

Morphology of the Lingual Papillae in the Least Weasel (*Mustela nivalis*)

Morfología de las Papilas Linguales en la Comadreja Común (*Mustela nivalis*)

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SUMMARY: The dorsal surface structure of the lingual papillae in the least weasel was compared with that of other carnivorous mammalian species. Two types of mechanical papillae (filiform and conical) and two types of gustatory papillae (fungiform and vallate) were observed. The filiform papillae had secondary processes. Rarely conical papillae were observed. A few taste buds were seen on the surfaces of the fungiform papillae. The four vallate papillae were located on both sides of the posterior end of the *lingual body*. In conclusion, morphological characteristics of the lingual papillae and their distribution in the least weasel were similar to those of the Japanese marten and ferret. The conical papillae in the *lingual apex* of the Japanese marten and ferret were not observed, but the conical papillae were seen in the *lingual apex* of the least weasel.

KEY WORDS: Lingual papillae; Least weasel; *Mustela nivalis*; Morphology.

INTRODUCTION

The definite characters of the *dorsal lingual surface* in mammals were the shape and distribution of the lingual papillae. The papillae on the *lingual surface* were closely related to the animal diet and feeding habits (Iwasaki, 2002; Kumar & Bate, 2004; Erdogan *et al.*, 2015). Much work has been published on the structures of the lingual surfaces in various animals. In the order Carnivora, there have been many SEM studies of the tongues of cat (Boshell *et al.*, 1982; Kobayashi *et al.*, 1988), dog (Iwasaki & Sakata, 1985; Kobayashi *et al.*, 1987), mongoos (Iwasaki *et al.*, 1987), Japanese weasel (Furubayashi *et al.*, 1989), sea otter (Shimoda *et al.*, 1996), Asian black bear (Inatomi & Kobayashi, 1999), bush dog (Emura *et al.*, 2000), panther and Asian black bear (Emura *et al.*, 2001), lion (Emura *et al.*, 2003), tiger (Emura *et al.*, 2004), silver fox (Jackowiak & Godynicki, 2004), raccoon dog and fox (Emura *et al.*, 2006), Japanese marten (Emura *et al.*, 2007), ferret and Siberian weasel (Emura, 2008) and ferret (Takemura *et al.*, 2009). Such studies reveal variations in the structure and distribution of papillae on the *dorsal lingual surface* among animal species. However, no SEM study of the tongue of the least weasel (*Mustela nivalis*) has been performed. Therefore, this study examined the dorsal lingual surface of the least weasel and compared the features with those of other mammals.

MATERIAL AND METHOD

Five tongues of healthy young adult *Mustela nivalis* were obtained, immediately after their death, from a local hunter. The tongues were rinsed with 0.1 M cacodylate buffer (pH 7.4) and specimens bearing lingual papillae were dissected out and fixed in 2 % glutaraldehyde (pH 7.4) with cacodylate buffer for 4–6 h at 4 °C. The samples were then postfixed in 1 % cacodylate-buffered osmium tetroxide at room temperature for 3–5 h. The samples were dehydrated in an ascending series of ethanols and dried, substituting carbon dioxide for ethanol in a critical point drying apparatus. The specimens were mounted on metal stubs and coated with gold palladium. The specimens were examined in a JEOL Scanning Electron Microscope in EM Unit at Alexandria University.

RESULTS

The tongue of the least weasel was about 5 ± 0.25 cm. The tongue was divided into 3 parts; the apex, the body and the root. Four types of lingual papillae were observed in the dorsal lingual surface of the least weasel; filiform, conical, fungiform and vallate. These papillae differed in the structure, number and location.

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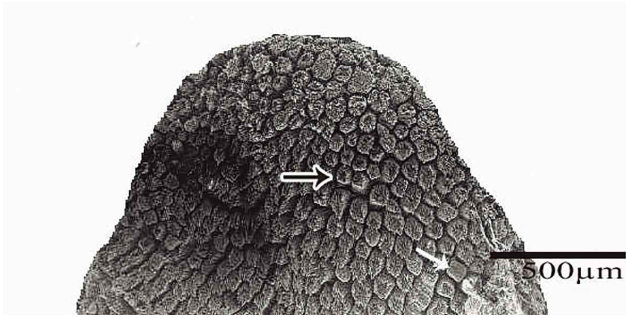


Fig. 1. Scanning electron micrograph of the lingual apex showing the filiform (black arrow) and fungiform papillae (white arrow).

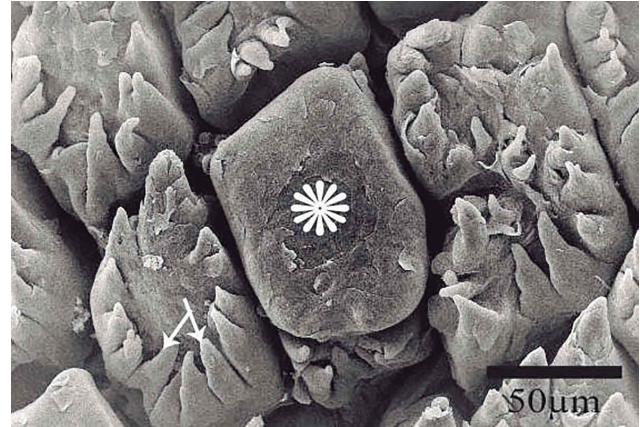


Fig. 3. Scanning electron micrograph of the lingual apex showing the filiform papilla with the secondary processes (white arrow) and fungiform papilla (white star).

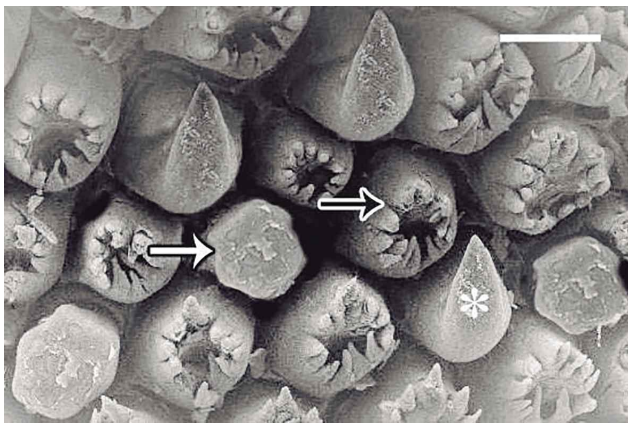


Fig. 2. Scanning electron micrograph of the lingual apex showing the filiform (black arrow), fungiform (white arrow) and conical papillae (asterisk).

Lingual apex. Two types of filiform papillae were found on the dorsal lingual surface. The filiform papillae covered a large area of the whole surface of the tongue. Firstly, overlapping papillae with numerous processes in the direction of the lingual root and had close contact to each other. The tips had ten secondary processes with a leaf-like shape (Figs. 1, 2 and 3). A few numbers of conical papillae were seen in the dorsal surface of the tongue with only one process in the direction of the lingual root (Fig. 2). A few fungiform papillae were found in the apex, body and root.

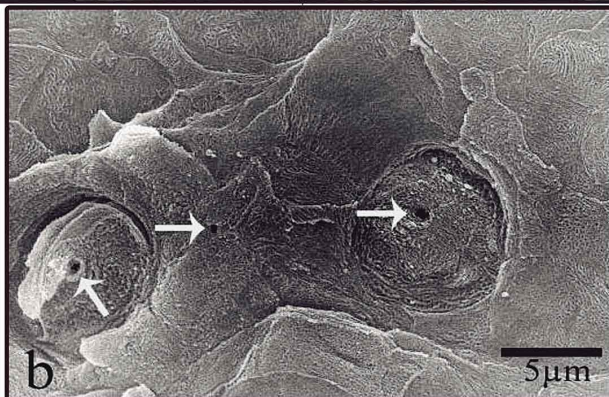
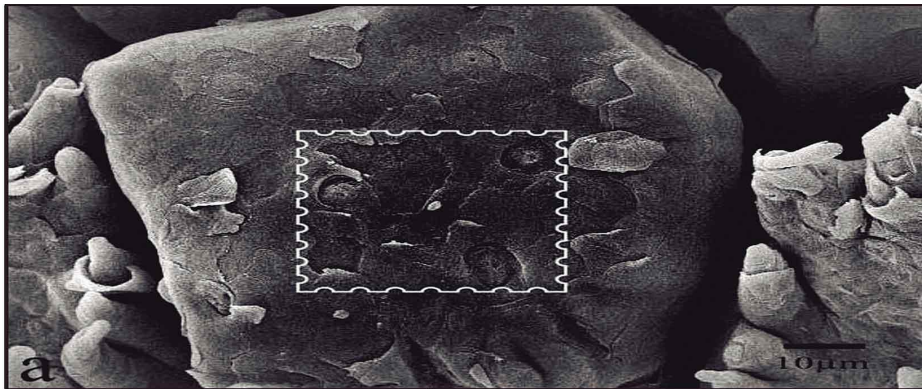


Fig. 4. a) Scanning electron micrograph of the surface of the fungiform papilla showing several taste buds. b) Magnification of the surface of fungiform papilla showing several taste pores (white arrow).

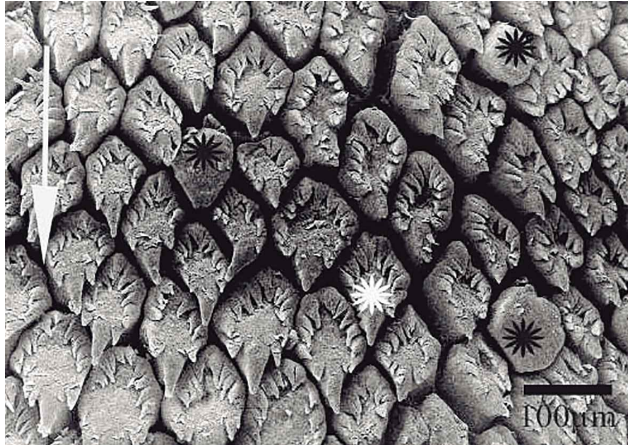


Fig. 5. Scanning electron micrograph of the *lingual body* showing filiform (white star) and fungiform (black star) papillae. The arrow indicates posterior direction of tongue.

They were sparsely appeared on the filiform papillae. A few taste buds were seen in the dorsal epithelial surface. There were many microgrooves with several microridges on the epithelial surface (Figs. 4a and 4b).

Lingual body. The second types of filiform papillae covered the body of the tongue. They were a leaf-like shape with several pointed edges (Figs. 5 and 6).

Lingual root. Four vallate papillae were observed in the dorsal surface of the root of the tongue; this area was covered by rough mucosa without any types of papillae. These papillae were a rounded bulb-like shape with a central groove. The surfaces of these papillae were smooth and devoid of a taste buds (Figs. 7a and 7b).

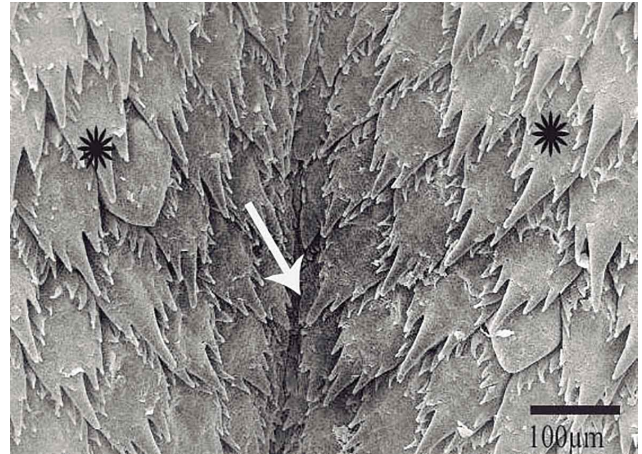


Fig. 6. Scanning electron micrograph of the posterior part of the *lingual body* showing leaf-like pointed papillae (black star). A white arrow shows a median groove.

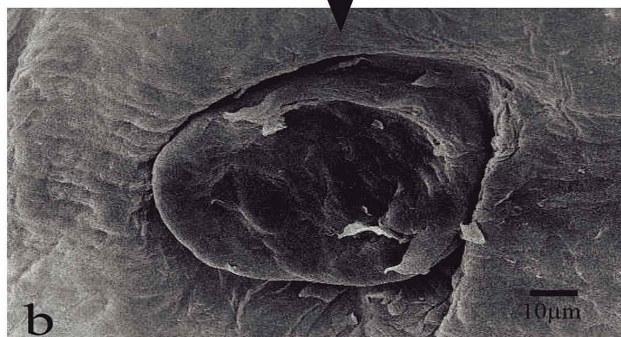
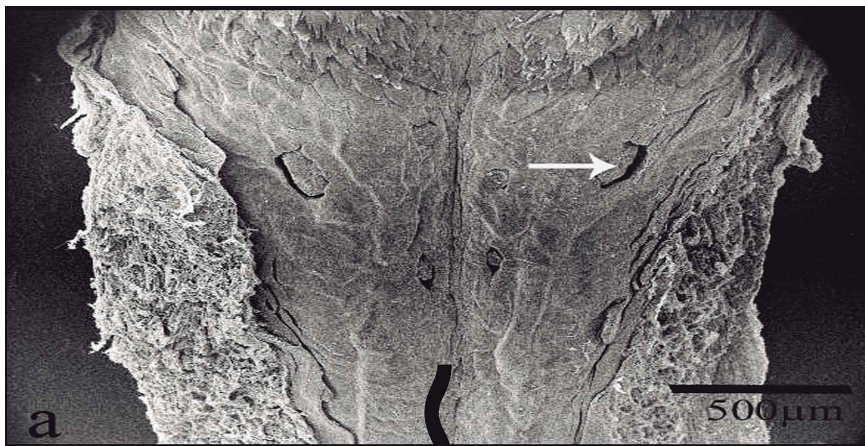


Fig.7. a) Scanning electron micrograph of the *lingual root* showing four vallate papilla (white arrow). b) Magnification of the vallate papilla.

DISCUSSION

Shimoda *et al.* reported that the filiform papillae on margin of the tongue of the newborn sea otter were divided into two shapes which were horny or club-shaped papillae, and the fungiform papillae also were divided into two shapes which were hemispherical or club-shaped papillae. Emura *et al.* (2001, 2003) described that the large papillae were observed on margins of the *lingual apices* of the newborn panther, newborn asian black bear and lion. In the cat (Boshell *et al.*), newborn panther (Emura *et al.*, 2001), lion (Emura *et al.*, 2003) and tiger (Emura *et al.*, 2004), a marked transition occurred between the tip and midportion of the dorsum of the tongue. The transition was characterized by an increase in size of the projection of the filiform papillae. In the midportion of the tongue, the projections were very prominent. In the silver fox (Jackowiak & Godynicki), the filiform papillae on the anterior part of the tongue were divided into 1 main and 10-12 accessory processes. In the posterior part of the body of the tongue the number of accessory processes was reduced. In the raccoon dog (Emura *et al.*, 2006), each filiform papilla on the apical surface of the tongue had several pointed processes, and the filiform papillae of the *lingual body* consisted of a main papilla and some secondary papillae. In the Japanese marten (Emura *et al.*, 2007). A small filiform papilla on the apical surface of the tongue had several pointed processes. A large filiform papilla of the *lingual body* consisted of a main papilla and some secondary papillae. In the ferret and Siberian weasel (Emura), a filiform papilla on the apical surface of the tongue had several pointed processes. A filiform papilla of the lingual body consisted of a main papilla and one or two secondary papillae.

The conical papillae in the *lingual apex* of the Japanese marten (Emura *et al.*, 2007) and ferret (Takemura *et al.*) were not observed. In the present study, a few numbers

of conical papillae were seen in the *lingual apex* with only one process in the direction of the *lingual root*.

In the present study, there were dome-shaped fungiform papillae scattered among the filiform papillae. Similar SEM studies have been reported on the *dorsal lingual surface* of the other mammals (Emura; Emura *et al.*, 2000, 2003, 2004, 2006, 2007; Jackowiak & Godynicki).

Many works have been published on the three-dimensional structure of the vallate papillae in the mammalian tongue. The vallate papillae of the cat, dog and flying squirrel were encircled by the filiform papillae in the posterior body (Boshell *et al.*; Iwasaki & Sakata; Emura *et al.*, 1999). The vallate papillae of the bush dog were surrounded by a groove and crescent pad, and in the dorsal surfaces of the papillae small conical papillae were observed (Emura *et al.*, 2000). Some vallate papillae of the Asian black bear were composed by a primary papillae which was divided into several secondary papillae by intermediate grooves (Emura *et al.*, 2001). The dorsal surfaces of the vallate papillae in the tiger, raccoon dog and fox were irregular (Emura *et al.*, 2004, 2006). The surfaces of the vallate papillae in the silver fox were smooth (Jackowiak & Godynicki). In the Japanese marten, the four vallate papillae were located on both sides of the posterior end of the *lingual body* and each papilla was surrounded by groove and crescent pad. In the ferret and Siberian weasel, the four or six vallate papillae were located on both sides of the posterior end of the lingual body and each papilla was surrounded by groove.

In conclusion, morphological characteristics of the lingual papillae and their distribution in the least weasel were similar to those of the Japanese marten and ferret. However, the conical papillae were seen in the lingual apex in the least weasel.

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RESUMEN: La estructura de la superficie dorsal de las papilas linguales en la comadreja se comparó con la de otras especies de mamíferos carnívoros. Se observaron dos tipos de papilas mecánicas (filiformes y cónicas) y dos tipos de papilas gustativas (fungiformes y circunvaladas). Las papilas filiformes presentaron procesos secundarios. En raras ocasiones se observaron papilas cónicas. Unas pocas papilas gustativas fueron observadas en las superficies de las papilas fungiformes. Las cuatro papilas circunvaladas se encuentran a ambos lados de la parte posterior de la lengua. En conclusión, las características morfológicas de las papilas linguales y su distribución de la comadreja menor fueron similares a los de la marta y hurones japonés. No se observaron papilas cónicas en el ápice de la lengua de la marta y hurón japonés, pero si en el ápice de la lengua de la comadreja común.

PALABRAS CLAVE: Papilas linguales; Comadreja común; *Mustela nivalis*; Morfología.

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