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Comparative studies of tongue of *Gopherus gopherus* (turtle), *Mus musculus* (mice), *Erinaceus auritus* (hedgehog) and *Psammomys obesus*

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Abstract

Tongue from four types of species was investigated in the present study. One reptilian species; *Gopherus gopherus* and three mammalian Sp. *Erinaceous auritus, Mus musculus, Psammomys obesus obesus.* The tongue of the selected speciemens were removed and fixed in 10% phosphate buffered formalin and processed for histological and scanning electron microscopic investigation. Habitat and diet interfered with the degree of keratinization which increased in *Gopherus gopherus and Psammomys obesus obesus* more than the other species. Abundant mucous glands were detected underlying the lingual mucosa of *Gopherus gopherus* more than others. *Erinaceous auritus* and *Mus musculus* possessed a variety of gustatory papillae including fungiform, valate and foliate papillae with regular pattern of taste buds which were disappeared in *Psammomys obesus obesus.* Gustatory papillae is almost missing in *Gopherus gopherus.* Different pattern of filliform papillae are distinguished and varied between the studied species. Finally, it is concluded that lingual structures varied between species depending on developmental aspects, habitat and diet.

Keywords: *Erinaceous auritus*, Filliform papillae, *Gopherus gopherus*, Gustatory papillae, *Mus musculus, Psammomys obesus obesus*,. Tongue,

1 Introduction

The tongue is a complex, muscular organ that shows variable morphological and histological structural pattern.
The tongue performs a wide diversity of functions, including prey capture, drinking, breathing, chemosensation and defensive behaviors. Within Iguanidae, the tongue is used primarily for prey capture and transport. In other groups, however, the tongue appears specialized for chemoreceptive purposes (Schwenk, 1995). For prey capture, reptilian tongue characterized by rapid ballistic movements as in chameleons or plethodontid salamanders, to capture prey (Deban and Dicke, 1999 and Deban and Dicke, 2004). Reptiles generally have taste buds in the lingual epithelium (Toyoshima & Shimamura, 1987; Delheusy *et al*., 1994), and taste buds are often also located in the epithelium of the gingiva (Schwenk, 1985).
The lingual structures varied markedly between mammals living in sea water such as the fur seal (Yamasaki *et al*., 1978), dolphin (Shimoda *et al*., 1996) and sea otter (Hosley & Oakley, 1987) and those of land species. Also, the distribution of taste buds all over the dorsal and lateral surfaces of the tongue (Chamorro *et al*., 1993), reflecting its importance in feeding habits and taste. The mammalian tongue plays a major role in ingestion, as in licking, lapping, and browsing; and it moves food distally through the oral cavity. In dogs, the tongue has a thermoregulatory function in panting. Chemo-receptors and mechanoreceptors in the tongue surface sense the nature and mechanical properties of ingested food, and prevent the digestion of noxious substances. There was a marked variation of the distribution and structural adaptation of gustatory papillae on the dorsal surface of the tongue in mammals (Iwasaki 2002). Three forms of lingual papillae were identified in mammalian armadillo, *Dasypus novemcinctus* (de Morais *et al.*, 1994) such as filiform, fungiform and vallate papillae. However in the Florida manatee (*Trichechus manatus latirostris*), numerous filiform and fungiform papillae were distributed over the dorsal surface of the rostral tongue. Foliate papillae,

presenting as multi-fossulate openings, were oriented on the caudo-lateral margins (Levin and Pfeiffer, 2002).

Although, many mammals have four different types of lingual papilla- filiform, fungiform, circumvallate, and foliate papillae- on the dorsal or lateral surface of the tongue. Three kinds of lingual papillae were identified in rat including filiform, fungiform, and circumvallate papillae. The fungiform and circumvallate papillae were large, and their outlines were somewhat irregular, meanwhile filiform papillae were long and slender (Iwasaki *et al.*, 1997). The filiform papillae serve for mechanical protection and varied markedly in both gross shape-structure and pattern of distribution allover the dorsum lingual mucosa in cat. It appeared either short with several basal conical processes or large with a single sharp spinous process projecting posteriorly (Boshell *et al*., 1982). In humans, keratinized filiform papillae were found to cover the entire anterior part of the dorsum of the tongue and become conical with 5-12 hairlet structures (Kullaa-Mikkonen *et al*., 1987). Concerning keratinization of lingual mucosa, the lingual dorsal epithelium showed varying degrees of keratinization, especially in the anterior, posterior and the interpapillar cell columns (Iwasaki & Miyata, 1990). In most mammals, keratohyalin granules were recognized only in the anterior region of the filiform papillae (Iwasaki, 1992*a*; Iwasaki *et al*. 1992*a*). Iwasaki et al. (1996a, 1997a) demonstrated fungiform and circumvallate papillae in rats and mice. Taste buds were taste organs of vertebrates and occurred on various parts inside the mouth, such as tongue surfaces, soft palates pharynxes in mammals. On the anterior part of mouse tongues, each taste bud was found to contain 50 cells, and only a few taste bud cells have synaptic contacts with taste nerves. Taste bud cells, which are classified into four cell types: type I to type IV cells, based on the ultrastructural and morphological features (Lindemann, 1996). Type I cells play a supportive or glia-like role and are not believed to have a receptive function. Type IV cells are progenitor cells that restock the taste bud during its normal course of cell turnover. Type II cells express taste receptor proteins for bitter, sweet, and umami tastes and their downstream signaling effectors, e.g., PLCβ2 and IP_3 receptor type III (IP_3 R3) (Asano-Miyosh *et al*., 2001). Type III cells lacked receptors and signaling effectors for bitter, sweet, and umami stimuliaims. Tongue from four types of species was investigated in the present study. One reptilian species; *Gopherus gopherus* and three mammalian Sp. *Erinaceous auritus*, *Mus musculus*, *Psammomys obesus obesus.*

Table 1.feeding habbits

	Investigated Animals	Types of feeding
	A. Class Reptilian	
1.	family: Testudinidee; e. g.: *Gopherus goherus*	Feed on desert vegetation
	C. Mammals	
2.	family: Erinaceidae; Erinaceus auritus (hedgehog)	Feeds on Insects
3.	family: Muridae e.g.: *Mus musculus* (mice)	Feeds on hard food as seeds, roots and grains
4.	e.g.: *Psammomys obesus obesus* (sand rat)	Vegetation and seeds

2 Materials and Methods

I) Experimental animals

Selected three different species of mammalian species were used in the present study. Feeding habits are illustrated in table (1).These species have the following Classification:

Reptilian species:

1. *Gopherus gopherus* (Tortoise): Order: Testudines ➤ Suborder: Cryptodira ➤ Family: testudinidae ➤ Genus: Gopherus Rafinesque, 1832.

Mammalian species:

2. *Mus musculus* : Order: Rodentia ➤ Suborder Myomorpha ➤ Family Muridae ➤ Subfamily Murinae ➤ Genus Mus.

3. *Erinaceus auritus* (hedgehog): Order Erinaceomorpha ➤ Family Erinaceidae ➤ Subfamily Erinaceinae ➤ Genus Erinaceus Linnaeus , 1758..

4. *Psammomys obesus* : Order: Rodentia ➤ Family: Muridae ➤ Subfamily: Muroidea ➤ Genus: Pasammomys.

Five individuals per each species were used during the present work. The animals were sacrificed by overdose of chloroform, dissected and tongue were removed and processed for investigations:

1. Gross morphology of the tongue:

The tongues of the selected species were immediately fixed in 10 % formal saline. The gross morphological structure of the lingual mucosa was investigated to outline both the morphological similarities and differences between them. The thickness of lingual mucosa was measured. Assessments of both length and width of filiform and gustatory papillae including fungiform, vallate and foliate papillae were determined and recorded. The degree of keratinization was determined in correlation with the lingual mucosa thickness.

2 Histological techniques:

Tongue specimens were dehydrated in ascending grades of ethyle alcohol cleared in xylol and mounted in molten paraplast 58-62 C. Five µm thick longitudinal histological sections were carried out and stained with Harris haematoxylin and eosin and examined under bright field light microscope.

3. Scanning Electron Microscopy:

Tongue specimens were fixed in 2.5% glutaraldhyde in cacodylate buffer for 24 hours, dehydrated in an ascending grades of ethyl alcohol (60, 70, 80, 90 and 100%) and critical point dried in a Critical Point Drier. The samples were coated with gold a Balzers 020 Sputter Coater. Specimens were viewed and microtographed using a Joel scanning electron microscope operated at 10 kV.

3 Results

1. *Gopherus gopherus* :

Macroscopically, Gopherus gopherus tongue appeared short triangular with a slightly round apex when viewed dorsally but it appeared flattened when viewed laterally. Median sulcus was clearly seen posteriorly and ill-distiguished in the other tongue surface. The overall surface became rough (Fig.1A).

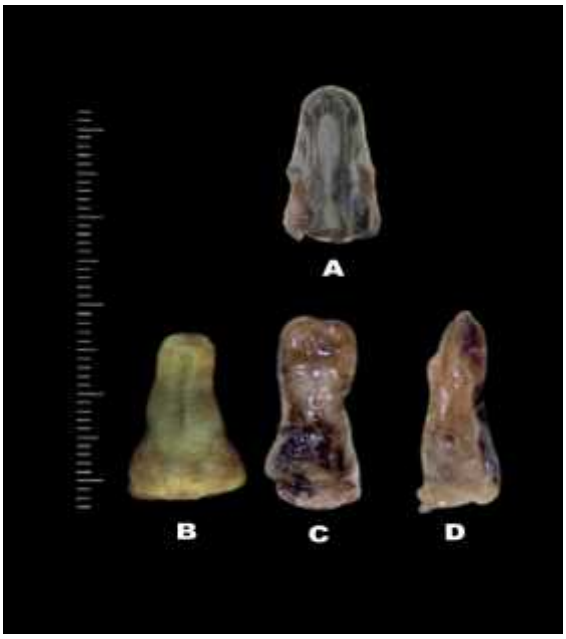

Fig. 1. Photomacrographs of dorsal view of tongue. A. Reptilian species *Gopherus gopherus*. B.Mammalian Sp. ***Erinaceous auritus.*** **C.** ***Mus musculus. D. Psammomys obesus*** *obesus.*

At SEM level, irregular, dome-shaped or ridge-like papillae were observed on the anterior part of the dorsal lingual surface. Large, cylindrical papillae lengthened 2.5-5.5µm and base diameter 1.5-5.2 µm were located along the midline of the posterior part of the tongue. Small conical papillae were located on both sides of the dorsal surface of the tail of the tongue. The lingual papillae appeared bifurcated laterally at their base. The shapes and width of the papillae varied markedly. Microridges were detected on the lingual surface and the thickenings of the cell margins were clearly evident. Numerous mucous pores were scattered allover the lingual surface (Fig.2 A-C). At light microscopic level***, the*** lingual mucosa was composed mainly of multilayered stratified squamous epithelium with thin keratinized surface. Tubular glands were appeared numerous and lying adjacent to the lingual mucosa. The connective tissue core infiltrated the lingual mucosa (Fig. 2 A1-C1).

Mammals:

1. *Mus musculus*:

Macroscopically, the dorsum tongue was elongated with a rounded flat apex and constricted middle region. A distinct

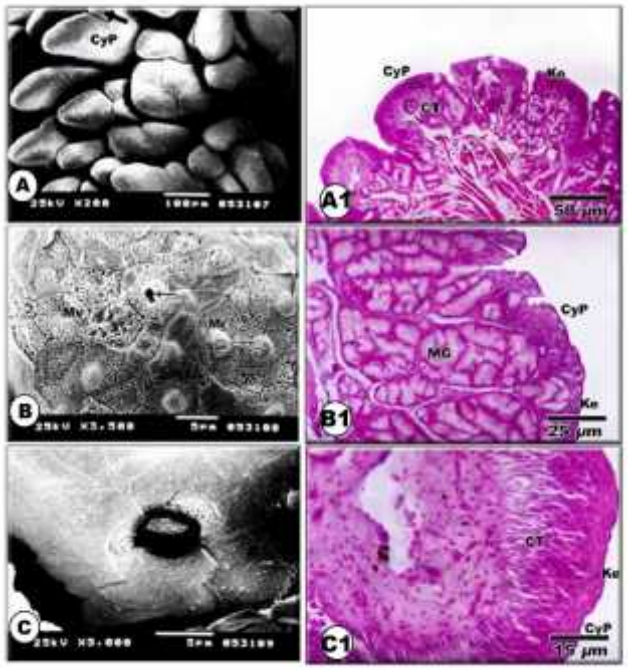

Fig. 2. A-C. Scanning electron micrographs of *Gopherus gopherus*. A. Showing large cylindrical papillae with small 2ndry papillae. B. Showing microridges on surfaces of lingual papillae.C. Showing mucous pore on lingual surface.

A1-C1. Photomicrographs of longitudinal transverse histological section of dorsum lingual mucosa of *Gopherus gopherus* showing less keratinized lingual mucosa covering with cylindrical papillae. Numerous mucous glands appear in the underlying connective tissue. H &E

(Abbreviations; CFP, conical filiform papillae; CT, connective tissue; CyP, cylindrical papillae; Ke, keratinization; MuG, mucous glands; Mr, microridges, Thin arrow indicates the mucous gland opening; thick arrow indicate 2ndry papillae).

narrow median groove dividing the tongue into two symmetric parts may be seen on the dorsal surface of the apex and the body of the tongue. The groove disappears at the distal third, near tongue root which become slightly wide base (Fig.1C). At SEM level, Three different types of papillae were observed: filiform, fungiform, and circumvallate. Filiform papillae were the most numerous, extending over the whole dorsal surface of the tongue up to the root. They were tongue or leaf-like in shape with pointed tips which were directed posteriorly. Filiform papillae consisted of larger main papillae and smaller secondary papillae. In general, each main papilla was accompanied by 2 or, in some instances, 3 secondary papillae on the anterolateral side of its base. Secondary papillae were rare or absent in the posterior third of the tongue. In this region, the groove surrounding each filiform papilla became more pronounced. Fungiform papillae were rounded and larger and distributed irregularly among the filiform papillae, being more numerous in the anterior than in the posterior part of the tongue. At the tip of the tongue, the papillae were larger and abundant. A pair of long-flat

circumvallate papillae were observed. Each papilla was surrounded by a prominent circular primary groove and a thin annular pad. At higher magnification, the epithelium of the filiform papillae showed a smooth surface, while that of the interpapillar regions possessed microridges. Taste pores were observed on the dorsal surface of fungiform papillae . Newly formed filiform papillae were observed in the distal end of tongue near root base (Fig3. A-F). At light microscopic level , each type of lingual papilla was covered by stratified squamous epithelium and had a core of connective tissue. Keratinization become more prominent in covering epithelium of filiform papillae comparing with slightly weak cornification at the interpapillar region. In the filiform papillae, cells on their anterior aspect consisted of clear cells with weakly stained cytoplasm in the dorsal part, their precursor cells in the ventral part showing keratohyalin granules. Taste buds were found in the epithelium of the dorsal parts in the fungiform papillae and the lateral parts of the papillae. The core of both lingual papillae was composed of highly vascularized connective tissue (Fig 3 A1-F1).

2. Psammomys obesus obesus:

Macroscopically, the dorsum tongue surface took the form of spatula-like structure, constricted nearer to its anterior part. The median groove ill-demarkated along the whole length. Its base become widened, and gradually constricted and had tapersed tip (Fig.1D). At SEM level , the entire covering of lingual surface possessed different forms of lingual papillae. The filiform papillae covered almost the entire surface and appeared either filamentous or conical-like structures. Large filiform papillae were distributed at the anterior margin of the lingual prominence. The base of the filiform papillae showed protruded conical-shaped structure with centrally located pore of subsequent mucous gland. Fungiform papillae, which were distributed at the anterior tongue. Fungiform papillae of the posterior of the lingual prominence were large and surrounded with a papillary groove. Fungiform papillae were completely devoid of taste buds, indicating a more mechanical function (4 A-F). At LM level, the lingual mucosa become heavily keratinized. Both filiform and fungiform papillae were resting on underlying connective tissue core with abundant of fibroblast cells (Fig.4 A1-C1).

3. 3. Erinaceous auritus:

Macroscopically, the dorsum tongue surface was flattened laterally and rounded ape. A distinct median sulcus extended from the front to the root of the tongue and dividing the tongue into two symmetric parts. The groove disappears at the distal third, near tongue root which become slightly wide base (Fig.1B). At SEM level, lingual papillae covered almost the tongue dorsal surface. Four different kinds of filiform papillae were detected. In the anterior part of the tongue and near the circumvallate papillae, single or bifurcated long conical filiform papillae were observed. The single conical papillae showed pocket structure near its base. The third type is short conical

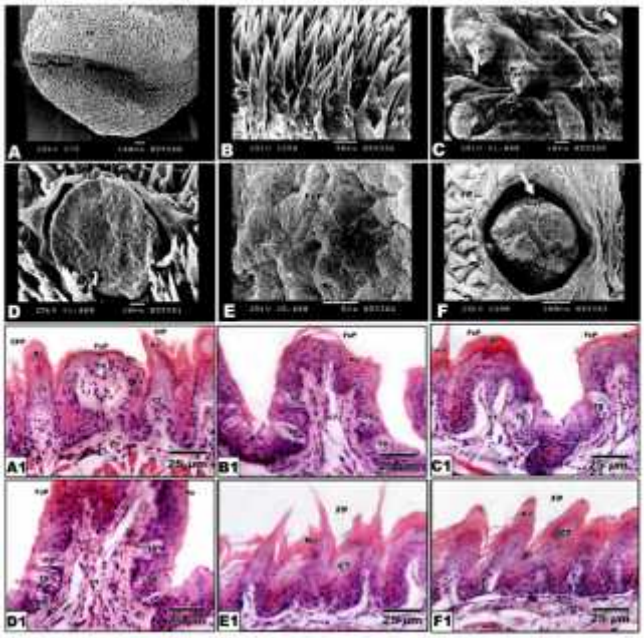

Fig.3. A-F. Scanning electron micrographs of *Mus musculus*. A. Showing tongue gross structure with median groove. B. Showing idented filiform papillae.D-E. Showing fungiform papillae carrying microridges on its surface. F. Showing circumvallate papillae.

A1-F1. photomicrographs of lingual papillae. A1. Showing fungiform papilla with apical taste bud. B1-D1. Showing foliate papillae with parietal distribution of taste buds. E1-F1. Showing filiform and conical-shaped papillae with keratinized surface. H&E.

Abbreviations; CFP. Conical filiform papillae; CT, connective tissue; CvP, circumvallate papillae; FP, filiform papillae; FoP, foliate papillae; FuP, fungiform papillae; Ke, keratinization; Mr, microridges; TB, taste bud.

papillae with broad base and tapered end. The fourth type was located in the anterior part of the tongue and appeared long filamentous structure. The circumvallate papillae were located on the dorsal surface of the middle third of the tongue. Their taste buds are located near the vallum (Fig.5 A-F). LM observation revealed that the lingual epithelial layer showed a characteristic mucosal structure, with many epithelial papillae containing blood vessels and bundles of collagen fibers. The basal epithelial surface of the tongue mucosa possessed irregular projections that are rounded or polygonal in shape, with a depression in the center. These depressions interdigitated with the underlying connective tissue. The lingual mucosa composed of several cell layers thick. The stratum germinativum appeared large with prominent nuclei. Stratum spinosum were formed of several cell layers. Stratum granulosum was formed of two or three cell layer. The outermost of stratum corneum was markedly thickened and formed of several layers of keratin. The circumvallate papillae were markedly larger and showed abundant distribution of taste buds. The connective tissue core filled almost the entire cavity and become enriched with blood vessels (Fig. 5 A1-C1).

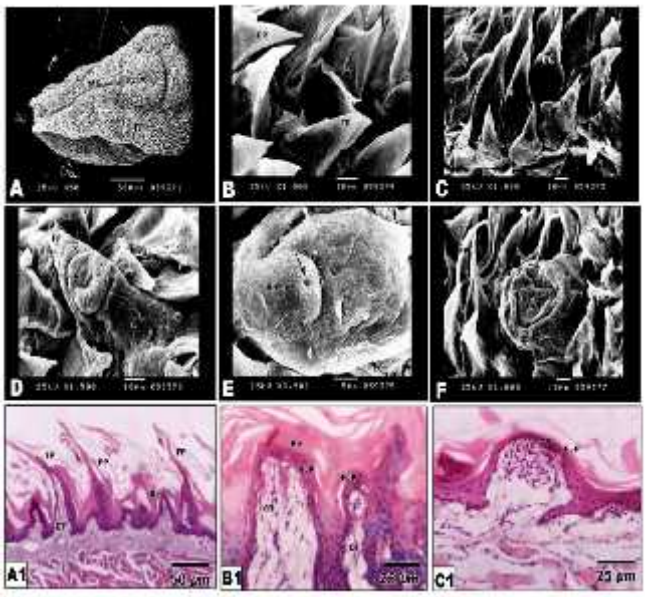

Fig.4. A-F. Scanning electron micrographs of dorsal view of *Psammomys obesus obesus* lingual mucosa. A. showing triangular tongue with median groove and indented apex. B &C. filiform papillae with broad base and pointed apex with 2nd papillae. D&E. Showing filiform papillae with lingual gland opening (D) and breast-like structure with central glandular opening (E). F. Showing rudimentary structures of fungiform papillae.

A1-C1. Photomicrographs of lingual papillae. A1. Showing filiform papillae with dense keratinized surface. B1. Showing rudimentary structure of fungiform papillae lacking taste buds and heavily keratinized surface. H&E.

Abbreviations; Ap, apex; BrS, breast-like structure; arrows indicate glandular opening; CT, connective tissue; FuP, fungiform papillae; Ke, keratinization; FP, filiform papillae; MG, median groove;

Morphometric observations:

The reptilian species Gopherus gopherus exhibited diversity of lingual mucosa thickness and degree of keratinization. Keratinization attained markedly thickening in G. gopherus. G. gopherus which showed the least degree of keratinization. Mammalian species *Psammomys obesus obesus* showed the highest keratinization of lingual mucosa E. auritus > M. musculus mucosa (Tables 2 & 3).

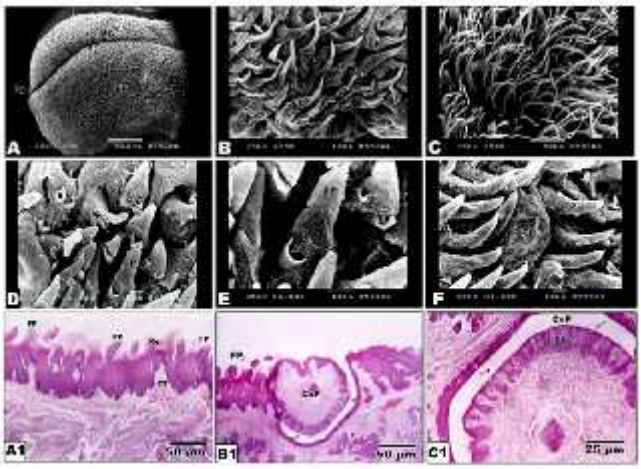

Fig.5. A-F. Scanning electron micrographs of f dorsal view of *Erinaceous auritus* lingual mucosa. A. showing proximal tongue with deep median groove. s B&C. Showing filiform papillae. D&E. Showing filiform papillae with basal outgrowth structure semilike socket. F. Showing fungiform papillae surrounded by filiform papillae.

A1-C1. Photomicrographs of longitudinal transverse histological sections of lingual mucosa. A1 Showing keratinized filiform papillae**.** B1 &C1. Showing circumvallate papillae with peripheral distribution of taste bud. H&E.

Abbreviations; Ap, apex; MG, median groove; FP, filiform papillae; arrow indicates a semilike socket structure; FuP, fungiform papillae; Ke, keratinization.

Table 2. Morphometry of lingual mucosa, papillae and mucous glands of *Gopherus gopherus*, *Mus musculus,* *Psammomys obesus* *obesus*, *Erinaceous auritus*

	Reptilian	Mammals		
	G. gopherus	M. musculus	P. obesus	E. auritus
Lingual Mucosa	26.25	40.5	66.3	49.8
St. corneum	7.0	15.0	23.1	10.6
% Keratinization	10.5	12.5	36.5	33
Filiform papillae	*Two: -Conical end -Flat fan shaped	*One: -Leaf-like with 2nd papillae	*Three: -Dome-like -Large filiform - Conical filiform	* Four : -Single conical -Bifurcated -Short -Long filamintous
Fungiform papillae	-	+	+	+
Circum vallate papillae	-	+	-	+
Foliate papillae	-	+	-	-
Taste bud	-	+	-	+
Mucous glands	+	-	-	-

Table 3. Length and diameter of lingual papillae.

	Species	Items	Length (µm)	Diameter (mm)
Reptilian	G. gopherus	1. Filiform papillae	2.5-6.5	1.5 – 5.2
		2. Mucous pore opening	1.5	2.0
Mammalia	M. musculus	1. Filiform papillae	2.5-6.0	0.5-1
		2. Fungiform papillae	7.5	6.5
		3. Buccal gland opening	1.5-5.0	1.5-4.0
		4. Circumvallate papillae	4.5	5.0
	P. obesus	1. Filiform papillae	1.3-6.0	1-2.5
		2. Fungiform papillae	5.0	4.0
		3. Buccal pore	1.0	0.5
	E. auritus	1. Filiform papillae	2-3	0.1-0.5

4 Discussion

In *Gopherus* gopherus, the filiform papillae appeared either large cylindrical in the midline of tongue and gradually reduced at the lateral surface. Cornification of the lingual surface and ridge formation reflected the herbivores feeding habits. The reptilian tongue characterized by the presence of abundant mucous gland opening being more abundant in Gopherus. gopherus and these facilitated the sticking of food materials as well as moving rapidly to the digestive tract. From the present work the general morphological features of the tongue show a considerable similarity to the structure of the tongue in the investigated rodent species, however, there is a distinguished species-specific feature in the morphology of the tongue and in the microscopic structure of the lingual papillae. The median sulcus on the apex of the tongue is a characteristic feature found in many rodents, although its length and width are species-specific (Grandi et al., 1994; Iwasaki et al, 1996a & 1997a). The present findings illustrated that the median sulcus is much more prominent in Erinaceous auritus comparing with Psammomys obesus obesus and Mus musculus. In Erinaceous auritus, the median sulcus is deep and more elongated, extended from the proximal part to the posterior 2/3 of the tongue length to the lingual prominence. On the other hand, the lingual body constricts in the middle region of *Mus musculus and Psammomys obesus obesus* comparing with much more wider in Erinaceous auritus. The lingual apex becomes indented in Psammomys obesus obesus and conical round-shape in the other species. Similar indented tongue apex was reported in adult bank vole species (Jackowiak and Godynicki , 2005). Scanning electron microscopic observations of the lingual papillae revealed that the most numerous lingual papillae are filiform papillae. As was shown on the SEM images, the three dimensional structure of the filiform papillae, and different types of filiform papillae were recognized depending on their location on the tongue regions. In *Mus musculus,* filiform papillae appeared numerous, covering the whole dorsal surface of the tongue up to the root. Two different forms filiform papillae were recognized either thread like or large conical-shaped structure. Large conical papillae were detected surrounding the vallate papillae. Each filiform papilla had two or three secondary papillae subtypes emerged from its broad base. These secondary subtypes of filiform papillae were rare or absent in the posterior third of the tongue. Newly formed filiform papillae were detected in the posterior tongue region. *Psammomys obesus obesus* lingual surface carried different forms of lingual papillae varied markedly from *Mus musculus.* The filiform papillae shape structures were comparatively similar to *Mus musculus* except the presence of basal several accessory processes. A characteristic appearance of some large conical filiform papillae was the presence breast-shaped structure with central glandular opening. These structure served for storing saliva which moist the ligual papillae and protect the lingual surface from hard salted environmental food materials enriched the surrounding habitat. In *Erinaceous auritus*, four different types of filiform papillae were recognized including either thread-like structure, single or bifurcated long conical filiform papillae and short conical papillae. The large conical filiform possessed basal socket outgrowth. Filiform papillae, which are considered to have a mechanical function (Nickel, 1979) have been reported to vary considerably in shape and structural organization from one species to another (Kullaa-Mikkonen et al. 1987). The arrangement of the filiform papillae provides the tongue with a rough surface suited for the movement and grinding of food (Svejda & Skach, 1975; Yamada et al. 1983). At LM, each type of lingual papilla was covered by stratified squamous epithelium and had core of connective tissue. Keratinization becomes more prominent in covering epithelium of filiform papillae comparing with slightly weak cornification at the interpapillar region. In the filiform papillae, cells on their anterior aspect consisted of clear cells with weakly stained cytoplasm in the dorsal part, their precursor cells in the ventral part showing keratohyalin granules. Keratinization attained a considerable thickening in *Psammomys obesus obesus* more than *Erinaceous auritus. Mus* musculus showed the least cornification of lingual papillae comparing with the observed mammalian species. The increased cornification of *Psammomys obesus obesus* reflected accommodation with the surrounding habitat preventing water loss. Also, *Erinaceous auritus* live in deep furrow which characterized by elevated surrounding temperature and these lead to the development of lingual cornification. The present findings supported the work of Jabbar (2014) whom observed widespread of filiform papillae throughout the tongue surface. Heavily keratinized conical papillae were detected. Keratinized lingual papillae were observed in cattle and cats (Nickel, 1979) and Florida manatee (*Trichechus manatus latirostris*) (Levin and Pfeiffer, 2002). Similar keratohyalin granules were detected in filiform papillae of cats (Boshell et al., 1982). Farbman (1970) was the first to observe two distinct types of epithelial cells in the filiform papillae of rat tongue, one producing hard and the other soft keratin. In the lesser mouse deer, the epithelial cells on the anterior aspect of these papillae consisted of cells possessing keratohyalin granules in their ventral part as precursors for clear cells with soft keratin in their dorsal part, whereas those on their posterior aspect consisted of the predominant cells that culminated in a keratin spine. These histological

appearances resemble those of cattle (Steflik et al. 1983) and pig (Boshell et al. 1980). The presence of taste buds in the fungiform papillae of the lesser mouse deer resembles cattle, horse (Chamorro et al. 1986), man, monkey (Arvidson, 1976) and rat (Mistretta & Baum, 1984), which further reconfirms the gustatory function of this type of papilla. The characteristics of the fungiform papillae in the investigated *Erinaceous auritus*, *Psammomys obesus obesus* and *Mus musculus*, being larger and scattered sporadically and irregularly among filiform papillae. Their numbers appeared more numerous in the anterior than in the posterior part of the tongue forming a spoon-like structure, the concave face of which pointed in an anterior direction, in abundance in the lingual body of *Erinaceous auritus , Mus musculus*. However in *Psammomys obesus obesus* considerable atrophy was detected. Light microscopic observation possessed the presence of apical taste buds in *Erinaceous auritus* and, *Mus musculus* and completely missing in *Psammomys obesus obesus*. Absent of taste function in *Psammomys obesus obesus esus* reflected depending of the animals of one sort of feeding diet. Similar findings of distributed fungiform papillae are detected among filiform papillae meanwhile only three circumvallate papillae in the distal region, however foliate papilla is rudimentary (Jabbar , 2014). However Nasr (2012) detected the presence of a pair of foliate papillae in the lateroposterior part of the root of the tongue.Yoshimura et al. (2008) investigated the tongue of Cape hyrax *Procavia capensis* and identified Filiform, fungiform and foliate papillae on the dorsal surface of the tongue; however, fungiform papillae were quite diminished on the lingual prominence. The present findings agree with several species of primates (Hofer et al. 1993). The tip of the tongue can therefore be considered as a special sense organ, transmitting several kinds of sensory information. The round-flat circumvallate papillae represent the main second type of gustatory papillae. It was varied markedly between the examined species, being abundant in *Mus musculus* and comparatively less in number in *Erinaceous auritus*. In ***Psammomys obesus*** *obesus* this kind of lingual papillae were not detected. Numerous taste buds were detected in the epithelium of the dorsal and lateral parts in the vallate papillae. Circumvallate, is commonly found in other mammalian species such as rat and mouse (Iino and Kobayashi, 1988; Kobayashi et al., 1989), guinea pig (Kobayashi, 1990), flying squirrel (Emura et al., 1999), armadillo, *Dasypus novemcinctus* (de Morais et al., 1994) and ruminants (Tichy, 1992; Scala *et al.* 1993). Foliate papillae were less numerous and located on the postero-lateral margin of the body of the tongue in *Mus musculus* and absent in the other two species. Each foliate papilla possessed numerous taste buds. The structure of these papillae was similar to those in the gerbilus, and rat (Grandi et al., 1994). The taste buds are relatively abundant in both foliate and circumvallate papillae, more than fungiform papillae (Levin and Pfeiffer, 2002).

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