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First Report of *Dermestes frischii* Kugelann (Coleoptera: Dermestidae) on a Human Corpse, South of Iran

Case Report

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Abstract

The necrophagous species of beetles provide useful complementary data to estimate the post-mortem interval in forensic cases. We report, for the first time, *Dermestes frischii* Kugelann, 1792 larvae from a mummified human body covered with bushes and located in a canal in Sarvestan district, Fars province, south of Iran. The human corpse was a 63 year old male. The time of death was estimated to have been 23 days prior to the finding of the body based on the police investigations and confessions of a suspect. This beetle can be helpful to estimate the time of death in the future.

Keywords: Beetles (Coleoptera); *Dermestes Frischii*; Forensic Entomology; Human Cadaver.

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Introduction

The study of beetles (Coleoptera) is important in forensic investigations. This can be helpful in determining the time of death or postmortem interval (PMI) [1]. Insects colonize the corpse in a predictable regularity; and beetles are found in the late stage of body decomposition [2]. Decomposition stages in an open environment are different from those in a closed environment, as closed environment may act as a barrier to insect species that are important in forensic entomology [3].

Dermestid (or hide) beetles are a family of insects in the order of Coleoptera. This order is distinct from others by the presence of a pair of hardened and thickened wings or "elytra". The key

characteristics that differentiate this family from other families are clubbed antennae that fit into deep grooves and round oval shaped bodies covered in scales. Most genera of Dermestidae family are scavengers that feed on dried animal tissues or plants. In this family, *Dermestes* genus is important in forensic entomology and is active during the warmer months of the year [2, 3].

The *Dermestes frischii* which belongs to the *Dermestes* genus, is differentiated from other genera by the absence of a median ocellus on front head and the presence of a pair of compound eyes, hind wings and a scutellum. This species is black and oval shaped. The size of this species is 6-12mm in length and 4-5mm in width. The elytra is completely covered with pale scales [4, 5]. This species is cosmopolitan in distribution and appears to be similar to *Dermestes maculatus*, but the apical part of the elytra has a specific spine in *D. maculatus*. Each abdominal sternite has 2 lateral black spots in adults. The sternite of the abdomen has a white pubescence.

The species of *Dermestes ater* can be separated from *Dermestes frischii* by the underside of the abdomen that is light brown with dark brown patches in the middle and on the sides in *D. ater*. The larvae are elongated, narrow and dark brown to black in color. Their size ranged from 5-15mm in length. On the 9th abdominal segment, there are two rigid sharp spikes called "urogomphi". The larvae of this species can be distinguished from other species by an equally wide light-color longitudinal dorsal stripe on the head, thorax and the abdomen and spiky ends of the urogomphi that are curved distinctly toward the insects' backs [5, 6]. This species has been reported in various regions of the world on human and animal cadavers, as this species was reported on human corpses in France. *D. frischii* was dominant in this study [7]. This species was reported from animal carcasses in different regions [8, 9]. In Iran, dermestid beetles have never been reported from any human corpses so far.

Case Study

A 63 years old man was found dead in the field, in Sarvestan district, Fars province (29°20' N, 53°15' E) and taken to Shiraz Institute of Legal Medicine on 19th September 2014. The cause of death was homicide. The time of death was estimated to have been 23 days before the discovery of the body based on the police investigations. The victim was strangled in the trunk of a car and then transferred to a channel to hide instantly. Part of the body that was in indirect contact with sunlight was hard, stiff and leathery. The head of the corpse was completely skeletonized exposing the skull and the lower jaw was broken. Beetles' larvae were collected from the corpse during autopsy procedures by the first author at 8.45 am. Some five beetles' larvae were collected from the face and transferred to the laboratory of Entomology for rearing. It should be noted that in this case, we did not find any adult fly on the corpse.

The live larvae were reared on chicken meat and they were kept in a separate container and placed in a dark place. The temperature of the rearing room was 28±1°C and monitored daily. The mean length of the beetle larvae were 11±2mm. The body color was dark brown and have a hairy appearance (Figure 1). The growth time of the larvae to become pupae was 9.5 days and the time of pupation to adult emergence was 8 days. The emerged beetles were then killed and identified by using valid taxonomic keys [10, 11] and compared with the valid pictures [12].

The *Dermestes frischii* adult can be distinguished from other species in Dermestidae family by the small black spots at each side on the sternite; also the last sternite has a median blackish spot on

its rear border, which does not extend to the front border of the sternite [5, 6]. The confirmation of this species was done based on its habitus and the abdomen of the adult (Figures 2 and 3) by Andreas Herrmann, a leading expert on Dermestidae beetles.

Discussion

The presence of this species larva and adult is varied with the decomposition stage of the corpse or carcass. The *Dermestes* genus larvae were found on a human corpse in the early stages of advanced decay (day 21) [13]. The *Dermestes frischii* adults are reported on human leftover parts at all decomposition stages (fresh, bloat and dry stage), but larval first appearance was in the decay stage of body decomposition (day 9) [4]. This species was collected in the active decay stage (days 2-8), advanced decay (days 8-13) and dry stage (days 13-21) in summer [8]. Study on pig carcasses showed that *Dermestes frischii* was seen in the advanced decay and dry stages of decomposition [14]. Other species of *Dermestes* genus associated with corpses were found in many parts of the world, as *Dermestes ater* larvae were first found on a dead human body 14 days after death in Malaysia [15]. *Dermestes maculatus* and *Dermestes ater* (adults) were recorded on animal cadavers in the stages of a bloat (day 4) and decay (day 15) [16]. *Dermestes maculatus* adult was found on a pig carrion in the advanced decay stage (4-6 days) in Thailand [17]. Other life stages of Dermestid beetles such as pupa and exuviae may be collected from the human corpse in late stage of body decomposition and serve as reliable alternate specimens for toxicological analyses in the absence of tissues and fluids normally, for example; Amitriptyline and Nortriptyline drugs isolated from Dermestidae exuviae in a mummified human

Figure 1. The habitus of *Dermestes frischii* larva with a hairy body.



Figure 2. The habitus of *Dermestes frischii* adult with a pair of elytra.



Figure 3. Ventral view of *Dermestes frischii* adult showing the apical abdominal sternite with black pubescence at apex.



remains [18].

This difference between previous reports could emanate from the geographical and climatic differences because the decomposition process is different in each region [19]. Therefore, our report indicates the presence of larvae in the stage of advanced decay, when the tissues are suitable for feeding larvae. The aim of this study was not to estimate the PMI for a corpse, because in our study the maximum postmortem interval of 23 days was indicated by confessions of a murderer. The goal of this study was to document a beetle species associated with the human corpse in Iran, where many infectious and non-infectious diseases also prevail.

For estimation of post-mortem interval using this beetle larvae in Iran, it is important to study the rates of development in this species because the rates of development for *Dermestes frischii* and other species of the Dermestidae family is different in different strains and different foodstuffs [20, 21]. Forensic entomology is a neglected field in Iran and in order to make baseline studies, more research is needed. Eventually, we hope to advance forensic entomology in Iran.

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