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Malpractices Concerning Collection of Forensic Entomological Evidence and Importance of Standardization in Turkey

Abstract

Every material in crime scene, which is considered as evidence, has to be examined by forensic authorities. This can contribute to solve cases and thus to justice. However, entomological evidence seems to be disregarded by some public prosecutors, crime scene investigators and forensic specialists. Disregard for entomological evidence and even simple, unimportant mistakes made during collection and transfer of specimens, identification of species and estimation of post-mortem interval may interact with each other and prevent one from reaching accurate results. The aim of this study was both to identify these lapses and emphasize appropriate precautions to prevent them. Entomological material collected from seventeen cases and their crime scene reports and photographs were examined. The entomological evidence could be seen easily on all of the cases, but mostly there were not any records of entomological evidence in their crime scene investigation (CSI) protocols. In our cases, the particular problem was measuring ambient temperatures. It can be recommended that judges, public prosecutors and lawyers, the most important forensic authorities, should be informed about disregard for entomological evidence and mistakes concerning their collection and transfer. This is the only way to enable entomological examination results to be accepted as evidence in courts.

Keywords: Forensic sciences; Forensic entomology; Insects; Malpractice; Standardization

Research Article

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Introduction

In forensic medicine, early and late post-mortem changes are used to determine the time of death. The former group of changes include lack of respiration and blood circulation, loss of muscle tone, a pale look of the face, lack of reflexes, loss of brightness in the eyes, looseness of the eye balls, cloudiness of the cornea, blood clotting and development of autolysis. Late post-mortem changes are post-mortem spots, rigor mortis [1], and loss of body fluids, decreased body temperature, putrefaction, saponification and mummification. Based on early post-mortem changes, the time of death can be expressed in hours. Putrefaction, a late post-mortem change accelerated by insects and varying with environmental temperatures and corpse conditions, may even start 24 hours after death. Based on conventional forensic methods, the time of death can be expressed in days or weeks during putrefaction. However, based on rates of growth of larvae, estimations of post-mortem intervals can be sufficiently clear to express in hours [2-4]. Forensic entomology is rarely referred to in Turkey. There have been experimental studies on estimations of the post-mortem interval and determination of the place of death based on entomological evidence, on detection of toxic substances likely to cause death based on examinations of larvae and on fauna of forensic insects as well as reviews about forensic entomology from Turkey. Developmental stages and successions of arthropods are used to determine the time of death or post-mortem interval (PMI) in forensic entomological practice [5].

The growth rate of larvae directly depends upon such environmental conditions as ambient temperature, body temperatures of larvae and heat sent out by larvae clusters. The most significant predictor for determination of PMI is that each species has a growth rate depending on their own body temperature [6,7]. Therefore, the most important variable employed when one works with entomological evidence to determine PMI is temperature [8,9]. In a crime scene where entomological evidence is available, data about activities of insects, ambient temperature, barometric pressure, humidity, rain fall per square meter, burial depth and presence of carnivore should be sent to the entomologist. The best methods for determination of PMI are the accumulated degree day (ADD) and the accumulated degree hours (ADH)and are based on measurements of temperature [10-13]. It is not possible for a forensic entomologist to determine PMI without data about temperature [14,15]. The study has several aims. The goals of the present study were both to identify lapses and malpractices concerning collection of entomological evidence, emphasize appropriate precautions to prevent them and to create a "Forensic Entomology Crime Scene Investigation Form" for Turkish crime scene investigators and forensic scientist.

Material and Methods

Entomological material collected from seventeen cases and their crime scene reports and photographs obtained between 2006 and 2012 were examined at Ankara Morgue Department, The Council of Forensic Medicine and Laboratory of Forensic Entomology/Forensic Biology, Institute of Forensic Sciences, Ankara University.

In the morgue

The corpses were photographed before autopsy. All available larvae were collected on the corpses. They were labelled appropriately and sent to the Institute of Forensic Sciences Laboratory of Forensic Entomology/Forensic Biology, Ankara University.

Identification and evaluation

Larval species were washed and dried gently. Each larva was measured and identified. Crime scene investigation reports and death examination reports were reviewed. Best practice forms created in Europe and in the United States were examined [16-18]. Anew practice form was specifically designed for Turkey taking into consideration working conditions of crime scene investigators teams in Turkey (Appendix 1). Data obtained from the cases were transferred to the forms and deficits of the form were determined and eliminated. A checklist for collection of entomological evidence was developed and data which have to be collected from each case were recorded in the form. Thus, missing data were identified.

Results

Entomological evidence could be seen easily in all of the cases in this study, but mostly there were not any records of entomological evidence and temperature in the crime scene investigation (CSI) protocol. In our cases the particular problem was collecting ambient temperatures. Data collected from the files examined were recorded in the checklist for collection of data and missing data detected are presented in Table 1. Table 1 is based on crime scene investigation reports and death examination reports. Data in the first seven columns are complete, but data in the eighth and ninth columns are incomplete. Entomological evidence was mentioned for 10 out of 17 cases and temperature was recorded for only one case, but it was incomplete.

Table 1: Checklist for collection of data.

Cases	Data about personal characteristics	Data about Position	Data about Clothing	Data about Decomposition	Data about Death Scenes	Data about Wounds	Data about Scavengers	Entomological Data	Data about Temperature
1	+	+	+	+	+	0	0	-	-
2	+	+	+	+	+	+	0	-	-
3	+	+	+	+	+	+	+	-	-
4	+	+	+	+	+	0	0	+	-
5	+	+	+	+	+	+	+	-	-
6	+	+	+	+	+	+	+	-	-
7	+	+	+	+	+	+	+	+	-
8	+	+	+	+	+	+	0	-	-
9	+	+	+	+	+	0	0	+	-
10	+	+	+	+	+	0	0	+	-
11	+	+	+	+	+	+	0	+	-
12	+	+	+	+	+	+	0	-	-
13	+	+	+	+	+	+	+	+	-
14	+	+	+	+	+	0	0	+	-
15	+	+	+	+	+	0	0	+	-
16	+	+	+	+	+	+	0	+	-
17	+	+	+	+	+	+	+	+	+ (incomplete)

As seen in Table 1 and Table 2, various mistakes regarding collection of entomological evidence from the17 cases and recording data obtained from crime scene investigations were found. Five hundred and thirteen larvae, three pupae and four adults were collected from the bodies. In Table 2, it is shown that for cases 4, 10 and 15 no report was established by crime scene investigators teams. Data about ambient temperature, air pressure, humidity and light intensity, used to determine PMI, were not obtained in 16 out of the remaining 17 cases. In only one case, ambient temperature was measured but incomplete. In addition, in the CSI form, entomological evidence was reported to be available in 3 out of these 17 cases, but presence of entomological evidence was not mentioned in 14 cases. As seen in Table 2, reports established during forensic medicine death examination of the entomological evidence was mentioned in 10 out of 17 cases, but was not mentioned in the remaining seven reports. Two corpses were found to be washed with water containing vinegar before autopsy and entomological evidence turned out to be removed. As a result, the larvae became black and useless for morphological identification.

Table 2: Data of Crime Scene Investigation Form.

Crime Scene Investigation Form (CSIF)			Death Examination Reports	Species Identified in the Laboratory	
Cases	**Temperature, Humidity, Air Pressure and Light Intensity**	**Entomological Evidence**	**Entomological Evidence**	**Species**	**Number**
1	Unknown	Unknown	Unknown	*Ch. megacephala*	47 L
				S. haemorrhoidalis	
2	Unknown	Unknown	Unknown	*Ca. vicina*	31 L
				Ca. vomitaria	
				P. terranovae	
				S. exuberans	
				S. tibialis	
				W. magnifica	
3	Unknown	Unknown	Unknown	*Ca. vicina*	19 L
				Ca. vomitaria	
				L. sericata	
				Ch. megacephala	
4	Exhumation (No CSIF)		Available but washed	Heleomyzidae	5 L
5	Unknown	Unknown	Unknown	*Ca. vicina*	40 L
				Ca. vomitaria	
				Ch. megacephala	
				S. exuberans	
				S. haemorrhoidalis	
				W. magnifica	
6	Unknown	Unknown	Unknown	*Ca. vicina*	34 L
7	Unknown	Unknown	Available	*Ca. vicina*	18 L
				S. exuberans	3:00 PM
				S. haemorrhoidalis	1:00 AM
				W. magnifica	
8	Unknown	Unknown	Unknown	*L. sericata*	27 L
				*Cochliomya*sp.	
9	Unknown	Available	Available	*Ca. vicina*	45 L
				L. sericata	
				S. exuberans	
10	No CSIF		Available	*Ca. vomitaria*	12 L
				S. haemorrhoidalis	
11	Unknown	Unknown	Available	*Ch. albiceps*	49 L
12	Unknown	Unknown	Unknown and washed	Coleoptera	4 L
13	Unknown	Unknown	Available	*Ch. albiceps*	59 L

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14	Unknown	Unknown	Available	*Ch. albiceps*	16 L
				M. domestica	
15	No CSIF		Available	*Ch. albiceps*	25 L
16	Unknown	Available	Available	*Ca. vicina*	64 L
				Ca. vomitaria	
				L. cuprina	
				L. sericata	
				Cochliomya sp.	
				Cynomya sp.	
				Chrysominae	
17	Available but incomplete	Available	Available	*Ca. vicina*	18 L
				Ca. vomitaria	3:00 AM
				Nicrophorushumator	

Discussion

The purpose of the present study was both to identify mistakes and malpractices concerning collection of entomological evidence and emphasize appropriate precautions to prevent them. For case 4, the absence of crime scene investigation report was due to exhumation, however, we believe that a report could have been prepared before. Determination of PMI is of great importance in terms of both individuals and the society. People whose relatives are deceased have the right to know when they passed away. Besides, determination of PMI is both a social and legal requirement including inheritance cases [2].

In estimation of PMI, the most important data for forensic entomologists are ambient temperature, air pressure, humidity and light intensity in addition to eggs, larvae, pupae and adult insects [9,19]. These data should be recorded in the crime scene investigation report. As demonstrated in Table 2, entomological evidence was recorded for only three out of 17 cases in which larvae were easily seen and data including any temperature and humidity were not mentioned at all, which can be considered serious malpractice. As presented in Table 2, entomological evidence was found to be supplied for only ten cases in death examination reports, which can be accepted as important malpractice as well. While fingerprints and biological fluids as evidence have gained acceptance, entomological data are not considered as evidence both in Turkey and in many other countries [9,20]. In fact, larvae are washed with vinegar or other agents and killed in morgue departments, some public prosecutors and armed forces disregard and do not collect this evidence [9,21-23]. To reduce these mistakes, we developed a new practice form (Appendix 1).Using "Forensic Entomology Crime Scene Investigation Form" a member of the team will supply reliable data. We can attribute this failure to collect complete data to the idea among forensic investigation teams that time to perform all measurements of temperature is considered as waste of time. Moreover, the appearance and the odour of crime scenes where entomological evidence is available seem to force the staff to finish their job quickly and leave the scene as fast as possible. Procedures used to kill and keep larvae collected are important for reliability of morphological identification. Larvae killed in 70% ethyl alcohol become black a few days after their death due to putrefaction and get shrunk, which cause morphological features of larvae to disappear and hinders making an accurate identification of insect species [24,25]. Therefore, CSI team members should kill the larvae by keeping them in hot water (not boiling) for 30 seconds. The larvae should be put in 95% ethyl alcohol.

DNA analysis allows more accurate identification of species and is not affected by damage to or disappearance of morphological features. It is not only an alternative to the conventional morphological method for species identification but also a quick, reliable and accurate method [26,27]. As in all other countries in the world, in Turkey there are some problems in forensic entomological practice [20]. In the beginning, forensic entomological evidence was not approved by the crime scene investigators and the courts, which brought about many problems [28]. It is true that entomological evidence has not been collected from crime scenes and has always been considered as an unimportant detail and therefore washed and removed during autopsies [29]. Specimens for DNA analyses and specimens of hair are always collected from crime scenes; however, the ambient temperature is not measured. In fact, the ambient temperature is not necessarily considered valuable in DNA analyses and analyses of hair specimens, but it is crucial in terms of forensic entomology. Not measuring the ambient temperature, not examining the ground on which a corpse was lying and not collecting entomological evidence render determination of the time of death impossible. Not collecting sufficient entomological evidence from crime scenes and corpses on autopsies [20], absence of an entomologist during autopsies of cases having entomological evidence are the most frequent problems encountered in practice [3,29].

Conclusion and Recommendations

We created a new practice form for standardization for collecting insect evidence from crime scene. It can be recommended that judges, public prosecutors and lawyers, the most important forensic authorities, should be informed about disregard for entomological evidence and mistakes concerning their collection and transfer. This is the only way to enable entomological examination results to be accepted as evidence in courts. In addition, crime scene investigators should be offered training to standardize what they should do for collection and transfer of entomological evidence to the laboratory. Moreover, forensic specialists and laboratory assistants should be provided with continuous appropriate training. It is necessary to offer MSc. and PhD programmes in forensic entomology at the institutes of forensic sciences to achieve improvements in forensic entomology. Graduates of these programmes can have the title of the forensic entomologist. They can be hired by Forensic Sciences Institutes, the departments of forensic medicine at universities, in gendarme and police criminal laboratories. Departments of forensic entomology exist in many universities in Europe and the United States. Graduates of these departments start working as forensic entomologists. In Turkey, forensic entomology courses are offered at science faculties of universities. So that forensic entomology can be considered as a scientific discipline, there should be academicians specializing in forensic entomology. Another important issue is that cooperation between forensic entomology and other forensic sciences is needed to conduct interdisciplinary studies and projects.

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