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Structure of phytobezoars found in the stomach of a crested porcupine, *Hystrix cristata* L., 1758

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Abstract. In this note we describe for the first time the inner structure of bezoars found in the stomach of a free-living crested porcupine. These foreign bodies were composed by three concentric layers made up of vegetal matter. The presence of nettle trichomes in the central core, probably due to an accidental ingestion, may have determined the development of these foreign bodies.

Key words: bezoars, foreign bodies, vegetal matter, nettle trichomes

Bezoars are foreign bodies found into the digestive tract of mammal species, made up by hairs (trichobezoars) or indigestible plant matter (phytobezoars). They are variable in size and very compact, with a hard surface. The inner structure is made up of heavily compressed thick fibers intertwined with each other (Sciumè et al. 2004). Phytobezoars are mainly composed by poorly digested fruit and vegetable skins (persimmon, grape, fig, plum, cherry, orange and potato; Holloway et al. 1980). Phytobezoars have been found also in the digestive trait of man (Sciumè et al. 2004, Teng et al. 2005). Phytobezoars were detected both in domestic species, such as sheep and goat (Bath et al. 1992), cow (Martins et al. 2004), buffalo (Veeraiah et al. 2008) and horse (Kellam et al. 2000) and wild species like muntjak, *Muntiacus muntjak* (Sharma & Chauhan 1997), spotted deer, *Axis axis* (Kumar et al. 2000) and Alpine chamois, *Rupicapra rupicapra* (S. Lovari pers. comm.). For medium-sized mammals, as domestic carnivores (cat: Barrs et al. 1999) as well as herbivores (rabbit: Wakamatsu et al. 2001, Guinea pig: Künze & Hitmar 2002), only trichobezoars were recorded. The occurrence of bezoars in a wide range of species with different ecology and digestive system anatomy makes it difficult to clearly interpret their role and their mechanism of formation. The function of bezoars, if any, is still unknown. Some authors hypothesed a connection between their presence and a pathogenetic status of the host (Sciumè et al. 2004). In his "Histoire Naturelle des Quadrupèdes", Georges-Louis Leclerc de Buffon (1799) mentioned the presence of bezoars in crested porcupine, without speculating about the structure and the possible functions.



Fig. 1. Phytobezoars found in the stomach of a female adult crested porcupine (photo IZS).

In this note we describe the inner structure and the content of phytobezoars found in a free-living crested porcupine *Hystrix cristata* L., 1758. An adult female of 14 kg was found dead in a wooded area of the Metalliferous Hills in Southern Tuscany (Prata, Grosseto, Central Italy), in the framework of a research project on the ecology of this species. The animal was subjected to a complete necropsy at the IZS (Istituto Zooprofilattico Sperimentale) veterinary

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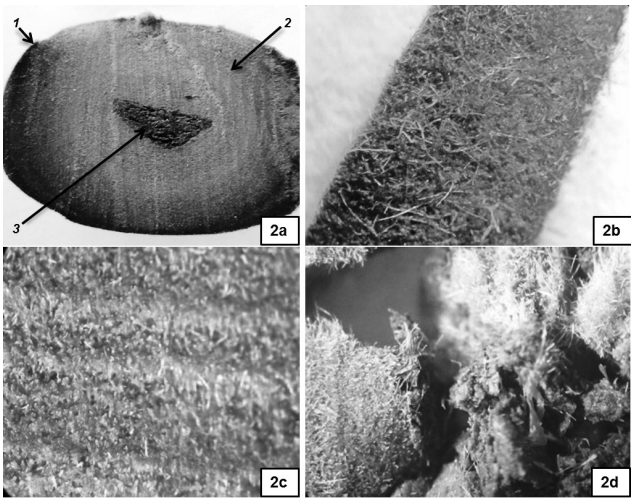


Fig. 2. a) Section of the phytobezoars: 1 = Cortex, 2 = Intermediate layer, 3 = Core, b) Cortex (4× magnification), c) Intermediate layer (4× magnification), d) Core (4× magnification).

labs in Grosseto. Cereals and blackberries were found in its stomach. Crested porcupines feed, indeed, mainly on underground storage plant organs, such as roots and tubers, but also cereal seeds and fruits (Bruno & Riccardi 1995, Riccardi & Bruno 1996). Porcupines are able to digest small quantities of fibers, which are supposed to constitute an important part of the diet only at times of food shortage (Van Jaarsveld 1983). The two phytobezoars found in the stomach were irregularly elliptical (dimensions: about 5 × 5 × 3.5 cm) and greenish in colour (Fig. 1). Presence of phytobezoars in porcupines is supposed to be rare, as these foreign bodies were not found in other 82 necropsies performed on road-killed crested porcupines between 1990 and 2000 in Southern Tuscany (S. Lovari et al., unpublished data).

Phytobezoars were sectioned and observed by means of a binocular microscope. They turned out to be mostly composed by vegetal fibers and structured into three concentric layers (Fig. 2a): i) an external olive-green cortex, made up by less compressed fibers (Fig. 2b), ii) an intermediate bronze-brown layer, made up by very thick vegetal fiber clusters (Fig. 2c), arranged in almost concentric rings around the central core, and iii) a small dark green core, constituted by uncompacted vegetal detritus and some plant hairs (Fig. 2d).

A similar structure was previously reported for bezoars of goats (Bath et al. 1992). A detailed investigation on the core layer composition lead to the determination of the vegetal material as stinging hairs (trichomes) of *Urtica* sp. Nettle has not previously been recorded in the diet of the crested porcupine (Bruno & Riccardi 1995, Riccardi & Bruno 1996), as well as related species (Alkon & Saltz 1985, Skinner & Smithers 1990, Barthelmess 2006).

No lesion was identified in the gastric mucosa. Although phytobezoars occupied *c.* 20 % of the total volume of the stomach (maximum distended stomach volume in porcupines: 1019.1 ± 241 cm^3; Van Jaarsveld 1983, Alkon & Saltz 1985), the individual was in an excellent nutrition status (see Van Jaarsveld 1983). So, phytobezoars are considered incidental findings: the likely cause of death seems to be a pulmonary collapse after a sternal fracture, maybe due to a collision with a vehicle. Even if stinging trichomes evolved as a response to grazing (Tuberville et al. 1996), nettle is included in the diet of many mammals and gastric reactions have never been reported (e.g. Göker & Özmen 2009, Vulla et al. 2009). Thus, we hypothesized that bezoar formation could be due to the mechanical nature of the nettle trichomes, that may have favoured the intertwining of the undigested plant fibers.

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