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Light and Scanning Electron Microscope Studies of Lingual Papillae in Common Tree Shrew (*Tupaia glis*) and Variable Squirrel (*Callosciurus finlaysoni*) : A Comparative Study.

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ABSTRACT

The fine structure and distribution pattern of the lingual papillae of common tree shrew (*Tupaia glis*) and variable squirrel (*Callosciurus finlaysoni*) were comparatively investigated using scanning electron microscope and light microscope.The tongue of the common tree shrew had the same size and shape as that of the variable squirrel but consisted of three types of papillae: filiform, fungiform and circumvallate, instead of four types of papillae : filiform, fungiform, circumvallate and conical,as in the variable squirrel. The circumvallate papillae of both animals had the same number, size and position and located in an inverted triangle on the posterior portion of the tongue. Most of the fungiform papillae were found on the tip and lateral edge of the common tree shrew's tongue, while there were no specific locations of their distribution in variable squirrel. However the shape of filiform papilla was totally different.It consisted of a basal circular budge and had 8-13 upper processes in the common tree shrew, while that of variable squirrel consisted of a basal flat plate like budge and had 4-6 upper processes.

Keywords : Tupaia glis, Callosciurus finlaysoni, lingual papillae.

INTRODUCTION

Common tree shrew is better known than other tree shrews. They present their general structures like those of the squirrel, and one occasionaly found living together with the squirrel. Both common tree shrew and variable squirrel are found commonly throughout Thailand.

There are some degree of disagreement in classifying the tree shrew into its order. Simpson (1945) and Napier and Napier (1967) classified tree shrew to be a primitive primate, while McKenna (1975) grouped tree shrew in the order scandentia under the grand order archonta which consisted of four living orders of mammals: the scandentia, dermoptera, chiroptera and primates respectively. Simons (1972), on the other hand, had included them with the Marcroscelidae in the order insectivora.

Since the morphology and distributton of the papillae on the lingual surface are usually found to be different among the animal order (Sontag 1920; Iwasaki, et al.1987), therefore, the study of the shape, fine structure and distribution pattern of

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the lingual papillae of the common tree shrew and variable squirrel are useful to confirm the classification of the common tree shrew to its order.

In this study, the fine morphological structure and distribution pattern of the various types of lingual papillae of common tree shrew and variable squirrel were comparatively investigated using scanning electron microscope (SEM) and light microscope.

MATERIALS AND METHODS

Tongues from five adult common tree shrews (*Tupaia glis*), weighting 100-150g. and five variable squirrel (*Callosciurus finlaysoni*), weighting 120-180g. were used. The animals were killed by an overdose of sodium pentobarbiturate. The tongues were removed and fixed in Bouin fixative for light microscopy and 5% glutaraldehyde in 0.1M. cacodylate buffer for scanning electron microscopy.

Light microscopy

Paraplast embedded samples of filiform, fungiform, circumvallate and conical papillae (in variable squirrel) was sectioned at 6 um thick and stained with hematoxylene and eosin.

Scanning electron microscopy

The papillae were fixed with 5% glutaraldehyde in 0.1 M cacodylate buffer for 2 h and rinsed with 0.1 M cacodylate buffer and postfixed in 1% osmiumtetroxide for 1 h. The samples, were then, dehydrated by a series of ethanol alcohol solution. Afterwards this solution was replaced with isoamylacetate and dried at a critical point dryer with liquid CO_2, and coated with gold by scattering in a vacuum evaporator. They were examined under scanning electron microscopy at 5 Kv.

RESULTS

Common tree shrew

The tongue of common tree shrew was about 25 mm. in length and a maximum of 6 mm. in width. It could be roughly divided into anterior portion (anterior two-third) and posterior portion (posterior one-third). The anterior portion covered the tip of the tongue to the anterior end of the two lateral circumvallate papillae (Figure. 1). The remaining region was posterior portion. Lingual papillae were classified into three types of which were filiform, fungiform and circulmvallate papillae. Filiform papillae were distributed entirely on

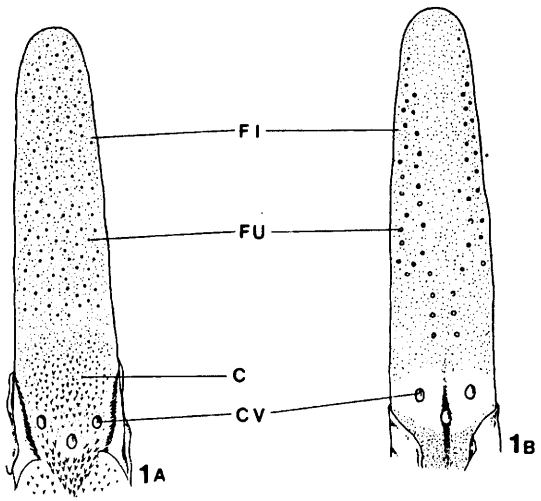


Figure 1 Schematic diagram of the dorsal view of the variable squirrel (1A) and common tree shrew (1B) tongue. Three circumvallate papillae are presented in aninverted triangle on the posterior portion of the tongue in both animal. While most of the fungiform papillae in the common tree shrew are found on the tip and lateral edge of the tongue.

FI : Filiform papilla FU : Fungiform papilla
C: conical papilla CV : circumvallate papilla

the anterior portion of the lingual surface and were divided into two types based on their morphology. The low columm filiform papillae (Figures. 2, 3 and 5) were equally distributed on all part of the tongue, while the tall columm filiform papillae (Figures. 2 and 4) were found only on the mid-median area near the junction between the anterior and posterior portion. Both of them were similar in morphology but the height of the process of the papillae were considerably different. Each of the filiform papilla consisted of a basal circular budge with 8-13 equal processes at the upper part (Figures. 2 and 4). Approaching the rear part of the lingual body, the terminal processes of the filiform papillae gradually became longer and more slender. The direction of the processess were slightly inclined

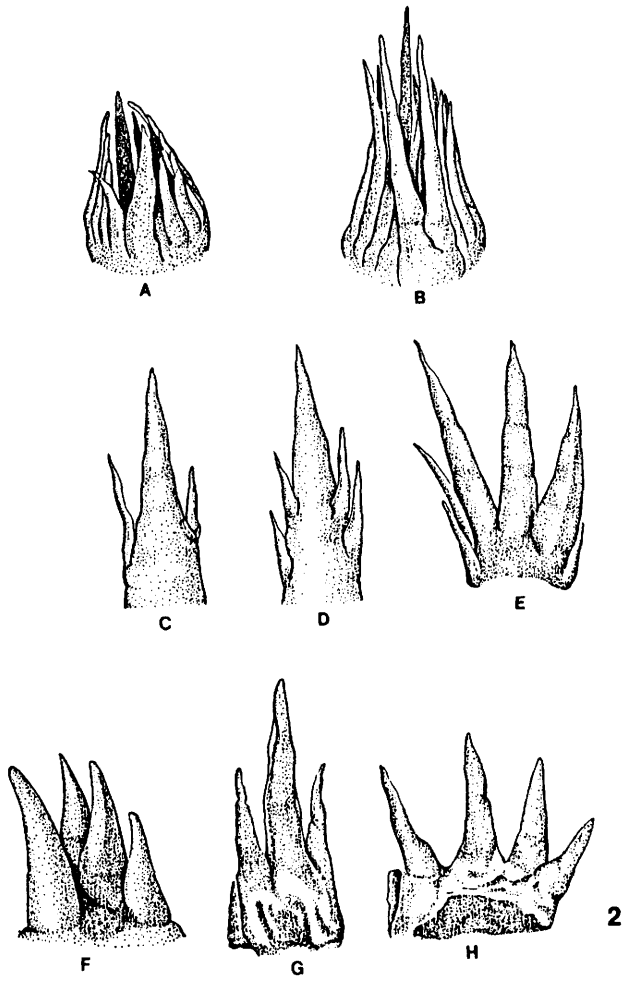


Figure 2 Schematic drawing of the filiform processes in common tree shrew (A-B) and variable squirrel (C-H). In the common tree shrew, the filiform papilla consists of 8-13 processes based on the basal circular budge. While in the variable squirrel, the filiform papilla consists of 4-6 processes based on the flat plate like budge. The size and shape of their processes vary, however, the middle rear one is the largest (C&D).

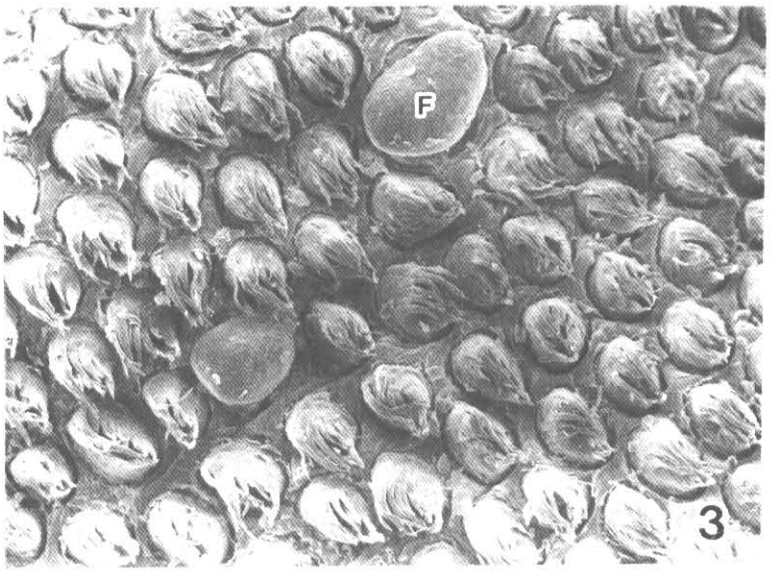


Figure 3 SEM of the dorsal view of the anterior portion of the common tree shrew tongue. The low column filiform papilla consists of a basal circular budge and the upper 8-13 processes. The fungiform papilla (F) scatters among the filiform papillae.X 50.

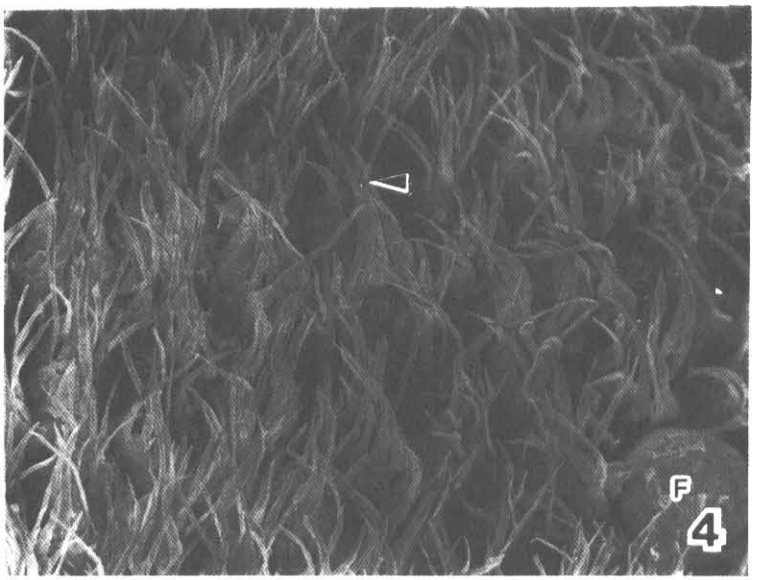


Figure 4 SEM of the dorsal view of the tall column filiform papillae in the common tree shrew tongue. The processes of the papillae become longer and more slender (arrowhead) than in the low column filiform papilla. X 65. F : fungiform papilla.

mediocaudally. Fungiform papillae (Figures. 1, 3 and 4) were scattered throughout the filiform papillae. Most of them were found on the tip and bilateral edges of the anterior portion of the tongue. The papilla contained taste bud on the dorsum. Three circumvallate papillae (Figure. 1), a paired lateral and a single median, were presented in an inverted triangle triangle on the posterior portion of the tongue. Taste buds were found on the lateral sides of the papilla. Each circumvallate papilla was elliptical in shape and surrounded by a smooth circular vallum. The lingual surface around the circumvallate papillae was smooth and free of any papillae (Figure. 1).

Variable squirrels

The variable squirrel tongues (Figure1) had the same size and also could be divided into the anterior and posterior portion as that in the common tree shrew, but it consisted of four types of papillae, the filiform, fungiform, conical and circumvallate papillae (Figure. 1). Filiform papillae were distributed entirely on the anterior portion of the tongue. Each filiform papilla consisted of 4-6 branches process with a basal flat platedlike budge (Figures. 2 and 6). The processes were variable in sizeand shape but the middle rear one was found to be the largest and pointed mediocaudally (Figure. 2). Like in the common tree

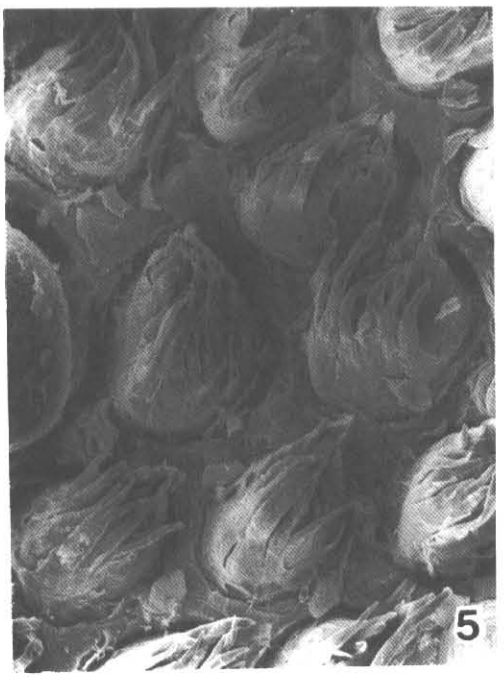


Figure 5 High magnification of the low column filiform papillae in the common tree shrew tongue showing the basal circular budge and 8-13 upper processes. X 130.

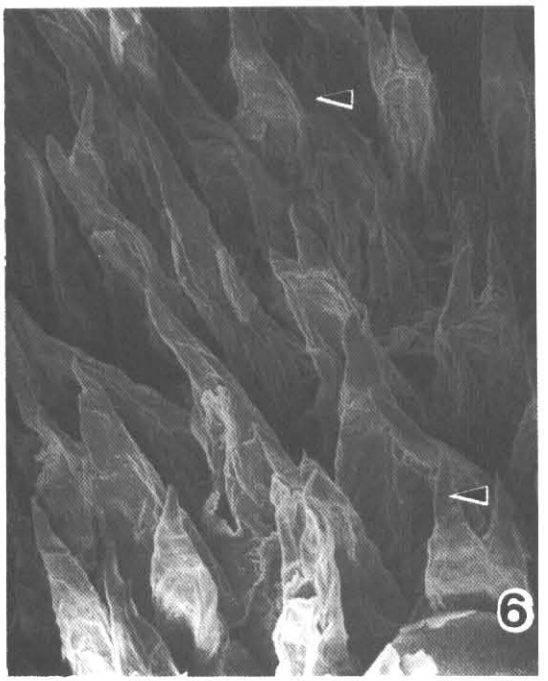


Figure 6 SEM of the dorsal view of the variable squirrel filiform papillae. The filiform papillae consists of 4-6 process (arrowhead) and is based on the basal flat plate-like budge. X 275.

shrew, the filiform papillae on the area near to the junction between the anterior and posterior portion had taller process than in the other area. Fungiform papillae (Figure. 1) were equally distributed on the anterior portion of the tongue and contained taste bud on the dorsum of the papillae. Conical papillae and circumvallate papillae (Figure1) were found at the posterior portion of the tongue. The circumvallate had the same size, position and structure as that of the common tree shrew. Conical papillae were distributed around the circumvallate papillae and their processes pointed caudally (Figure. 1).

DISCUSSIONS

The present study on common tree shrew and variable squirrels tongues showed that the distribution patterns of the filiform papillae and circumvallate papillae were similar. That was, the height of the processes were gradually increased from the apex to the posterior and reached the peak at the area near the end of the anterior portion of the tongue. There were three circumvallate papillae presented in an inverted triangle at the posterior portion of the tongue. However, the shape of the filiform papilla were totally different. In the common tree shrew, the filiform papilla had a circular basal part and 8-13 upper processes, which were similar to those of mush shrew (order Insectivora: Iwasaki *et al.* 1987) and squirrel monkey (order Primate: Iwasaki *et al.*1988). On the other hand, the variable squirrel had a flat sheet like basal part and 4-6 upper processes filiform papilla and consisted of conical papillae which were similar to those of the Manchurian Chipmusk (order Rodentia : Kobayashi et al. 1992) and rat (Iwasaki *et al.* 1987). The structure, number, shape and position of the circumvallate papillae of the common tree shrew and variable squirrel were the same as those of the Manchurian chipmush (order Rodentia : Kobayashi *et al.* 1992). However, the number was differen tfrom that of squirrel monkey (order Primate). There was a single circumvallate papilla in the squirrel monkey (Iwasaki *et al.* 1988), the rat (Yoshioka and Muto 1976), mouse (Yoshioka and Muto, 1975) and Mongolian gerbil (Iwasaki *et al.* 1984; Kobayashi *et al.* 1988).

Iwasaki *et al.* (1987) suggested that the morphology and the distribution of filiform papillae were different among the animal in the order. While the number of circumvallate papillae was also found to be different among species as suggested by Chunhabundit *et al.* (1992). In addition, the character of three circumvallate papillae presented in an inverted triangle was more primitive than the other in the same order (Kobayashi *et al.* 1992).

Considering the number of the circumvallate papillae and its filiform papillae morphological shape of the common tree shrew tongue. It is relevant to suggest that the common tree shrew should belong to the order insectivora or primate and was more primitive than the others in the same order. However to classify the exact taxonomical order of the common tree shrew must be considered using the other typical criteria or characters as well.

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