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Research Article

Identification of dipteran species of forensic entomology importance in summer season in Edirne

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Abstract

This study, performed in order to determine the dipteran species of forensic entomology importance at high temperatures, was carried out from 20 May to 12 September, 2008, and the obtained data belongs to Callihoridae and Sarcophagidae families including the important insect species of Diptera. Pig carrions and bovine viscera were put in iron cages in Balkan Campus of Trakya University to monitor and identify the dipteran species attracted. Observations and sampling were performed twice a day, one in the morning and one in the afternoon. Collected specimens were identified and *Calliphora vicina*, *C. vomitoria, Chrysomya albiceps, Lucilia coeruleiviridis, L. cuprina, L. sericata* and *Pollenia angustigena* from Calliphoridae and *Sarcophaga africa* from Sarcophagidae were determined. *L. coeruleiviridis, L. cuprina* and *P. angustigena* are first records for Turkish Diptera fauna.

Keywords: Carcass, diptera, Edirne, forensic entomology, new records, Turkey

1. Introduction

When a death human body is found, the main questions are how, when and where the death occurred. Forensic entomology tries to estimate the place of death and the post-mortern interval (PMI) considering development durations of insects attracted to the body, their behavioral models and home ranges. The major insects benefited from in forensic entomology are members of Sarcophagidae, and particularly Calliphoridae of the Diptera. The importance of use of dipterans in forensic cases depends on the correct identification of specimens. Also, existing data of drugs and poisonous or other chemical substances found in the body or in the scene would be supportive. Entomologic evidences, when compared to other methods such as autopsy results and police reports, are the most trustful scientific tools in terms of statistical methods in determination of post-mortern interval (Carvalho et al. 2004).

Regional distributional studies on members of Calliphoridae and Sarcophagidae, which are the most important groups in forensic entomology, were performed in north America (Petrik et al. 2004), in the central America and south America (Catts & Goff 1992), in Europe (Rognes 1991), in Africa (Kurahashi & Kirk-Spriggs 2006) and Australia (Norris 1994).

Members of dipteran families Calliphoridae and Sarcophagidae are the first occupants of a death body and are commonly used by forensic entomologists to estimate PMI. Experimental studies showed that these dipterans are attracted to the carrion in the first minutes (Watson & Carlton 2003). Larval size and stages are the most important elements used to identify the flight time of the fly (Gruner et al. 2007). Calliphoridae and Sarcophagidae larvae give the highest amount of destruction to the carrion during the early stages of decaying so that PMI of a death occurred two or three weeks can be estimated with a small error, as long as the ambient temperature is properly known (Putman 1978; Meyer 2007). Calliphoridae members were determined to fly long distances to find a food source. Studies in South Africa showed that flies were attracted by the carrion from far away. These flies are considered as reliable organisms in determination of death time since they are the first to arrive the carrion.

Forensic entomology is a recently developing field of study in Turkey. The very few studies so far belong to Açıkgöz et al. (2002), Özdemir (2007) and Şabanoğlu (2007) in Ankara, Karapazarlıoğlu (2004) in Samsun and Yüksel (2006) in İstanbul. The distributional patterns of forensically important dipterans in Turkey are partly known. This study was performed to determine the Diptera species in Balkan Campus of Trakya University in Edirne that could be considered important in terms of forensic entomology.

2. Material and Methods

The studies dealing with insects, which are important in forensic entomology, were performed mainly using animal subjects. Various carrions of different sizes have been used worldwide in decaying studies. Examples include from alligators (Watson & Carlton 2003) and bears to pigs (Tenorio et al. 2003; Watson & Carlton 2003) and sheeps (Deonier 1940). Despite the diversity of organism groups, one of the pig species (*Sus scrofa domestica*) (Linnaeus 1758) are the most preferred animals in such studies since this species is omnivorous, have an intestinal fauna similar to those of humans and have a skin with relatively less hair covering as in humans (Anderson & Van Laerhoven 1996). Depending on this last structural similarity, the time needed for decaying of a pig body is approximately the same needed for a human body (Campobasso et al. 2001).

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In the present study, *S. scrofa domestica* carrion and bovine viscera were used to determine Diptera members to be attracted. The study area was located in Balkan Campus Arboretum of Trakya University. The point where the material placed in a cage was selected in front of a bush mass. The trees of this mass were *Ulmus minor* Mill., *Salix alba* L. and *Populus x canadensis* Moench. and the front side of the cage was covered with crabgrass.

Samplings were performed during the hot period from 20 May to 12 September, 2008. During this period, 2 bovine viscera and 3 female pig carrions were used. Weather temperature and humidity were measured twice a day by visiting the study site between 09:00-11:00 am. and 15:30-19:00 pm (Figure 1).

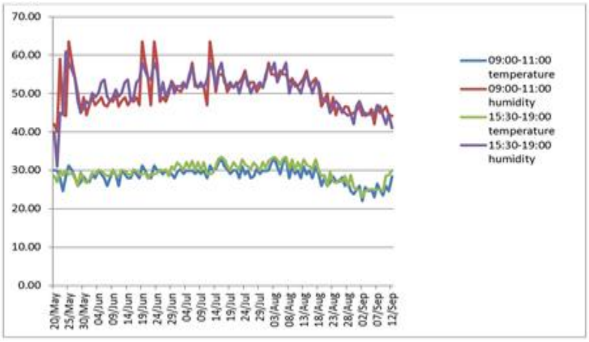

Figure 1. Temperature and humidity values recorded in the study site during the study period

Adult specimens on the material were obtained using a sweeping net and kept in 70% ethyl alcohol in tubes. Eggs, larvae and pupae of flies were taken with the help of a forceps. Some of these embryonic stages were put in 70% ethyl alcohol containing tubes and some were place in petri plates in order to make laboratory observations to determine development durations. Identifications were performed according to Greenberg & Kunich (2002) and Cutter (2002).

3. Results and Discussion

In the present study, *Calliphora vicina* and *C. vomitoria* within Calliphorinae, *Chrysomya albiceps* within Chrysomyinae, *Lucilia coeruleiviridis*, *L. cuprina* and *L. sericata* within Luciliinae, *Pollenia angustigena* within Polleniinae of Calliphoridae and *Sarcophaga africa* within Sarcophaginae of Sarcophagidae were determined. The most dominant taxa among these species were *L. sericata* and *L. cuprina*.

L. coeruleiviridis, *L. cuprina* and *P. angustigena* are not only new for Turkey fauna but also were recorded for the first time in Turkey with this study.

The finding that Calliphoridae species were the first to lay their eggs on the carrion within the first minutes of exposure are in accordance with results obtained by Byrd & Castner (2001) and Watson & Carlton (2003).

During the study period from May to September 2008, *Ch. albiceps* and *L. coeruleiviridis* were observed until mid-June, *C. vicina* until late June, *P. angustigena* and *S. africa* until the first week of July and *C. vomitoria* until August whilst *L. cuprina* and *L. sericata* were observed during the whole study period (Figure 2).

Although Cragg (1956) reported that *L. sericata* did not lay eggs below 30°C at field conditions, in our study, most of the eggs laid in May and June, when the weather temperature was below 30°C, were found to be those of *L. sericata*. Similarly, Greenberg & Kunich (2002) reported *C. vicina* as a low thermo-tolerant species stopping its development above 27°C, but adults of this species were obtained in laboratory rearings at 28°C and in May and June when the temperature was around 30°C. However, no *C. vicina* specimen was obtained in July and August when the temperature exceeded 30°C (Figure 3).

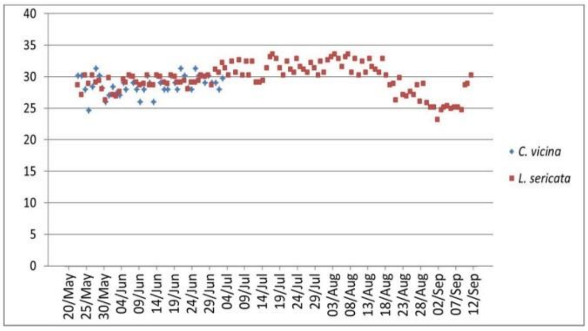

Figure 3. Egg laying by *L. sericata* and *C. vicina* with respect to weather temperature

Minimum and maximum durations of adult emergence in laboratory conditions (28°C temperature and 50% humidity) were found as 17-20 days for *C. vicina*, 16-19 days for *C. vomitoria*, 9-11 days for *Ch. albiceps*, 10-15 days for *L. coeruleiviridis*, 10-14 days for *L. cuprina*, 9-13 days for *L. sericata*, 10-13 days for *P. angustigena* and 16-23 days for *S. africa* (Table 1). Greenberg & Kunich (2002) reported that *C. vicina* needed 15-29 days to complete its metamorphosis from egg to adult at 25°C temperature and 60% humidity.

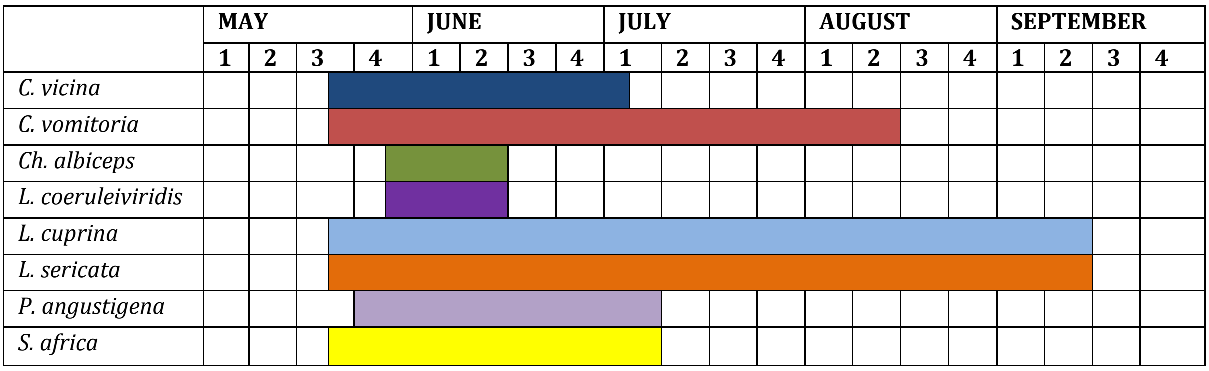

Figure 2. Distribution of species with respect to study months (20 May - 12 September, 2008)

Table 1. The metamorphosis time from egg to adult (28°C temperature and 50% humidity)

Families	Subfamilies	Species	Egg stage *		Larval stage *		Pupal stage **	
			Min.	Max.	Min.	Max.	Min.	Max.
Calliphoridae	Calliphorinae	*C. vicina*	20	22	100	120	12	14
		C. vomitoria	20	21	100	110	11	13
	Chrysomyinae	*Ch. albiceps*	8	10	90	100	5	6
	Luciliinae	*L. coeruloviridis*	8	11	90	105	6	10
		L. cuprina	8	11	90	100	6	9
		L. sericata	8	11	80	110	5	8
	Polleniinae	*P. angustigena*	10	12	80	100	6	8
Sarcophagidae	Sarcophaginae	*S. africa*	10	16	110	170	11	15

*: hour, **: day

We found that this period ranged for this species from 17 to 20 days in our laboratory conditions of 28 °C temperature and 50% humidity. This result shows that the main factor effecting life cycles of dipteran species is weather temperature. An increased temperature leads eggs to open quickly and fastens larval metabolism which in turn shortens the duration of the whole life cycle.

Greenberg (1990) and Goff (2001) reported that members of Calliphoriinae and Luciliinae were night active species and could lay their eggs during night, but in low numbers. However, no egg was observed in our early morning investigations on the material left in the study site in night, in accordance with results of Byrd & Butler (1997) and Haskell et al. (1997). Daytime investigations in mornings and afternoons revealed that the hours from midday to evening were the times when eggs were laid in dense amounts. The fact that egg laying in the hottest months (July and August) and in afternoons when increased temperatures were recorded was performed by *L. sericata* and *L. cuprina* indicates that these two species are comparatively more tolerant to increased temperature values.

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References

Açıkgöz HN, Hancı İH, Çetin G (2002). Adli Olaylarda Böceklerden Nasıl Yararlanırız. AÜ Hukuk Fak Derg 51, 117-125.

Anderson GS, Van Laerhoven SL (1996). Initial studies on insect succession on carrion in southwestern British Columbia. J Forensic Sci 41, 617-625.

Byrd JH, Castner JL (2001). Forensic Entomology: The utility of arthropods in legal investigation. New York: CRC Press, 418 pp.

Byrd JH, Butler JF (1997). Effects of temperature on *Chrysomya rufifacies* (Diptera: Calliphoridae) development. J Med Entomol 34, 353-357.

Campobasso CP, Di Vella G, Introna F (2001). Factors affecting decomposition and Diptera colonization. Forensic Sci Int J 120, 18-27.

Carvalho LML, Thyssen PJ, Goff ML, Linhares AX (2004). Observation on the succession patterns of necrophagous insects on pig carcass in an urban area of Southern Brazil. Aggrawal's Internet J Forensic Med Toxicol 5, 33-39.

Catts EP, Goff ML (1992). Forensic entomology in criminal investigations. Annu Rev Entomol 37, 253-272.

Cragg JB (1956). The olfactory behavior of Lucilia species (Diptera) under natural conditions. Ann Appl Biol 44, 467-477.

Cutter RM (2002). Identification Key to the Common Forensically Important Adult Flies (Diptera) of Northern Kentucky, (http://www.nku.edu/~dahlem/ForensicFlyKey/Homepage.htm.)

Deonier CC (1940). Carcass temperatures and their relation to winter blowfly populations and activity in the southwest. J Econ Entomol 33, 166-170.

Goff ML (2001). A Fly for the Prosecution: How Insect Evidence Helps Solve Crime. Cambridge: Harvard University Press. Boston, 240 pp.

Greenberg B (1990). Nocturnal oviposition behavior of blow flies (Diptera: Calliphoridae). J Med Entomol 27, 807-810.

Greenberg B, Kunich JC (2002). Entomology and the Law: Flies as Forensic Indicators. Cambridge University Press; 1st edition (October 2002), 356 pp.

Gruner SV, Slone DH, Capinera JL (2007). Forensically important Calliphoridae (Diptera) associated with pig carrion in rural north-central Florida. Journal of Medical Entomology 44(3), 509-515.

Haskell NH, Hall RD, Cervenka VJ, Clark MA (1997). On the body: insect's life stage presence and their postmortem artifacts. In WD Haglund, MH Sorg [eds.], Forensic Taphonomy. CRC Press, Boca Raton, 415-448 pp.

Karapazarlıoğlu E (2004). Doğal ortamda domuz karkasları üzerine gelen arthropoda'ların ve süksesyonlarının belirlenmesi. Institute of Natural Sciences, Master thesis, 19 Mayıs University, 48s.

Kurahashi HI, Kirk-Spriggs AH (2006). The Calliphoridae of Namibia (Diptera: Oestroidea). Zootaxa 1322, 131 pp.

Meyer JR (2007). Forensic Entomology. Department of North Carolina University (http://www.webring.org/cgi-bin/webring?ring=Forent;list)

Norris KR (1994). Three new species of Australian 'golden blowflies' (Diptera: Calliphoridae: Calliphora), with a key to described species. Invertebr Taxonomy 8, 1343-1366.

Özdemir S (2007). Ankara İli'nde (Merkez İlçe) Leş Üzerindeki Coleoptera Faunasının Belirlenmesi ve Morfolojilerinin Sistematik Yönden İncelenmesi, Institute of Natural Sciences, Master thesis, Hacettepe University, 199 s.

Petrik MS, Hobischak NR, Anderson GS (2004). Examination of factors surrounding human decomposition in freshwater: A review of body recoveries and coroner cases in British Columbia. J Can Soc Forensic Sci 37, 9-17.

Putman RJ (1978). The role of carrion frequenting arthropods in the decay process. Ecol Entomol 3, 133-139.

Rognes K (1991). Blowflies (Diptera, Calliphoridae) of Fennoscandia and Denmark. Fauna Entomologica Scandinavica 24, 1-272.

Şabanoğlu B (2007). Ankara İli'nde (Merkez İlçe) Leş Üzerindeki Calliphoridae (Diptera) Faunasının Belirlenmesi ve Morfolojilerinin Sistematik Yönden İncelenmesi, Institute of Natural Sciences, Master thesis, Hacettepe University, 134 s.

Tenorio FM, Olson JK, Coates CJ (2003). Decomposition studies, with a catalog and description of forensically important blow flies (Diptera: Calliphoridae) in central Texas. Southwestern Entomologists 28, 37-45.

Watson EJ, Carlton CE (2003). Spring succession of necrophilous insects on wildlife carcasses in Louisiana. J Med Entomol 4, 338-347.

Yüksel Y (2006). Adli Entomoloji Açısından İstanbul Çağlayan Bölgesinde Hayvan Karaciğer Dokusuna Gelen Böceklerin Fauna Tespiti, Institute of Forensic Sciences, Master thesis, Istanbul University, 94 s.