

Seasonality of Insect Succession on Decomposing Dog (*Canis Lupus Familiaris* L.) Carcass in Samsun, Turkey: Their Importance in Forensic Science

Samsun Türkiye’de, Çürümekte Olan Köpek (*Canis Lupus Familiaris* L.) Leşi Üzerinde Mevsimsel Böcek Suksesyonu, Adli Bilimlerdeki Önemi

Research Article

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ABSTRACT

The study was conducted at Samsun between June 2009 and June 2010. In this study ten species of Coleoptera and nine species of Diptera were observed during one year. Insect fauna and its seasonal differences associated with corpse decomposition in Samsun (Atakum region) were reported for the first time in this study. The data composed from this research are available for forensic investigations in North of Turkey.

Key Words

Forensic entomology, insect succession, Samsun, dog carcass

ÖZET

Çalışma haziran 2009-haziran 2010 arasında Samsunda yapılmıştır. Bu çalışmada bir yıl boyunca 10 Coleoptera, 9 Diptera takımına ait türler gözlemlenmiştir. Samsunda (Atakum bölgesinde) çürümüş cesette böcek faunası ve mevsimsel farklılıkları bu çalışmayla ilk kez rapor edilmiştir. Bu araştırmadan elde edilen veriler Türkiyenin kuzey bölgelerinde adli araştırmalarında kullanılabilir olacaktır.

Anahtar Kelimeler

Adli entomoloji, böcek süksesyonu, Samsun, köpek karkası

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INTRODUCTION

Forensic entomology is the study of insects with bodies for legal investigations purposes [1]. After death, insect colonize the carrion in a predictable sequence [2,3,4,]. Season, temperature, humidity, geographic location and type of habitat affect insect succession and the decomposition of carrion [3,4,5]. Insects have been categorized respecting to their role in decomposition of carrion [1,6]. Knowledge of insect succession is helpful for estimating postmortem interval (PMI) [7-12], determining manner, cause of death, place of death, post-mortem transfer [13-15], toxicological investigations [13-19] and estimating period of neglect in the elderly or children [13,14,20,21]. Investigation on ecological succession are the basis of forensic entomological study and varies with habitat therefore study of insects on carrion have been conducted in several regions of the world [22]. The objective of this study was to determine of forensically important insect fauna and seasonal differences of insect activity on dog carcass in Samsun (Atakum region) during four seasons.

MATERIAL AND METHODS

Study site

The study was conducted during 2009 in a rural area (Atakum) of Samsun (41°15' N, 36°19' E) at an altitude of 30.35 m above sea level. In its native form, this region is characterized by broad-leaved herbs, mixed grasses, and deciduous shrubs. Two dogs (*Canis lupus familiaris* L.) were used in each of the four experiments, weighing between 20 and 35 kg (mean \pm 25.5 kg). were employed as models to study arthropod succession. All dogs were left to decompose naturally.

Sampling and identification

Samples were taken daily (between 12.00 and 14.00 h) in autumn and summer, three times a week in winter and spring. Larvae and pupae were collected from the carcasses using hand, forceps. Samples of larvae were divided in two where half were killed in hot water and preserved in 70% ethanol (egg samples were directly preserved in 70% ethanol). The remaining specimens were reared to adulthood for identification. Larvae were placed on a small

piece of raw chicken liver (approximately 10 g) and then a 3 cm layer of vermiculite was added to 200 ml clear plastic containers. Containers were held at room temperature (i.e., 22-24 °C) with a light: dark regime of 12:12 hours. Pieces of furnished with small holes for air circulation, were used to cover containers.. Adult flies and larvae were identified using the following keys [23-33].

RESULTS AND DISCUSSION

Temperature data

During the working periods, average air temperature and relative humidity were recorded. Environmental data were gathered at the local weather station. For the duration of the summer experiment (from June to September) the minimum mean ambient temperature was 18.9°C, and the maximum mean temperature was 27.1°C In winter the minimum mean ambient temperature was 0.8°C and the maximum mean temperature was 18°C. Environmental temperature was lower during winter experiment. The highest air temperature was 27.1°C in summer, 25.6°C in autumn, 20.0°C in winter and 21.7°C in spring.

Decomposition of carcasses

Insects played a important role in the process of decomposition. Four experimental periods were selected for the study; July 18 2009 and July 15 2010. Five phases of decomposition were observed during the study; fresh, bloated, active decay, advanced decay and dry (Figure 1) and each stage was observed in the physical process of decomposition. In seasonal differences in the duration of decomposition was observed (Figure 1). In summer, carcasses decomposed quickly. Carrion took 23 days from fresh to dry decomposition whereas during winter seasons decaying of carcass was slowly and 83 days were needed for carrion to reach the dry stage (Figure 1).

Insect Succession

In study site, eleven species of Coleoptera and nine species of Diptera were identified in all seasons (Table 1). Seasonal differences in insect succession were observed insect succession occurred in a predictable sequence; the Diptera were the first to

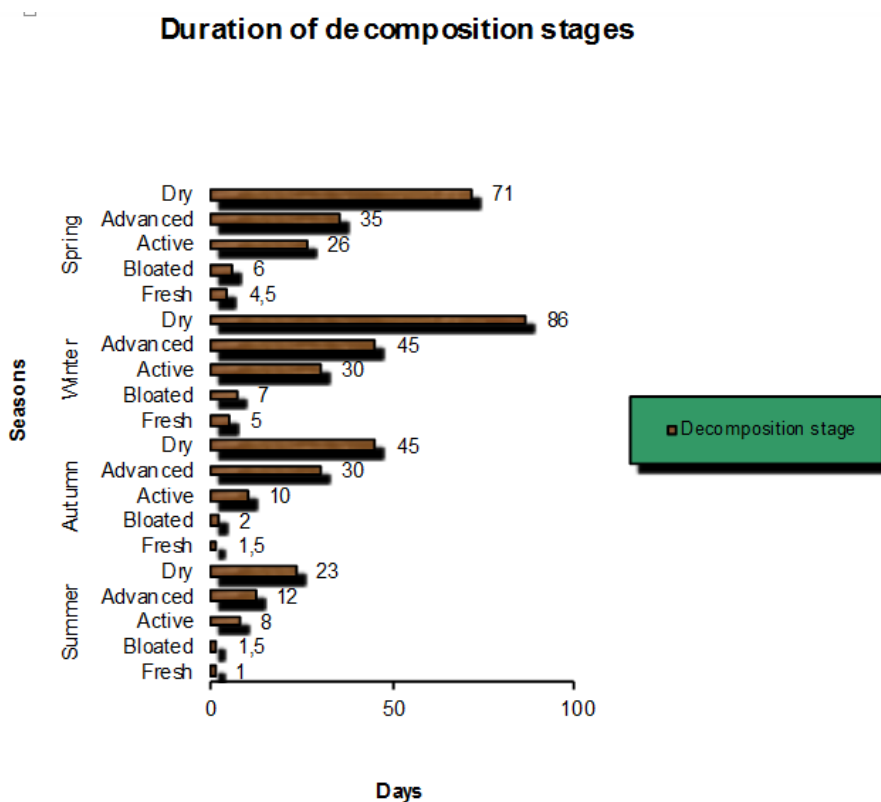


Figure 1. Decomposition stage with duration in season.

colonize the carrion and the Coleoptera appeared later. The observed pattern of insect succession is very similar to those described by Anderson et al. [34], Wolff et al. [35], Martinez et al. [36]; Okiwelu et al. [37], Velásquez [38], Tullis and Goff, [39]. This result is different from that recorded by Braack [40]. This author obtains Coleoptera (Histeridae) at the first stage of decomposition during his research.

The succession patterns for the four seasons were shown in Table 1. Within the Diptera, Calliphoridae played a major role in decomposition of carrion and were collected from fresh stage to end of advanced decay stage, other researchers have found similar results Tullis and Goff, 1987; Anderson and VanLaerhoven [34], Wolff et al. [35], Okiwelu et al., [37] Velásquez, [38], Ortloff [41].

Four species of Calliphorids (Table 1) were recorded on the carcasses. Calliphoridae were the first colonizers of all carcasses. *Chrysomya albiceps* was the most common calliphorid species in all three seasons, specially in the summer, followed by autumn and spring, and were completely absent

during winter. *Chrysomya albiceps* was observed along the fresh, bloated, active and advanced decay stages of the carcass (Table 1). In spring seasons, it was collected only during the advanced decay stage. This finding is parallel to the findings of the study that was carried out by Horestein [42], Tantawi et al [43] Şabanoğlu and Sert [44]. *Sarcophaga argyrostoma* and *Lucilla sericata* were collected from the bloated stage to dry stage during summer experiment (Table 1). This two species were observed only summer season in Atakum region.

This species recorded on the carcasses during the first days, together with calliphorids Our findings agree with that reported by Shi. et al [5], Parado et al. [45], Tantawi et al. [43] recorded a great abundance of sarcophagids in spring and fall with a subsequent decrease in the summer which was opposite to this study.

There was no capture of species of Diptera at dry stages (Table 1). Other two calliphorids *Calliphora vicina* and *Calliphora vomitoria* were the first species attracted to and collected from carcasses. These two

Table 1. Insects of forensic importance species collected on carcasses in Samsun (Atakum region).

Order	Family	Species
Diptera	Calliphoridae	Chrysomya albiceps (Wiedemann, 1819)
		Lucilia sericata (Meigen, 1826)
		Calliphora vomitoria (Linnaeus, 1758)
		Calliphora vicina Robineau-Desvoidy, 1830
	Fanniidae	Fannia canicularis (Linnaeus, 1761)
		Fannia scalaris (Fabricius, 1794)
		Fannia manicata (Meigen, 1826)
Hellomyzidae	Hellomyzidae ssp.	
Sarcophagidae	Sarcophaga argyrostoma (Robineau-Desvoidy, 1830)	
Coleoptera	Staphylinidae	Creophilus maxillosus (Linnaeus, 1758)
		Ontholestes murinus (Linnaeus, 1758)
	Silphidae	Necrodes littoralis (Linné, 1758)
		Thanatophilus rugosus (Linnaeus, 1758)
	Histeridae	Saprinus subnitescens Bickhardt, 1909
		Margarinotus burunnes (Fabricius, 1775)
	Dermestidae	Dermeste frischii (Kugelann, 1792)
		Dermestes undulatus (Brahm, 1790)
		Dermestes maculatus (DeGeer, 1774)
	Cleridae	Necrobia rufipes (De Geer, 1775)
Necrobia violacea (Linnaeus, 1758)		

species have preference for lower temperatures, disappearing during the summer and reappearing in spring and autumn in very low percentages (Table 1). This finding is parallel to the findings of the study that was carried out by Tantawi et al. [43], Şabanoğlu and Sert [44], Horestein et al. [42].

Other two Diptera families; three species of Fanniidae and one species of Hellomyzidae were collected in winter seasons. *Fannia scalaris*, *Fannia manicata*, *Fannia canicularis* and *Hellomyzidae ssp.* appeared on the carcasses during the active decay stage (Table 1).

A eleven species of Coleopteran belonging to the Staphylinidae, Cleridae Dermestidae, Silphidae and Histeridae, families were observed throughout the study. More Coleopterans continued to be arrive on the carrion from active decay stage to the end phases of the dry. Only three species, respectively *Necrodes littoralis* (in autumn), *Necrobia rufipes* and *Necrobia violaceae* (in summer) were collected along advanced decay and dry decay stage. This findings consistent with Wolff et. al. [35], Özdemir and Sert [46]. No Coleopteran was observed on winter

seasons (Table 1).

Among Coleoptera, Staphylinidis were the first attracted group, followed by dermesids, histerids, clerids and silphids. Species of Dermestidae have the most number of species on carcasses, *Dermestes frischii*, *Dermestes undulatus* and *Dermestes maculatus*. *Dermestes frischii* and *Dermestes undulatus* were recorded during summer and autumn and continued to be found spring. *Dermestes maculatus* was found only during summer (Table 1). The most abundant family during summer, autumn and spring was the Staphylinidae Two species of Staphylinidae were recorded (*Creophilus maxillosus* and *Ontholes murinus*). *Creophilus maxillosus* were observed in three seasons. *Ontholes murinus* were recorded only during autumn seasons. Of the Cleridae family, *Necrobia rufipes* and *Necrobia violacea* were found in three seasons along active decomposition advanced and dry stage. In summer they arrived during advanced decomposition and dry stage. Two species of Silphidae were recorded, *Necrodes littoralis* was found in autumn during advanced decomposition and dry. stages. *Thanatophilus rugosus* was recorded in spring during active, advanced decay and dry stages (Table 1). This

findings consistent with Wolff [35], Özdemir and Sert [46]. Of the Histeridae family, *Margarinotus brunneus* was found mainly during active advanced decomposition and dry stage in at three seasons (Table 1).

CONCLUSIONS

This preliminary study provides information on forensic entomology using dog carcass for the first time in Turkey during one year period.. Regional faunistic studies of the arthropod community are newly developing fields in Turkey and need more attention of scientists in the future.

This kinds of studies will use determine baseline forensic entomological information for Turkey, on colonization and succession and data acquired from the study can be employed in forensic investigation in Samsun and other similar biogeoclimatic regions.

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