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Histology of Barbels of *Blepsias cirrhosus draciscus* (Cottidae)

Mitsuo Satō

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Abstract *Blepsias cirrhosus draciscus* has eleven noticeable barbels on the snout, supra-orbital part and the lower jaw. Each barbel is composed of epidermis, dermis, and a central rod of cartilage. The epidermis is formed of stratified epithelium which contains a number of terminal buds, granular cells, and elongated cylindrical cells with pointed apex. The dermis consists of loose connective tissue which encloses blood vessels and bundles of nerve fibers. The barbels of this fish can be categorized into a flexible type (Baecker, 1926). Besides these noticeable barbels, short barbels and barbel-like appendages are also found near the posterior nostril, upper jaw and preoperculum. They show similarity in their structure to that of the noticeable barbel, though they have ill-developed axial rod.

Barbels of fishes, especially catfishes, have tactile and taste sensitivity, and are useful for recognition of food. The barbels show considerable variations in their structures among fishes. Comparison of histological structures of the barbels was made by Meng (1923), Baecker (1926), Satō (1937b), Ducros (1953～'54), Raffin-Peloz (1955), Satō and Kapoor (1957), Nagar and Mathur (1958), Srivastava and Sinha (1961), Lukowicz (1966), Rajbanshi (1966), Kapoor and Bhargava (1967), Singh and Kapoor (1967), and Krapp (1975). Most of these studies were concerned with the barbels of cyprinoid, cobitid, siluroid, and gadoid fishes, and studies for other forms are rare.

Blepsias cirrhosus draciscus Jordan et Starks (family Cottidae) has eleven barbels on the head, and their structures have not been investigated histologically. The paper deals with the histology of barbels of this fish and with categorization of the barbels into the type classified by Baecker (1926).

Material and methods

The specimen was obtained from Mutsu Bay near the Marine Biological Station of Asamushi. Barbels were fixed in Bouin's fluid and Zenker-formol. Tissues embedded in paraffin were sectioned at 8 μ and were stained with Delafield's haematoxylin and eosin, and with Mallory's phosphotungstic acid haematoxylin.

Results

This fish bears eleven noticeable barbels on the muzzle and supraorbital part (Fig. 1): one pair on the anterior region of snout, a single on the posterior region of snout, one pair on the supra-orbital part and three pairs on the mandible. The author proposes to designate these barbels as anterior snout (6.5 mm), posterior snout (4.5 mm), supraorbital

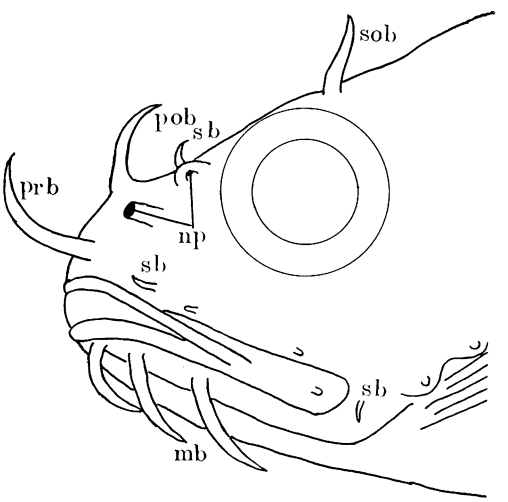

Fig. 1. Scheme of the head *Blepsias cirrhosus draciscus*, showing noticeable barbels, short barbels, and very short projections. mb, mandibular barbel; np, nasal pores; pob, posterior snout barbel; prb, anterior snout barbel; sb, short barbel; sob, supraorbital barbel.

(4 mm), and mandibular barbel (5～5.2 mm), respectively. The figure in parenthesis indicates the length of each barbel measured in a fish of head length 20 mm. The posterior snout barbel rests on the median line of the interspace between two anterior nostrils, behind the anterior snout barbel. In addition to the above-mentioned barbels, short barbels and very short projections resembling barbels are also found near the dorsal edge of posterior nostril, and on maxillary part and ventral margin of the preoperculum (Fig. 1). The length of each short barbel is about 1 mm or more, and that of each projection is less than 1 mm in the specimen mentioned above.

All the barbels show similar histological structure, and they are formed of epidermis and dermis bearing an axial rod (Fig. 2, A). The epidermis is composed of stratified epithelial cells which have flattened shape in the surface layer, while they are columnar shaped in the basal layer. Among the epithelial cells, a considerable number of terminal buds, granular cells, and melanophores are

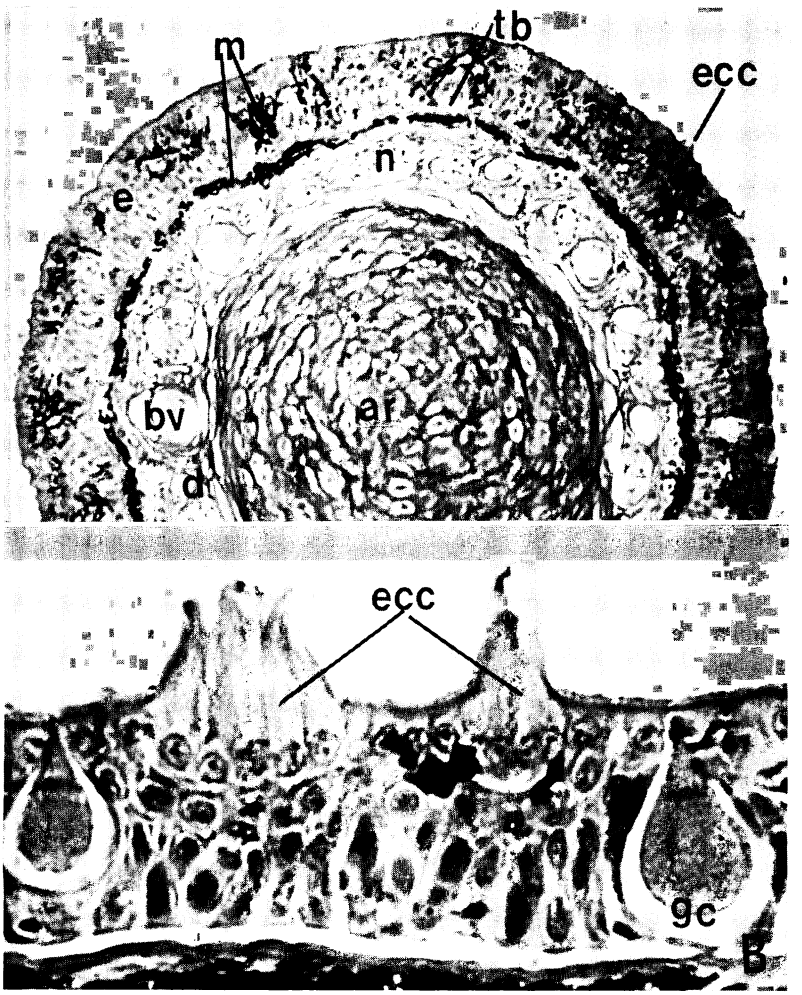

Fig. 2. Photomicrographs of the barbel of *Blepsias cirrhosus draciscus*. A. A part of transverse section of the anterior snout barbel, showing epidermis, dermis, and axial rod of cartilage. ×ca. 600. B. A part of transverse section of the supraorbital barbel, showing granular cells and elongated cylindrical cells with pointed apex. ×ca. 1200. ar, axial rod; bv, blood vessel; d, dermis; e, epidermis; ecc, elongated cylindrical cell; gc, granular cell; m, melanophore; n, nerve fibers; tb, terminal bud.

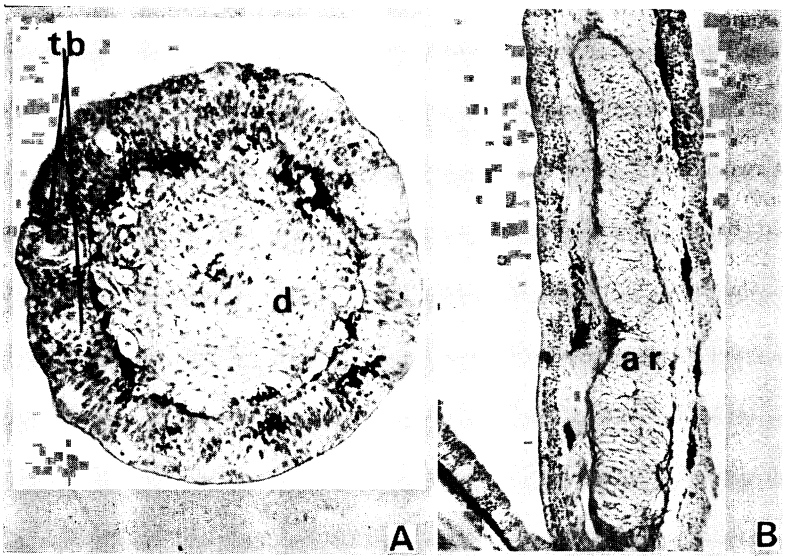

Fig. 3. Photomicrographs of the barbel of *Blepsias cirrhosus draciscus*. A. Cross-section of tip of the posterior snout barbel, showing terminal buds. ×ca. 450. B. Longitudinal section of short barbel on the upper jaw, showing curved axial rod. ×ca. 200. For abbreviations see Fig. 2.

found. The terminal buds lie closer in the distal portion than the proximal of the barbel (Fig. 3, A). They are not situated upon so high eminence of the dermis as those of catfishes and goatfishes. Of the barbels, the anterior snout is provided plentifully with the terminal buds. The granular cells are generally buried in the middle or upper layer of the epidermis of the barbel (Fig. 2. B). They are oval or pear-shaped with variable sizes and their contents are stained intensively by eosin. The granular cells are also found in the skin of the whole body of this fish, as reported already by Satō (1967) under the name of eosinophilic vesicle which should be called the granular cell. The structure of this cell in the barbel is essentially like that of the body skin. In the superficial layer of the epidermis of the barbel, specialized cells are found. They are elongated cylindrical cells with pointed apex, and the distal one-third of the cell projects over the surface level of the epidermis (Fig. 2, A and B). This cell is almost three times as high as that of the ordinary epithelial cell. The nucleus of this cell is situated regularly at the proximal portion of the cell. These cells are generally located in the epidermis as a mass, but are frequently found as a solitary cell. The mentioned cells are found also in the skin epidermis of the whole body. The granular cells and elongated cylindrical cells do not seem to be scattered to the distal end of the barbel. Mucous cells and club cells are not observed in the epidermis of the barbel.

The epidermis rests on a basement membrane along which melanophores are abundantly scattered (Fig. 2, A). The basement membrane is followed by dermis which is made up of loose connective tissue. Bundles of nerve fibers and blood vessels are found numerously in the connective tissue (Fig. 2, A), but muscular elements are not detectable. The melanophores are also scattered in the dermis. The major portion of inner part of the barbel is occupied by axial rod which consists of cartilaginous tissue (Fig. 2, A). Cartilage cells are irregular in shape and each of them bears a nucleus in the center. This cartilage has a little ground substance which contains scattered fibers. From the appearance of the fibers, they were considered as elastic fibers. But their nature could not be determined by only the histological methods applied in the present investigation. The axial rod stretches from the base of the barbel to near the tip, forming "supporting rod" of

the barbel.

The histological picture of short barbels and very short projections is similar to that of the barbel mentioned above, though the axial rod is not straight, but curved considerably (Fig. 3, B).

Discussion

According to Biedenbach (1971), barbels, especially movable barbels such as those of catfishes (Singh, 1967), seem to play an important role in food localization. Baecker (1926) classified two types of barbels: (a) tender and yielding type—each lacks the axial cartilaginous rod, but has a network of blood vessels in the core of the dermis, (b) stiff type which may be either flexible or motionless type. The motionless barbel has a supporting axis of true bone, and the flexible has a cartilaginous axis. Satō (1937b) divided the barbels of 18 Japanese fishes into two main groups with and without the terminal buds in their epidermis. The former group is subdivided into three types according to the component of axial core of the barbel. From the view-point of mobility of the barbel, the classification of barbels by Baecker is more reasonable than that of Satō. Taking into consideration the characteristics of the barbel of *Upeneus bensasi* and *Polymixia japonica*, the author will propose a new classification of the barbels in the near future, although it will be based mainly on Baecker's classification. According to Baecker's classification, the barbels of *Blepsias cirrhosus draciscus* fall under the flexible type.

A characteristic of the barbel epidermis of the present specimen is that the granular cells and elongated cylindrical cells with pointed apex are found among the epithelial cells. These two kinds of the cells, however, do not restrict their distribution within the barbel epidermis, but are scattered in the epidermis of the head, trunk and tail. Accordingly, the presence of the granular cell and elongated cylindrical cell does not indicate the peculiarity of the barbel epidermis. According to Rajbanshi (1966), tactile organs are found in the epidermis of the barbel of *Wallago attu* which is a kind of Indian siluroid fishes. But such a tactile organ is not detectable in the present specimen.

Judging from the observations on the behavior of this fish in the laboratory tank, this fish does not seem to move its barbels voluntarily. They are moved passively by water, and hence they do not seem to have so important role in daily activity of this fish as in the goatfish whose barbels are movable voluntarily (Satō, 1937a).

Literature cited

Baecker, R. 1926. Beiträge zur Histologie der Barteln der Fische. Jahrb. Morphol. Mikrosk. Anat., Abt. 2, 6: 489～507, figs. 1～8.

Biedenbach, M. A. 1971. Functional properties of barbel mechanoreceptors in catfish. Brain Res., 27: 360～364, figs. 1～2.

Ducros, C. 1953～54. Les barbillons et l'organe palatin de *Misgurnus fossilis* Linne et de *Cobitis barbatule* Linne. Trav. Lab. Hydrob. Pisc. Univ. Grenoble, 45～46: 55～70, figs. 1～7.

Kapoor, B. G. and S. C. Bhargava. 1967. A study on the barbels of a marine catifish, *Arius thalassinus* (Rüpp.). Japan. J. Ichthyol., 14: 201～206, figs. 1～4.

Krapp, v. C. 1975. Morphologische Besonderheiten bei *Osteoglossum bicirrhosum* und *Osteoglossum fereirai* (Pisces, Osteoglossidae). Zool. Anz., 195: 387～406, figs. 1～22.

Lukowicz, v. M. 1966. Über die Barteln und die Lippenepidermis verschiedener ägyptischer Süszwasserfische mit einiger Versuchen zum Geschmackssinn. Zool. Anz., 176: 396～413, figs. 1～10.

Meng. F. 1923. Beiträge zur Kenntnis der Morphologie der Barteln einiger Fische. Zool. Jahrb. Abt. Anat. Ontog. Tiere, 45: 149～160, figs. 1～2, pl. 1.

Nagar, S. K. and R. P. Mathur. 1958. Morphological observations on the barbels of a few Indian fresh-water teleosts. Proc. Zool. Soc., (Bengal), 11: 63～68, figs. 1～3.

Raffin-Peyloz, R. 1955. Etude histologique des barbillons de queleques poissons d'eau douce. Trav. Lab. Hydrob. Pisc. Univ. Grenoble, 42: 73～97, pls. 1～3.

Rajbanshi, V. K. 1966. A note on the study of gustatory senses of the barbels of fresh water teleosts. Naturw. Berlin, 53: 208～209, fig. 1.

Satō, M. 1937a. Preliminary report on the barbels of a Japanese goatfish, *Upeneoides bensasi* (Temminck & Schlegel). Sci. Rep. Tohoku Imp. Univ., Biol., 11: 259～264, figs. 1～3.

Satō, M. 1937b. Histological observations on the barbels. Sci. Rep. Tohoku Imp. Univ., Biol., 12: 265～276, figs. 1～11.
Satō, M. 1967. Histological and histochemical observations on the eosinophilic vesicles found in the head epidermis of *Blepsias cirrhosus* (Pallas). A preliminiary report. Arch. Histol. Jap., 28: 377～382, figs. 1～9.
Satō, M. and B. G. Kapoor. 1957. Histological observations on the barbels of Indian freshwater fishes, Alaska codfish and *Podothecus acipenserinus*. Annot. Zool. Japon., 30: 156～161, figs. 1～2.
Singh, B. R. 1967. Movements of barbels in some siluroid fishes. Zool. Anz., 178: 402～412, figs. 1～14.
Singh, C. P. and B. G. Kapoor. 1967. Histological observations on the barbels of a bagrid catfish, *Rita rita* (Ham.). Japan. J. Ichthyol., 14: 197～200, figs. 1～6.
Srivastava, C. M. and A. N. Sinha. 1961. Contribution to the study of barbels of fishes. Vest. Cs. Zool. Spol., 25: 12～15, fig. 1.

(2-3 Sakurabayashi-cho, Hirosaki, Aomoriken, 036, Japan)

イソバテングウのひげの組織学的構造

佐藤 光雄

カジカ科に属するイソバテングウは頭部に 11 本のひげをもっている．各ひげは表皮，真皮および支軸の 3 部からなる．表皮層には終末球のほかに，顆粒細胞および先端のとがった長円筒形細胞がみられる．ひげ内部の支軸は弾性軟骨からなるように考えられたが，今回の観察からは決定できなかった．上記のひげのほかに，あまり目立たない短かいひげや，極めて短かいひげ様突起が頭部に認められる．これらの組織構造は，上述のひげのそれとほぼ同じである．この魚のひげは，その構造から Baecker (1926) の flexible type に属する．この魚のひげは随意的に動かされなく，索餌などの活動において，ナマズやヒメジのひげ程には，顕著な働きをしないのであるまいかと推測される．

(036 青森県弘前市桜林町 2-3)