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Full Length Research Paper

Preliminary study and Identification of insects' species of forensic importance in Urmia, Iran

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The proper identification of the insect and arthropod species of forensic importance is the most crucial element in the field of forensic entomology. The main objective in this study was the identification of insects' species of forensic importance in Urmia (37°, 33′ N. and 45°, 4′, 45″ E.) and establishment of a preliminary data-base for forensic entomology purposes in Iran for the first time. A combination of various body viscera and tissues of some of vertebrates (sheep, cow, fish and hen), such as head, paunch, spleen, intestine, derma and liver was exposed in an open land on the private possession for 53 days. Ambient daily temperature (maximum and minimum) and relative humidity values were recorded; and existing keys were used for identification of different species. During the period of study, rainfall was none; average total temperature was 23.77°C; and average of mean RH or average total RH was 46.41%. Five stages of decomposition were recognized. A total of 3179 individuals were collected; belonging to 5 orders (Diptra, Coleoptera, Hymenoptera, Dermaptera and Blattaria), 11 families, 16 genera and 18 species: *Psychoda sp*, (Dip. Psychodidae), *Calliphora vicina* (Dip. Calliphoridae), *Calliphora vomitoria* (Dip. Calliphoridae), *Lucilia sericata* (Dip. Calliphoridae), *Chrysoma sp*. (Dip.Calliphoridae), *Musca domestica* (Dip. Muscidae), *Muscina stabulans* (Dip. Muscidae), *Fannia canicularis* (Dip. Fannidae), *Sarcophaga haemorrhoidalis* (Dip. Sarcophagidae), *Sarcophaga sp*. (Dip.Sarcophagidae), *Wohlfartia magnifica* (Dip. Sarcophagidae), *Dermestes maculates* (Col. Dermestidae), *Necrophorus sp*.(Col.Silphidae), *Blatta orientalis* (Blattaria . Blattidae), *Vespula germanica* (Hym.Vespidae), *Messor caducus* (Hym. Formicidae), *Cataglyphis sp*. (Hym. Formicidae) and *Forficula auricularia* (Dermaptera. Forficulidae). The species of *Psychoda sp*, (Dip. Psychodidae), *M. caducus*, *Cataglyphis sp.* (Hym. Formicidae) and *F. auricularia* (Dermaptera. Forficulidae) are seldomly reported in previous researches; and they were heavily focused to tissues of animals in these studies.

Key words: Forensic entomology, postmortem interval, daily rhythm of temperature and humidity, Urmia.

INTRODUCTION

Insects constitue a dominant life form, with their species number of more than 2 millions, in the earth's ecosystem. Some of the researchers even describe the era that we are living in as the insect era. The insects are the labors of the ecosystem that implements many tasks from the substance cycle to pollination of the plant. On the other hand, some species that can be described as very infrequent in regards to the total number of species, for example, agricultural insect pests, parasite vectors and species of forensic significance, have been known and researched more; because of their interaction through the humans. These insect species are significant especially for the implementation regarding the determination of the time of death, detection of the transport conditions of the corpse and forensic toxicology.

Wastes created by the living beings and corpses belonging to ones, of which their life period is over, are disposed by the environment because of the substance cycle and then added to the ecosystem energy flow to be used in the food pyramid. The corpse of every living being, let it be plant or animal, are separated in their basic elements somehow via other living beings (that is, saprophytic bacterias and yeasts, saprofak insects). It becomes much more significant when separation process considered is for the human corpse. If the corpses of the

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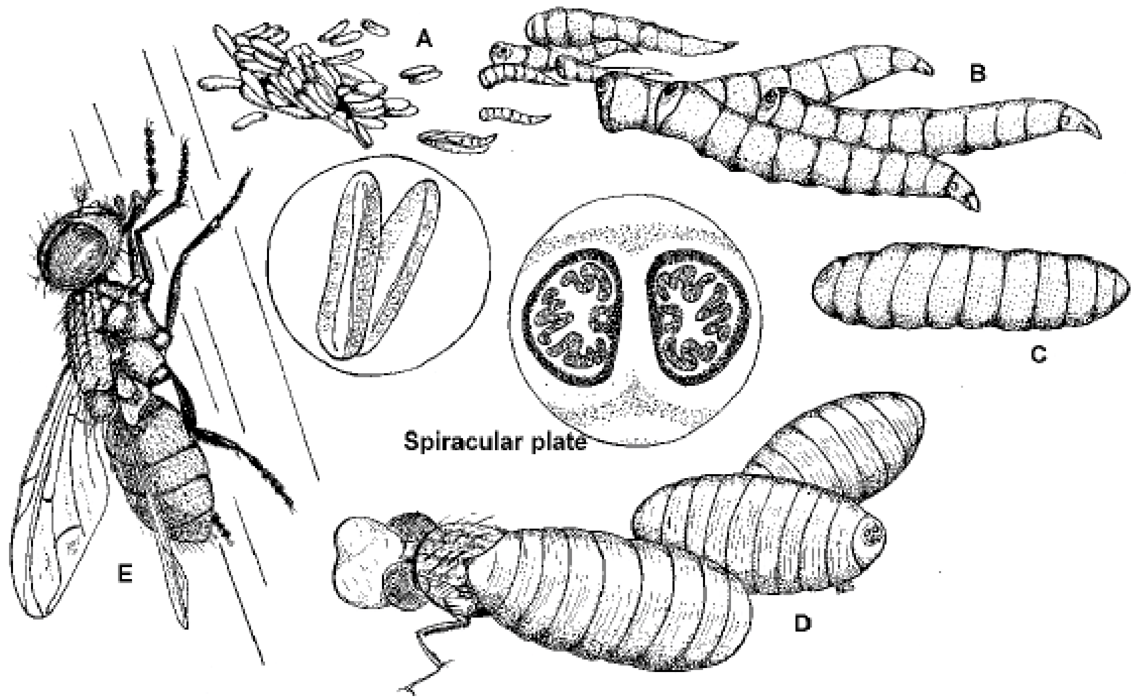

Figure 1. General kife cycle of dipteria (Stafford, 1987).

deceased people are not buried after some time, then natural mechanisms steps in; and corpses are more heavily invaded by the insects overground. The sequence (succession) of the insects regarding their coming to the corpse and their time of coming in relation with the period of deformation are stated by their forensic entomology researchers, in their articles and researchers, since especially 1980s. A main reason for the insects found in the corpses to be considered forensically significant is the fact that their succession and time of coming to the corpse and their development graphics during their stay in the corpse are important factors for determing the time of death. Moreover, the existence of non-cosmopolitan species in the corpse can be important for considering the possibility of the transportation of the corpse. The insects coming to the corpse, belonging to the same species, are from different geographical regions; they might show some differences regarding some of their genes. Maximum parsanomy analysis, conducted through DNA sequences, do help to describe such situations.

Among the insects that went to the corpse, the most significant classes of them belong to Diptera, Coleoptera and Lepidoptera orders.

General information regarding Diptera, Coleoptera and Lepidoptera (flies, beetles, and butterflies) and their biologies

Flies (members of the Diptera family) belong to Insecta (insects) class. Diptera can be observed in homes, farms and different living habitats. Diptera has a lexical meaning of having two wings. Diptera is believed to have 20000 species in North America only. Merely some of these species have a veterinary, medical and forensic significance. Although home flies are considered when one says "fly", there are numerous articles about Diptera species such as gasterophilus, gnats and drosophila. Since sinantropic Dipteria species exist in nutritional elements, wastes, habitat and agricultural lands of human beings, a close relation has been formed between these species and humans (Harwood and James, 1979; Kettle, 1995).

Flies do show holometabolical development. Significant differences do exist between the holometabolical metarmorphosis of adult and newly formed living creatures. Holometabolical metarmorphosis consists of egg, larva, pupa and adult phases, respectively (Figure 1). The larva of the fly is generally named as grub. Larva has a shape that is generally cylindirical and pointed towards the edge. Larve is frequently saprofak. Saphorak larva feeds with bacteria, yeast and little organic substances. It lives in a semi-liquid environment. Another type of larva, on the other hand, feeds with living or dead tissues. Flies with a forensic and medical significance do belong in this group. Pupa and adult phases follow the larva phase. The characteristic feature of its adult, which differentiates it from other winged insects, is the transformation of the second pair of wings to a structure called halteres organ (Greenburg, 1973).

The actively existing phase of the Dipteria species, with a forensic significance, on the corpse is the larva phase.

Thus, the identification of the specie using larva is considerably difficult. Therefore, adult formations of the larva are enabled by completing their development in the artificial feeding area. The identifications of the species are implemented by the use of the adult flies (Stafford and Collison, 1987).

The species of the Coleoptera (beetles) order, on the other hand, go through hemimetaboly. Although there are many species that belong to the order, only some of them are agriculturally and forensically significant. The other species are employed in the formation of the soil and substance cycle. Storage pets, an important group different from agricultural pests, cause significant damages in the grain barns. The adults of the species with forensic significance, however, actively exist in the advanced deformation periods of the corpse.

Lepidoptera (butterflies) are generally named as moths. The larvas of the Lepidoptera, which are employed in the last deformation phases of the corpse, consume the hardest structures such as keratin and nails.

There is no means to use the corpse of the human for identifying the insects that are coming to the corpse. Therefore, the researchers generally use corpses of pigs. Especially the species that comes to the corpses of the pig are significant for forensic entomology researches. The species that come to the corpse of the pig in both terrestrial and aquatic environments; the species found on the human corpse; and the species identified on the corpses of various animals are mentioned in this study.

Forensic entomology is a new investigation area regarding the both forensic and entomology sciences in Iran; therefore, the expanding literature in forensic entomology and entomotoxicology is still very limited compared to some other fields of science in Iran and numerous world countries; especially in Middle East Region (Tüzün et al., 2009).

Arthropods are associated with decaying organic matter in different ways. Insects can be important indicators in a forensic investigation. The proper identification of the insect and arthropod species of forensic importance is the most crucial element in the field of forensic entomology. It is the species identification that allows the proper developmental data and distribution ranges to be applied to an investigation. If the species determination is incorrect, or otherwise in error, then the estimated postmortem interval is invalid (Byrd and Castner, 2000).

This study was designed to identify the insects' species of forensic importance in Urmia, West Azerbaijan Province, Iran (37°, 33′ N. and 45°, 4′, 45″ E.). In other words, the main objective was the establishment of a preliminary data-base for forensic entomology purposes in Iran for the first time.

MATERIALS AND METHODS

A combinations of various body viscera and tissues of some of vertebrates (sheep, cow, fish and hen), such as head, paunch, spleen, intestine, derma and liver, were exposed in an open land on the private possession in the city of Urmia (West Azerbaijan Province, Iran), for 53 days during the time period between July 14th and September 4th, 2008.

The animals' tissues and viscera were contained in an open plastic container, exposed directly to sunlight and placed under a wooden cage for attracting arthropoda specimens. The animals' viscera were sampled daily. Ambient daily temperature (maximum, minimum) and relative humidity were recorded using a max/ min thermometer and a sling- type psychrometer, respectively. Representative specimens were collected at each visit in the afternoons (at 6 o'clock, approximately). Adult Diptera (with the exception of *Psychoda sp.* that was collected using a vial type aspirator) and *Vespula germanica* were collected by using a hand insect net. The collected material was fixed in 75% alcohol in the case of the existence of immature specimens. Some of these immature specimens were used in conjunction with the living samples to help the identification of species. Adult were killed with ethyl acetate and then mounted on entomological pins. Existing keys were used for the identification of different species:

For Diptera: Peterson, 1951; Snyder, 1957; Oldroyd, 1964; Zumpt, 1965; Bei-Bienko, 1970; Oldroyd, 1970; Denno and Cothran, 1975; Brindle and Smith, 1978; Chinery, 1984; Skidmore, 1985; Soos and Papp, 1986; Colles and McAlpine, 1991; Borror et al., 1992; Carvalho et al., 1993a, b; Crosskey and Lane, 1993; Pape, 1996; Rognes, 1997; and Wang et al., 2006.

For Coleoptera: Hatch, 1927, 1957; Peterson, 1951; Dillon and Dillon, 1961; Arnett, 1968; Crowson, 1968; Hradstrom, 1977; Lawrence, 1982; Papp, 1983; White, 1983; and Borror et al., 1992.

For Hymenoptera: Brown, 1955; Hölldobler and Wilson, 1990; Radchenko, 1997; Ardeh, 1994; Bolton, 1994; and Bolton et al., 2006.

For Blattaria: Rehn, 1951; Thorne and Carpenter, 1992; and Grandcolas, 1997.

For Dermaptera: Popham, 1985; Bharadwaj and Kapoor, 1970; Brown, 1982; Steinmann, 1988, 1989; Nickle and Sakai, 1990; and Rentz and Kevan, 1991.

RESULTS AND DISCUSSION

During the period of study, the amount of rainfall was none, as shown in Table 1. Daily mean temperature range was 21 - 26.5°C (average of mean temperatures or average total temperature was 23.77°C); minimum temperature range was 12-20°C (average was approximately 16°C); and maximum temperature range was 25 - 36°C (average was approximately 31.5°C) in this period. Moreover, as shown in Table 1, daily mean relative humidity range was 39 - 56.5% (average of mean RH or average total RH was 46.41%); minimum RH range was 16 - 37% (average was 24.71%); and maximum RH range was 57 - 79% (average was 68.13%) in this period.

Temperature is one of the most critical factors for the insects. Most insects are "poikilothermic" with body temperature more or less directly varying with environmental temperature; thus, heat is the driving force for the rate of growth and development when food is unlimited (such as in this study). Physiological time is the cumulative

Table 1. Stages of decomposition, daily temperature (maximum, minimum, average), and relative humidity (maximum, minimum, average) during the period of study.

Day	Stage of decomposition	Tmin (ºc)	Tmax (ºc)	Tmean (ºc)	RH min (%)	RH max (%)	RH mean (%)
1	Fresh	18	30	24.0	25	74	48.5
2	Fresh	14	30	22.0	21	72	46.5
3	Bloated/ fermentation	16	31	23.5	25	71	48.0
4	Bloated/ fermentation	13	31	22.0	29	79	54.0
5	Bloated/ fermentation	16	33	24.5	22	68	45.0
6	Bloated/ fermentation	15	32	23.5	26	66	46.0
7	Bloated/ fermentation	16	34	25.0	25	63	44.0
8	Bloated/ fermentation	17	33	25.0	29	65	47.0
9	Bloated/ fermentation	20	33	26.5	24	62	43.0
10	Bloated/ fermentation	17	32	24.5	23	69	46.0
11	Bloated/ fermentation	17	32	24.5	26	66	46.0
12	Bloated/ fermentation	18	33	25.5	23	73	48.0
13	Bloated/ fermentation	18	34	26.0	22	67	44.5
14	Bloated/ fermentation	17	35	26.0	18	69	43.5
15	Bloated/ fermentation	16	35	25.5	18	64	41.0
16	Bloated/ fermentation	18	35	26.5	22	63	42.5
17	Bloated/ fermentation	17	36	26.5	16	71	43.5
18	Bloated/ fermentation	19	32	25.5	18	64	41.0
19	Bloated/ fermentation	18	32	25.0	24	72	48.0
20	Decay/ putrefaction	18	35	26.5	21	68	44.5
21	Decay/ putrefaction	18	32	25.0	24	62	43.0
22	Decay/ putrefaction	17	32	24.5	28	71	49.5
23	Decay/ putrefaction	17	36	26.5	21	69	45.0
24	Decay/ putrefaction	18	35	26.5	25	57	41.0
25	Decay/ putrefaction	15	31	23.0	26	69	47.5
26	Decay/ putrefaction	17	30	23.5	29	73	51.0
27	Decay/ putrefaction	17	25	21.0	36	72	54.0
28	Decay/ putrefaction	17	26	21.5	37	76	56.5
29	Decay/ putrefaction	15	31	23.0	34	78	56.0
30	Decay/ putrefaction	18	31	24.5	29	69	49.0
31	Decay/ putrefaction	18	30	24.0	27	69	48.0
32	Decay/ putrefaction	14	29	21.5	24	78	51.0
33	Decay/ putrefaction	15	29	22.0	26	61	43.5
34	Postdecay	16	31	23.5	24	68	46.0
35	Postdecay	16	31	23.5	23	66	44.5
36	Postdecay	17	33	25.0	24	61	42.5
37	Postdecay	16	32	24.0	25	63	44.0
38	Postdecay	17	31	24.0	21	63	42.0
39	Postdecay	15	31	23.0	27	65	46.0
40	Postdecay	15	31	23.0	25	62	43.5
41	Postdecay	16	29	22.5	24	65	44.5
42	Postdecay	16	29	22.5	19	63	41.0
43	Postdecay	14	30	22.0	28	73	50.5
44	Postdecay	13	30	21.5	27	79	53.0
45	Postdecay	14	31	22.5	22	73	47.5
46	Postdecay	14	30	22.0	29	71	50.0
47	Postdecay	14	30	22.0	28	71	49.5
48	Skeletal	15	31	23.0	26	63	44.5
49	Skeletal	12	34	23.0	17	61	39.0
50	Skeletal	12	31	22.5	22	65	43.5
51	Skeletal	13	29	21.0	28	69	48.5
52	Skeletal	14	31	22.5	23	72	47.5
53	Skeletal	14	32	23.0	25	68	46.5
Mean		15.98	31.54	23.77	24.71	68.13	46.41
S. D.		1.83	2.23	1.61	4.23	5.12	3.91

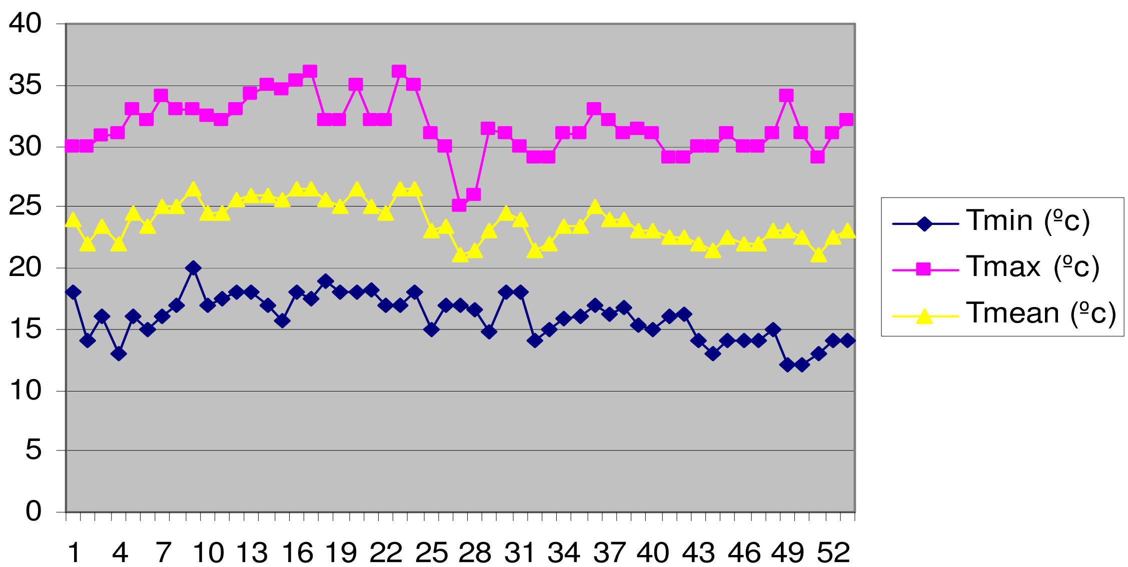

Figure 2. Curve of variation of environment temperature (above) and relative humidity (below).

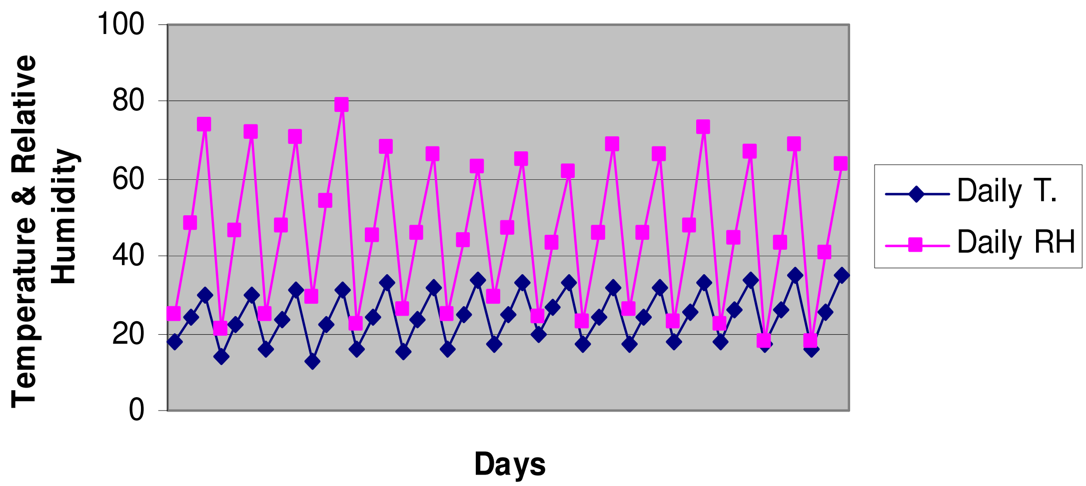

Figure 3. Daily rhythm of temperature and relative humidity of Urmia for the first 15 days of study.

product of the total development time (in hours or days) multiplied by the temperature (in degrees) above the developmental (or growth) threshold or the temperature below at which no development occurs. Daily minimum temperatures during the study period showed little variation average (1.83°C), remaining around 16°C, as shown in Figure 2, for most of the study.

During the 24- hour cycle of day and night, there is a "daily rhythm of temperature and humidity" characteristic of each area (Ross et al., 1982). Daily rhythm of temperature and humidity of Urmia for the first 15 days of study can be seen in Figure 3. Activities of most insects are very definitely related to this rhythm (Ross et al., 1982). For instance, Greenberg (1991) and Catts and Goff (1992) discussed the age determination of maggots by temperature for the estimation of postmortem intervals in forensic entomology.

Five stages of decomposition, as defined by Goff (1993), were recognized during this study: Fresh (Figure 4a.) in days 1 and 2; bloated (Figure 4b.) in days 3 to 19; decay or active decomposition (Figures 4c and 4f) in days 20 to 33; post decay or advanced decomposition (Figure 4d) in days 34 to 47; and skeletal or dry remains (Figure 4e) in days 48+.

A total of 3179 individuals, belonging to 5 orders, 11 families, 16 genera and 18 species, were collected, as shown in Table 2, over a period of 53 days (Diptra, Coleoptera, Hymenoptera, Dermaptera and Blattaria).

There existed 5 collected adult families of Diptera. Adults in the families, Calliphoridae, Sarcophagidae and

Figure 4. Stages of decomposition of head and various viscera and tissues of some of vertibrates in stage of; fresh (a); bloated/fermentation (b); decay/ putrefaction (c); postdecay (d); and skeletal (e); decomposition of fish in decay stage (f).

Table 2. Adult and immature insects' species collected on daily basis in different stages of the decomposition.

Species	Order/ family	Days of capture -dev. stage
Psychoda sp	Dip. Psychodidae	23- adult
Calliphora vicina	Dip. Calliphoridae	1 to 16 - adult
Calliphora vomitoria	Dip. Calliphoridae	3 - adult
Lucilia sericata	Dip. Calliphoridae	2,4,5 - adult
Chrysomya albiceps	Dip. Calliphoridae	2- adult
Musca domestica	Dip. Muscidae	1 to 32 - adult & 5 to 19 - larva & 11 - 23 pupa
Muscina stabulans	Dip. Muscidae	2 - adult
Fannia canicularis	Dip. Fannidae	2 - adult
Sarcophaga haemorrhoidalis	Dip. Sarcophagidae	1, 2, 3, 6, 7,13, 20, 21, 22, 23 - adult & 19 to 42 larva and 31 to 53 pupa
Sarcophaga sp.	Dip. Sarcophagidae	3 - adult
Wohlfartia magnifica	Dip. Sarcophagidae	1 - adult
Dermestes maculates	Col. Dermestidae	8, 15,16, 21, 26 to 53 adult & 28 to 53 larva
Necrophorus sp.	Col.Silphidae	34, 35, 39- adult
Vespula germanica	Hym.Vespidae	1- adult
Messor caducus	Hym. Formicidae	2 to 53- adult
Cataglyphis sp.	Hym. Formicidae	1, 2,3,6,7, 19, 29, 30, 31, 32-adult
Blatta orientalis	Blattaria . Blattidae	48- nymph
Forficula auricularia	Dermap.Forficulidae	16

Muscidae, were the initial colonizers of the body viscera and tissues of animals shortly after the exposure of them.

This pattern is somewhat different from the observations in other decomposition studies (Carvalho et al., 2004); where adult Sarcophagidae species were attracted to the pig carcass on days 4+. Adult Muscidae species were attracted early to the pig carcass in that same study.

There were 4 species of insects recorded, from the viscera of animals in this study, as immatures: *Sarcophaga haemorrhoidalis, Musca domestica, Dermestes maculates* and *Blatta orientalis.*

Conclusion

The species of *Psychoda sp*, (Dip. Psychodidae), *Messor caducus*, *Cataglyphis sp.* (Hym. Formicidae) and *Forficula auricularia* (Dermaptera. Forficulidae) were seldomly reported in the previous research while they were heavily attracted to tissues of animals in these studies. No Lepidoptera specimens were collected in this study; perhaps, because the viscera of animals used for attracting insects in traps, did not contain wool, hair, or feather.

Species of *Psychoda sp*, (Dip. Psychodidae), *Calliphora vicina* (Dip. Calliphoridae), *Calliphora vomitoria* (Dip. Calliphoridae), *Lucilia sericata* (Dip. Calliphoridae), *Chrysoma sp*. (Dip.Calliphoridae), *Musca domestica* (Dip. Muscidae), *Muscina stabulans* (Dip. Muscidae), *Fannia canicularis* (Dip. Fannidae), *Sarcophaga haemorrhoidalis* (Dip. Sarcophagidae), *Sarcophaga sp.* (Dip. Sarcophagidae), *Wohlfartia magnifica* (Dip. Sarcophagidae), *Dermestes maculates* (Col. Dermestidae), *Necrophorus sp*. (Col.Silphidae), *Blatta orientalis* (Blattaria . Blattidae), *Vespula germanica* (Hym.Vespidae), *M. caducus* (Hym. Formicidae), *Cataglyphis sp*. (Hym. Formicidae), *Forficula auricularia* (Dermaptera. Forficulidae), and *Acarus siro* (O. Astigmata,F. Acarida) were encountered on the carcasses of chicken, sheep, cow and fish.

The species of *Psychoda sp*, (Dip. Psychodidae), *M. caducus* (Hym. Formicidae), *Cataglyphis sp* and *F. auricularia* (Dermaptera. Forficulidae), among them, were not encountered in the previous researches. The variation of the species identified on the pig (Table 3) is remarkable when compared with the species coming to the human cadaver.The identification of the different species belonging to the same genus in Gill's study (2005) revealed the significance of identification from the genus level to the species level. The species on the human corpse identified by Gomes and Zuben (2006) frequently belong to the families of Diptera and Coleoptera (Table 4). Diptera and Coleoptera families are respectively followed by Lepidoptera and Hymenoptera families. This condition does not change for the insects coming to the corpse of the pig. Insects groups that are observed on the corpses in aquatic environments mainly belong to the orders of Ephemeroptera, Coleoptera, Hemiptera and Odonata. The species of Diptera and Coleoptera (Table 5), however, are densely observed on the corpses of chicken, sheep and cow (Vance et al., 2005).

The great similarity between the insects coming to the pig and other animals carcasses and the insects coming to the human corpses display the significance of using animal carcasses in forensic entomology investigations. The compability of the experimental results obtained from the animal carcasses and the results belonging to the

Table 3. Insect species observed on the pig corpse according to Gill (2005).

Class Arachnida	***Nicrophorus hybridus***	***Bolboceras falli (Wallis)***	**Fam:Therevidae**
Order:Araneae	*Nicrophorus obscurus Kirby*	*Geotrupes semiopacus Jekel*	Fam:Empididae
Order:Opiliones	*Nicrophorus orbicollis Say*	Fam:Trogidae	Fam:Dolichopodidae
Order:Acarina	*Nicrophorus pustulatus*	Tro unistriatus Beauvois	Fam:Syrphidae
Order:Pseudoscorpiones	*Nicrophorus sayi Laporte*	Fam:Elateridae	Section Acalyptratae
Class Diplopoda	*Nicrophorus tomentosus*	Fam:Dermestidae	Fam:Micropezidae
Class Chilopoda	*Oiceoptoma noveboracensis*	*Dermestes ater DeGeer*	Fam:Otitidae
Class Heapoda	*Thanatophilus lapponica*	*Dermestes fasciatus*	*Physiphora* spp.
Order:Orthoptera	Fam:Staphylinidae	*Dermestes frischi*	Fam:Piophilidae
Order:Hemiptera	*Creophilus maillosus*	*Dermestes lardarius*	*Boreopiophila tormentosa*
Order:Homoptera	*Ontholestes cingulatus*	*Dermestes signatus*	*Prochyliza anthostoma*
Order:Neuroptera	*Philonthus cyanipennis*	Fam:Cleridae	*Stearibia nigriceps (Meigen)*
Order:Coleoptera	*Staphylinus badipes* LaConte	*Necrobia rufipes (DeGeer) †*	Fam:Sciomyzidae
Suborder Adephaga	Fam:Hydrophilidae	*Necrobia violacea*	Fam:Sepsidae
Fam:Carabidae	Cercyon spp.	Fam:Nitidulidae	Fam:Lauaniidae
Agonum spp.	Sphaeridium spp.	*Glischrochilus quadrisignatus*	Fam:Heleomyzidae
Agonum cupreum Dejean	Fam:Histeridae	*Nitidula bipunctata*	Fam:Sphaeroceridae
Agonum placidum (Say)	*Acritus nigricornis (Hoffman)†*	*Nitidula nigra Schaeffer*	*Coproica* spp.
Agonum retractum LeConte	*Atholus americanus (Paykull)*	*Nitidula ziczac Say*	*Ischiolepta* spp.
Amara obesa (Say)	*Atholus falli Bickhardt*	Fam:Rhizophagidae	*Leptocera* spp.
Anisodactylus verticalis	*Carcinops pumilio (Erichson)*	Fam:Cucujidae	*Sphaerocera curvipes*
Bembidion spp.	*Euspilotus assimilis (Paykull)*	Fam:Cryptophagidae	Fam:Drosophilidae
Bembidion canadianum	*Geomysaprinus*	Fam:Phalacridae	Fam:Chloropidae
Bembidion quadrimaculatum	*cheyennensis (Casey)*	Fam:Coccinellidae	Section Calyptratae
Chlaenius spp.	*Hister abbreviatus Fabricius*	Fam:Lathridiidae	Fam:Scathophagidae
Dicaelus sculptilis Say	*Hister furtivus*	Fam:Mycetophagidae	Fam:Anthomyiidae
Diplocheila striatopunctatus	*Margarinotus brunneus*	Fam:Tenebrionidae	Fam:Muscidae
Harpalus spp.	*Margarinotus harrisii (Kirby)*	Fam:Meloidae	*Fannia* sp.
Harpalus pensylvanicus	*Margarinotus hudsonicus*	Fam:Anthicidae	*Musca domestica Linnaeus*
Oypselaphus pusillus	*Margarinotus immunis*	Fam:Chrysomelidae	*Muscina* sp.
Platynus decentis (Say)	*Margarinotus lecontei Wenzel*	Fam:Curculionidae	*Stomoxys calcitrans*
Poecilus lucublanda (Say)	*Saprinus* sp.	Takım:Mecoptera	Fam:Calliphoridae
Pterostichus spp.	*Saprinus lugens Erichson*	Takım:Diptera	*Calliphora terraenovae*
Pterostichus melanarius	*Saprinus oregonensis*	Suborder Nematocera	*Calliphora vicina Robineau-*
Pterostichus pensylvanicus	Fam:Eucinetidae	Fam:Bibionidae	*Calliphora vomitoria*
Syntomus americanus	Fam:Lucanidae	Fam:Mycetophilidae	*Cynomya cadaverina*
Synuchus impunctatus (Say)	Fam:Scarabaeidae	Fam:Cecidomyiidae	*Lucilia illustris (Meigen)*
Suborder Polyphaga	*Aphodius* spp.	Fam:Sciaridae	*Phaenicia sericata*
Fam:Ptiliidae	*Dichelony* spp.	Fam:Scatopsidae	*Phormia regina (Meigen)*
Fam:Leiodidae	*Onthophagus* spp.	Fam:Culicidae	*Protophormia terraenovae*
Fam:Silphidae	*Onthophagus hecate*	Fam:Ceratopogonidae	Fam:Sarcophagidae
Heterosilpha ramosa (Say)	*Onthophagus nuchicornis*	Fam:Chironomidae	Takım:Lepidoptera
Necrodes surinamensis		Suborder Brachycera	Takım:Hymenoptera
Necrophila americana	Fam:Geotrupidae	Fam:Rhagionidae	Fam:Eulophidae
Nicrophorus defodiens	Fam:Vespidae	Fam:Stratiomyidae	Fam:Formicidae
Sphecidae		*Dolichovespula* sp.	*Vespula* spp.

insects coming to the human corpses would pave the way of using animal carcasses in forensic entomology investigations. Therefore, the implementation of experimental studies commonly existing in both animal and human corpses would contribute to the science of forensic entomology. In this regard, the identification of the species coming to the human and animal corpses is considered to be significant in this study.

Table 4. Insects groups that are idenfitied on the human corpse according to Gomes ve Zuben (2006).

Order	Family	Genus
Coleoptera	Cleridae	*Necrobia*
	Dermestidae	*Dermestes*
	Geotrupidae	*Geotrupes*
	Histeridae	*Hister*
	Silphidae	*Necrodes, Silpha*
	Staphilinidae	*Aleochara*
Diptera	Calliphoridae	*Calliphora, Chrysomya, Cochliomyia, Lucilia*
	Drosophilidae	*Drosophila*
	Fanniidae	*Fannia*
	Muscidae	*Musca, Ophyra, Muscina*
	Phoridae	*Conicera, Megaselia*
	Piophilidae	*Piophila*
	Sarcophagidae	*Liopygia, Sarcophaga*
	Stratiomyidae	*Hermetia*
Lepidoptera	Tineidae	*Tineola*
Hymenoptera	Ichneumonidae	*Alysia*
	Pteromalidae	*Nasonia, Muscidifurax*

Table 5. Aquatic insects that comes to corpses of pig in aquatic environment according to Vance et al. (2005).

Order	Sub-Order	Family	Genus	Specie
Ephemeroptera	Schistonota	Baetidae	*Baetis*	*propinguus (Walsh)*
Ephemeroptera	Schistonota	Baetidae	*Baetis*	*intercalaris*
Ephemeroptera"	Schistonota	Baetidae	*Baetis*	*flavrisiriga*
Ephemeroptera	Schistonota	Oligoneuriidae	*Isonychia*	sp.
Ephemeroptera"	Schistonota	Heptageniidae	*Heptagenia*	*diabasia Burks*
Ephemeroptera	Schistonota	Heptageniidae	*Heptagenia*	*flavescens (Walsh)*
Ephemeroptera"	Pannota	Caenidae	*Caenis*	*latipennis Banks*
Ephemeroptera	Pannota	Caenidae	*Caenis*	sp.
Odonata	Zygoptera	Calopterygidae	*Calopteryx*	sp.
Odonata"	Zygoptera	Coenagrionidae	*Zoniagrion*	sp.
Odonata	Zygoptera	Coenagrionidae	*Argia*	sp.
Hemiptera	Nepomorpha	Pleidae	*Neoplea*	sp.
Hemiptera	Nepomorpha	Corixidae	*Palmacorixa*	sp.
Hemiptera	Nepomorpha	Corixidae	*Pehodytes*	sp.
Coleoptera	Polyphaga	Chrysomelidae		
Coleoptera	Adephaga	Dytiscidae		
Coleoptera	Adephaga	Dytiscidae		
Coleoptera	Adephaga	Dytiscidae		
Coleoptera	Adephaga	Hallplidae		
Diptera"	Nematocera	Chironomidae		

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