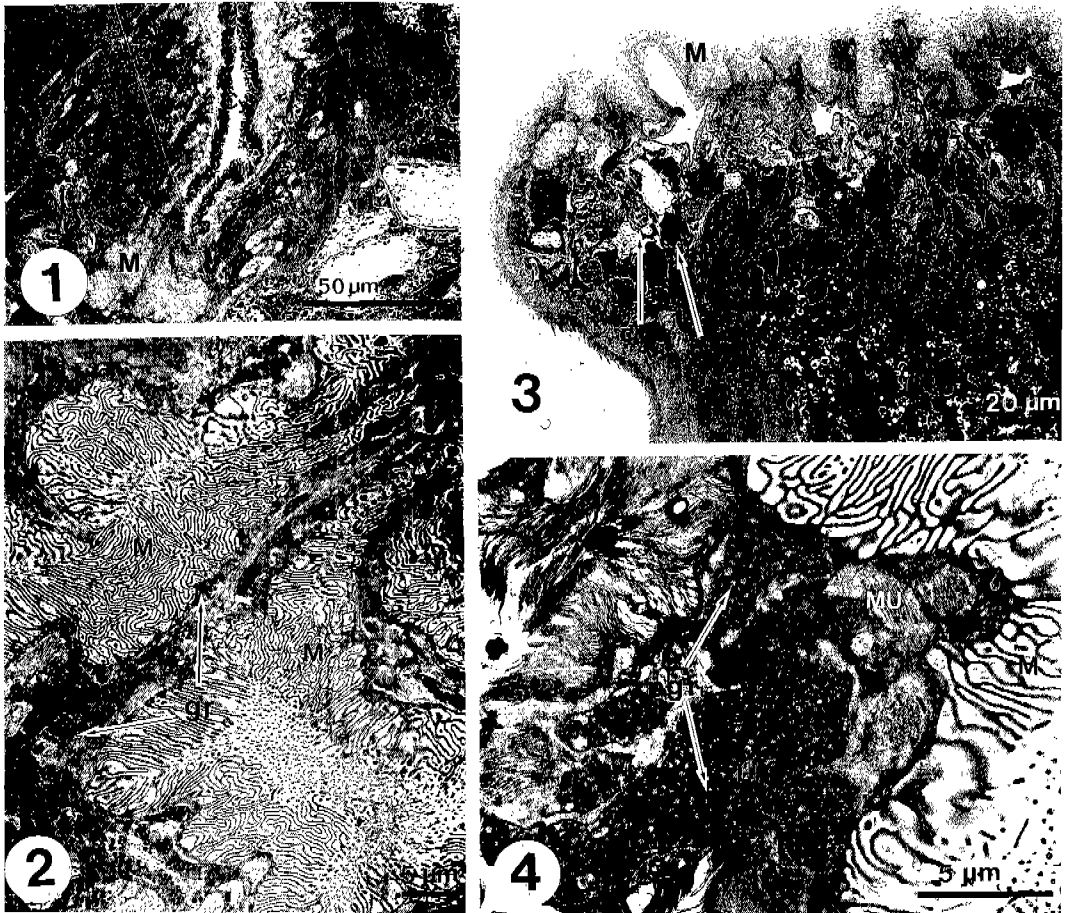


layer, muscle layer and tegumental cells (Figs 3 & 5). When the tribocytic organ is retracted into the body of the worm, the microvilli are located on the lacuna-like space (ventral slit) of the tribocytic organ (Figs. 1 & 2). There are two kinds of granules in the cytoplasmic syncytial layer. One is homogeneous and its size is 0.3-0.4  $\mu\text{m}$  (Figs. 2). The other is 0.1-0.2  $\mu\text{m}$  and comprises the particles (Fig. 4). When the tribocytic organ is bulging out, the microvilli cover the surface. The microvilli originate from the cytoplasmic layer. Beneath the microvilli the cytoplasmic syncytial layer has no spines

(Figs. 3 & 4). Between the muscle, the homogeneous granules ranging 0.3-0.6  $\mu\text{m}$  in diameter can be observed (Fig. 5). The structure of the tegument in the lacuna-like space is different with that of the peripheral area. Former has microvilli and later does not. Microvilli appear at the central part of the tegument of the tribocytic organ. The transitional zone is evidently shown (Fig. 3).

Three types of the cells are grouped in the tribocytic organ. Type I cell is ellipsoidal, and its nucleus and cytoplasm are electron lucent. It retains a few homogeneous round granules



**Fig. 1.** Electron microscopic findings of the tribocytic organ of *Fabricicola seoulensis* which shows the cytoplasmic syncytial layer of tegument (Cy), microvilli (M) when this organ is retracted. **Fig. 2.** Microvilli (M). There are electron dense granules (gr) ranging 0.3-0.4  $\mu\text{m}$  in diameter below microvilli. **Fig. 3.** Bulged tribocytic organ. There can be found the microvilli (M), type I cell (c1) of which cytoplasm is electron lucent, and type II cell (c2) of which cytoplasm is electron dense. **Fig. 4.** Tegument of the tribocytic organ. Microvilli (M), particulate granules (pgr) ranging 0.1-0.2  $\mu\text{m}$  in diameter, lipid droplets (L) and muscles (MU) are shown.

0.1-0.2  $\mu\text{m}$  in diameter (Figs. 3 & 6). Type II cell is also ellipsoidal, and its nucleus and cytoplasm are electron dense. Its cytoplasm contains the granules ranging 0.1-0.2  $\mu\text{m}$  in diameter. Those granules are differ with that of type I. The granule is composed of numerous particles. It also contains a large amount of the endoplasmic reticulum and lipid droplets 0.5-0.8  $\mu\text{m}$  in diameter (Figs. 3 & 6). Type III cell is ellipsoidal. Its cytoplasm is electron dense. It contains many electron dense homogeneous round or oval granules ranging 0.3-1.2  $\mu\text{m}$  in diameter or in width (Fig. 7). Near the type III cell, the granules are seen in the cytoplasmic tubules (Fig. 8). Two kinds of electron dense granules can be also observed from the cells like from the cytoplasmic syncytial layer. The homogeneous ones, ranging 0.1-1.2  $\mu\text{m}$  in diameter are found in the cytoplasm of type I and III cells. The other particulate ones, ranging 0.1-0.2  $\mu\text{m}$  in diameter are observed in the cytoplasm of type II cells. Type II cells are shown most frequently. The next is type I. Least shown cell is type III cell (Table 1).

### DISCUSSION

There were some reports on the tribocytic organ of the other strigeoid trematodes. Erasmus & Ohman (1965) described the electron microscopic findings of the tribocytic organ of *Cyathocotyle bushiensis*, the intestinal parasite of the bird. The duct contained secretions discharged from the gland cells. The secretes comprised the dense spherical bodies 0.1 to 0.2  $\mu\text{m}$  in diameter. Secretes accumulate in a lacuna-like space between the microvillous surface and the basement membrane (basement layer). *Apathemon gracilis minor*, another intestinal parasite of bird, was also examined. Below the basement membrane of the tribocytic organ the

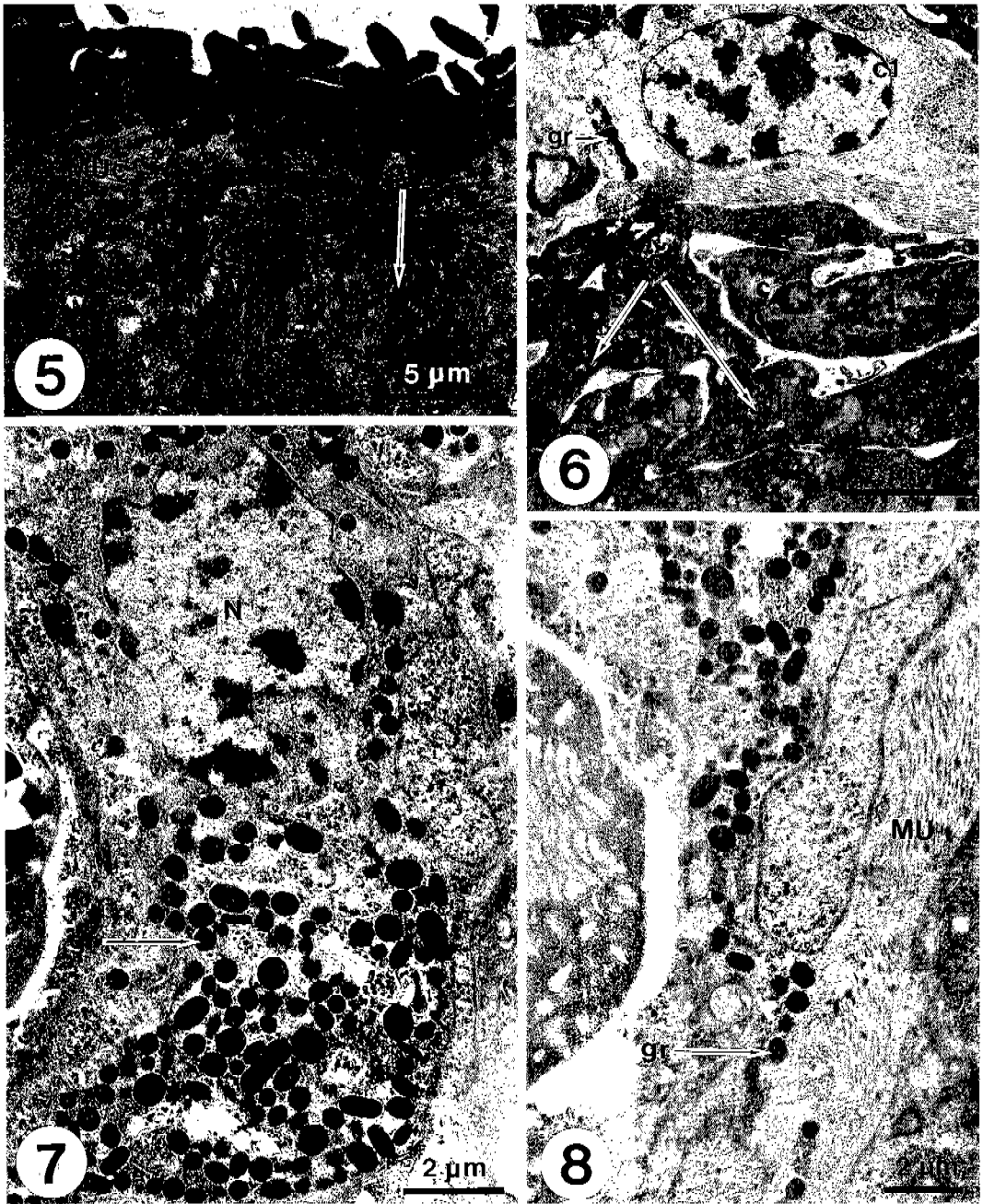
cytoplasm contains large quantities of the granular endoplasmic reticulum, several Golgi complexes and many mitochondriae (Erasmus 1969). Sohn & Lee (1993) described the ultrastructure of the tegument of *F. seoulensis* i.e. heptalamilated microvilli, cytoplasmic syncytial layer, basement layer (basal lamina), muscle layer, and the tegumental cells. They observed two types of secretory granules in the secretory tubules (cytoplasmic tubule) from parenchyma to microvilli. One is round, 0.1-0.5  $\mu\text{m}$  in diameter and the other is ellipsoidal, 0.5-1.0  $\times$  0.35-0.6  $\mu\text{m}$  in diameter. Lee *et al.* (1985a) described the inner portion of the tribocytic organ as honeycomb appearance by scanning electron microscope.

Tegument of the tribocytic organ of *F. seoulensis* has same component with that of other part of worm except the presence of microvilli. Central area shows unique appearance due to presence of microvilli. On the other hand, the peripheral areas are almost same in structure with body surface. The tribocytic organ moves forward when it anchors to the host villi (Fig. 3), and backward into the forebody of the worm when it is detached from the villi (Fig. 1). When the tribocytic organ is bulging out forward, microvilli are arranged at the outermost layer of the tegument (Fig. 3). If it is retracted backward, microvilli make a ventral slit (Fig. 1). The shape of the microvilli is almost same as those of the host intestine.

We have thought that the microvilli of the tribocytic organ have absorptive and secretory functions like those of the host intestine. It is well known that there is the decrease of the brush border membrane-bound enzyme activities of the mouse duodenum with fibricoliasis (Lee *et al.*, 1991). It may be an outcome of destruction of the villi by the mechanical or biochemical action of the *F.*

**Table 1.** Electron microscope findings of three types of cells of the tribocytic organ of *F. seoulensis*

Type	Shape	Electron density of cytoplasm	Granules in cytoplasm		Frequency of appearance
			homogeneous	particulate	
I	spindle	lucent	+	—	++
II	spindle	dense	—	+	+++
III	spindle	dense	+++	—	+



**Fig. 5.** Tegument of the tribocytic organ. Spine (s), circular muscle (MUc), longitudinal muscle (MUt) and homogeneous granules (gr) ranging 0.3-0.6  $\mu$ m in diameter are shown. **Fig. 6.** Cells of the tribocytic organ. type I cell (c1) with homogeneous granules (gr) ranging 0.1-0.2  $\mu$ m in diameter. Type II cells with rich endoplasmic reticulum (ER), particulate granules (pgr), ranging 0.1-0.2  $\mu$ m in diameter and lipid droplets (L) are observed. **Fig. 7.** Type III cell of the tribocytic organ which contains many electron dense round or oval homogeneous granules (gr) ranging 0.3-1.2  $\mu$ m in diameter or in width. N: nucleus. **Fig. 8.** Type III cell of the tribocytic organ. There are the homogeneous granules (gr) ranging 0.3-1.2  $\mu$ m in diameter in the cytoplasmic tubules. MU = muscle.

*seoulensis*. Although the oral sucker and ventral sucker can destroy the host villi, the tribocytic organ may play a major role since it is the largest and it has microvilli to compete with those of host. The nature of the two kind of granules seen in the cytoplasm of cells and collected in the cytoplasmic syncytial layer is a question. Some will be the end products of the worm metabolism and the others are mucus, enzymes or other biochemical materials that are related with digestive function of the tribocytic organ.

We can see three types of cells in the tribocytic organ according to the electron density of the cytoplasm and presence of the two kinds of granules, homogeneous and particulate at our discretion (Table 1). It is difficult to classify the cells only with those criteria since the findings can be variable according to the direction of the cutting and the stain quality. Despite of those weak points, Type I and II cells are thought to be tegumental cells since it is beneath the muscle layer (Fig. 6). Type III cell has many homogeneous granules in its cytoplasm. Those granules can be seen in the cytoplasmic tubule and near the cytoplasmic layer (Figs. 2 & 8). Although type II cell has also granules in its cytoplasm, type III is thought to be a specific gland cells of the tribocytic organ, since it is only found in this organ. Nature of the those homogeneous granules were unidentified. First assumption is that those will be a neutral mucopolysaccharide (Huh *et al.*, 1990). It is necessary to unveil the nature of these two kind of granules in future.

According to the fact that the granules are beneath the microvilli (Figs. 2 & 4) and that the granules are found in the cytoplasmic tubules (Fig. 8), the estimated way of the extrusion of granules can be explained as following; They are protruded by the tegumental cells. They move to the cytoplasmic syncytial layer near microvilli through the

cytoplasmic tubules, reserved in the cytoplasmic syncytial layer. In case of bulging of the tribocytic organ, they will be passed out of the worm probably with exocytosis.

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## *Fibricola seoulensis* 조직음해구의 투사전자현미경 소견

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*Fibricola seoulensis* 조직음해구(tribocytic organ)의 미세구조를 알기 위하여, 전자현미경으로 관찰하였다. 조직음해구의 표피에서 미세음모가 관찰되었다. 조직음해구에는 3가지 형태의 세포들이 관찰되는 데, 첫째는 방추형이고, 핵 및 원형질이 전자밀도가 낮고, 원형질내 직경 0.1-0.2  $\mu\text{m}$ 의 과립이 소수 관찰된다. 둘째는 방추형이고, 핵 및 원형질이 전자밀도가 높고, 직경 0.1-0.2  $\mu\text{m}$ 의 미립자로 구성된 과립을 포함한다. 셋째는 원형질이 전자밀도가 높고, 직경 0.3-1.2  $\mu\text{m}$ 의 과립을 다수 포함한다. 위의 세포들 중, 첫째와 둘째 세포는 표피세포로, 셋째는 조직음해구의 특이 분비세포로 추정한다. 이것은 조직음해구의 분비 기능을 설명할 수 있는 또 다른 소견이라고 할 수 있다.

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