



Morphological, Histological and Ultrastructural Study of the Tongue in House Gecko (*Hemidactylus flaviviridis*) Lizard

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Abstract: The aim of this study to investigate the tongue morphology and histology in house gecko *Hemidactylus flaviviridis* using light and scanning electron –microscopy (SEM) technique. The morphology result revealed the presence of three parts : apex , body and lingual root .The light microscopy result showed that the tongue is covered with mucous membrane composed of non keratinized stratified squamous epithelium based on lamina propria which contain bundles of striated muscles its fibers in different directions including connective tissue , blood vessels and nerves. The lingual mucosa of the dorsal surface is covered with different pattern of lingual papillae which are widely distributed all over the dorsal surface except the apex. Noticed on the dorsal surface different types of papillae were like fungiform, long and short folliolate, conical and cuboidal papillae. SEM examination showed that the tongue in *Hemidactylus vlaviviridis* appeared elongated with triangular shape and bifurcated free tip, also it is divided into three parts: apex, body and root; many types of papillae are distributed on the dorsal surface of the body and root of tongue. Fungiform papillae are widely distributed all over the dorsal surface of the tongue body .In the root of tongue, there are different types of papillae like filiform and foliate papillae , a lot of goblet cells have been showed in this region .

Key words: *Hemidactylus flaviviridis* , Tongue, Pappillae Scanning electron microscopic.

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Introduction

The feeding mechanism is a crucial factor for vertebrate presentence and continuity (1), and the tongue is a principle organ in this mechanism. Although the stratification and keratinization of the lingual epithelium are common features, the tongue structure and function reflects vertebrates' lifestyles and environment

(2). In snake and other squamates, the forked tongue is used for chemo and mechano-reception (4) and breathing (5). In Tuarta, it is used for the prehension of small prey items during feeding (6). In amphibian, it helps in catching and moistening the food (7, 8). Many studies examined the structure and function of tongue in avian species such as emu (9), Zebra finch (10), Nuctcraker (11), Golden Eagle (12),

Male Ostrich (13) Hoopoe (14), Red Jungle fowl (15), White-eared bulbul (16) and White-breasted kingfisher (17). The present study aimed to clarify the histological and morphological features of the tongue in Iraqi Gecko house *Hemidactylus flaviviridis*.

Materials and Methods

Thirteen adult geckos *Hemidactylus flaviviridis* were collected from different regions of Baghdad, then all collected geckos were killed using formalin and their lower jaws were separated, the tongues were removed and immediately fixed in formalin solution 10% for 24 hours, and then examined by dissecting microscope. All sections were followed by dehydration in ascending series of ethanol alcohol, cleared in xylene and infiltrated with hot paraffin and embedded in paraffin wax. The sections were cut cross and longitudinal with Seven mm thickness; then all sections stained with hematoxylin and eosin (H&E) (18), mounted and examined by light microscope, then pictures are taken for each section to clear results of the present study using digital camera (sony 14.1 mega pixels).

For Scanning electron microscopy (SEM) examination, extra fresh tongue specimens were removed and immediately fixed in formaldehyde 10% for 24 hours and followed by washing in phosphate buffer and dehydrated in ascending grades of ethyl alcohol and critically drying in carbon dioxide apparatus. The specimens were coated with gold in sputter coater and their dorsal lingual mucosa were viewed using (SEM).

Results

Cross Morphology

Tongue of *Hemidactylus flaviviridis* is an elongated muscular membranous organ with a triangular shape, lies in the floor of the buccal cavity with rounded and very slightly bifurcated end (Figure-1-). Three different regions are distinguished in the dorsal surface of the tongue, apex, body and root; the apex of the tongue is black in color and bifid. The ventral surface of the tongue is free from lingual papilla and also appear two midline sulcus that interdigitates with a process rising from the floor of the oral chamber (Figure-2-A,B).

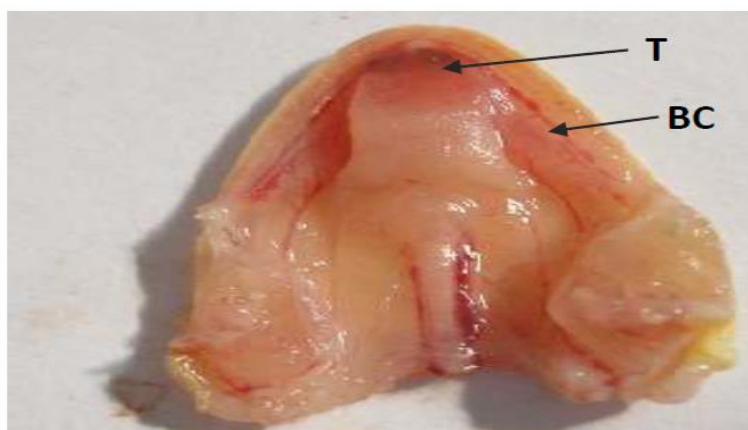


Figure (1): Photograph of the tongue *Hemidactylus flaviviridis* position of tongue (T) in buccal cavity (BC)

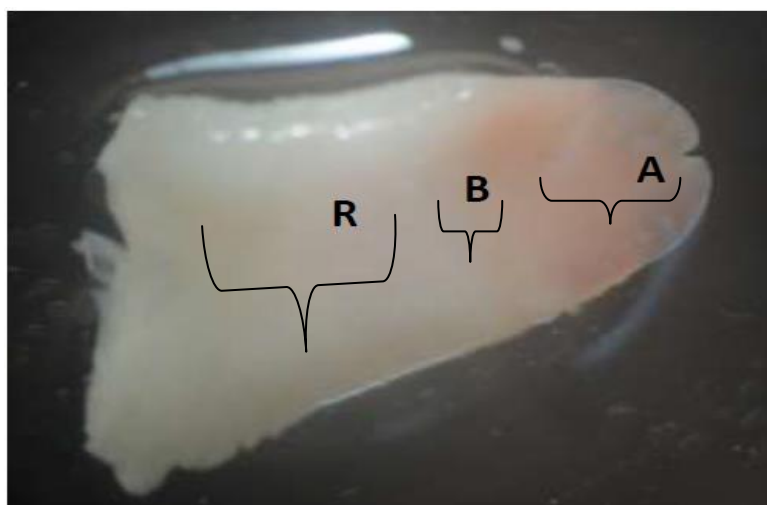


Figure (2A): Photograph of the *Hemidactylus flaviviridis* tongue showing dorsal surface and lingual bifurcated apex (A), Body (B), Root (R).4X

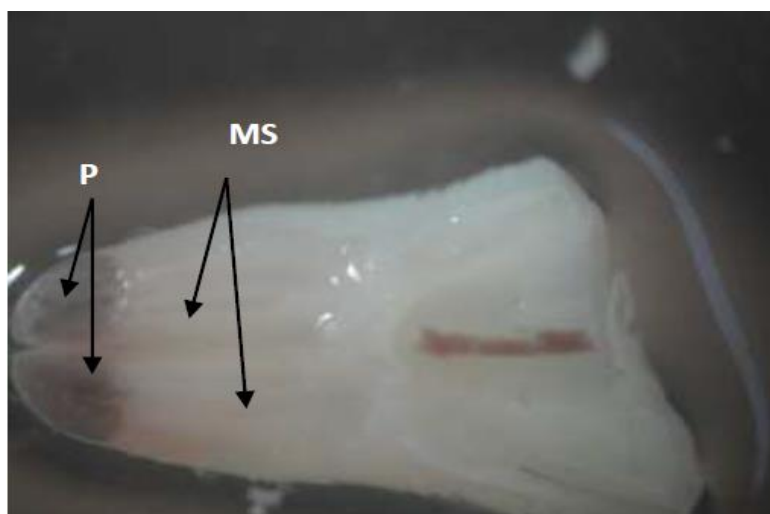


Figure (2B): Photograph of the *Hemidactylus flaviviridis* tongue ,the ventral surface of the tongue demonstrate the two median sulcus (MS) and pigments (P) in the apex of the tongue.4X

Histological Structure

The lingual mucosa of the dorsal surface except the apex is covered with different pattern of lingual papillae which are widely distributed all over the dorsal surface except the apex. (Figure-3-) . All papillae types in the dorsal surface is covered by stratified squamous epithelium non keratinized in

addition to the ventral surface which covered with keratinized stratified squamous epithelium (Figure-4-). Some taste buds observed in papillae located between superficial keratinized epithelial cells (Figure -5-). Noticed on the dorsal surface different types of papillae were like fungiform, long and short folliolate , conical and cuboidal papillae (Figure-6-).

The lamina propria in the tongue, consist of dense connective tissue which is rich in blood vessels and penetrates deeply into the central of each papillae; Glandular goblet cells are detected (Figure-7).

The extreme of the tip is underlined by two extensions of the hyoglossus muscle one on each other side and close to the midline (Figure-8-).

Pigment cells are scattered between lamina propria compenent and form continuous row down the basement membrane of the epithelial tissue that cover the ventral surface in the tongue apex (Figure- 8-).

In the middle of tongue appeared muscle in different direction that represent the supporting tissue of the tongue (Figures-3-9-).

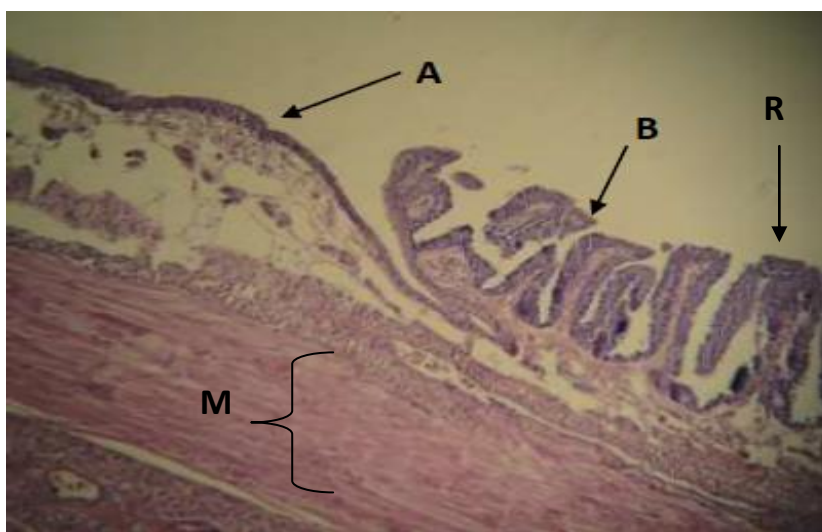


Figure (3): Light micrography transverse section of *Hemidactylus flaviviridis* tongue ,the dorsal surface, the apex (A)without papillae, while the body(B) and root(R)) have different type of papillae,(M); Muscles (H&E) X10.



Figure (4A,B): Light micrography of *Hemidactylus flaviviridis* tongue a transverse section of stratified pavement non- keratinized epithelium of the papillae(PA) while the ventral surface(VS) is keratinized (H&E)X40.

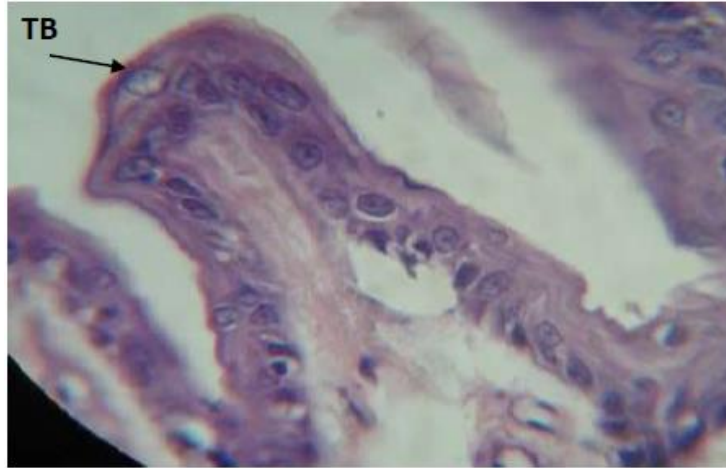


Figure (5): Light micrograph of *Hemidactylus flaviviridis* tongue transverse section, the taste bud (TB) in papilla(H&E)X100.

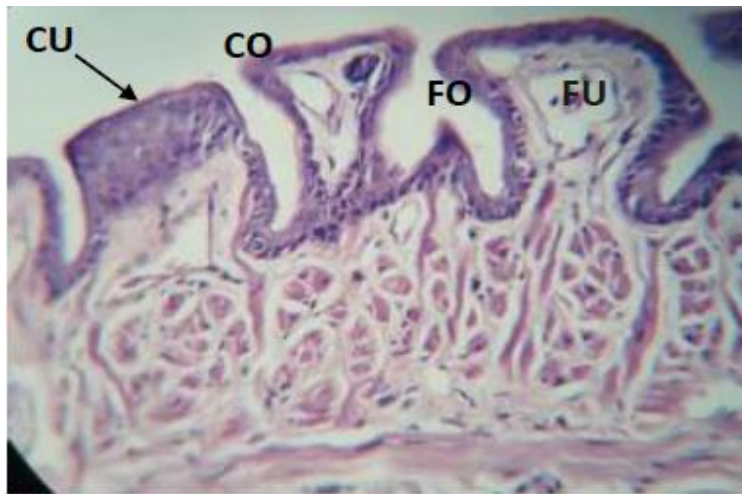


Figure (6): Light micrograph of *Hemidactylus flaviviridis* tongue transverse section, the body of tongue different type of papillae like, fungiform (FU), long and short foliate (FO), conical (CO) and cuboidal (CU) (H&E)X40.

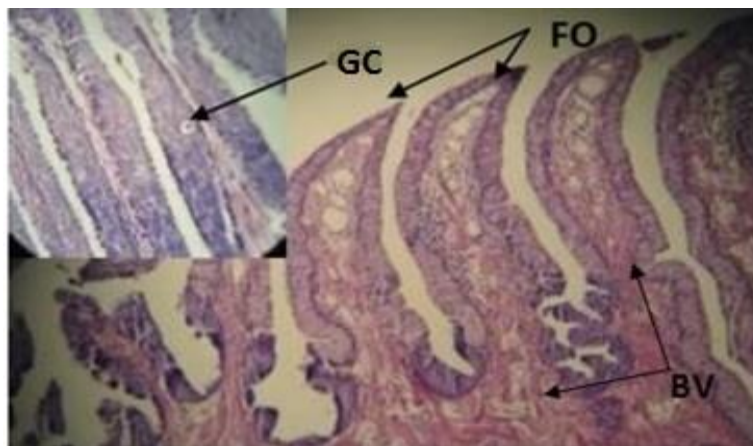


Figure (7): Light micrograph of *Hemidactylus flaviviridis* tongue transverse section, the root of tongue foliate like papillae (FO) with many Goblet cells(GC) on the lateral parts (H&E)X40.

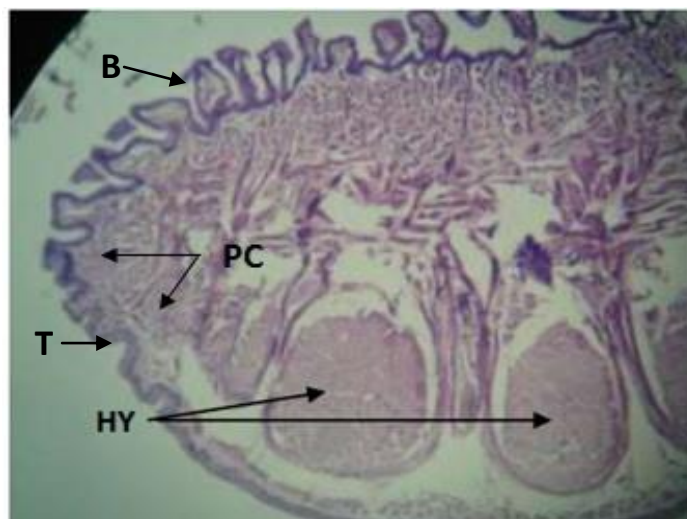


Figure (8): Longitudinal section of *Hemidactylus flaviviridis* tongue, (PC) pigment cells , hyoglossus muscle (HY), (T) tip of tongue, (B), body (H&E)X10.



Figure (9): Longitudinal section of *Hemidactylus flaviviridis* tongue showing muscles (M) in different directions appears in middle of tongue (H &E)X10.

Scanning Electron Microscope (SEM)

SEM examination showed that the tongue in *Hemidactylus vlaviridis* appeared elongated with triangular shape and bifurcated free tip, also it is divided into three parts: apex, body and root (fig-10-); many types of papillae are distributed on the dorsal surface of the body and root of tongue. Fungiform papillae are widely distributed all over

the dorsal surface of the tongue body (Fig-11-). In the root of tongue, there are different types of papillae like filiform and foliate papillae (Fig-12-), a lot of goblet cells have been showed in this region (Figure-13 -).

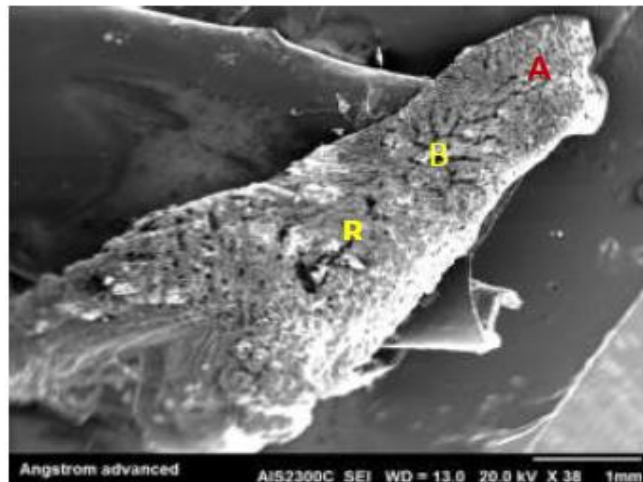


Figure (10): Electron micrograph of *Hemidactylus flaviviridis* tongue ,the apex (A), body (B), root (R).

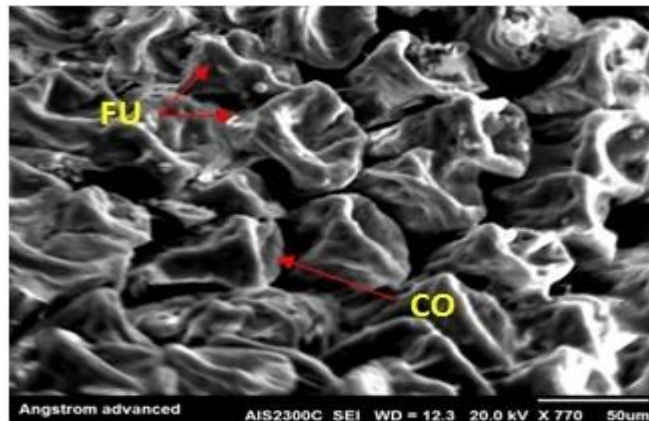


Figure (11): Electron micrograph of *Hemidactylus flaviviridis* tongue (CO) conical ,(FU)fungiform papillae in the dorsal surface of body tongue

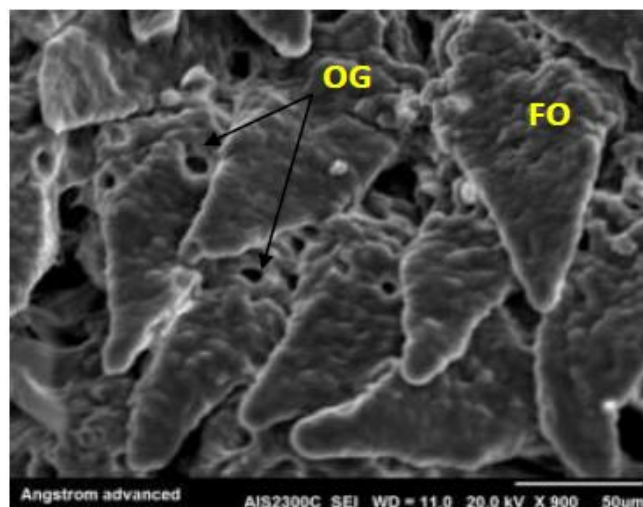


Figure (12): Electron micrograph of *Hemidactylus flaviviridis* tongue , the foliate papillae (FO) and opening of goblet cells (OG) in the root of tongue

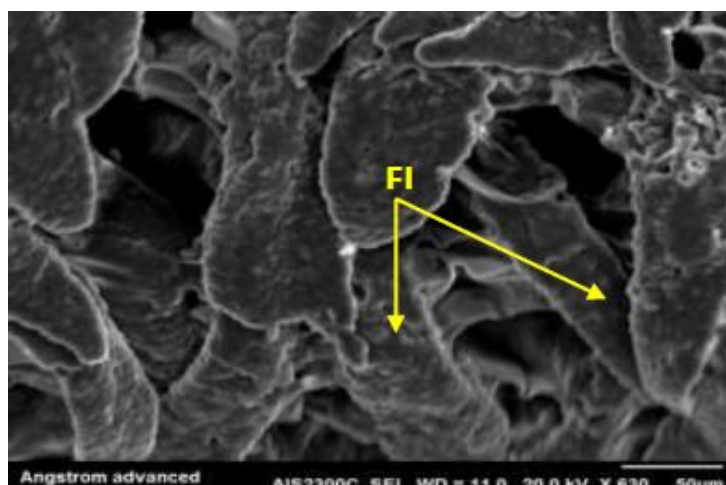


Figure (13): Electron micrograph *Hemidactylus flaviviridis* tongue , the filiform papillae (FI) in the root of tongue

Discussion

The morphology of vertebrate tongue is strictly related to its functions in food taking, transporting and manipulating (1). In addition, tongue is very important as a key in the evolution of a terrestrial life style (19), therefore, there is considerable differences invertebrates tongue structure (16, 20). The present results by light and scanning electron microscope showed there are three parts distinguished in the tongue, apex, body and root, this design appeared also in the most vertebrates species (21,22) . The apex appeared bifurcated and forked tongue might be provide more surface available for sensory function in lizards, forked tongue apex is also seen in different types of reptilian such as *Takydromus takydromus* (23); and in most vertebrates (14, 20, 24, 25, 26). The anterior bifurcation of the tongue of geko is also present in all squamates except legless lizards Dibamidae (27), *Hemiechinus auritus* (28); Black rat snake (29), Scincine lizard (5), lacertida lizards (19), *Ptyodactylus guttatus*, *Stenodactylus petrii* (1), *Arvicanthis niloticus* (30).

In snakes and Varanids adept bifurcation was reported also (4,31). The apex could has a role not only in food prehension and prey transport inside the oral cavity, but also in the chemosensorial perception (32). The body of tongue could be essential in the prey keeping inside the oral cavity, while the root could has an important role in the helping the deglutition for the presence of numerous calciformes cells (26,33,34). Current study also showed that the dorsal surface of the body and root of the tongue in *Hemidactylus vlaviviridis* are covered by various types of papillae, and these papillae are different in shape, size, number and distribution among different groups of vertebrates (1,14, 28, 35). Types of papillae on the dorsal surface of the body and root of the tongue like fungiform, filiform, long and short foliolate, conical and cuboidal, and that also appeared in some reptiles and other vertebrates (1,2,5,19,36). Moreover, this study described the demo shaped papillae which are correspond to the cuboidal in *Geko japonicas*, Present results almost similar with (1,37) that found the apex

without papillae in *Hemidactylus Flaviviridis*.

Present result demonstrated that the *Hemidactylus vlaviviridis* showed differences among different regions of the tongue in the structure of the lingual epithelium which is become keratinized at the lingual apex and without papillae, and this result agree with (1,2), while disagree with (23, 28, 37).

The dorsal and ventral surface of the tongue in gecko surrounded by stratified squamous epithelial tissue that almost non-keratinized in *Trachylepis vittata* (28), the non-keratinized stratified squamous epithelium appeared also in some vertebrates (9,38).

Lamina propria in the three parts of tongue in *Hemidactylus vlaviridus* consists of dense connective tissue which is rich in blood vessels (1,28,37). The pigment cells are appeared in apex of *Hemidactylus vlaviviridis* tongue, and these pigments cells reported in Lacertida lizards (19), and in *Trachylepis vittata* (28), *Chalcides ocellatus* (39). This could be the reason of the dark color in the apex tongue in gecko. Stratified muscle fibers appeared in different arrangement and density, these muscles observed in all vertebrates studied and the muscular organization is helped the tongue on its movement, while the hyoglossus muscle appear clearly in the body and root of the tongue, this reported in other reptiles (1,19, 28, 36, 37).

The SEM examination revealed that the dorsal region of the tongue in gecko covered with various types of papillae that showed clearly differences between the body and root of tongue and this is agree with (6, 24, 26). The present results revealed the presence of numerous goblet cells especially in the posterior lingual region, *Chalcides ocellatus* (39), and in *Acanthodactylus boskianus* (40).

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