Morphology of the lingual papillae of the Chapman’s zebra
(*Equus quagga chapmani*)

By

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Summary: We examined the dorsal lingual surfaces of an adult Chapman’s zebra by scanning electron microscopy. The filiform papillae of the lingual apex consisted of a main papilla and smaller secondary papillae. The fungiform papillae were round in shape. The filiform papillae of central region of the lingual body were needle-like in shape. The filiform papillae of posterior region of the lingual body were hair-like in shape. Many grooves were observed on posterolateral regions and the fungiform papillae were observed on the inside of some grooves. The vallate papillae were located on both sides of the posterior region and surrounded by a groove. The anatomical characteristic of the lingual surface of the Chapman’s zebra is the fungiform papillae on the inside of some grooves.

Many studies have been published on the structures of the lingual surfaces in various animals. In the order Artiodactyla, there have been many scanning electron microscopic (SEM) studies of the tongues of cows (Steflik et al., 1983; Camorro, 1986), serows (Funato et al., 1985; Atoji et al., 1998), one humped camels (Qayyum et al., 1988), buffalos (Scala et al., 1993), lesser mouse deer (Agung-priyono et al., 1995), blackbuck (Emura et al., 1999), Barbary sheep (Emura et al., 2000a), Bactrian camels (Eerduunchaolu et al., 2001), hippopotamuses (Yoshimura et al., 2009), sitatunga and roan antelope (Emura, 2011a, b), Egyptian buffalo (Emura and El-Bakary, 2014) and eland (Emura et al., 2016). Such studies reveal variations in morphology and distribution of papillae on the dorsal lingual surface among animal species.

In the order Perissodactyla, there have been SEM studies of the tongues of horses (Pfeiffer et al., 2000; Kobayashi et al., 2005) and donkey (Abd-Elnaeim et al., 2002).

However, no SEM study on the tongues of the Chapman’s zebra has been carried out. This study three-dimensionally examined the dorsal lingual surface of the Chapman’s zebra, in order to compare results with those from previous reports on other mammals.

Materials and Methods

The tongue of an adult Chapman’s zebra (*Equus quagga chapmani*) of the family Equidae was used in this study. The tongue was fixed in 10% formalin. Small blocks containing papillae were cut with a razor blade, post-fixed with 1% osmium tetroxide for 1 h. Thereafter, the specimens were dehydrated through a graded series of acetone and critical-point-dried. All specimens were sputtered with Pt-Pd before being examined under SEM (Hitachi S-3000N, Tokyo, Japan) at an accelerating voltage of 10 kV.

Results

Macroscopically, the tongue of the Chapman’s zebra was about 32 cm long (Fig. 1). At the posterior end of the lingual body, four vallate papillae was observed (Fig. 1).

The filiform papillae of the lingual apex consisted of a main papilla and smaller secondary papillae (Fig. 1a). The fungiform papillae were round in shape (Fig. 2a). The filiform papillae of central region of the lingual body were needle-like in shape (Fig. 2b). The filiform papillae of posterior region of the lingual body were hair-like in shape (Fig. 3). Many grooves were observed on postero-
Fig. 1. Macrograph of the Chapman’s zebra tongue. A = lingual apex. B = central lingual body. C = posterior lingual body. D = posterolateral region. Arrow = vallate papilla.

Fig. 2. Scanning electron micrographs of the lingual apex and central lingual body. (a) The filiform papilla on the apical surface consists of a main papilla and secondary papillae. The fungiform papillae (Fu) are round in shape. (b) The filiform papillae of central lingual body are needle-like in shape.

Fig. 3. Scanning electron micrograph of the posterior lingual body. The filiform papillae of posterior lingual body are hair-like in shape.
lateral region and the fungiform papilla was observed on the inside of a groove (Fig. 4a, b). The vallate papilla was located on both sides of the posterior region and surrounded by a groove (Fig. 5).

Discussion

Agungpriyono et al. (1995) reported that filiform papillae consist of a larger main papilla and smaller secondary papillae, and in the filiform papillae that the distribution of the secondary papillae in the lesser mouse deer, being present from the anterior part of the tongue to the end of the middle third and rare or absent in the posterior part, is relatively restricted. Atoji et al. (1998) observed filiform papillae and conical papillae, and reported that the filiform papillae have secondary papillae in the Formosan serow. Emura et al. (1999, 2000a, 2011a, b) also observed similar filiform papillae in the blackbuck, Barbary sheep, sitatunga and roan antelope. The filiform papillae of the Chapman’s zebra in this study were morphologically different from those of the blackbuck, Barbary sheep, sitatunga and roan antelope (Emura et al., 1999, 2000a, 2011a, b). The fungiform papillae were more densely distributed on the tip and ventral surface of the lingual apex in Japanese serow, Formosan serow, blackbuck, Barbary sheep, sitatunga and roan antelope and the papillae were smaller than that of the body (Funato et al., 1985; Atoji et al., 1998; Emura et al., 1999, 2000a, 2011a, b). The lenticular papillae of the various sizes were limited on the lingual prominence of the sitatunga and eland (Emura et al., 2011a, Emura 2016). However, the lenticular papillae were not observed in the Chapman’s zebra. The vallate papillae surrounded by a groove was round or
oval in shape (Funato et al., 1985; Atoji et al., 1998). It was reported that a pair of long-flat vallate papillae were observed in the lesser mouse deer tongue (Agungpriyono et al., 1995).

In the order Perissodactyla, the filiform papillae on the lateral sides of the lingual apex and body of the black rhinoceros had a hair-like shape, and consisted of main papillae and some smaller secondary papillae (Emura et al., 2000b). On the lingual apex of the donkey, the filiform papillae were abundant with more or less slim cylindrical form with pointed endings (Abd-Elnaeim et al., 2002). On the caudal part of the body, the filiform papillae were thinner than those on the apex, very long, cylindrical and abundant (Abd-Elnaeim et al., 2002). In this study, the filiform papillae of posterior region of the lingual body were hair-like in shape. In the Chapman’s zebra, many grooves were observed on posterolateral regions and the fungiform papillae were observed on the inside of some grooves. This finding is not reported in the animals. In the Equine vallate papillae were composed of a primary papilla which was divided into several secondary papillae by intermediate grooves (Chamorro et al., 1998). In this study, the vallate papillae were oval-shaped.

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