



Case report

Outdoor post-mortem bite injuries by *Tapinoma nigerrimum* (Hymenoptera, Formicidae) on a human corpse: Case reportTeresa Bonacci ^{a,*}, Vannio Vercillo ^b^a DIBEST Department, University of Calabria, via P. Bucci, s.n., 87036 Rende, CS, Italy^b Azienda Sanitaria Provinciale di Cosenza – Unità Operativa di Medicina legale, Cosenza, Italy

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ABSTRACT

Ants are among the insects that colonize exposed human and animal corpses during the early stage of decomposition. In Calabria, Italy (as well as in other countries), Formicidae have been observed preying on immature stages of Diptera and other insects, as well as causing irregular scalloped areas of superficial skin loss on human corpses and animal carcasses. We present a case of injuries on a human corpse caused by ant feeding. The macroscopic appearance is described and the results of a histochemical investigation of the skin lesions caused by worker ants are reported for the first time. The investigation was carried out on the fresh corpse of a 53-year-old man discovered in a rural area of Cosenza province (Calabria, southern Italy). Numerous irregular areas of superficial skin loss caused by the ant *Tapinoma nigerrimum* (Nylander 1856) (Hymenoptera, Formicidae) were observed on the body surface, inflicted very early in the post-mortem period. Because the classification of lesions is of crucial importance for forensic investigations, the macroscopic appearance and distribution pattern of the lesions on the corpse are illustrated. The histochemical investigation of the damaged skin explains, for the first time, the mechanism of production of the lesions.

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1. Introduction

Human corpses exposed outdoors and indoors are subject not only to the process of decomposition but also to the feeding activity of the local macro- and micro-fauna. The scavenging activity varies considerably by region, season and environmental conditions. In some cases it can affect the rate of decomposition of corpses and the post-mortem interval (PMI) estimation and even destroy indicators of cause of death.^{1–3} The activity of fauna on the corpse is an important factor that must be taken into account in all forensic cases involving cutaneous lesions and their chronology.⁴ The animal species causing post-mortem injuries can be determined by the nature of the bite marks or the patterns of the lesions. Damage caused by micro- and macro-fauna to different parts of the human body has been reported by many authors.^{5,6} Ant bites inflicted post mortem appear as serpiginous, scalloped areas of superficial skin loss which in some circumstances could be misinterpreted as ante-mortem injuries.^{3,4} The distinction between ante- and post-mortem injuries (an important factor in the interpretation of a

crime scene) is often rather easy but in some cases it is very hard to assign the cause. In such cases the attribution of a specific post-mortem injury or pattern of lesions to animal interference is very important.^{1,4}

Tapinoma nigerrimum is an ant with a Mediterranean distribution which preferentially nests in habitats with a sparse arboreal stratum.⁷ It builds extensive nests at the base of the plants and is active at temperatures between 10 and 30 °C, at night or in early morning. Its activity decreases at midday and in the hottest months. *T. nigerrimum* is omnivorous, feeding preferentially on organic liquids although saprophagous and necrophagous habits have been reported. Hence this insect uses different feeding strategies in which various systems are employed according to the type of food available.⁷ 2-Methyl-4-heptanone has been reported from the anal (pygidial) glands of *T. nigerrimum*.^{8,9}

The aim of this paper is to report on the lesions inflicted by worker ants on a corpse discovered outdoors and their distribution pattern on the skin. The feeding activity of *T. nigerrimum* on a fresh human corpse is reported here for the first time.

2. Case report

A 53-year-old man was found dead in a rural area in Calabria (southern Italy) during spring. The corpse was in a supine position.

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The man was wearing a sweater, pants, socks and shoes. Blood-stains were totally absent at the scene. The post-mortem interval was estimated to be around 72 h. According to the autopsy and histological findings, death was attributed to acute cocaine intoxication complicated by ischemia in the left parietal-occipital part of the brain. The toxicological analysis revealed alcohol and cocaine in the blood and urine. Subsequent information revealed that the deceased had a history of drug dependence and alcoholism.

At autopsy, post-mortem interference by animals was inferred. External examination revealed multiple irregular injuries (1–4.5 mm) with serpiginous margins; the lesions were brown and red and scattered over the skin surface of the hands (Fig. 1A), wrists, neck, arms and armpits (Fig. 1B, C). Several *Tapinoma nigerrimum* workers were observed feeding on the skin, inside the mouth (Fig. 1D) and around the skin lesions on many other parts of corpse. The lesions on the thorax, armpits and neck had a typical brown dried appearance, contrasting with the red lesions on the wrists, hands and arms.

Macroscopically the inflicted injuries were characterized by irregular-shaped formations with scalloped edges (Fig. 1A). There were no ante-mortem reactions, since no bleeding or cellular response was associated with the ant marks. The skin injuries were explained by the presence of *T. nigerrimum* workers around the skin lesions, both during the external examination of the corpse and at autopsy. To explain the mechanism of production of the lesions by the workers we carried out a histochemical investigation of wound vitality markers. To assess the skin modifications we used Masson's Trichrome stain (TRI) with Aniline Blue 04-010802 – Bio Optica^{10–13} on samples of skin taken from the axillary region (Fig. 1B, C). Control samples were pieces of unbroken skin from the same axillary region. The histochemical investigation (Fig. 2) showed a clear difference between intact and damaged skin. The observed changes in dermal structure are due to the action of chemicals that the ants use during feeding and not to a mechanical action of the worker's mandibles. Fig. 2B, C, D show the typical

change in collagen coloration from blue in intact skin to red in damaged skin. Raised skin was observed (see Fig. 2D) but only at the epidermal level. The ants probably use their glandular secretions to change the consistency of the skin which will then be raised and consumed with the mouthparts. We did not identify the substances involved but this will be the aim of future research.

3. Discussion

The activity of macro- or micro-fauna on corpses can modify pre-existing skin lesions and/or ante-mortem injuries or cause extensive tissue damage over the skin surface.^{2,3,5} Skin damage caused by ant workers is the result of their post-mortem feeding activity. Macroscopically these lesions can be confusing and misinterpreted as ante-mortem excoriations.⁶ However their nature is immediately apparent when the ants are found on the corpse.³ The effect of the ant mandibles is to create lesions with scalloped or serpiginous margins.⁴ Macroscopically ant injuries can be yellow-brown, red or yellow and in particular cases the feeding activity of workers causes considerable blood loss resulting from damage to superficial capillaries in the papillary dermis.^{2,4} Some authors have suggested that formic acid may enhance blood loss.¹⁴ In our case the macroscopic pattern of ant injuries was different. The lesions appeared red and without raised skin on the wrists, hands and arms while they were brown with raised skin on the thorax, armpits and neck. Our histochemical investigation confirmed the secretion of chemicals on the skin by workers. This may modify the dermis and top layer of the skin, perhaps to facilitate chewing of the epidermis. 2-Methyl-4-heptanone has been reported as a first secretion stored in the anal (pygidial) glands of *Tapinoma nigerrimum*^{8,9} but we cannot confirm its involvement in these skin lesions.

T. nigerrimum is very abundant in Calabria but has never been reported to cause post-mortem artifacts in human corpses in other geographical areas. This ant should be considered an opportunistic member of the carrion community, capable of removing fly eggs



Fig. 1. Skin injuries inflicted by *Tapinoma nigerrimum* workers in a 53-year-old man. **A**, irregular and extensive red lesions on the hands; **B** and **C**, ant bites, brown in color, on the neck, arms and armpits; **D**, *T. nigerrimum* workers inside the mouth at autopsy. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

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