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*Araştırma Makalesi / Research Article*

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## **Determination of Coleoptera Species of Pig Carcasses and Internal Organs of Bovine in Edirne City of Turkey**

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### **Abstract**

The present study was carried out for the first time to observe the process of Coleoptera succession and stages of decomposition by using pig carcass and internal organs of bovine in Edirne city of Turkey. In this study, 11 species and 3 genera which belong to Dermestidae, Histeridae, Silphidae, Staphylinidae, Cleridae, Nitidulidae and Scarabaeidae families of order Coleoptera which were found on 3 pig carcasses (*Sus scrofa* L.) and 2 internal organs of bovine (lungs, liver, heart and kidney) were identified and recorded at Trakya University Balkan Campus.

**Keywords:** Forensic entomology, Coleoptera, carcass, decomposition, succession, Edirne, Turkey

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## **Edirne İlinde Domuz Leşi ve Büyükbaş Hayvan İç Organları Üzerinde Adli Entomoloji Açısından Önemli Coleoptera Türlerinin Saptanması**

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### **Özet**

Bu çalışma Türkiye Edirne İli'nde ilk defa, domuz leşi ve büyükbaş hayvan iç organlarının çürüme aşamalarını ve Coleoptera türlerinin leşe geliş sırasını belirlemek için yapıldı. Bu çalışmada, Trakya Üniversitesi Balkan Yerleşkesi lokalitesinde 3 domuz leşi (*Sus scrofa* L.) ve 2 büyükbaş hayvan iç organ takımı (akciğer, karaciğer, kalp ve böbrek) üzerinde Coleoptera takımının Dermestidae, Histeridae, Silphidae, Staphylinidae, Cleridae, Nitidulidae ve Scarabaeidae familyalarına ait 11 tür ve 3 cins teşhis edildi ve kaydedildi.

**Anahtar Kelimeler:** Adli entomoloji, Coleoptera, leş, çürüme, süksesyon, Edirne, Türkiye.

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### **1. Introduction**

Entomology is the study of insects while forensic is the application of medical knowledge in legal uses [1]. The field of forensic entomology has been divided into three areas: medicocriminal entomology (also referred to as medicolegal entomology), urban entomology and stored product entomology. Information gained from forensic entomology typically is used to determine time of death, place of death and other issues of medical or legal importance [2].

The basic reason for using insects in criminal investigations, a science denominated as forensic entomology, resides in the fact that insects are the first ones to detect and to find a cadaver and are present in all stages of decomposition and, furthermore, some species are specific for certain areas and seasons. Another important point to be considered is that oviposition can occur minutes after death [3].

The decomposition of a dead body starts firstly through the action of microorganisms such as fungi and bacteria, followed by the action of a series of arthropods, with the predominance of the sarcosaprophagous insects [4]. After death, the body undergoes natural changes, going through different stages of decomposition that are attractive to necrophagous insects [5]. Bornemissza [6] and

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Payne [7] were described five decomposition stages as fresh, bloated, active decay, advanced decay and remains stages. According to Bornemissza [6] the decomposer community of a carcass goes through a process of ecological succession. The studies about determination of Coleoptera species which are important for forensic entomology are new in Turkey. The first study was performed by Özdemir and Sert [8] in Ankara, Turkey.

Pigs, *Sus scrofa* are omnivorous, have similar gut fauna, are relatively hairless and have skin that is very similar to that of humans [9]. The putrefaction of pigs proceeds approximately at the same rate as for human bodies that are of the same torso weight [10].

Two major groups of insects are predictably attracted to cadavers and provide the majority of information in forensic investigation; the flies and the beetles (Coleoptera) [11]. In this study, it was purposed to observe important data for forensic entomology by determining Coleoptera succession and stages of decomposition using pig carcass and internal organs of bovine in Edirne city of Turkey.

## 2. Materials and Methods

The present study was conducted in Balkan Campus of Trakya University in Edirne, western Turkey. The region which was selected for this study is located approximately between 41°38'43" N, 26°37'20" E and is about 62 m above sea level. The front site of this area is open and the back site is undergrowth field. The undergrowth field prevented to exposition of sunlight until 1 p.m. Most of the tree species in this region are *Ulmus minor* Mill., *Salix alba* L. and *Populus canadensis* Moench.

This study was carried out between 20.05.2008 - 13.08.2008 and 02.02.2009 – 20.05.2009. Carcasses of 3 *Sus scrofa* L. and 2 internal organs of bovine were used as animal models for this study. The study was separated into 5 sections. Internal organs of bovine were used for first and third sections of study. Carcasses of domestic pigs were used for second (75 kg in weight), fourth (68 kg in weight) and fifth (72 kg in weight) sections of study. The first, second, third and fourth sections were carried out in summer and the last section was carried out in a part of winter and spring.

Each material was placed inside a metallic cage (100x100x100 cm) which allows the materials contact with the ground while also preventing the carcasses from being eaten by other scavengers. The materials were sampled three times a day, morning, afternoon and noon. Adult members of Coleoptera species were collected by using a hand pincers and preserved in bottles with ethyl acetate. After the collected specimens taken out from bottle with ethyl acetate, leaved to dry up and were pinned. All the Coleoptera specimens were deposited in Zoological Museum of Department of Biology of Trakya University.

The Coleoptera species were identified according to Lohse [12], Bousquet [13], Choate [14], Hava [15], Madge [16] and Özdemir and Sert [8]. The controls of identifications were carried out by Özdemir and Sert.

## 3. Results and Discussions

The Coleoptera species which were collected during the decomposition of materials belonged to 7 families; Staphylinidae, Silphidae, Histeridae, Cleridae, Dermestidae, Nitidulidae and Scarabaeidae. The determined species in this study are given on Table 1.

In this study, decomposition of materials was determined by five stages as fresh, bloated, active decay, advanced decay and dry. The fresh stage was about 1 day, bloated stage was 2 days, active decay stage was 4 days, advanced decay stage was 6 days in summer while they were 10, 15, 32 and 33 days in winter, respectively. The dry stages were started after the advanced decay stages were finished. The end of dry stage wasn't determined because of the bone and tissue remains. Differently to this study, Özdemir and Sert (2009) were reported that bloated stage was 2,5 days, active decay stage was 6 days and advanced decay stage was 11 days in summer in Ankara, Turkey. These differences on periods of decomposition stages should be associated with different geographic and climatic conditions.

**Table 1.** Coleoptera species which are determined in this study (Edirne, 2009)

Family	Subfamily	Genus	Species
Staphylinidae	Staphylininae	<i>Creophilus</i>	<i>Creophilus maxillosus</i> (Linnaeus, 1758)
		<i>Ontholestes</i>	<i>Ontholestes murinus</i> (Linnaeus, 1758)
		<i>Philonthus</i>	<i>Philonthus laminatus</i> (Creutzer, 1799)
		<i>Tasgius</i>	<i>Tasgius</i> sp. (Stephens, 1829)
Silphidae	Silphinae	<i>Silpha</i>	<i>Silpha obscura</i> (Linnaeus, 1758)
		<i>Thanatophilus</i>	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)
			<i>Thanatophilus rugosus</i> (Linnaeus, 1758)
Histeridae	Histerinae	<i>Margarinotus</i>	<i>Margarinotus (Ptomister) brunneus</i> (Fabricius, 1775)
	Saprininae	<i>Saprinus</i>	<i>Saprinus</i> sp. (Erichson, 1834)
Cleridae	Korynetinae	<i>Necrobia</i>	<i>Necrobia violacea</i> (Linnaeus, 1758)
Dermestidae	Dermestinae	<i>Dermestes</i>	<i>Dermestes frischii</i> (Kugelann, 1792)
Nitidulidae	Nitidulinae	<i>Nitidula</i>	<i>Nitidula flavomaculata</i> (Rossi, 1790)
Scarabaeidae	Scarabaeinae	<i>Onthophagus</i>	<i>Onthophagus coenobite</i> (Herbest, 1783)
	Aphodiinae	<i>Aphodius</i>	<i>Aphodius</i> sp. (Illiger, 1798)

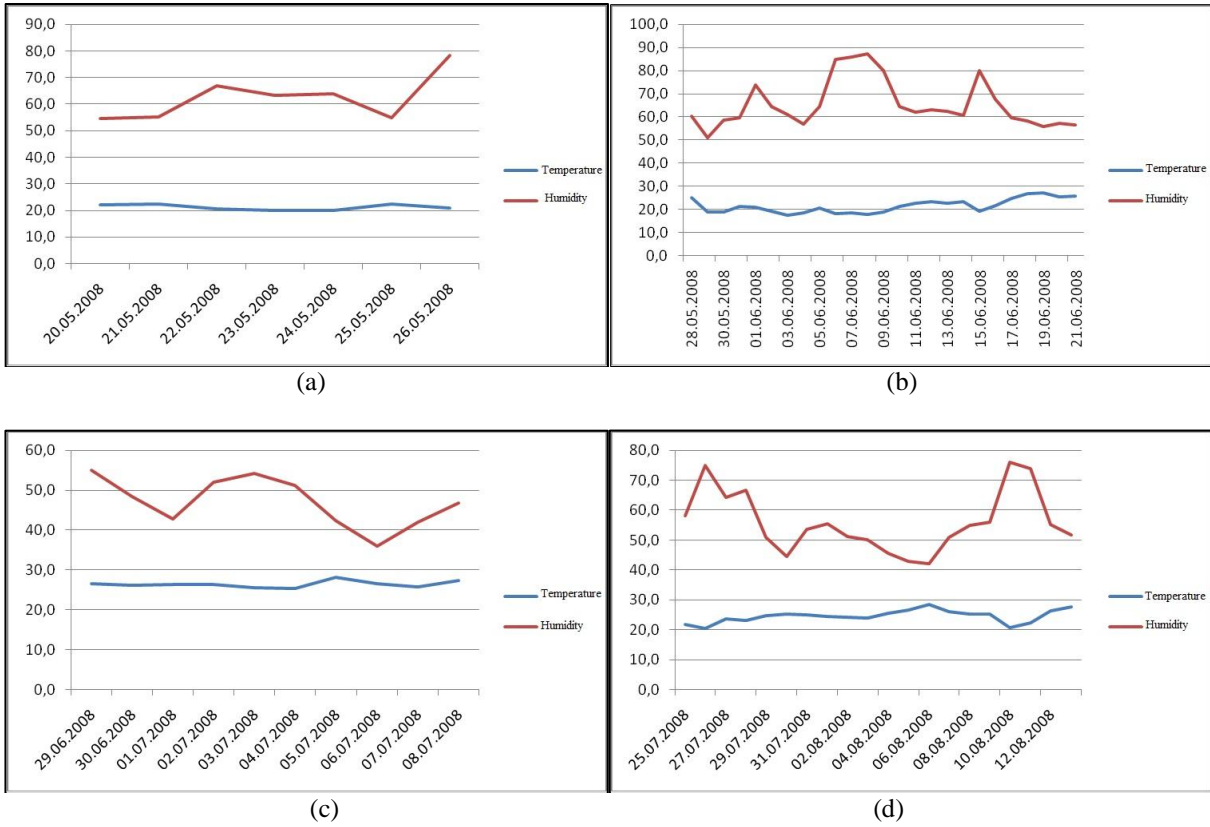
The Coleoptera species were absent in fresh and bloated stages in this study. Silphidae species were seen active decay stage; Staphylinidae, Scarabaeidae, Nitidulidae and Histeridae species were found active and advanced decay stages. However, Cleridae and Dermestidae species were seen advanced decay and dry stages of decomposition. In contrast to this study, Özdemiş and Sert [17] were not observed Scarabaeidae and Nitidulidae species on active and advanced decay stages and also Cleridae and Dermestidae species on advanced decay and dry stages. Each stage is attractive to different species and each stage of decay provides an ideal habitat for certain species to lay eggs and feed. This results in a succession of insect species [7, 18]. Each geographical region is characterized by its season, temperature, humidity, habitat, vegetation, soil type and environmental conditions [18, 19]. These parameters affect the arrival and colonization of insects to carrion.

Temperature and Humidity in order to evaluate the effect on insect development and decomposition; Directorate of Meteorology Station at the Edirne field studies, giving rise to Edirne encounters per day Temperature - Humidity Graphs provided in Figure 1(a-d) and Figure 2 (a-d).

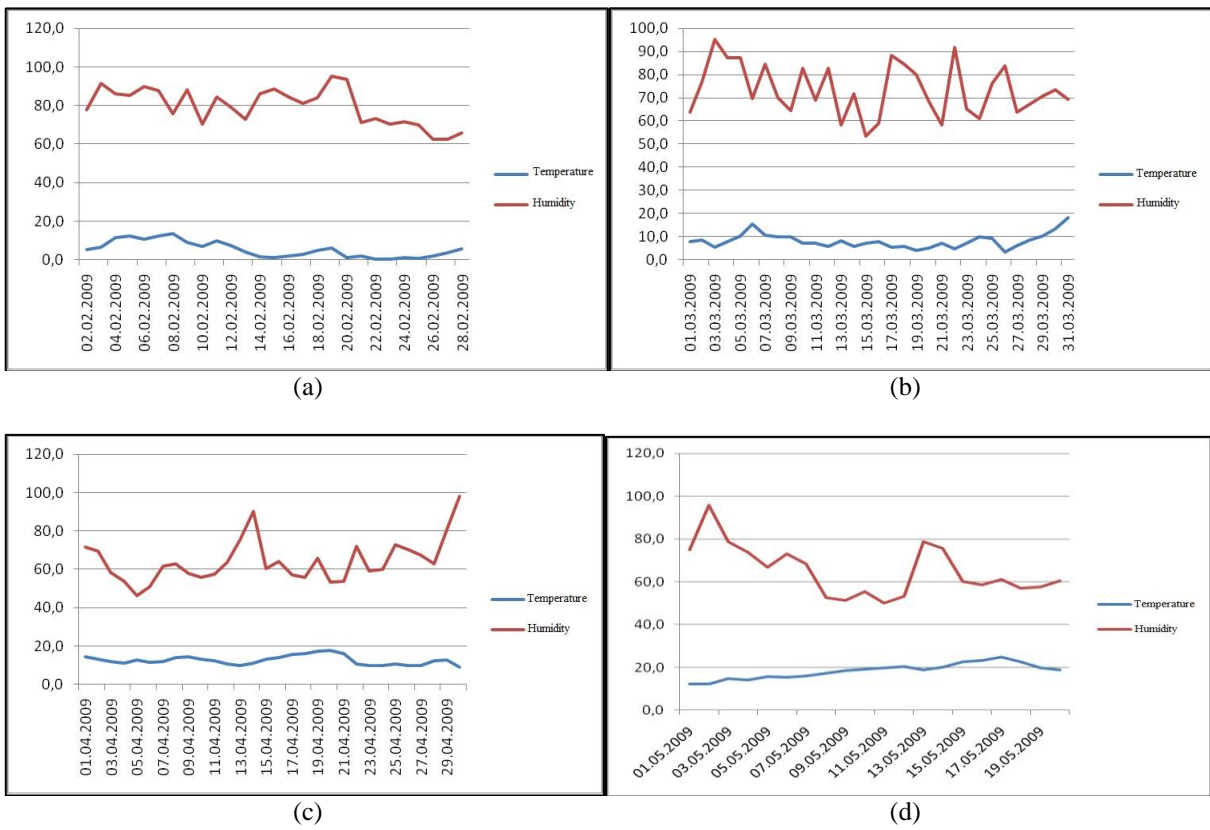
Temperature and humidity heavily influence insect activity and rates of oviposition and development [3, 20, 21]. Therefore, decomposition rate principally depends on climatic conditions such as temperature and humidity. High temperatures increase the insect activity and decomposition rate while low temperatures decrease them. It was determined that decomposition rate was fast and carcass was dried up in a short period in summer whereas these periods was longer than summer in winter because of temperature and humidity differences. It was also observed that temperature and humidity changes effect on decomposition rate. However, it was found out that long decomposition period didn't alter Coleoptera fauna on carcass.

When pig carcasses and internal organs of bovine were compared, it was observed that variety of species and number of members differed. The members of Coleoptera that visiting pig carcass were more than internal organs of bovine because of the abundance of food sources in pig carcass. The members of 7 families of order Coleoptera were observed on pig carcasses while the members of 5 families of order Coleoptera were observed on internal organs of bovine. The members of Scarabaeidae and Nitidulidae families were not visit the carrion of internal organs of bovine. Because only a few species of Nitidulidae feed on fresh or dry carrion and the members of Scarabaeidae family especially feed on gut contents. Therefore, species of both families were not observed on internal organs of bovine because of the absence of convenient food source.

It is necessary to establish Coleoptera fauna as well as Diptera fauna and seasonal distribution of them for illumination of forensic events in Edirne and providing justice in our region. For this aim, this study provides information on forensic entomology using pig carcass and internal organs of bovine for the first time in Edirne, Turkey. Further investigations should be carried out on different locations and distribution of Coleoptera fauna in region should be determined to make entomological the datum utilizable in forensic events.



**Figure 1.** Temperature and Humidity Graphic: (a) Section 1, (b) Section 2, (c) Section 3, (d) Section 4.



**Figure 2(a-d).** Temperature and Humidity Graphic of Section 5

## Acknowledgements

This study is a master's thesis accepted on 20.01.2010 by the Trakya University Institute of Science and supported by TÜBAP 2009 / 42 numbered Project.

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