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FUNCTIONAL RESPONSES OF CAT FISH BARBELS*

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ABSTRACT

Catfish barbels are generally considered as intended for tactile purposes. Evidences have indicated that the barbels have diverse fuuctions. These gustatory, locomotory, aggressive and sexual aspects are discussed.

INTRODUCTION

It is well known that all siluriform fishes have barbels ranging from one pair (as in *Silonia* Swainson, *Osteogeniosus* Bleeker) to four pairs in number and from most minute (*Leiocassis rama* (Hamilton)) to as long as body length, if not longer in size (*Mystus cavasius* (Hamilton)). The maxillary barbels which are nearly always the longest are usually between half and twice the length of the head. It has been generally considered that these barbels act mainly as feelers for searching food in the media they live which are generally sluggish, ill-lit stream bottoms. Diverse functions other than merely of a tactile nature have come to light which are discussed here.

STRUCTURE

In investigating the functions of the barbels it becomes necessary to know their histological structure. Sato (1937), Sato and Kapoor (1957), Nagar and Mathur (1958) found that the maxillary barbels possess an axial rod of cartilagenous tissue. Alexander (1965) found this central rod as a thick sheath of Collagen filres. Ghiot (1976) observed that the Bagroidei (*sensu* Chardon, 1968) have such an elastic axial rod. The epidermis is studded with cutaneous pear-shaped taste buds. These taste buds are found to be more numerous on the apical region than on the basal region, and are with mucus cells and club cells, the presence or absence of either of them being not uncommon. For instance *Bagarius bagarius* (Hamilton) does not have any mucus or club cells unlike *Ompok bimaculatus* (Bloch) and *Heteropneustes fossilis* (Bloch) which have many of these cells. Pfeiffer (1963) condidered club cells as distinct from mucus secreting cells as the nucleus in the former lies in the center unlike the latter where it is on the periphrey. Moreover, barbel epidermis contains no club cells or only a few very small ones, while the body expidermis are abundantly supplied with these cells.

Baecker (1926) divided the barbels into different categories on the basis of the structure of the barbel. Thus *Ompek bimaculatus* and *Heteropneustes fossilis* are grouped by him to be with barbels of the flexible type as they have an axial rod of cartilaginous tissue. Other nonsiluriform fishes such as *Botia* and *Barbus* are considered as with barbels of the

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tender type since the central core of the maxillary barbels in these fishes has only a channel for the blood vessel besides nerve fibres. The movement of the barbels in these fishes are effected by the blood vessels becoming turgid unlike in Catfishes where generally the adductor muscles act as a rotatory axil for the barbels.

FUNCTIONS

Gustation :—Taste buds as their name indicate helps in the selection of food items for these fishes. These are found all over the body in most catfishes (Bhatti, 1938), but are plentiful on the barbels. A wide variety of bottom feeding fishes bear these taste buds on their barbels near the mouth. Herrick (1903) demonstrated that in *Ictalurus* the nose informs the fish the proximity of food which is then searched for and located with barbels. The long barbels on the maxilla cause a stream of water containing food such as insects, crustaceans, etc. to come near the mouth by their rotatory movements (Burne, 1909). These observations are substantiated by their feeding habits. For instance *Mystus* species feed largely on crustaceans (Kamal Pasha, 1964) ; *Ictalurus* and *Porcus* mainly on bottom living invertebrates (Corbet, 1961). Besides the maxillary barbels, the mental barbels on the ventral side are admirably arranged for exploring the bottom, near the mouth for

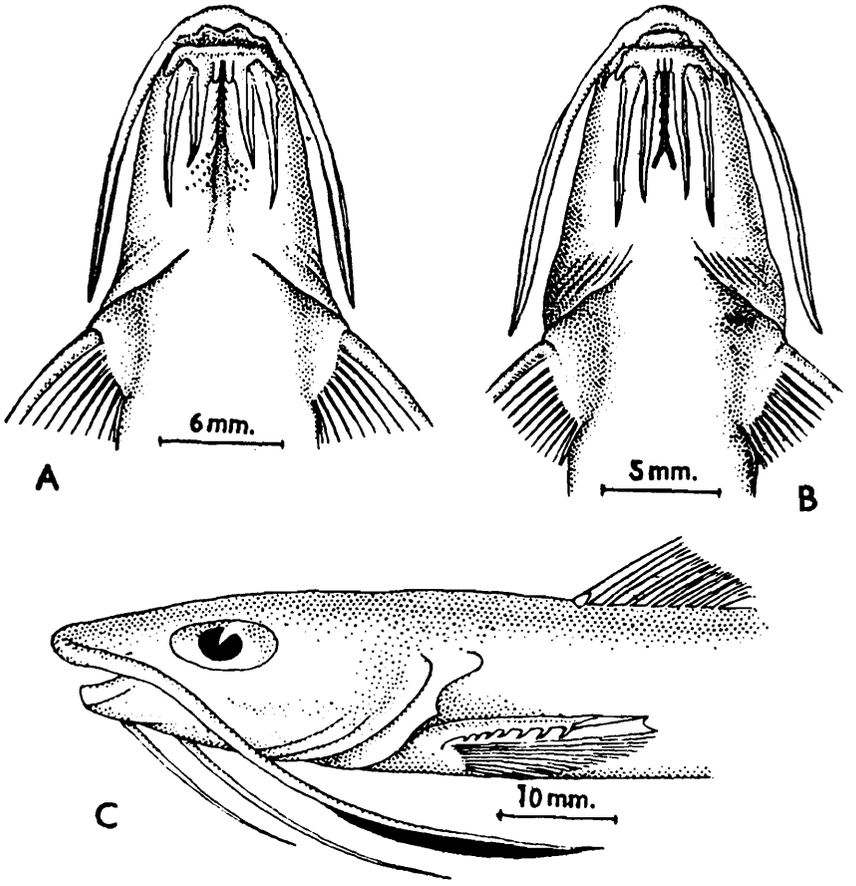

Fig. 1. Ventral view of head and anterior part of body of *Gagata cenia* (Hamilton), B. Of *Nangra viridescens* (Hamilton), showing the small papillae- like barbels in between the mandibular pair and the sieve-like formation. C. Lateral view of *Phyllonemus typus*. Beulenger showing the leaf-like expansion of the maxillary barbels.

food. In *Nangra* and *Gagata* besides the usual pair, a small pair of papillae-like barbels are found in between, which additionally help in discriminating the food. Added to these, a stiff sieve-like formation of the in between skin-fold assist in sievieng extraneous matters. Considering that *Nangra* and *Gagata* are inhabitants of rocky streams, with many pebbles, and sand particles, this adaptation of the mandibulary barbels is very striking.

Locomotion :—Longer barbels of fishes such as *Pimelodella* of South America, *Porcus* of Africa, *Mystus* of India, have a secondary function to avoid obstacles, before the fish could move into crevices and mud holes in search of food. *Phyllonemus* of Tanganyika, Africa has the maxillary barbel flattened like a leaf at its anterior edges. Though, the exact nature of this modification is not known, it seems probable this flattened edge acts as a pad to clear obstacles and also to immobilise insects, crustaceans which form the food-items.

Fright : Pfiffer (1963) based on a number of experiments indicated that fright reaction occurred because of release of alarm substance when the skin is injured and not to barbel skin. Sato (1937) found *Plotosus anguillaris* recognising and reacting more by chemical sense such as the release of alarm substance, rather than by the barbels. Even when the barbels were severed, cognition of food substances took place. It would thus appear that barbels play no part in fright reaction.

Aggression : However, the barbels are put out stiffy in an aggressive manner for defense when irritated or in inescable situations of

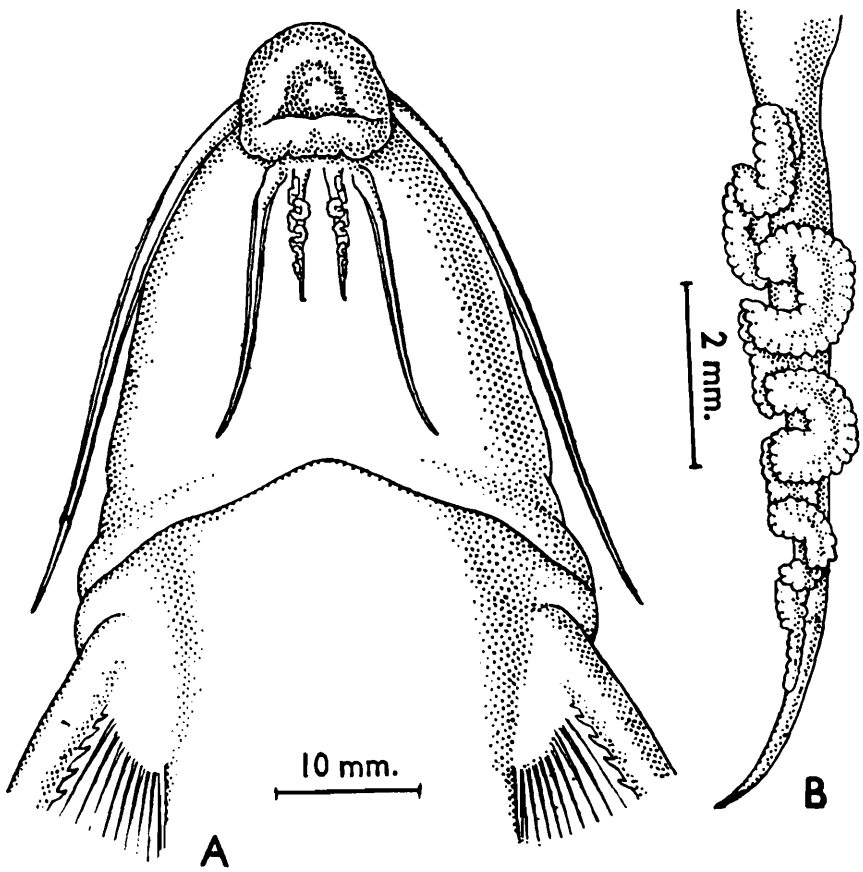

Fig. 2. A ventral view of head and anterior part of body of *Bagrichthys hypselopterus* Balcker showing the modified inner mandibular barbel. B. Enlarged view of the barbel to show the cup-like structure with papillae.

danger. Day (1878) recorded *Mystus vittatus* known as the fiddler fish in Mysore to act in this manner. He observed (p. 449) "I touched one which was on the wet ground, at which it appeared to become very irate, erecting its dorsal fin and making a noise resembling the buzzing of a bee evidently a sign of danger. Having put some small carp into an aquarium containing one of these fishes it rushed at a small example, seized by the middle of its back and shook it like a dog killing a rat, at the time its barbels were stiffened out laterally like a Cat's whiskers". *Clarias batrachus* and *Heteropneustes fossilis* are also known to put out their barbels and spines stiffly in a defensive or aggressive posture when irritated. Fishermen would rather cut the meshes of their nets and allow a fighting dreadful *singi* escape with its pectoral fins poised, than dare to handle it.

Sexual attraction : Breder (1935) considered that tactile stimulation of the barbels played a part in mating of catfishes. *Bagrichthys hypselopterus* from Thailand has the inner mandibular barbels frilled with cup-like borders. Though this also may help in procuring food, the modification of only the inner mandibular pair seems to suggest that it may be for sexual attraction. Further, this adaptation is present only in the females ; the males have plain barbels.

Conclusions

The barbels of catfishes which are largely responsible for their popular name are their most conspicuous feature. Though considered primarily for tactile purposes, it appears that some have other functions such as aggressive, locomotory and even sexual. Experimental work on these aspects is much needed and may help in ascertaining the diverse functions of the whiskers of catfishes.

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