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Relationships between the Taste Buds and the Peculiar Structures and Movements of the First Dorsal Fin in *Motella mustela* (L.) (Pisces, Gadiformes)

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With 2 Figures

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Abstract

The needs of the chemoreception function alone do not explain the anatomical peculiarities of the first dorsal fin of *M. mustela*. These ones are surely in relation with other necessities as those of the protection of the structure.

Introduction

In teleosts, the main chemoreceptor organs are nares and taste buds (Kapoor et al. 1976). The latter are displayed on the whole body outer surface and especially in the bucco-pharyngeal cavity, on the lips and on the barbels when present (Iwai 1964; Atema 1971).

In acanthopterygian and paracanthopterygian fishes, chemoreceptors also lie on fins in parallel with an increased importance of the ramus lateral accessorius facialis (Freihofer 1963).

Motella mustela is a small gadiform paracanthopterygian fish common in the intertidal zone of the rocky shores of North-Western Europa. It is provided with 5 barbels and also with a very peculiar 1st dorsal fin referred by Thomson (1912) to be in relation with chemicals in the milieu thanks to taste buds. That latter fin is morphologically different from the other teleostean fish dorsal fins (Thomson 1912; Poll 1947; Vandewalle et al., in press). It lies in a groove. Rays, except the 1st one, are small. Rythmic lateral inclination of the small rays results in undulation travelling backward along the fin and in a water flow supposed to help chemoreception (Thom-

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SON 1912; POLL 1947). This undulation is permanent during locomotion but discontinuous at rest (VANDEWALLE et al., in press).

Our aim is to confirm the presence of taste buds on the 1st dorsal fin and to discuss the relationships between its chemosensitive function and its structures and movements.

Material and Methods

M. mustela specimens were collected in the intertidal zone in Wimereux and St. Malo (France).

Small pieces of the 1st dorsal fin, of the groove where it lies in, as well as pieces of the 2nd dorsal fin and of barbels of 2 specimens were observed with a *Cambridge Mark II Stereoscan Scanning electron microscope*. Samples were prepared by methods of double fixation with glutaraldehyd and OsO_4 (JEOL 1972) and deshydratation by critical point (BOYDE 1972).

2 more specimens were serially cut into 10 μm sections, stained by the improved trichrome method.

Observations

In *M. mustela,* S.E.M. observation reveals numerous prominent taste buds on the anterior margin of the big 1st ray of the 1st dorsal fin (Fig. 1 A, 2 A) and scarce ones on the rays of the 2nd dorsal fin (Fig. 1 B). No taste buds were conspicuous elsewhere on the dorsal fins nor in the groove of the 1st fin.

The taste buds on the 1st ray of the anterior dorsal fin (Fig. 1 A) are less numerous and smaller than the non-prominent taste buds of the barbels (Fig. 2 C, D) and lips.

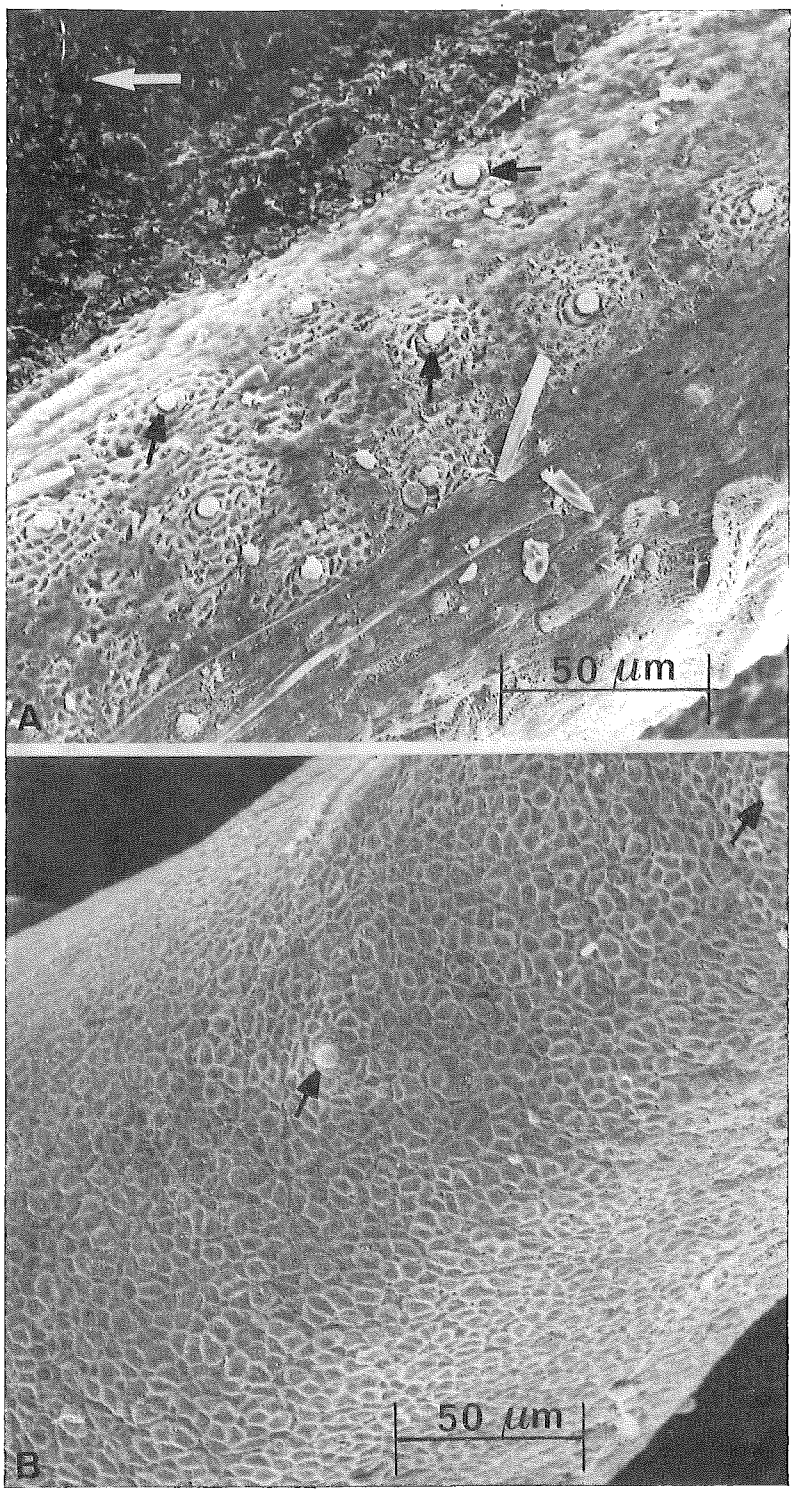
No taste buds were observed on the smaller rays of the 1st dorsal fin nor on the membrane joining them but just some pores (Fig. 2 B). There were no such pores on the 1st ray nor in the groove. Those pores might be openings of peculiar buds (REUTER 1973; REUTER et al. 1974).

Histological slices confirm the presence of taste buds on the 1st ray of the anterior dorsal fin. Their structure is the same as that described by OVALLE and SHINN (1977) in *Corydoras arcuatus*. Moreover, sparse buds are observed in the groove as well as on the whole surface of the body. Hence, the non observation of these buds on the S.E.M. preparations is very likely related to their scarceness. We however never observed any pit, pore or taste bud on the histological sections made in the smaller rays nor in their membrane. We should explain the pores observed there on the S.E.M. preparations as artefacts if we observed such structures also on the 1st ray of the dorsal fin, but it is not the case.

Discussion

The taste buds of the 1st dorsal fin are mainly located on the anterior side of the 1st ray. It is not an unique situation. ATEMA (1971) describes in *Ictalurus natalensis*

Fig. 1. *Motella mustela*. *A*. Lateral view of the 1st ray of the anterior dorsal fin. Notice numerous taste buds on the anterior face. *Black arrows* point out 3 buds. The *white arrow* indicates the forward direction. *B*. Lateral view of the 1st ray of the posterior dorsal fin. The 2 conspicuous taste buds are pointed out by way of *arrows*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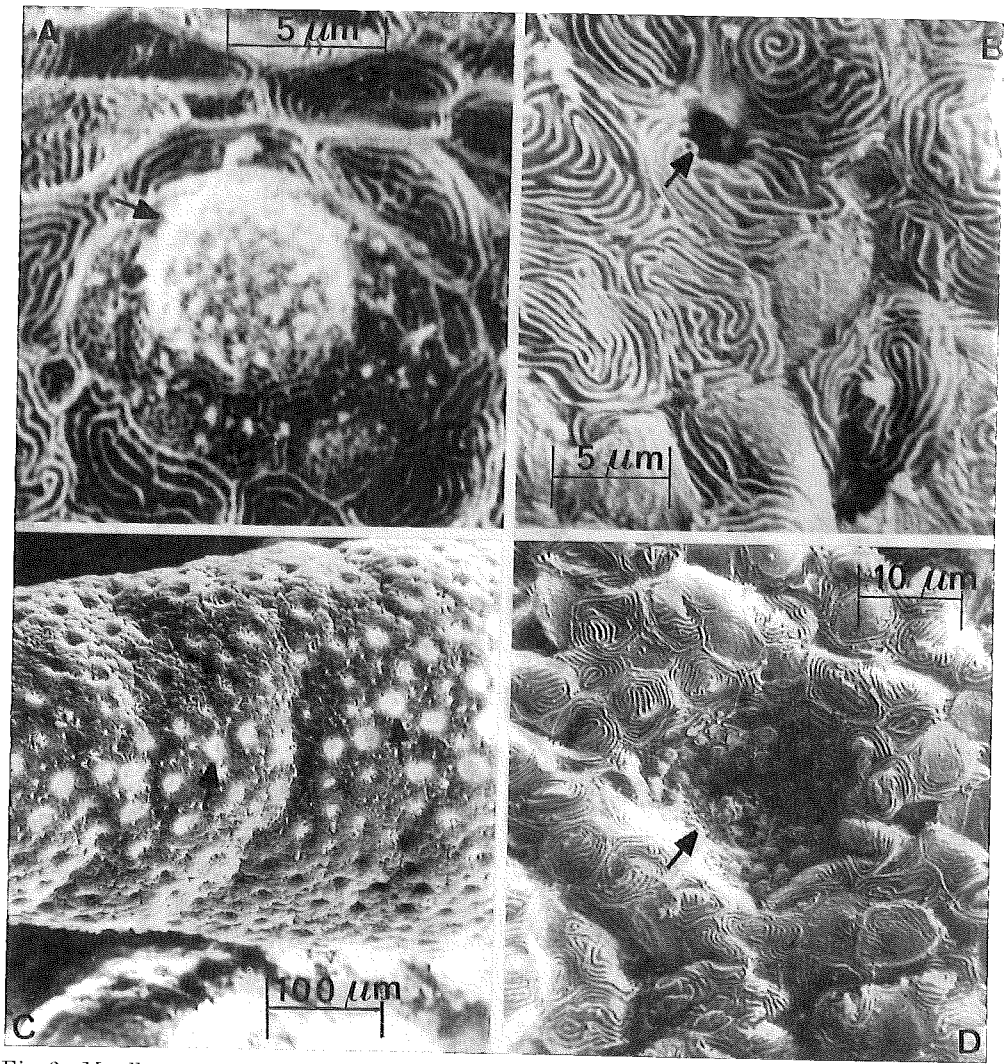

Fig. 2. *Motella mustela*. *A*. Taste bud *(arrow)* of the 1st ray of the anterior dorsal fin. *B*. A part of the interradial membrane of the anterior dorsal fin, with a pore *(arrow)*. *C*. A part of a barbel with many conspicuous taste buds (2 of them are indicated by *arrows*). *D*. A taste bud of a barbel *(arrow)*

a great amount of taste buds on the spring ray of the dorsal fin which does not perform rythmic undulations. Hence a relation between the taste buds and the fin movements of *M. mustela* is not sure, all the more as many taste buds are located above the level of the lesser rays, so that the water flow created by the fin is seemingly unefficient for them. During swimming, erection of the 1st ray is sufficient for placing the taste buds across the water current. At rest would there be any advantage from favouring working of the dorsal fin taste buds while the barbels bearing more buds remain motionless?

It is also unlikely that the undulation of the dorsal fin is related to the few buds of the groove of the 1st dorsal fin or to the few pores of the lesser rays, because these buds and pores are not more dense by located on these structures than on the rest of body.

We thus disagree with THOMSON (1912) and POLL (1947) that the specialized structure and movements of the 1st dorsal fin are related to classical chemical perception of the milieu by taste buds.

KORTSCHAL and WHITEAR (1985) have described on the lesser rays of the dorsal fin numerous cells susceptible to certain amino-acids and mucopolysaccharids. Hence undulatory movements prove useful for water circulation at the level of those cells.

We though think that this explanation is not quite satisfactory because, like for the taste buds, sensory cells are also present in the oral epithelium and in the external epidermis (WHITEAR 1971). So we put forward another hypothesis. The sinking of the fin into a groove and the shortening of the rays are a way of protecting the organ in regard to the milieu (sea shore life for example). That protection results in a need for an efficient water flow in the restricted channel where the rays with their sensory cells are confined. We are aware that there is not yet any explanation for the fact that the undulation is continuous during locomotion and intermittent at rest.

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