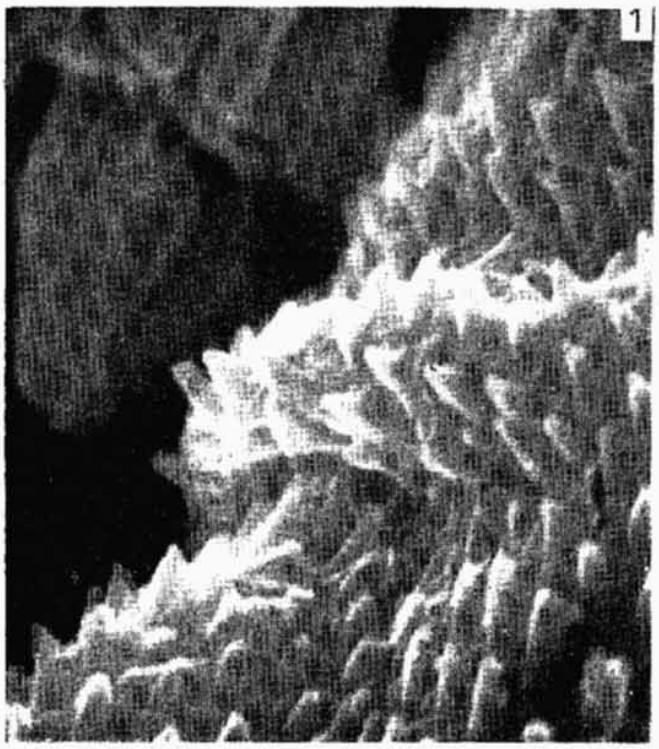
Figs. 1—6. Scanning electron micrographs of spicular sheath of *Trichocephalus skrjabini*. **Fig. 1.** Spicular sheath — general view. (× 800). **Fig. 2.** Opening of spicular sheath. (× 2 400). **Fig. 3.** Lateral part of spicular sheath under the margin of opening. (× 2 400). **Fig. 4.** Detail of spine distribution and their shape on margin of spicular sheath opening. (× 8 000). **Fig. 5.** Distribution and shape of spines on ventral side of spicular sheath. (× 10 000). **Fig. 6.** Detail of tip of spines. (× 24 000).

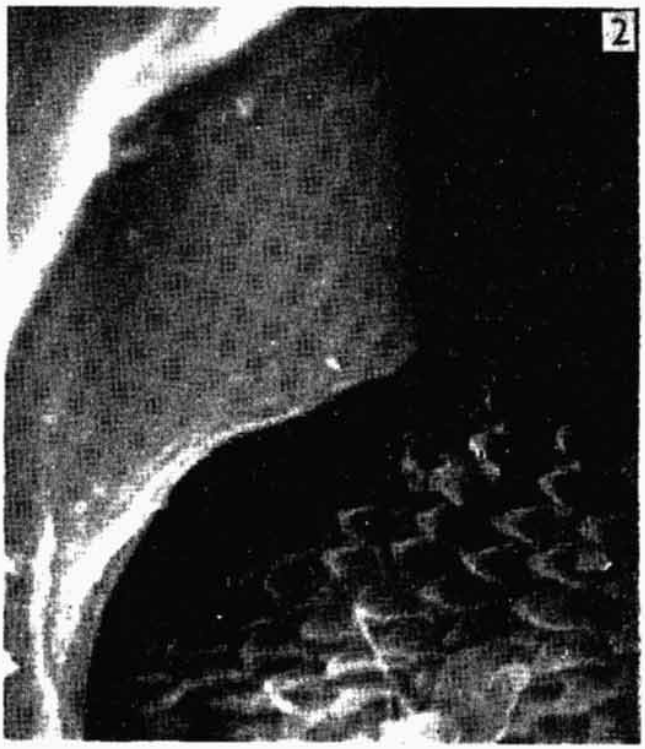


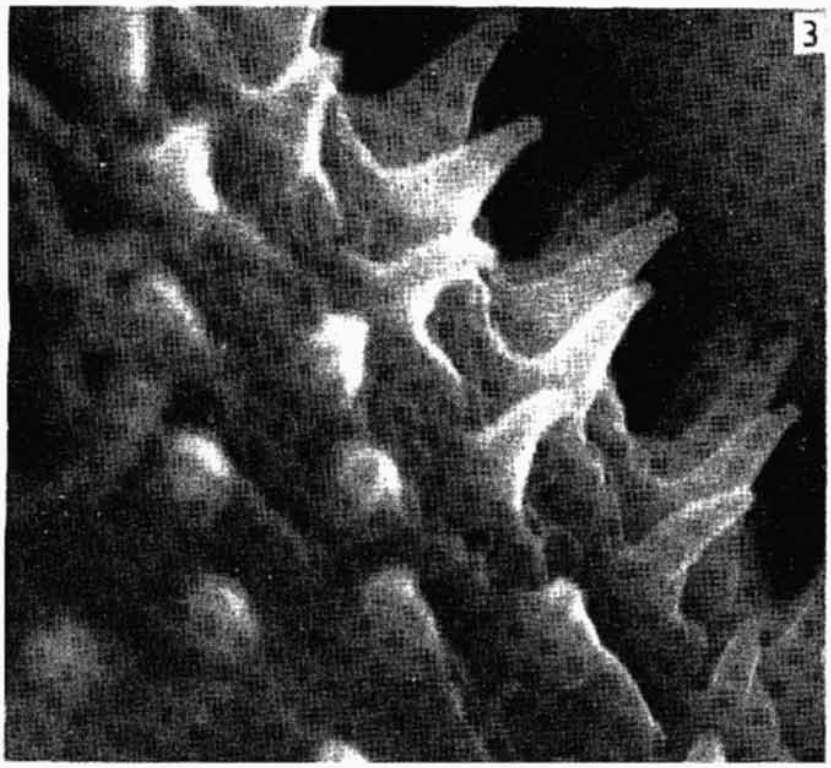
Figs. 1—6. Scanning electron micrographs of spines of spicular sheath. **Fig. 1.** Topography and shape of spines on middle part of spicular sheath of *Trichocephalus skrjabini* — ventral view. (× 7 800). **Fig. 2.** Topography and shape of spines on middle part of spicular sheath of *T. suis* — apical view in lower half, ventral view in upper half. (× 2 300). **Fig. 3.** Detail of spines on spicular sheath of *T. suis* — ventral view. (× 7 800). **Fig. 4.** Topography and shape of spines on middle part of spicular sheath of *T. cervicaprae* — ventral view. (× 2 300). **Figs. 5—6.** Detail of shape of spines on spicular sheath of *T. cervicaprae* — ventral view. (× 7 800).



Figs. 1—7. Scanning electron micrographs of spicular sheath. **Fig. 1.** Shape of spines of *Trichocephalus suis* — lateral view. (×2 500). **Fig. 2.** Detail of spine of *T. suis* — lateral view. (×8 500). **Fig. 3.** Topography and shape of spines of *T. globulosus* — in various positions. (×2 500). **Fig. 4.** Spines on middle tubular part of spicular sheath of *T. globulosus*. (×5 000). **Fig. 5.** Detail of shape of spines on middle part of spicular sheath — ventral view. (×8 500). **Fig. 6.** Topography of spines on distal bulbous part of spicular sheath of *T. globulosus*. (×2 500). **Fig. 7.** Detail of distribution and shape of spines on distal, bulbous part of spicular sheath. ×8 500).







Figs. 1—3. Scanning electron micrographs of spicular sheath. **Fig. 1.** Upper part of spicular sheath of *Trichocephalus skrjabini;* left at the top, paracloacal papilla — ventral view. (×2 600). **Fig. 2.** Lateral margin of cloaca and part of spicular sheath of *T. globulosus* — lateral view. (×2 600). **Fig. 3.** Spines on middle tubular part of spicular sheath of *T. globulosus* — lateral view. (×5 200).