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## **Anatomy of the nasal cavity of nine-banded armadillo (*Dasypus novemcinctus*, Linnaeus, 1758)**

### **Anatomia da cavidade nasal do tatu verdadeiro (*Dasypus novemcinctus*, Linnaeus, 1758)**

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#### **A B S T R A C T**

Nine-banded armadillo (*Dasypus novemcinctus*) stands out for its adaptability in different environments, a fact that requires the species, an olfactory capacity developed with a keen sense and related organs potentially evolved. Five specimens of nine banded armadillo were submitted to anatomic dissection with occipital disconnection and isolation of part of the skull in order to obtain a hemi-skull to view the arrangement of internal structures of the nasal cavity. The obtained specimens were identified and photographed with the assist of digital camera. The nine-banded armadillo nose is incorporated into the face of the skeleton located in nasal plan with the triangular shape and facing forward. The nostrils are separated by the nasal septum. Paranasal sinuses, two (frontal and parietal), resemble diverticula of the nasal cavity. The nine-banded armadillo nasal shells are presented divided into three: the ethmoid shell, the dorsal nasal shell and the ventral nasal shell. The shells are delimited dorsal and ventral nasal meatus by. The respiratory system of nine-banded armadillo presented features anatomical that justify their behavior in the nature, as their olfactory ability for hunting. Thus, the development of the nasal shell, especially, ethmoid shells check the animal facility in the searching for subterranean food.

#### **KEYWORDS**

Armadillo; Nasal cavity; Nose; Nasal shells

#### **R E S U M O**

O tatu-verdadeiro (*Dasypus novemcinctus*) destaca-se pela sua adaptabilidade em diversos ambientes, fato que exige da espécie, uma capacidade olfatória desenvolvida com um sentido apurado e órgãos relacionados potencialmente evoluídos. Foram utilizados cinco exemplares de tatu verdadeiro submetidos a dissecação anatômica com desarticulação occipital e isolamento da peça craniana no intuito de se obter um hemicrânio para visualizar a disposição das estruturas internas da cavidade nasal. As peças anatômicas obtidas foram identificadas e fotografadas com o auxílio de câmera digital. O nariz do tatu verdadeiro encontra-se incorporado dentro do esqueleto da face localizado em plano nasal com o formato triangular e voltado para frente. As narinas são separadas pelo septo nasal. Os seios paranasais, dois (frontal e parietal), assemelham-se a divertículos da cavidade nasal. As conchas nasais do tatu-verdadeiro apresentam-se distribuídas em três: a concha etmoidal, a concha nasal dorsal e a concha nasal ventral. As conchas são delimitadas dorsal e ventralmente por meatos nasais. O sistema respiratório do tatu-verdadeiro apresenta características anatômicas que justificam o seu comportamento na natureza, como a sua habilidade olfativa para a caça. Assim, o desenvolvimento das conchas nasais, principalmente, das conchas etmoidais confere ao animal facilidade na procura de alimentos subterrâneos.

#### **P A L A V R A S - C H A V E**

Tatu; Cavidade nasal; Nariz; Conchas nasais

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## INTRODUCTION

The existing biodiversity in Brazil makes the country a natural reservoir of species, having many rare elements of fauna and flora (AYRES et al., 2005; VALENTE; GARCIA; SALIMENA, 2006). This wealth of species earned the country the title of "biologically healthy nation" (MITTERMEIER et al., 2005).

Among the dasipodídeos, the nine-banded armadillo (*Dasypus novemcinctus*) stands out for its adaptability in different environments and can thus receive many denominations as chicken-armadillo, gray-armadillo or nine-banded armadillo (BARBOZA, 2009).

Recent researches has shown that armadillos these are development metabolism of animals and possible sources for the occurrence of respiratory disease in animals or humans that are continually coming in contact with these animals, the most recent being the Pulmonary coccidioidomycosis (DEUS FILHO et al., 2010; SILVA et al., 2014). However, studies related to the respiratory system of these animals still faces obstacles due to the lack of anatomical basis to sustain such information. At first, studies the nervous system of these animals have shown a developed olfactive area, highlighting a keen smell and potentially evolved related organs (SILVA; GUAZZELLI; BAGAGLI, 2007).

Overall, the respiratory system comprises a system consisting of a group pipes that communicate with the external environment lung. Some authors divide it into conductive portion formed by the nose, nasal cavity, nasopharynx, larynx, trachea, bronchi and bronchioles, and respiratory portion formed by the respiratory bronchioles, alveolar ducts and pulmonary alveoli (JUNQUEIRA; CARNEIRO, 2013; ROSS; PAWLINA; BARNASH, 2012).

Once the information about the anatomy of the respiratory system of brazilian fauna animals are scarce, which can provide relevant data for forensic veterinary medicine, yet little studied, the aim of this study was to describe the anatomy of the nasal cavity of nine-banded armadillo (*Dasypus novemcinctus*) and to make comparisons with other animals already studied.

## MATERIAL AND METHODS

For this research were used five nine-banded armadillo from the Chico Mendes Institute for Biodiversity (ICMBio) of the Serra da Capivara National Park. Such research has permission from SISBIO with 22826-01 protocol issued on 03 August 2010. For this work were used animals resulting from other previous research on

this, which were fixed in formaldehyde solution 10%, hence no other sacrifice.

The animals were subjected to anatomical dissection with occipital dislocation and isolation of the cranial part. The same has been sectioned along the forward end (nose) to the trailing edge (side flow occipital bone) in order to obtain a half skull to view the arrangement of internal structures of the nasal cavity. The anatomical structures have been identified and described in anatomical specimens obtained and photographed with the assist of digital camera.

The information regarding the anatomy were described as the International Committee on Veterinary Gross Anatomical Nomenclature (2005).

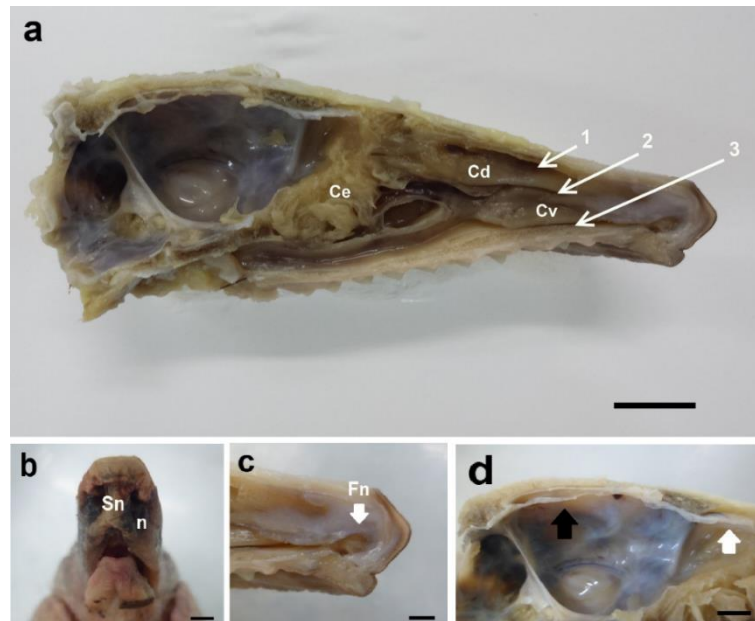
## RESULTS AND DISCUSSION

In nine-banded armadillo features are similar to domestic animals described in Hare (1975), Dyce, Sack, Wensing (2004), the nose is incorporate into the backbone of the face, that located in the nasal plane with the triangular shape and facing ahead. Nostrils are separate by the nasal septum (Figure 1.b), and within these are the nasal fossae (Figure 1.c), which communicate with a cavity covered by mucus, called sinuses.

The paranasal sinuses are considered diverticula of the nasal cavity, in which they enter the skull bone in case of nine-banded armadillo, paranasal sinuses are less prominent and receive bone denomination which are correlated: front and pre-sphenoid (Figure 1.d). In domestic carnivores (dog and cat), the frontal sinuses have clinical significance for their involvement in the nasal conditions, which may be explained by deficient drainage of fluids to the ethmoid shells, similar to the frontal sinuses of armadillos are divided without communication between itself (YOSHITOSHI, 2003; AULER, 2010; CONCHOU et al., 2012).

The nasal shells of nine-banded armadillo penetrate the nasal cavity, projecting from the side wall and almost reach the nasal septum. They present divided into three shells: the ethmoid shell, the dorsal nasal concha and the ventral nasal concha (Figure 1.a). The ethmoidal shell constitutes the lateral mass of the ethmoid bone, the dorsal nasal concha is shorter and wider and the ventral nasal concha is more elongated and narrow.

In domestic animals described by König and Liebich (1986), penetrate the turbinates in the nasal cavity, projecting from the side wall reaching the nasal septum, which is also observed in nine banded armadillo. In dogs, the dorsal nasal concha is elongated, narrow, short, and wide ventral nasal concha, the reverse of that in armadillos,



**FIGURE 1.** Photograph of nasal cavity and paranasal sinuses of the nine-banded armadillo (*Dasypus novemcinctus*). Showing in (a) hemimaxilla in detail to the ethmoid nasal concha (Ce), ventral nasal concha (Cv), dorsal nasal concha (Cd) and nasal meatus: dorsal (1), medium (2) and ventral (3). Bar: 1 cm. In (b) Armadillo front view showing the nose septum (Sn) and nose (n). Bar: 12mm. In (c) a side view of the cranial nasal cavity showing the nasal fossa (Fn). Bar: 22mm. In (d) the frontal sinuses (white arrow) and pre-sphenoid (black arrow). Bar: 22mm.

a characteristic that can be justified by the skull shape of these animals, which in dogs is flatter and shorter than armadillos (KÖNIG; LIEBICH, 1986).

The ethmoidal shells are well developed sense of smell of the animals as characterized by a complex turbocharged folds the ethmoid bone with neurosensory epithelium coating. The greater the amount of sensory cells present in most developed is the ethmoidal shells animal smell (ALVES, 2009). These shells in nine-banded armadillo have become larger over the other, which explains the success in the search for underground food with the help of smell.

The shells are delimited by dorsal and ventral meatus (Figure 1.a). The dorsal nasal meatus separates the nasal bone dorsal nasal concha. The middle nasal meatus separates the dorsal and ventral nasal turbinates. In addition, the ventral nasal meatus separates the ventral nasal concha and the floor of the nasal cavity. The ventral nasal meatus is larger than the others and extends the nasopharyngeal space, entering the nasopharynx through the choana. Meatus present in the nasal cavity are important avenues of access to the lower respiratory tract, silted substances, such as potential pathogens for lung parenchyma.

## CONCLUSION

The anatomical features of the nasal cavity nine-banded Armadillo justify their behavior in nature, as the

presence of ethmoid turbinates developed at the expense of others, investigating their olfactory ability for hunting.

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