

## Histological Observations on the Barbels of a Bagrid Catfish, *Rita rita* (HAM.)

C. P. SINGH\* and B. G. KAPOOR

(Department of Zoology, University of Jodhpur, Jodhpur, India)

### Introduction

Barbels, popularly designated as feelers, are accessory feeding and sensory structures in many fishes of fresh-water and marine habitat. The histological aspect of the barbels has received the attention of MENG (1924), BAECKER (1926), SATÔ (1937a, b, 1959), DUCROS (1954), RAFFIN-PEYLOZ (1955), SATÔ and KAPOOR (1957), NAGAR and MATHUR (1958), SRIVASTAVA and SINHA (1961) and RAJBANSHI (1966).

This paper communicates our detailed observations on the histology of the barbels of a fresh-water carnivorous fish, *Rita rita* (Ham.) [Order—Cypriniformes; Suborder—Siluroidei; Family—Bagridae]. This will largely supplement to a brief, almost negligible, description reported along with cutaneous sense organs by BHATTI (1952).

Specimens were collected from Burhi Gandak, a tributary of river Ganges, at Muzaffarpur, Bihar, and were fixed in Bouin's solution and 10% formalin. Paraffin imbedded tissues were sectioned at 6-8 $\mu$  and were stained with Delafield's haematoxylin and eosin, and with Mallory's triple stain.

### Observations

*Rita rita* possesses three pairs of barbels: maxillary, mandibular and nasal. The maxillary and mandibular pairs reach nearly the end of the head. The nasal barbels are short and have flapped bases, facing respective nasal apertures.

Transections of maxillary barbels show two principal layers: epidermis and dermis. The zone of epidermis is of unequal thickness and has a stratified epithelium. Two types of unicellular glands, i.e. the mucous cells and club cells, are present. The mucous cells, with basal nuclei, are disseminated along the epidermal periphery. Conspicuous round or oval club cells, with central nuclei and occasional vacuolations, are profusely found amongst the middle epidermal cells. These club cells are lacking in the distal tip region of the barbel. The cutaneous taste buds contain sensory and supporting cells and lie on dermal papillae or on the epidermal cells-cushions. They vary in size and flush with or even cross the periphery. They are particularly abun-

\* On study-leave from L.S. College, University of Bihar, Muzaffarpur (Bihar).

dant at the distal end of the barbel which touches objects in search of food and thus indicate its intense sensory nature.

The basement membrane delimits the epidermis and dermis.

The dermis is comprised of connective tissue fibres. Pigment cells are dispersed in the dermis below the basement membrane. An axial rod of cartilage extends through it. Bundles of nerve fibres and blood vessels run across the dermis (figs. 1 and 2).

From the comparative viewpoint, the histological picture of mandibular barbel exhibits no differences.

The nasal barbel has interesting features to mention. The mucous cells and club cells increase in number and size in the basal part of the barbel. The club cells first occur at the beginning of the flap. Only the lower half of the flap, facing nasal aperture, is devoid of taste buds (figs. 3, 4, 5 and 6).

### Discussion

Barbels are of two types: (i) tender and yielding barbels, characterised by the absence of a cartilaginous axial rod and the occupation of its place by blood vessels, (ii) stiff barbels of motionless, and flexible kinds. The motionless barbel has a bony axial rod while the flexible one has a cartilaginous axial piece (BAECKER, 1926). The criteria of another indubitable classification of barbels by SATÔ (1937b) are the presence or absence of taste buds, and the nature of tissue of the axial support in barbels with taste buds. According to SATÔ and KAPOOR (1957), the carp and catfish types of SATÔ (1937b) are the same as tender, and flexible kinds of BAECKER (1926). The barbels of *Rita rita* fall under the stiff, and flexible category (catfish group).

The barbels of *Rita rita* are histologically akin to those of the following fishes:

*Liobagrus reini* (SATÔ, 1937b), *Callichrous bimaculatus*, *Heteropneustes fossilis* (SATÔ and KAPOOR, 1957) and *Clarias batrachus* (SRIVASTAVA and SINHA, 1961). We agree with BHATTI (1952) that the posterior flattened surface of the barbel, which faces narial opening, is completely devoid of taste buds. This is so, because the face of the nasal barbel which is towards the nasal opening presumably does not need gustatory receptors as it lies within the olfactory region (BHATTI, 1952). We differ with BHATTI (1952) on the presence of basal cells in the taste bud besides the sensory and supporting cells.

Different histological constituents in the epidermis of barbels of siluroids are on record. Only the taste buds and club cells are found in the barbels of *Plotosus anguillaris* (SATÔ, 1937a) and of *Arius thalassinus* (KAPOOR and BHARGAVA, 1967 in press). The presence of a cuticle and taste buds, and the absence of mucous cells and club cells are mentioned in the barbels of *Bagarius bagarius* (NAGAR and MATHUR, 1958). The barbels of *Mystus vittatus* are devoid of taste buds, mucous cells and club cells (AGARWAL and RAJBANSHI, 1965). The barbels of *Wallago attu*

possess thin cuticular covering, taste buds, mucous cells and tactile organs, while those of *Clarias batrachus* have the same constituents except the tactile organs (RAJBANSHI, 1966).

The hitherto published works on the barbels, excepting that of RAJBANSHI (1966), make no mention of tactile organs. Hence, it expressly needs evidential photomicrograph.

The discussion on the functions of mucous cells, club cells, and taste buds is available in the papers by KAPOOR (1965, 1966a, b). The fine structure of taste cells (chemoreceptor cells) in the food-finding barbels of *Corydoras paleatus* is known through the contribution of TRUJILLO-CENÓZ (1961).

The barbels of *Rita rita* are accessory, feeding and sensory structures and thus we substantiate the statement made by BHATTI (1952) that they are gustatory receptor organs.

### Summary

The histological observations on the barbels of *Rita rita* (HAM.) are reported. The maxillary barbel has epidermis and dermis surrounding a cartilaginous axis. The stratified epidermis embodies mucous cells, club cells and taste buds. The basement membrane lies in between epidermis and dermis except at the places of dermal papillae. The dermis is made up of connective tissue fibres and encloses nerve bundles and blood vessels.

The mandibular barbel has an identical structure. The mucous cells and club cells increase in number and size in the basal region of nasal barbel. The club cells appear first at the beginning of the flap. Only the lower half of the flap, facing the narial aperture, lacks in taste buds.

### Acknowledgements

We express our hearty thanks to Prof. Dr. Toki-o YAMAMOTO, Nagoya University, Nagoya, Japan for reading and communicating this paper. C. P. S. conveys deep gratitude to Prof. Dr. U. S. SRIVASTAVA, University of Bihar, Muzaffarpur, for encouragement and to Prof. Dr. S. D. MISRA, Department of Zoology, University of Jodhpur, for giving facilities to carry out this investigation.

### References

- AGARWAL, V. P. and RAJBANSHI, V. K. 1965: Morphology and histology of the cutaneous sense organs of *Mystus vittatus* (Bl.). Proc. Ind. Acad. Sci., B, lxi, 39-48.
- BAECKER, R. 1926: Beiträge zur Histologie der Barteln der Fische. Jahrb. Morphol. u. Mikrosk., Anat., Abt. 2, vi, 489-507.
- BHATTI, I. H. 1952: On the cutaneous sense-organs of a common siluroid fish, *Rita rita* (Hamilton). Proc. Nat. Inst. Sci. India, xviii, 547-556.
- DUCROS, C. 1954: Les barbillons et l'organe palatin de *Misgurnus fossilis* Linné et de *Cobitis barbatula* Linné. Trav. Lab. Hydrob. Pisc. Univ. Grenoble, xlv-xlvi, 57-70.

- KAPOOR, B. G. 1965: Histological observations on the skin of the head of a Siluroid fish, *Wallago attu* (Bl. & Schn.). *Mikroskopie*, xx, 123-128.
- 1966a: Histological notes on the skin of the head of a Cyprinoid fish, *Catla catla* (Hamilton). *Zool. Anz.*, clxxvi, 264-270.
- 1966b: Histological observations on the skin of the head of a Clupeoid fish, *Gudusia chapra* (Ham. Buch.). *Jap. J. Ichthyol.*, xiv (1/3), 107-109.
- and BHARGAVA, S. C. 1967: A study on the barbels of a marine catfish, *Arius thalassinus* (Rüpp.). *Jap. J. Ichthyol.*, xiv (4/6). (In press).
- MENG, F. 1924: Beiträge zur Kenntnis der Morphologie der Barteln einiger Fische. *Zool. Jahrb.*, xlv, 149-159.
- NAGAR, S. K. and MATHUR, R. P. 1958: Morphological and histological observations on the barbels of a few Indian fresh-water teleosts. *Proc. zool. Soc., Calcutta*, xi, 63-68.
- RAFFIN-PEYLOZ, R. 1955: Étude histologique des barbillons de quelques poissons d'eau douce. *Trav. Lab. Hydrob. Pisc. Univ. Grenoble*, xlii, 73-97.
- RAJBANSHI, V. K. 1966: A note on the study of gustatory senses of the barbels of fresh-water teleosts. *Naturwissenschaften*, viii, 208-209.
- SATŌ, M. 1937a: On the barbels of a Japanese sea catfish, *Plotosus anguillaris* Lacépède. *Sci. Rep. Tôhoku Imp. Univ., Biol.*, xi, 323-332.
- 1937b: Histological observations on the barbels of fishes. *Sci. Rep. Tôhoku Imp. Univ., Biol.*, xii, 265-276.
- 1959: Some observations on the temporary mental barbels of the larva of the Japanese catfish, *Parasilurus asotus*. *Annot. Zool. Japon.*, xxxii, 18-22.
- and KAPOOR, B. G. 1957: Histological observations on the barbels of Indian fresh-water fishes, Alaska codfish and *Podothecus acipenserinus*. *Annot. Zool. Japon.*, xxx, 156-161.
- SRIVASTAVA, C. M. and SINHA, A. N. 1961: Contribution to the study of barbels of fishes. *Vest. Cs. spol. zool.*, (*Acta soc. zool. Bohemoslov.*), xxv, 12-15.
- TRUJILLO-CENÓZ, O. 1961: Electron microscope observations on chemo- and mechano- receptor cells of fishes. *Z. Zellforsch.*, liv, 654-676.

### Explanation for the figures of the barbels of *Rita rita* (HAM.)

- Fig. 1. A cross section of a maxillary barbel.
- Fig. 2. A part of a transverse section of the maxillary barbel showing mucous cell, club cell and taste bud.
- Fig. 3. A cross section of flapped base of the nasal barbel.
- Fig. 4. A transverse section of the anterior portion of the nasal barbel showing occurrence of club cell at the beginning of flap.
- Fig. 5. A part of transverse section of the nasal flap showing mucous cells and club cells.
- Fig. 6. A part of transverse section of the nasal flap exhibiting a taste bud and profusion of mucous cells.

### Key to lettering

|                            |                       |
|----------------------------|-----------------------|
| BM—Basement membrane.      | BV—Blood vessel.      |
| CC—Club cell.              | CR—Cartilaginous rod. |
| CT—Connective tissue.      | D—Dermis.             |
| EP—Epidermis.              | MC—Mucous cell.       |
| NF—Bundle of nerve fibres. | PC—Pigment cell.      |
| TB—Taste bud.              |                       |



