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Marks caused by the scavenging activity of *Necrobia rufipes* (Coleoptera: Cleridae) under laboratory conditions

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ABSTRACT

Insects are an important group involved in carrion consumption and are thus of forensic interest. In the laboratory we studied the taphonomic marks that *Necrobia rufipes* (Cleridae) can produce. Pig trotters were exposed to adult beetles at 21 ± 3 °C and 12:12 h day/night cycle. We made observations and took photographs every 4–5 days for 12 months. Marks were noted after a month. We found scratches, pits, holes, and tunnels in several kinds of tissue such as integumental, connective and muscular. This work contributes preliminary data of significant application in biology, ecology, anthropology and forensics. Until now, no study has provided taphonomic information with *N. rufipes*.

1. Introduction

Human or animal remains can suffer changes which can result from different factors such as physical variables; environmental conditions; the stage of the corpse; the activity of scavenger animals, among others.[1] All these changes are studied by Forensic Taphonomy. Insects are an important group involved in carrion consumption and are thus of forensic interest. Denic et al.[2] described body wounds which had been initially confused with acid but were finally identified as the result of cockroach activity. Some species of Formicidae have been observed to produce marks and lesions potentiated by formic acid.[3] Several artifacts produced by ants are described in Byard[4] and Zanetti et al.[5] Termites have an osteophagic behavior and this was observed upon human remains in archeological tombs.[6,7] Britt et al.[8] pointed out that they can colonize the burial place and damage bone remains and thus influence taphonomic processes. These authors also suggested that tineid moths (Lepidoptera) can be involved in the deterioration of bones.

Skin, checkered, clown and burying beetles could probably cause artifacts in human body parts.[9] Ururahy-Rodrigues et al.[10] found that a scarab beetle species caused different post-mortem effects in the corpse and modified the discovery scene. These alterations can be confused with lesions or artifacts which may have actually caused death.

The study of the feeding habits and other biological aspects of scavenger species may represent a great contribution to forensic taphonomy. Mazzanti[11] indicated that making observations on the effects caused on skeletons by coleopteran can provide interesting contributions such as ecological and paleontological information.

The Cleridae family (Coleoptera) contains mostly predaceous species but some are scavengers and others have been found feeding on flower pollen.[12] *Necrobia rufipes* De Geer and *Necrobia ruficollis* Fabricius (Coleoptera: Cleridae) are species with an omnivorous habit which have been found associated with Egyptian mummies,[13,14] are pests of stored commodities and other products of rich protein contents, and have been found in forensic cases and succession experiments some of them conducted in Argentina,[15–18] thus they are important beetles in forensic entomology and stored product entomology.

Thus, the aim of this study was to conduct research into the artifacts that *N. rufipes* can produce on animal tissue when feeding and reproducing or completing its life cycle.

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2. Materials and methods

To perform this study, adults of *N. rufipes* were selected from a culture established in 2010. The colony was obtained from pig carcasses used in field succession experiments performed in Bahía Blanca, Argentina.[18] Fifteen adults were placed inside a 2 kg glass container filled with approximately 3 cm of sand. The neck of the container was greased with mineral oil to prevent insects from escaping. To allow ventilation and eliminate excess humidity and fungal growth, the opening was covered with a piece of voile mesh secured with a rubber band. Protection and a water source were provided by introducing a piece of cotton sprayed with distilled water. To evaluate taphonomic marks, pig trotters (n = 2) were boiled in a pot for 10 min and then exposed for 30 h to open-air temperature and humidity, sheltered from the rain and covered with a piece of voile material to protect them from scavengers, this procedure was followed for the reasons explained in Zanetti et al.[5]

The trotters were photographed for control purposes and then introduced to insects except in the control sample. Three replicates were carried out. Containers were maintained in a room at approximately 21 ± 3 °C and 12:12 h day/night cycle. Insect activity was observed and photographed every 4–5 days for 12 months. All

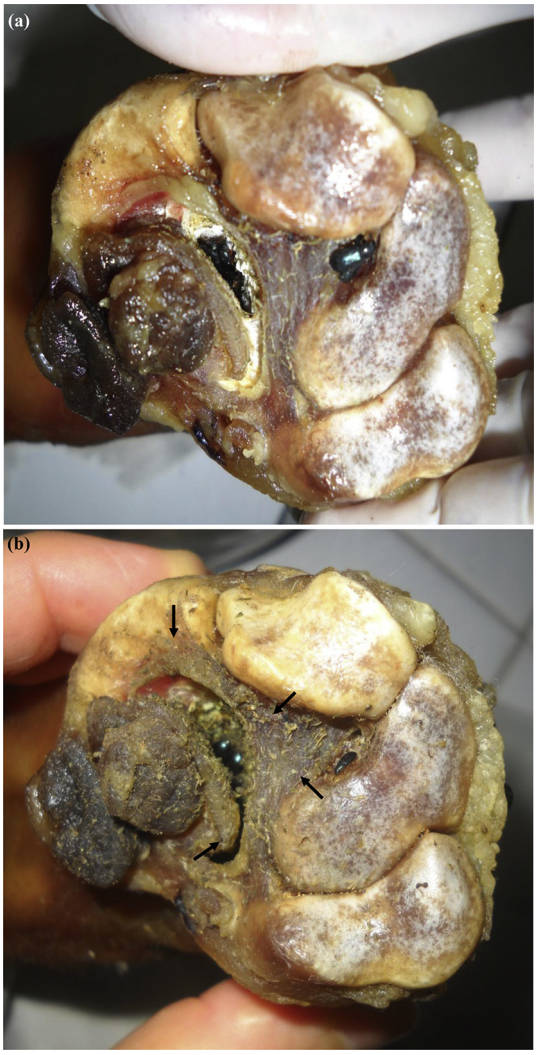

Fig. 1. Insect activity on cadaveric substrate. (a) Cadaveric substrate at the beginning of the experience. (b) Cadaveric substrate after 7 months of *N. rufipes* activity at adult stage (arrows indicate the tissue consumption in the joint area).

Fig. 2. Marks on pig hoof. (a) Pig hoof without marks (control). (b) Pig hoof eaten by checkered beetles after 2 months of insect activity (arrow). The black horizontal marker equals 1 cm.

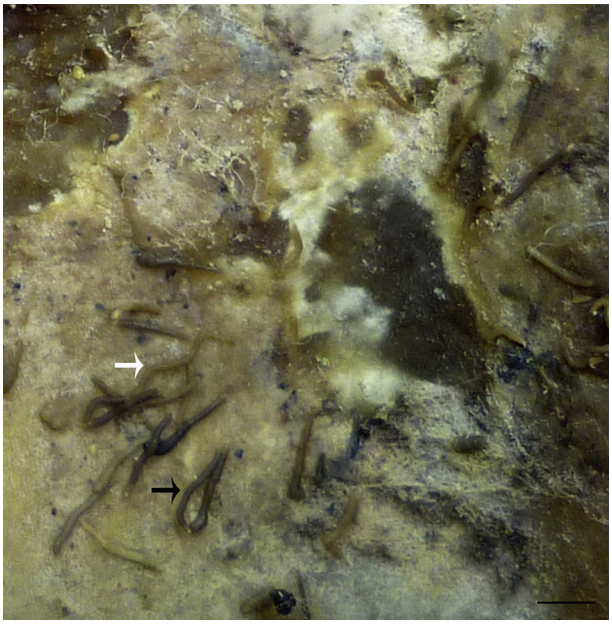

Fig. 3. Fecal pellets of *N. rufipes* over the trotter. Oldest pellets (black arrow) were darker than youngest pellets (white arrow). The black horizontal marker equals 1 cm.