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Evaluation of relation with pet food and first record of *Necrobia rufipes* (De Geer, 1775) (Coleoptera: Cleridae) associated with pet clinic in Turkey

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ABSTRACT:

The purpose of this study is to report clinical infestations caused by *Necrobia rufipes* (*N. rufipes*), mainly related to forensic entomology, in pet food. As a result of the evaluation of the infested materials which came to our laboratory within the scope of the study, clinical observations were made to understand the intensity of infestations in the region and to learn their origins. As a result, dry cat and dog foods were determined to be responsible for infestation. During the observations, intense insect populations were found, especially in pet food bowl and bags. The related insects have caused considerable loss of product and significant economic damage in infested pouches. Reports on clinical infestations from *N. rufipes* are quite rare. However, considering the high protein content of cat and dog food present in clinic and the nutritional habits of these insects, the possibility of having clinic infestations from *N. rufipes* should not be ignored. Many factors, such as lack of sanitation, can play an important role in infesting foods with insects. With the early detection and control of the invasions, it is possible to prevent the spread of pests throughout the clinic and to maintain the wholeness and quality of food products.

Necrobia rufipes'in pet mamalarıyla ilişkisinin değerlendirilmesi ve Türkiye'deki kliniklerden ilk bildirimi

ÖZET:

Bu çalışmanın amacı, esas olarak adli entomoloji ile ilgili olan *Necrobia rufipes*'in evcil hayvan mamaları aracılığıyla neden olduğu klinik enfestasyonları bildirmektir. Çalışma kapsamında laboratuvarımıza gelen enfeste materyallerin değerlendirilmesi sonucunda, enfestasyonların bölgedeki yoğunluğunun anlaşılması ve kökenlerinin öğrenilmesi için klinik gözlemleri yapılmıştır. Bunun sonucunda kuru kedi ve köpek mamalarının enfestasyondan sorumlu olduğu belirlenmiştir. Gözlemler sırasında, özellikle evcil hayvan mama tabaklarında ve poşetlerinde yoğun böcek popülasyonu tespit edilmiştir. İlgili böcekler enfeste poşetlerde ciddi miktarda ürün kaybına ve önemli ekonomik hasara yol açmıştır. *N. rufipes* kaynaklı klinik enfestasyonlara dair raporlar oldukça azdır. Fakat klinik içerisinde mevcut olan yüksek protein içeriğine sahip kedi ve köpek mamaları ve bu böceklerin beslenme alışkanlıkları değerlendirildiğinde, *N. rufipes* kaynaklı klinik enfestasyonları olma olasılığı gözardı edilmemelidir. Sanitasyon eksikliği gibi birçok faktör yiyeceklerin böcekler ile enfeste olmasında önemli bir rol oynayabilir. İstilaların erken tespiti ve mücadelesi ile haşerelerin tüm kliniğe yayılmasını önlemek, gıda ürünlerinin bütünlüğü ve kalitesini korumak mümkündür.

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1. Introduction

The species *Necrobia rufipes* (De Geer, 1775) is a beetle of the family Cleridae and is commonly called as red-legged ham beetle as well as the copra beetle. The red-legged ham beetle is a cosmopolitan pest, causing significant damage to stored products such as copra (dried coconut), ham, cheese, dried fish and other high protein foods (11, 16). It was also reported on animal carrions and human corpses in various countries such as Brazil (2), Hawaii (14), Turkey (13) and Angola (12). In addition, *N. rufipes* are known as predators of larvae (*Lasioderma serricorne*, *Oryzaephilus mercator*, *Carpophilus dimidiatus*), parasites and scavengers (3). Due to this feeding habits, *N. rufipes* has an importance in both stored product and forensic entomology.

The body of adult insect is metallic greenish blue and have prolonged ovalize shape with three body part and 11 segmented antennae. The length of the body is varying from 3.5 to 7 mm. Legs' color could be shiny reddish-brown or orange which give this insect its name. Antennae mostly seem as reddish-brown but with a black club or dark brown at the end. Especially lateral parts of thorax and elytra has stiff bristle-like hairs. Females' elytra are more evident and oriented toward the head. Males have more uniform and oblique elytra (8, 10, 15).

Full-grown form of larvae is approximately 10 mm long; somewhat hairy. Most of body parts are creamish-grey with dappled violet-grey markings on the top. Hardened brown plates are available on first thoracic and last (the ninth) abdominal segment and head; small brownish plates can also be found on 2nd and 3rd thoracic segments. Last abdominal plate has two protuberances seems like horn which extremely curve upwards (10, 15).

The life cycle is completed between 35-150 days depending on existence of the food and temperature. An adult insect could lay approximately 2000 transparent eggs. The eggs are laid generally in cluster on the surface of the food. After 4 or 5 days, they hatch in optimal condition and the life cycle proceeds with succession of 4 larval stages. Pupal chambers are built after 13 days. 7th day of the pupation, emergence of the imago occurs. (4, 8, 15, 16). *N. rufipes* could use variety of ingredients for build their chambers. For *N. rufipes*, optimum development temperature is about 30-34 °C, it needs minimum 22°C to continue their life cycle. The maximum temperature boundary is unknown, however if it is reaches above 40-42 °C; this may prevent beetles' development. Also this pest needs 50% or above equilibrium relative humidity (1, 5, 10).

The physical methods such as polythene and thick brown paper for sacks line of food bags, fitting doors and fly screens around or over drying racks can be used for the prevention and control for this pest. In addition, quality of the processing and bags are important. Freezing or the exact opposite high temperatures (45°C or higher) can be used for killing the pests. In addition, low oxygen (O_2) obtained by low pressure under a vacuum, ozone (O_3) and high carbon dioxide (CO_2) exposure up to 144 hours at 23°C for kill %100 of all stages of *N. rufipes* (5, 6, 7, 8, 10, 15).

Furthermore, we have to consider other stored food product pests especially fed with meat such as Larder Beetle, *Dermestes lardarius* L.; Black Larder Beetle, *Dermestes ater*; Hide Beetle, *Dermestes maculatus*; Cheese Skipper, *Piophila casei* (L.) (4). Since these pests' existence depends on the content of the food and also their habitat requirements are similar to the *N. rufipes*, there is a possibility of encounter these insects in the pet clinics.

In the present study, we would like to raise awareness about the occurrence of *N. rufipes* in pet clinics due to the food with rich protein content. In addition, this study has an importance to become first record for *N. rufipes* associate with pet food in Turkey.

2. Material and Methods

The owners of four pet clinics from Ankara province was applied to our laboratory at different time with the beetle infestation problem. As a result of the examination of the infested materials, clinical observations were needed to understand the intensity of infestations in the region and to learn their origins.

Pet food specimens and insects were collected from different parts of the clinics, were transferred in 70% ethanol to Ankara University, Faculty of Veterinary Medicine, Department of Parasitology. In parasitology laboratory,

the samples were analyzed under stereomicroscope (Leica S8AP0) and specific key factors were recorded to enable the identification of species (9, 10, 13).

3. Results

Physical observation of related clinics exhibited a large number of adult insect and larvae population, especially intense infestation occurred in the pet food bowls and bags. Besides, three of the clinics were heavily infested that the beetles were observed even on the wall edges of store area and rooms.

All samples found from different part of clinics were adults, however, eggs and larvae stages were detected on food samples. Totally, 350 adults and 180 larvae were collected from infested clinics. The result of stereomicroscopic examination of the insect body parts, all samples were identified as *Necrobia rufipes*. Main morphological features are shown in Figure 1.

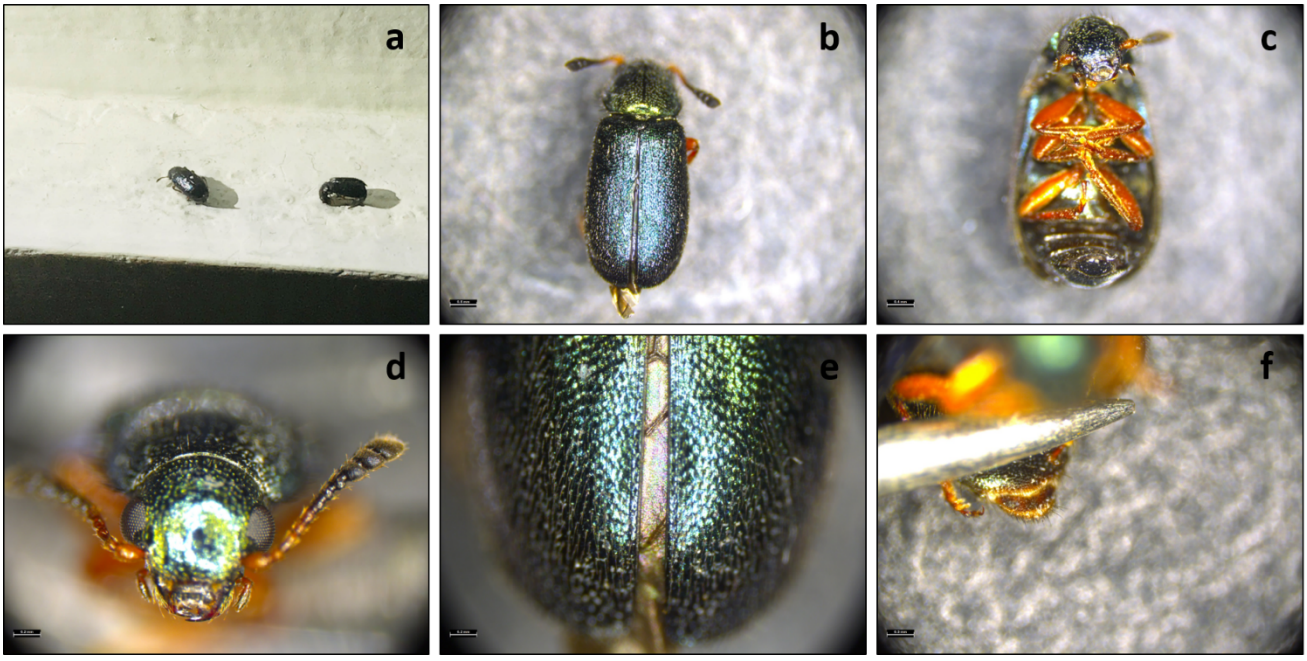

Figure 1: The morphologic characteristics of *N. rufipes*. a: photo of wall edge from the clinic b: dorsal view of the body (bar: 0,6mm) c: ventral view of the body (red-legs and mouthparts) (bar: 0,4mm) d: antennae (bar: 0,2mm) e: elytra (bar: 0,2mm) f: last part of the abdomen (bar: 0,3mm).

Şekil 1: *N. rufipes'e ait morfolojik özellikler. a: enfeste klinikten görüntü b: dorsal vücut görünümü (bar: 0,6mm) c: ventral vücut görünümü (kırmızı bacaklar ve ağız organelleri) (bar: 0,4mm) d: anten (bar: 0,2mm) e: elytra (bar: 0,2mm) f: abdomenin son kısmı (bar: 0,3mm).*

4. Discussion and Conclusion

The results of the current study indicate that these insects threaten pet clinics via pet food and this is the first report of *Necrobia rufipes* in Turkey. They led to significant economic damage and loss of food products.

There is only two report about red-legged ham beetle infestation related with retail pet store (11) and pet food (8), but the origin of the insects' infestation is unknown.

Pet foods, especially dried carnivore food, are rich in animal protein content, which is suitable for *N. rufipes* life cycle and even completely packing of pet food is not often able to prevent to insect infestation. In some cases, it can come from raw material or from the place where dry pet food products are stored. Therefore, *N. rufipes* infestation may have been associated with stored pet foods (8, 11). In addition, some authors indicate that due to their predator properties, the occurrence of *N. rufipes* mostly link to this (9, 11).

In present two cases, the infestation of *N. rufipes* could be detected accidentally while changing the food plate. Several adult and larvae *N. rufipes* were also seen on crevices of the doors and some carton material that exist in clinics. As a matter of fact, the main infested food bags material was also made from carton. It can be suggested that wood material and carton packaging are preferred by *N. rufipes* larvae for becoming pupae and this can be the way to spread infestation.

Early detection and management of infestation is important to avoid to spread of the beetles to the whole clinic and integrity and quality of food products. Because of difficulty about the monitoring of *N. rufipes* infestation, some trap can be kept in clinics for early detection and for prevention of spread of insect. Even though there is no specific trap for *N. rufipes*, the larvae and adult forms can be captured with commercial traps which contain some food oil and pheromone lures (11).

Another point to consider is the lack of specific information about control strategies. The sanitation is more important to prevent and control for *N. rufipes*. But, there is a report that using cleaning alone did not have an effect on adult form, but reduced larval presence (6, 11). However, sanitation followed by cyfluthrin spray greatly reduced both larvae and adults.

We conclude that *N. rufipes* can be available in pet clinics due to food with high protein content. It causes not only unpleasant images and economic losses but also decreases the quality of food. It is important to pay attention to the hygiene conditions and avoid creating environments that they can maintain their biology. Still, there is not enough information about the detection and prevention methods. Detailed researches are needed to better understanding for food preference, behavior and vector potential of this emerging pest associated with pet sector.

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