

A Study on the Tongue of Fishes

B. G. KAPOOR

(Fisheries Section, Ministry of Food and Agriculture, Department of
Agriculture, Government of India, New Delhi)

Introductory

Despite an impressive body of knowledge concerning the digestive system of fishes, there is paucity of information on the histology of the tongue. Studies on tongue are based on two primary issues: whether the tongue has muscles to control it and whether it has the power to discriminate different tastes. CUVIER (2) wrote that *Anguilla*, *Conger* and other fishes which belong to apodes have a muscle called *M. hyoglossus* which starts from the hyoid. LUDWIG (11) later pointed out an incorrectness of this statement. RATHKE (14), STANNIUS (16), WIEDERSHEIM (18), GEGENBAUR (3) and HALLER (5) pointed out that the tongue of fish consists of the hyoid, i. e., the glossohyal and mucous membrane which wraps over the glossohyal, and that no muscle exists. MARCUS (12) describes that the smooth muscles are present in the tongue of *Polypterus*. MATUI (13) studied morphologically and histologically the tongue of *Plecoglossus altivelis*. Brief mentions about tongue are on record by ROGICK (15), CURRY (1), ISLAM (6) and KAPOOR (7, 8, 9, 10).

The author endeavours to present here the observations on the tongue of *Wallago attu* (BL. & SCHN.), *Catla catla* (HAM.), *Barbus stigma* (C. & V.) and *Gadusia chapra* (HAM.). The histological examination, reported in each case, is based on the tissue fixed in Bouin's fluid and on the sections (8 μ) stained with Delafield's haematoxylin and eosin.

Description of observations

The tongue in *Wallago attu* (7) is crescentic while in *Catla catla* (8) and *Barbus stigma* (9) it is small and rudimentary and in *Gadusia chapra* (10) it is spoon-like and is partially covered over by the mandibular valve.

MATUI (13) observed a very small, trianguloid tongue with minute teeth in *Plecoglossus altivelis*. He recorded "tongue-lappen" at the front and both sides of the tongue, which consists of the epithelium, connective tissue and muscles. SUYEHIRO (17) reports that "lateral tongue lappen" is the Musculi hypobranchiales, and the teeth on the tongue are simply rudimentary. ROGICK (15) and CURRY (1) mentioned the presence of a rudimentary tongue in *Campostoma anomalum* and *Cyprinus carpio communis* respectively. ISLAM (6), in his study on the comparative histology of the alimentary canal of *Rita rita*, *Cirrhina mrigala* and *Ophicephalus gachua*, recorded the presence of tongue only in *Ophicephalus gachua*. GIRGIS (4) states that there is no true tongue in *Labeo horie*.

The tongue in *Wallago attu* consists of mucosa and submucosa (Figs. a, b). The mucosa is made up of stratified epithelium containing mucous cells, club cells and taste buds in it. The epithelial cells lying at the surface are flat ; next are a few layers of polygonal or round cells. The fusiform cells, each with an oval or round nucleus, are more common in between the club cells. The columnar cells of the basal layer follow a zig-zag course and get interrupted at places where the sense organs are present. Dome-shaped cells lie in between the columnar cells. The mucous cells, each with a crescentic nucleus at the base, are in plenty and disorientate the surface cells which, due to compression, become irregular in shape. Numerous club cells fill up the middle portion of the epithelium and vacuolations appear in almost all the cells. Taste buds lie surrounded by the epithelial cells on elevated portions of the connective tissue in which blood capillaries are seen. Numerous granular cells are present which even project out of the general surface ; pigment cells are also observed.

The epithelium rests on the basement membrane. Under the basement membrane is a coat of fibrous connective tissue ; the fibres are more close along the basement membrane and are interrupted by a few longitudinal fibres. Below it are loose connective tissue fibres. Pigment cells and blood capillaries are present. A cartilage piece like that of the tongue in *Ophicephalus gachua* (ISLAM, 6) is prominent. Muscles of striated type are also present.

The tongue of *Catla catla* is composed of mucosa and submucosa (Fig. c). The mucosa is comprised of stratified epithelium possessing mucous cells and taste buds. The superficial cells lie parallel to the surface and the undifferentiated epithelial cells have a regular polygonal shape and at places regularity of the shape of cells is lost because of the great pressure of mucous cells as well as of the taste buds. The bottom or the basal layer consists of columnar cells and the nucleus in such a cell is oval and basal or even central in position. In between the columnar cells round or dome-shaped cells are noted. Mucous cells are limited to the border. At places the number of mucous cells is very large and the epithelial cells become a bit crowded below the surface of the epithelium. Each taste bud has the usual sense cells and the nutritive or supporting cells.

A basement membrane and the stratum compactum are present and underneath lies the submucosa which is made up of fine strands of connective tissue. A cartilaginous piece is present at the base. Blood capillaries are present and the muscle bundles were not observed in the sections examined.

The tongue of *Catla catla* is rudimentary like that of *Campostoma anomalum* (15). The abundance of taste buds and mucous cells is unlike that of *Cyprinus carpio communis* (1).

The two layers of the tongue of *Barbus stigma* are mucosa and submucosa (Fig. d). The stratified epithelium of mucosa has mucous cells and taste buds. Superficial layer of cells is orientated horizontally and is followed by the layers of polygonal or oval cells and the basal columnar cells. Mucous cells are sparsely present and the taste buds are more in number than in the tongue of *Wallago attu*. They lie on the summits of connective tissue and may be either isolated or crowded together. A few granular cells occur in the

mucosa.

The mucosa is separated from the submucosa by the basement membrane and stratum compactum. The submucosa is a fibrous connective tissue layer in which muscle bundles occur on both sides of the cartilage piece. Many blood capillaries run in this layer.

The mucosa and submucosa constitute the tongue in *Gadusia chapra* (Figs. e, f). The mucosa consists of polygonal, oval, and columnar cells. The mucous cells and the granular cells form a common element and taste buds are sparse. The submucosa is thick and it has a long cartilage piece surrounded by a coat of fibrous connective tissue which is vascular and has also the pigment cells.

Summary

The tongue in *Wallago attu* and *Gadusia chapra* is conspicuous while in *Catla catla* and *Barbus stigma* it is rudimentary. Both the mucous cells and taste buds occur in the mucosa of the tongue of fishes undertaken for study; with the only difference in the intensity of taste buds which are more in the tongue of *Catla catla* and *Barbus stigma*.

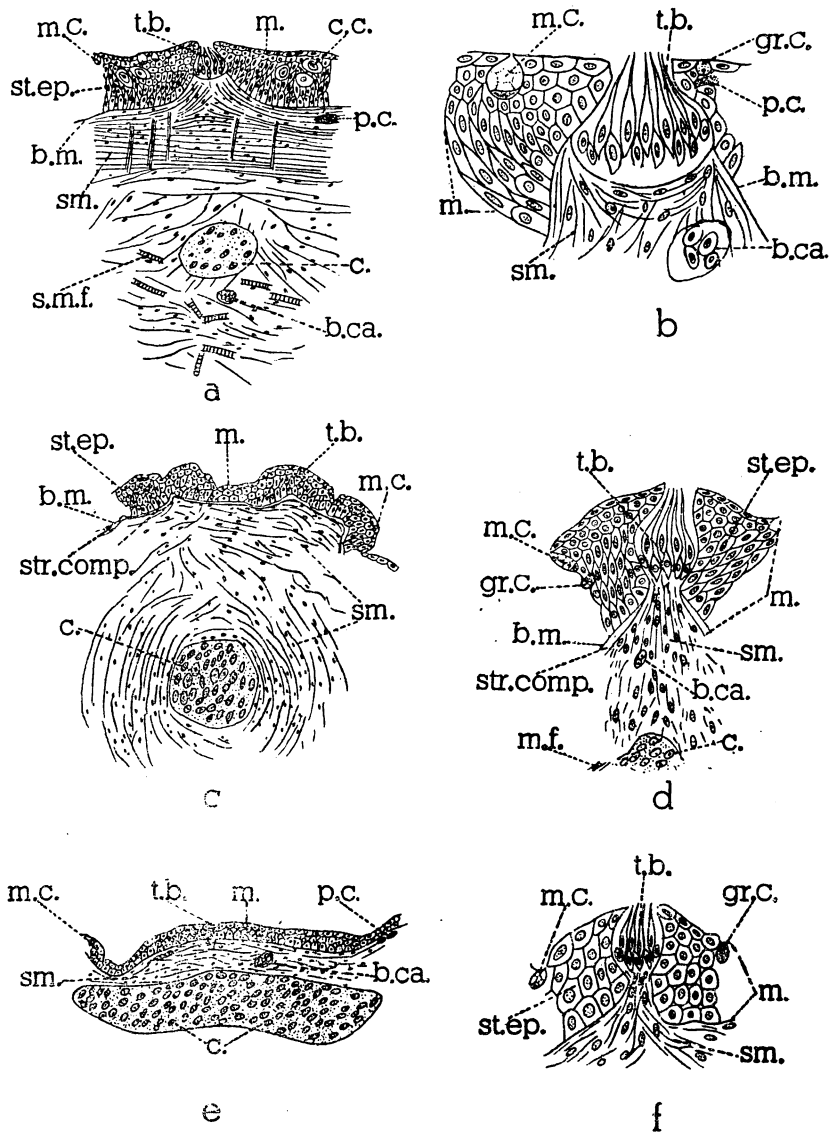
It may be emphasized that further work is necessary on the histology of the tongue particularly with a view to understanding its musculature.

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Explanation for illustrations and lettering:

Fig. a. A part of the transverse section passing through the tongue of *Wallago attu*.

Fig. b. A part of the mucosa of the tongue of *Wallago attu*. (Magnified)

Fig. c. A part of the transverse section passing through the tongue of *Catla catla*.

Fig. d. A part of the transverse section passing through the tongue of *Barbus stigma*. (Magnified)

Fig. e. A transverse section passing through the tongue of *Gadusia chapra*.

Fig. f. A part of the transverse section passing through the tongue of *Gadusia chapra*. (Magnified)

b. ca., blood capillary ; *b. m.*, basement membrane ; *c.*, cartilage ; *c. c.*, club cell ; *gr. c.*, granular cell ; *m.*, mucosa ; *m. c.*, mucous cell ; *m. f.*, muscle fibres ; *p. c.*, pigment cell ; *s. m. f.*, striated muscle fibres ; *sm.*, submucosa ; *st. ep.*, stratified epithelium ; *str. comp.*, stratum compactum ; *t. b.*, taste bud.

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*Cited by SUYEHIRO (17).