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Using Pig Carrion As an Experimental Model for a Human Body in Forensic Entomology Succession Study – a Methodology

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In the last decades, forensic entomology has begun to play an important role as an investigative procedure. For estimation of PMI, basic distribution data for the most indicator species of insects are required. It is apparent that the seasonality and species assemblage vary in different geographical areas. An initial succession study started in the suburban area of Gabrovo, Bulgaria, using pig carrion as model representing human body. The methods are described in details. It is important to introduce the basic knowledge of methods and applications of the science among all professionals involved in a death investigation. Only the good collaboration and a clear procedure can lead to a full understanding of all the evidence recorded at the crime scene and at the autopsy.

Key words: forensic entomology, succession study, methodology, pig, PMI.

Introduction

Forensic entomology is the name given to the study of insects and other arthropods for use in forensic investigations. For estimation of postmortem interval (PMI), basic distribution data for the major indicator species of insects are required. It is apparent that the seasonality and species assemblage vary in different geographical areas.

A study to determine possible indicator species of insects in suburban area of Gabrovo, Bulgaria, was conducted using pig carrion as models representing human bodies. The studies were planned for each season of the year 2007 and may be repeated. The main objective of the work is to study the entomofauna of a cadaver of a white pig (*Sus Scrofa*), the period of invertebrate activity with relation to the different phases of decomposition, to determine the most indicator forensic species of insects for the season and for the region, and to prepare a reference collection of insects from this region for subsequent studies. In view of the fact that forensic entomology has provided excellent results in other countries, a first step should be taken to include these **methodologies** in Bulgaria, with the purpose and tools that may be used subsequently in legal proceedings.

Study Site. Study site was chosen in a suburban area of Gabrovo (almost the geographical center of Bulgaria), on a semishaded slope of a hill. The field was specially surrounded by a fence before the experiments, against occasional human or animal intrusions.

Research Models. The use of human corpses for field studies is illegal in Bulgaria. Pig carcasses were used in experiments because they have been widely accepted as human models for decompositional studies [3]. Pigs are similar to humans since they are omnivorous and possess a similar digestive system including their gut fauna which is important in the evaluation of the decomposition process of carcasses. The last stage of digestion in the intestinal tract of both humans and pigs occurs through bacterial action, not by autolytic enzymatic action as occurs in many other animals. Differences exist between the types of bacteria found in the intestinal tract of the pig and humans, but the end result is the production of the same gases in the gastrointestinal tract which cause refloat [7]. Pigs are relatively hairless and have skin tissue similar to that of humans, in fact it has been used in human skin grafts. C a t t s and G o f f [2] claim that a 23 kg (50 lb) pig is approximately equivalent to an average adult male torso, which is the main site of decomposition and insect colonization.

Materials and Methods

Dead pigs, *Sus scrofa* L., were used as human models for this study, one animal for each season. The mean weight of the animals was 20-32 kg. All dead pigs were purchased from a farm near to the study site. Prior to purchase, the pigs were killed by a strong blunt force strike to the head. Each dead pig was immediately double bagged in a heavy-duty plastic trash bag and transported to the study site. Wire cage was placed over a pig body to protect it from large vertebrate scavengers. Pitfall traps were installed in the soil at the ground level, at 4 points in 1m distance from the body. Instruments: Tool box (data-loggers, containers, consumables, etc.).

Data Collection with Meteorological Measurements. Observations and collections were made from the day of deposition to the full decomposition of the body. Data loggers for measuring the ambient and cadaver temperatures together with air humidity were used for reference with the local meteorological station data, and for future calculating development periods of certain species at varying temperatures. In addition, every time of sample collection the ambient temperatures were measured with a digital thermometer.

Protocols. On day 1, the pigs were removed from bags and placed in a location on the site. There was made a stub wound in the center of the abdomen of each animal, modeling real conditions of crime, which was used for inserting a data loggers for inner corpse temperature measurement. Data were collected including pigs number (season), time of death, date, time, sample number, ambient temperature at 1.5 m high and at the ground level, inner corpse temperature, air humidity, a brief description of the weather. A collection of adult flies and other insects was made over, on and under the pig. These were placed in vials full of ethanol and labeled. Eggs of flies were placed on moistened tissue paper in vials for rearing. A part of the eggs were preserved by placing them in ethanol. After the first day, samples were made on a daily basis during first 40 days for each experiment, and every second or third day for later period. A collection of adult flies and other adult insects (and their larvae) was made over, on and under the pig. We also collected the insects from under the cadaver and from the soil, and from pitfall traps at 4

points in 1m distance from the body. They were placed in vials full of ethanol and labelled. Living samples of fly maggots from the corpse and from under it were placed in plastic containers (with perforated cups) for rearing. Another part of maggots specimens were killed as soon as possible with very hot (>80°C), but not boiling water for approximately 30 s to achieve best preservation. Afterwards they were stored in vials with ethanol. A photo and video documentation of the pigs, insects and study site was made.

Rearing Procedures. We stored the majority of maggots of each sample in plastic containers under controlled conditions, on a shelving in the forensic pathology district facility. The plastic containers with fine perforated lids were lined with coarse sawdust or tissue paper and filled in a part with a minced meat for feeding maggots. The maggots were checked daily. After adult emergence, the containers were placed into the freezer for a few minutes to kill the flies. Adults were put in labeled vials of 95% ethanol for future taxonomic identification. The data about the temperatures and the time of emergence were collected.

All the collecting of entomological evidence, documentation and processing were according to the standards established by the European Association for Forensic Entomology [1]. A single code was used in all of the documentation.

Results and Discussion

The application of the entomological method to determine the time of death consists essentially of two main procedures: 1. During the early postmortem period, the estimate is based on a direct age assessment of the oldest individuals of fly larvae (maggots) that have developed on the body (minimum PMI) [4]. 2. During the late postmortem period, the estimate is based on the composition of the arthropod community as it relates to expected successional patterns. The study of arthropod succession enables scientists to associate each species or group to a well-established decomposition stage and geographical region [5, 6].

International forensic institutions already have specific entomologic laboratories to assist law officers at the death scene. Unfortunately, there are no such resources in Bulgaria and in the Balkan area, and the putting into practice of this technique is unusual and it has no practical basis. It is obvious a need of introducing forensic entomology use in investigation of death in our region.

This is a first step done for use of standard methods, on an experimental model of carrion insect succession in our region. As a result of growing practical experience, a simple protocol for collecting entomological evidence at crime scenes is to be developed. It must be according European standards for the use of forensic entomology in criminal investigations and must fit to the Bulgarian law procedures.

There is a lot of work to do in next months and years to develop a high level of competency in the field of forensic entomology for our country. But not less important is to introduce the basic knowledge of methods and applications of the science among all professionals involved in a death investigation. Only the good collaboration and a clear procedure can lead to a full understanding of all the evidence recorded at the crime scene and at the autopsy. A close interaction of the forensic entomologist with the forensic pathologist is strongly recommended.

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