The morphology of the tongue in the feathertail glider (*Acrobates pygmeus*, Marsupialia)

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Abstract: The aim of the macro- and microscopic studies was to describe the morphology and the three-dimensional structure of the lingual papillae in the fruit nectar and fruit feeder marsupial feathertail glider (*Acrobates pygmeus*). Five tongues of an adult male feathertail glider were used for the study. The microscopic observations were made on the serial histological slides and on specimens under a scanning electron microscope. The elongated tongue of the feathertail glider with a sharpened apex is ca. 10 mm in length. On the dorsal surface of the tongue three types of lingual papillae were distinguished, i.e. filiform papillae, fungiform papillae and vallate papillae. The arrangement, shape and size of filiform papillae and its processes change, depending on the part of the tongue, so that the surface of the tongue resembles a brush adapted to effective ingestion of semi-liquid food. Fungiform papillae are uniformly scattered between filiform papillae only on the anterior and middle part of the lingual body. On the smooth root of the tongue three oval vallate papillae are arranged in the form of a triangle. The structure of the tongue and the arrangement of lingual papillae in the feathertail glider resemble those morphological traits observed in Marsupials and also in small Insectivores.

Key words: tongue, lingual papillae, feathertail glider, marsupials, SEM

Introduction

Marsupials in Australia, due to its geographic isolation, exhibit a wide morphological diversification, depending on the ecological niche they occupy and their anatomical structure, including also the morphology of the alimentary tract, taking features found in the representatives of orders in *Eutheria*. Results of previous microscopic observations showed in marsupials that some characteristics of the structures of the tongue and the mucosa covering it are closely correlated with the diet and similar to those found in large ruminants or carnivores (Kobayashi *et al.* 2003; Kubota *et al.* 1963).

The object of the investigations in this study is the feathertail glider, an arboreal marsupial living in eastern Australia, which is described as the world's smallest gliding mammal (Flannery 1994; Starck 1995). Most species belonging to Burramyids are

omnivorous, but in the feathertail glider living in dry sclerophyl forests and woodland, pollen nectar feeding is characteristic (Turner 1984).

Material and methods

The study was conducted on 4 tongues of adult feathertail gliders (*Acrobates pygmeus*), donated by the Zoological Garden in Poznań (Poland). The dissected tongues were cleaned in saline, fixed in 10% neutral formalin and prepared for observations under a scanning electron microscope (SEM). Fixed samples of the tongue were dehydrated in a graded series of ethanol (70%-99.8%) and acetone, and subsequently dried at critical point using CO_2 (Critical Point Dryer K850, EMITECH). All the specimens were mounted on aluminum stubs covered with carbon tabs, sputtered with gold (Sputter Coater S 150B, EDWARDS) and observed under a scanning electron microscope ZEISS 435 VP at the accelerating voltage of 15 kV.

Results and Discussion

The elongated tongue of the feathertail glider (Acrobates pygmeus, Marsupialia) with a sharpened apex is ca. 10 mm in length, while the width of the tongue is constant, amounting to approx. 2.3-2.4 mm. The posterior part of the root of the tongue, with the length of 2 mm, located under the pharyngeal-palatal arch, is narrowed to 0.7 mm (Fig. 2). On the dorsal surface of the tongue three types of lingual papillae were distinguished, i.e. filiform papillae, fungiform papillae and vallate papillae. Scanning electron microscopic observations showed that the arrangement, shape and size of

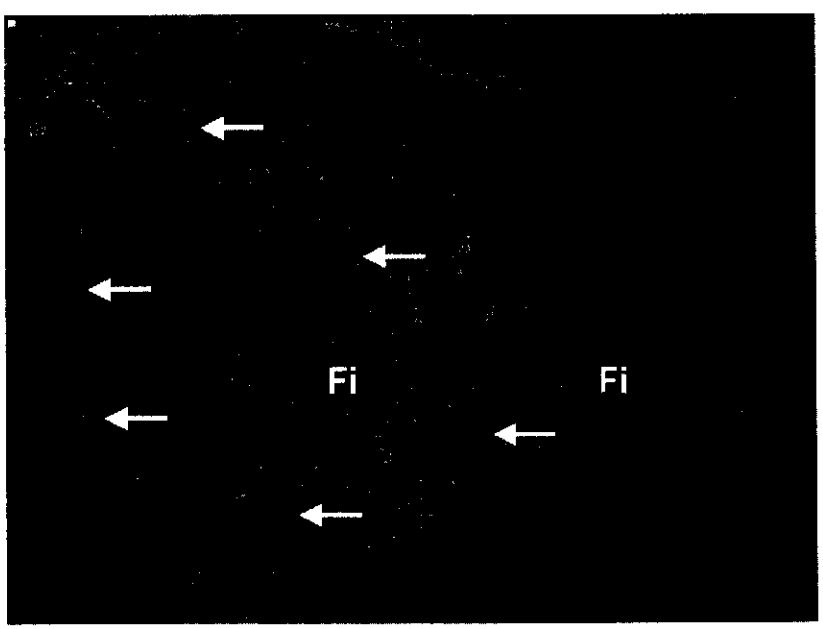

Fig. 1. Scanning electron micrograph of the dorsal surface of the apex of the tongue in the feathertail glider. Fi – filiform papillae, arrows – fungiform papillae, Scale – 200 mm

filiform papillae and its processes change, depending on the part of the tongue, so that the appearance of the surface of the tongue is rough. Filiform papillae are composed of 3-4 flattened keratinized processes with pointed tips, which are tilted towards the back of the tongue. The posterior process is bigger than the 2 or 3 anterior processes. At the margins of the body of the tongue anterior processes of filiform papillae are generally slightly wider and lower than in the papillae located in the medial part of the body of the tongue. In the posterior part of the body of the tongue, in the area of approx. 2 mm in front of the root of the tongue, the arrangement of filiform papillae changes radically, as the papillae with elongated hair-like processes are distributed transversely to the medial line of the tongue. The numerous fungiform papillae are uniformly scattered on the whole surface of the apex and on the anterior and middle part of the lingual body. The second type of gustatory papillae are three oval vallate papillae arranged in the form of a triangle on the smooth root of the tongue.

While comparing the morphology of the tongue of the feathertail glider with other groups of mammals, a similarity was found with the tongues of some species of small Insectivores, i.e. Sorex and Crocidura. The common traits are the short, pointed tip of the tongue and the elongated body of the tongue (Kobayashi *et al.* 1989; Jackowiak *et al.* 2004).

Among marsupials the structure of lingual papillae has been investigated so far in the following species, i.e. in the wombat, wallaby, kangaroo, koala and opossum (Abe *et al.* 2001; Beg and Qayyum 1976; Krause and Cutts 1982; Kobayashi *et al.* 2003; Kubota *et al.* 1963). The distribution of lingual papillae in the feathertail glider resembles the pattern of the lingual papillae in marsupials and also in insectivores. In both

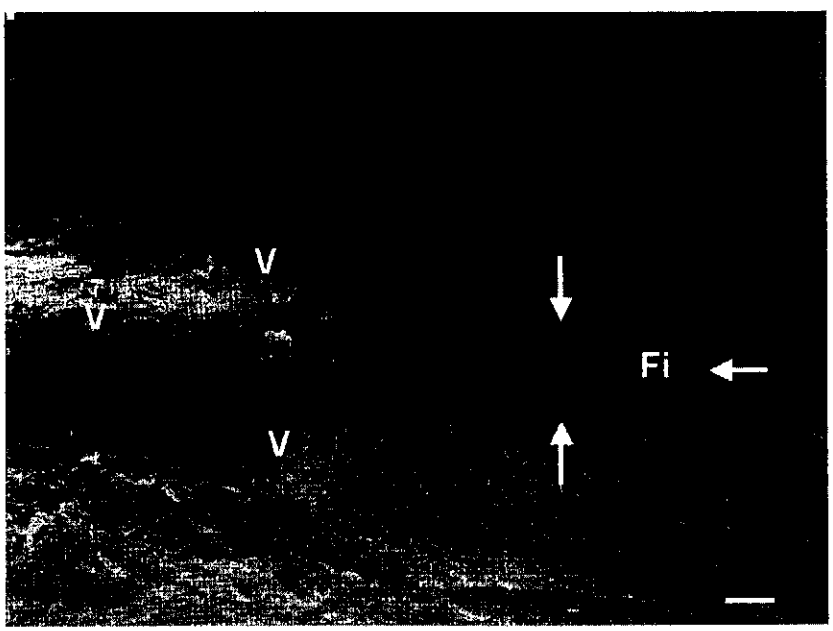

Fig. 2. Scanning electron micrograph of the posterior part of the body and root of the tongue. Fi – filiform papillae, V – vallate papillae on the smooth surface of root of the tongue, arrows show the direction of keratinized processes of the filiform papillae. Scale – 200 mm

systematic groups the surface of the lingual mucosa is covered mostly with filiform papillae and has a smooth root of the tongue, devoid of mechanical papillae.

The main food of the feathertail glider is honeydew, eucalyptus pollen, fruit exudates and/or scrapping fruit pulp and feeding on arthropods (Turner 1984). Under keeping conditions of the Zoological Garden artificial feed for feathertail gliders are mixed chopped fruits, honey, lactogen, baby cereal, moths, cicadas and fresh high nectar flowers, if available. In our observations we found a variable distribution of groups of keratinized filiform papillae on the body of the tongue, which is a morphological feature, which make the surface of the lingual mucosa rough and more adhesive. This feature was also observed in the Egyptian Fruit Bat, which suggests that it is a functional adaptation to effective licking.

The three vallate papillae in the feathertail gliders tongue are typical traits for all marsupials and common also for another mammal group – chiropterans (Emura 2002). A large number of fungiform papillae on the lingual body in the feathertail glider, a nocturnal animal, may be connected with the need for enhanced perception of substances in the ingested food.

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