CANADIAN POLICE RESEARCH CENTRE

CENTRE CANADIEN DE RECHERCHES POLICIERES

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Forensic Entomology

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TECHNICAL MEMORANDUM

Submitted by
Canadian Police Research Centre

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EXECUTIVE SUMMARY

Dr. Anderson is a professor and a full time forensic entomologist at Simon Fraser University, Burnaby, British Columbia· Insect analysis is being used more and more commonly in homicide investigations to determine time of death. This type of research is relatively new to Canada, and in order to obtain the appropriate data, research must be conducted eventually, throughout Canada. Dr. Anderson has initiated this project which may eventually be used as a model in future.

MS. Leigh Dillon has begun her graduate work at Simon Fraser University, under Dr. Anderson's guidance, and she is completing a qualifying semester which includes an advanced course in entomology· MS. Dillon is currently developing the project by studying reference specimens, designing protective cages and pulley systems to protect the carrion, and determining appropriate experimental sites for taking readings, It is intended that the first carcasses will be placed in the field in early May.

Simon Fraser University, the British Columbia Coroner's Service and the Canadian Police Research Centre are sponsoring this very important research.

RESUME

M. Anderson est un professeur et un entomologiste judiciaire a plein temps l'Universite Simon Fraser a Burnaby (Colombie-Britannique). L'analyse des insectes est utilisee de plus en plus dans le cadre des enquetes sur les homicides afin de determiner le moment du deces. Comme ce genre de recherche est relativement nouveau au Canada, des recherches devront etre menees partout au pays si l'on veut obtenir les donnees appropriees. M. Anderson a lance le present projet, lequel pourra eventuellement servir de modele.

Mme Leigh Dillon a commence ses etudes superieures a l'Universite Simon Fraser, sous la direction du professeur Anderson et elle acheve son semestre preparatoire, qui comprend un cours avance d'entomologie. Mme Dillon amorce actuellement le projet, par l'etude de specimens de reference, la conception de cages protectrices et de systemes de poulies afin de proteger le cadavre et l'identification de sites experimentaux appropries pour effectuer les lectures et les preleves. Les premieres carcasses devraient etre placees sur le terrain au debut du mois de mai.

L'Universite Simon Fraser, le Service de medecine legale de la Colombie-Britannique et le Centre canadien de recherches policieres parrainent cette recherche tres importante.

This research involves the study of insect succession associated with carrion in order to use the insects to determine elapsed time since death in human homicide cases. The initial research will determine the species of insects (and other arthropods) which attack a corpse in the Lower Mainland of B.C. The research will also examine biomass loss and change in soil fauna. Later work will look at insect succession in different seasons and geographic regions. This information, when complete, will provide essential data on carrion communities under varied geographical and seasonal conditions and will be of immense use in determining elapsed time since death in homicide cases in police investigations across the country.

The following describes the section of the research to be conducted.

Pigs can be used as models for human decomposition as they are omnivorous, with a digestion very similar to that of human digestion, are relatively hairless and have skin so similar to that of humans that it can be used in human skin grafts. A 25 kg pig is equivalent to an average adult male torso, which is the main site of decomposition and insect attack. Freshly sacrificed pigs will be used.

The first experiment will consist of 14 carcasses, 7 in sunlight and 7 in shade. Female 25 kg pigs will be placed a minimum of 50 m apart so that olfactory orientation to each one will be independent. All the carcasses will be protected from large carnivore attack by large mesh wire cages firmly affixed over the entire carcass. Two dataloggers, recording temperature every half-hour, will be placed at representative distances from the carcasses in the shade and a further two in sunlight to determine temperature differences between the two habitats, and for comparison with weather records from the nearest Environment Canada weather station. The carcasses will be divided into three groups:

Group 1 will consist of 3 pigs in each habitat. Each carcass will be placed on a large mesh wire platform, which will allow it to be raised by a pulley system, but will otherwise allow it to maintain contact with the ground. The carcasses will be examined for insect activity immediately after placement, and every day for the following six weeks. At each examination, samples of immature insects will be taken from the carcass and from the surrounding soil, as larvae of many species leave the body as prepupae. Insects will also be collected with a pit-fall trap placed with the lip at ground level within a few cm of the corpse, to collect nocturnal specimens. Adults will be caught by sweep net, or by hand collection, killed and pinned for identification. Insects below the body will be collected by briefly raising the carcass.

All larval Calliphoridae and Sarcophagidae will be examined under a binocular microscope to determine instar by number of spiracular slits. Some third instar larvae will be preserved for identification by mouthparts. Eggs and all larval stages of Calliphoridae, and larval Sarcophagidae will be raised to adulthood on

beef liver to confirm identification. Immature stages of insects in other families will be laboratory raised or killed, depending on ease of identification. At each sampling time internal and skin temperatures will be taken, together with the internal temperatures of any maggot masses present.

After six weeks, the carcasses will be sampled every other day until four months. Soil samples will be taken prior to carcass placement and processed using a Berlese funnel. They will be taken every week for the first 4 mo, then every two weeks, to study any changes in native soil fauna due to the presence of the carcass, and the duration until the soil fauna return to the pre-experiment state. Photographs of Group 1 carcasses will be taken on every sampling day for comparison with Group 3 carcasses.

Group 2 will consist of 2 pigs in each habitat. Each carcass will be placed on a platform as before and will be weighed on each sampling day using a scale hanging from a tripod, to determine loss of biomass due to decomposition. Insect fauna will be visually identified, but not sampled. Each pig will also be photographed. Otherwise, these two carcasses will not be disturbed.

Group 3 will consist of 2 pigs in each habitat. Each carcass will be placed directly on the ground. On each sampling day, the cages will be removed and the carcasses photographed. Temperature probes, attached to dataloggers, will be inserted permanently into each carcass immediately after death to monitor internal temperature. Each datalogger will record both ambient and internal carcass temperatures. Two dataloggers are required in each habitat as the carcasses will be too far apart for probes from one datalogger to reach two pigs. The temperature of the carcasses will be affected by insect attack and a comparison of ambient temperature with internal carcass temperature; and a comparison of differences in internal temperatures between carcasses in the same habitat, different habitats and different seasons will be important in determining insect development rates. Statistical comparison will be made between the automatic and static internal temperature recordings from these probes with those manually recorded both internally and specifically in any maggot masses present in Group 1 pigs to determine whether a general internal temperature reading is representative. Apart from the removal and replacement of the cages, and the temperature recording, these two carcasses, together with their insect fauna, will not be disturbed in any way. It is possible that repeated sampling and disturbance of the carcasses in Group 1 may affect the rate of insect attack and speed of development of the insects. Group 3 carcasses will be used to determine this, and the state of decomposition and visible insect fauna will be compared daily with carcasses in Group 1, which will also be photographed. It is not expected that the placing of the carcasses on a platform will impede insect attack in any way, as the preliminary experiment has indicated such carcasses decomposed at the same rate as those placed on the ground.

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