Histological Study of the Salivary Glands in *Zaedyus pichiy* (Mammalia, Xenarthra, Dasypodidae)

Estudio Histológico de las Glándulas Salivales de *Zaedyus pichiy*
(Mammalia, Xenarthra, Dasypodidae)

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ESTECONDO, S.; CODÓN, S. M. & CASANAVE, E. B. Histological study of the salivary glands in *Zaedyus pichiy* (Mammalia, Xenarthra, Dasypodidae). *Int. J. Morphol.*, 23(1):19-24, 2005.

SUMMARY: The histology of the salivary glands of the armadillo *Zaedyus pichiy* (Desmarest, 1804) was studied. Three pairs of major compound tubuloacinar salivary glands, parotid, submandibular and sublingual, were distinguished. The parotid gland is histologically a serous gland. The submandibular gland consists of two lobes. The anterior lobe is composed of mixed and serous acini. The posterior lobe is predominantly mucous. There is a reservoir or salivary bladder, related with the anterior lobe. The sublingual gland is mixed, composed of mucous acini with scattered serous demilunes.

KEY WORDS: Mammals; Xenarthra; Armadillos; Dasypodidae; *Zaedyus pichiy*; Histology; Salivary glands.

INTRODUCTION

Regarding their morphology, histochemistry and ultrastructure, the salivary glands of mammals have been the subject of numerous studies (Gargiulo *et al.*, 1991; Stolte & Ito, 1996; Watanabe *et al.*, 1996; Tandler *et al.*, 1997, 1998; Junior & Masuko, 1998; Cangussu *et al.*, 2002; Lentle *et al.*, 2002). However, information about the salivary glands of Xenarthra, a group in which they are of big dimensions (Grassé, 1955), is scarce and fragmentary (Pouchet, 1868; Burne, 1901; Ruby, 1978; Cuba Caparo, 1979; Fava de Moraes, 1965; Meyer *et al.*, 1993; Codón *et al.*, 2003); particularly, nothing is known about *Zaedyus pichiy* (pichi).

This armadillo is a native, typically solitary mammal, that inhabits in grasslands, open pampas and arid regions of southern South America, in central and southern Argentina and Chile, to the Strait of Magellan; it lives in burrows digged in open areas, on the base of small bushes; the diet consists of insects, worms, small vertebrates, some vegetable materials and carrion; local people use it as pet and food source (Parera, 2002). The pichi is still abundant and widely distributed in its natural environment, having no special conservation status yet (Díaz & Ojeda, 2000).

In this paper, the histological structure of the salivary glands of *Zaedyus pichiy* was studied and compared with that of other species of armadillos and of other mammals.

MATERIAL AND METHOD

Salivary glands of eight mature female and male *Zaedyus pichiy* captured in Bahía Blanca (Province of Buenos Aires, Argentina) region were used. They were fixed in Bouin's fluid, dehydrated in graded ethanol and embedded in paraffin. Sections 5-7 µm thick were stained with haematoxylin and eosin, Masson's trichrome, periodic acid Schiff reaction (PAS) and Alcian Blue pH 2.5 (AB). They were examined and photographed with a Nikon AFM microscope.

RESULTS

Three pairs of major salivary glands, parotid, submandibular and sublingual, were distinguished. They are tubuloacinar, exocrine glands. All of them are compartmentalized into several lobules by connective tissue, containing blood vessels, nerves and large excretory ducts.

The parotid gland (Fig. 1) consists of serous acini and intercalated and striated ducts. The serous acini lay close of each other, separated only by thin capillaries and very scarce connective tissue. They are composed of pyramidal cells, having basal basophilic and apical eosinophilic cytoplasm, with rounded and basal nuclei. The heterochromatin is principally confined

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to the area of the nuclear envelope. Cells showing a strong positive stain to PAS and negative stain to AB were observed. Myoepithelial cells surround the acinar cells. The acini drain into the intercalated ducts, composed of a single layer of cuboid epithelium. The intercalated ducts empty into the striated ducts, which have a single layer of cylindrical epithelium, the cells with eosinophilic cytoplasm, having a large nucleus located in the central-basal part. The typical striation was clearly seen. These ducts are surrounded by connective tissue in which blood vessels were observed. The striated ducts end in the interlobular ducts. These ducts are mainly located in the extralobular connective tissue, composed of pseudostratified columnar epithelium.

The sublingual glands are mixed (Fig.2), composed of mucous acini with scattered serous demilunes. The mucous cells possess spongy cytoplasm and flattened and basal nuclei. They occupy a larger volume of the organ than do the serous ones. The voluminous acini have big and irregular acinar lumen. Histochemically the cells were positive for PAS and AB. The ducts are very scarce.

The submandibular glands are of greater size and have two lobes, which differs in their histology and histochemistry (Fig. 3). The anterior lobe is composed of mixed and serous acini (Fig. 4). The mucous acini have clear cellular limits; the nuclei are confined to the basal cytoplasm and are capped by large serous demilunes. The acinar lumen is small and irregular. Mucous acinar cells showing a strong positive stain to AB and weakly stain to PAS were observed. The serous acini possess triangular shape cells with central nuclei. The serous cells of demilunes and acini were positive for PAS.

Fig.1. Parotid gland. General view showing several lobules with small serous acini. Masson. 100X.

Fig. 2. Sublingual gland with mucous acini and scattered serous demilunes (arrow). Masson. 100X.

Fig. 3. Submandibular gland. General view of the anterior (a) and posterior (p) lobes. Masson. 100X.

Fig. 4. Submandibular gland. Anterior lobe composed of mixed (m) and serous acini (s). Masson. 400X.

Fig. 5. Submandibular gland. Posterior lobe formed by mucous acini (asterisk) with scarce and small serous demilunes (arrow). Masson. 400X.

Fig. 6. Salivary bladder with pseudostratified columnar epithelium (small arrow), connective tissue (big arrow) and striated skeletal muscle (m). Masson. 40X.

The posterior lobe is bigger than the anterior one. It is predominantly mucous (Fig. 5), been almost exclusively formed by mucous acini with scarce and small serous demilunes. The mucous cells were only slightly stained whit AB and reacted strongly to PAS. The serous cells of demilunes stain to PAS. Intercalated ducts, striated ducts and interlobular ducts were observed in this gland.

There are a reservoir or salivary bladder (Fig. 6)

related with the anterior submaxillary gland. The bladder has pseudostratified columnar epithelium. The major component of the wall is striated skeletal muscle with circular and longitudinal fibbers. The connective tissue is located between the epithelium and the muscular tissue and at the periphery.

In the three major salivary glands myoepithelial cells were observed in contact with the secretory cells and ducts.

DISCUSSION

The parotid gland of *Zaedyus* is a typical serous gland, similar to those of *Chaetophractus villosus* and *vellerosus* (Estecondo *et al.*, 1995), *Dasyus hybridus* (Codón *et al.*, 2003), *Cabassous loricatus* (Fava de Moraes) and *Dasyus novemcinctus* (Fava de Moraes & Shackleford, 1963).

The salivary bladder observed in *Zaedyus* is histologically similar to that of the species of *Xenarthra* previously studied (Pouchet; Burne; Fahrenholz, 1973; Meyer *et al.* and Estecondo *et al.*). In other mammalian species as rat (Butcher, 1972 and Kim, 1976) and mouse (Matsuoka *et al.*, 1994), a salivary reservoir is found near the oral end of the main excretory duct (MED) of the submandibular gland; a similar structure exist in the MED of the mouse sublingual gland (Matsuoka *et al.*, 1993). These expanded structures can store preformed saliva, that is ejected as needed by contraction of surrounding skeletal muscle. In the bat *Tadarida thersites* (Tandler *et al.*, 1998) the parotid gland possesses giant ducts which have a huge storage capacity for saliva. An analogous function may be served by the end pieces of the submandibular glands of species of frog-eating bats (Tandler *et al.*, 1996 and 1997). According to Tandler *et al.* (1998), it seems that any part of the salivary parenchymal tree, from the secretory end piece to the ostium of the MED, can be modified in different mammals to serve as a reservoir for formed saliva.

The presence of two lobes in the submandibular gland of *Zaedyus* which display significant histological and histochemical differences, being the posterior lobe

predominantly mucous and greater in size than the anterior lobe, was also described for *Chaetophractus villosus* and *vellerosus* (Estecondo *et al.*), *Dasyus novemcinctus* (Shackleford, 1963), *Dasyus hybridus* (Codón *et al.*), *Chlamyphorus truncatus*, *Euphractus sexcinctus* and *Bradypus tridactylus* (Burne).

In his review of chiropteran salivary glands, Robin (1881) noted the presence in some species of two sets of submandibular salivary glands, which he labeled principal and accessory (for us anterior and posterior lobe). Binary submandibular glands are not uncommon either in bats or in other kinds of mammals (Nagato *et al.*, 1998). The significance of such glands is debatable. According to Ball (1993), they might partially serve as a form of built-in the excess of saliva. Other hypothesis is that they provide evolutionary opportunities for specialized adaptation (Phillips *et al.*, 1993 and Tandler *et al.*, 1998).

Regarding the sublingual gland of *Zaedyus*, similar glands were described in *Chaetophractus* (Estecondo *et al.*), *Chlamyphorus truncatus* and *Euphractus sexcinctus* (Burne). Nevertheless these glands have not been observed in *Dasyus hybridus* (Codón *et al.*) and *Dasyus novemcinctus* (Shackleford).

Finally, the comparative study reveals some similarities as well as some differences between the histology of the salivary glands of diverse species of *Xenarthra*. Additional studies are needed to clarify if they are related to feeding habits.

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RESUMEN: Se estudió la histología de las glándulas salivales del armadillo *Zaedyus pichiy* (Desmarest, 1804). Se identificaron tres pares de glándulas salivales mayores, tubuloacinares compuestas, parótida, submandibular y sublingual. La parótida es histológicamente una glándula serosa. La glándula submandibular posee dos lóbulos. El lóbulo anterior está formado por acinos mixtos y serosos. El lóbulo posterior es principalmente mucoso. Un reservorio o vesícula salival se relaciona con la glándula submandibular anterior. La glándula sublingual es mixta y está compuesta por acinos mucosos con escasas semilunas serosas.

PALABRAS CLAVE. Mamíferos; *Xenarthra*; Armadillos; *Dasypodidae*; *Zaedyus pichiy*; Histología; Glándulas salivales.

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