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Ecological Roles of Coleoptera Associated with Carcasses in Caatinga

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Abstract. The ecological roles of Coleoptera fauna associated with pig carcasses exposed in a Caatinga area were examined. Tray, pitfall and modified Shannon traps were settled together to collect these insects during two seasons (dry and rainy). 4,851 beetles were collected, belonging to 19 families and 88 species. The most abundant ecological category was predator/parasite (72.7%), followed by omnivorous (15.1%), necrophagous (10.9%) and incidental (1.3%). Future researches on the biology of predator/parasite species are required to understand their possible forensic utility for postmortem interval estimate.

Keywords: Beetles; Forensic Entomology; Postmortem Interval.

Papel Ecológico de Coleoptera Associados a Carcaças em Área de Caatinga

Resumo. O papel ecológico da coleopterofauna associada a carcaças de porcos em uma área de Caatinga foi examinado. Para captura desses insetos foram utilizadas armadilhas do tipo bandeja, *pitfall* e *Shannon* modificada, durante duas estações (seca e chuvosa). 4.851 coleópteros foram coletados, pertencentes a 19 famílias e 88 espécies. A categoria ecológica mais abundante foi predador/parasita (72,7%), seguida por onívoro (15,1%), necrófago (10,9%) e incidental (1,3%). Futuros estudos sobre biologia das espécies predadoras/parasitas são necessários para se determinar sua possível utilidade forense na estimativa do intervalo pós-morte.

Palavras-Chave: Besouros; Entomologia Forense; Intervalo Pós-Morte.

Carcasses and cadavers are colonized by several species of insects such as flies and beetles during the decomposition process (Smith 1986; Byrd & Castner 2010). This entomofauna is composed by necrophagous species, which feed on tissues in decomposition; predators/parasites, which feed on larvae, pupae and adults of others insects; omnivorous, which feed both body and associated entomofauna; and incidentals, which are found randomly (Catts & Goff 1992). Coleoptera belong to all guilds. Few species are effectively necrophagous, while most of them are predatory, but any category may provide useful information from the forensic point of view, concerning to the estimation of the postmortem interval (PMI) and other aspects of death, as the translocation of corpses (Smith 1986; Byrd & Castner 2010). This paper reports the ecological roles of Coleoptera associated with carcasses in an area of Caatinga, northeastern Brazil.

The study was carried out during October 2010 (dry season) and February 2011 (rainy season) at the Private Reserve for the Environmental Inheritance Fazenda Almas, in São José dos Cordeiros, State of Paraíba, Brazil (7° 28' 19" S, 36° 53' 40" W). The vegetation varies from open to dense arboreal Caatinga, with a strong deciduous characteristic during dry season (Santos *et al.* 2012). Two pig carcasses (*Sus scrofa* Linnaeus), about 50 m apart one from the other, weighing around 15 kg each, were used in both seasons. The animals were killed with a single gunshot to the head. Each carcass was exposed in an iron cage, with a tray buried underneath it. Pitfall traps were settled around the cage and a modified Shannon trap was hung over the cage (Mise *et al.* 2007). Coleoptera were daily collected in and from the traps and considered to belong to four ecological categories: necrophagous, omnivorous, predator/parasite and incidental (Catts & Goff 1992), according to their feeding habits (Marinoni *et al.* 2001). The average temperature and relative humidity recorded during dry and rainy seasons were, respectively, 26.9±1.8°C / 63.8±19.4% and 24.5±1.3°C / 78.5±11.7%.

A total of 4,851 adults belonging to 19 families and 88 species were collected. The most abundant ecological category and with higher species richness was predator/parasite (72.7%, S=34) in both seasons, represented mainly by species of Staphylinidae, such as *Atheta iheringi* Bernhauer, *Aleochara bonariensis* Lynch and *Philonthus* spp., and Histeridae, such as *Euspilotus* spp., *Xerosaprinus diptychus* (Marseul) and *Phelister* sp. (Table 1). This predominance was attributed to great prey availability on the same place for those Coleoptera (Smith 1986).

Omnivorous (15.1%, S=24) were represented mostly by *Stelidota geminata* (Say) (Nitidulidae) and several species of Scarabaeinae. Necrophagous (10.9%) were represented by only four species: *Necrobia rufipes* De Geer (Cleridae), *Omorgus suberosus* Fabricius (Trogidae), *Dermestes maculatus* De Geer and *Dermestes haemorrhoidalis* Küster (Dermestidae). Amongst the incidental beetles (1.3%, S=26), most belong to the families Curculionidae and Chrysomelidae, which have phytophagous habit, excluding its association with the carcasses. Its occasional records on carcasses are due to its great diversity and abundance in several environments (Mise *et al.* 2007).

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Table 1. Ecological categories of Coleoptera associated to pig carcasses during dry and rainy seasons in a Caatinga area, State of Paraíba, Brazil. n: Absolute abundance; %: Relative abundance; S: Richness.

Ecological category	Dry season			Rainy season			Total		
	n	%	S	n	%	S	n	%	S
Predator/Parasite	730	51.4	13	2,796	81.5	32	3,526	72.7	34
Omnivorous	356	25.1	11	376	11.0	17	732	15.1	24
Necrophagous	316	22.2	3	212	6.2	4	528	10.9	4
Incidental	19	1.3	8	46	1.3	19	65	1.3	26
Total	**1,421**	**100**	**35**	**3,430**	**100**	**72**	**4,851**	**100**	**88**

Mise *et al.* (2007), in a mixed Rain Forest fragment, reported great abundance of predators/parasites (55%) and omnivorous (38.1%) as in this study, but the incidentals (5.6%) were more abundant than the necrophagous (1.3%). In the same area, studying a longer decomposition process, Mise *et al.* (2008) also found many predators/parasites (84.6%) and only a few necrophagous (1.1%) specimens. Such as Silva & Santos (2012), at an urban area of Northern Paraná State, who collected mainly predators/parasites (80.5%) and omnivorous (12.7%) and only some necrophagous (0.4%) beetles. According to an analysis of the data collected by Rosa *et al.* (2011), in areas of Cerrado, it is possible to notice a variation on the ecological role of the Coleoptera between seasons, unlikely this study. During the rainy season, the authors found more predators/parasites (51.8%) than necrophagous beetles (12.4%) as well. However, the necrophagous (62.6%) were more abundant than the predators/parasites (23.6%) during the dry season. According to the authors, it was expected an increase in the number of necrophagous species found in the dry remains. Mayer & Vasconcelos (2013), in another Caatinga area, collected mainly copro-necrophagous (55.4%) and necrophagous (39.9%) and only a few predators/parasites (2.5%) beetles. Surprisingly, only 24 individuals of Histeridae were found and specimens of Staphylinidae were not collected by the authors.

The pupae of flies from forensic cases are frequently identified by rearing out the adults. However, parasite insects are often obtained instead. Like some species of wasps (Braconidae) and rove beetles of the genera *Aleochara* (Staphylinidae). It is suggested that, with knowledge of their durations of development, they can be employed as surrogates for their hosts for PMI estimates (Disney & Munk 2004; Caron *et al.* 2008).

In conclusion, predators/parasites beetles were the most abundant in both seasons in Caatinga due to the large amount of preys for these Coleoptera underneath the carcasses, especially during rainy season when environmental conditions may have favored these species. Similar results were also observed in studies conducted in other areas. Therefore, it is necessary a new direction of researches on the biology of species associated with carcasses, so far focused on necrophagous species (Richardson & Goff 2001), to understand the role of these beetles on carcasses and their possible forensic utility.

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