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FIREFLIES (*Lampyris noctiluca* L., Coleoptera: Lampyridae) AN ADVENTIVE FORENSIC INSECT

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INTRODUCTION

The application of forensic entomology in criminal cases is mostly focused on the presence of necrophagous insects attracted to a corpse which are useful in determining an accurate estimate of the PMI. Entomological investigations also have other applications such as identification of the movement of stored products [1] and in cases when a body has been moved after death or in the *peri-mortem* period [2,3]. In such cases the insects that become useful to investigators could be any of the species represented in the necrophagous, predator, parasite, omnivorous and adventive groups [4].

CASE-REPORT, NECROSCOPY AND TOXICOLOGICAL ANALYSES

In September 2003 two carcasses of the brown bear (*Ursus arctos* L.), an adult female and a young-subadult male, were found not far from the National Park of Abruzzo, Lazio and Molise (Central Italy) (Pic. 1). The park has an area of 50 000 ha plus 10 000 ha of adjacent territory.

Bears presented post-mortem thorax and abdominal lesions with loss of soft tissue, probably caused by animals scavenging on the body.

The necropsy was performed by forensic veterinary specialists (Pic. 2) [5]. After removing the skin no gunshot wounds were found. All the internal organs were complete, but a pulmonary oedema and an acute gastropathy with submucosal haemorrhage were observed in both carcasses.

The stomach content was composed mainly by vegetables and an odorous grey substance was also found (Pic. 3,4,5). Toxicological analyses confirmed that it was zinc phosphide (Zn_3P_2), a chemical compound used to control rodents, but also used by poachers as baits to poison a variety of different animals. Death occurs typically in 24-48 hours. Bears typically move about so they probably moved some distance from where the poison was ingested.

As a consequence the investigation involved the examination of a large area of the park which was time consuming and costly in terms of logistics and resources. One approach to restrict the enormity of the investigation was to map an area of possible movement around the death scene. The second approach was to examine each animals stomach contents. It was hoped that the contents might reveal an animal or plant species consumed by the bears giving some insight into their activities prior to death.



Pic. 1 – Carcass of adult brown bear



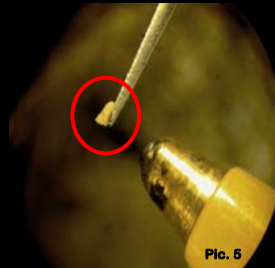
Pic. 2 – Collecting from the bear carcass



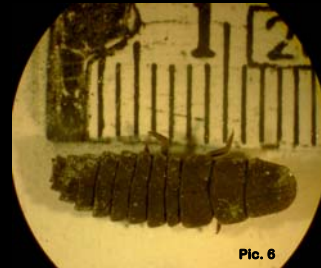
Pic. 3



Pic. 4



Pic. 5



Pic. 6

Pic. 3, 4, 5 – Microscopy images of the bear carcasses stomach contents composed mainly of vegetables. Also note the zinc phosphide (Zn_3P_2) residuals.

Pic. 6 – Firefly found in the bear stomach contents.

BOTANICAL ANALYSES

Using a micro-photographic atlas, a dichotomous key and a check-list of the plant species [6] in the Park were used to determine the contents of the bears stomach.

Analyses were completed in two phases. A preliminary observation using a stereomicroscope then a micro-histological study of leaf specific cellular structures.

It was possible to distinguish samples from the Families Rosacea, Umbelliferae, Graminaceae and Compositae. The low number of seeds of *Robus* ssp. (Fam. Rosacea) found in the stomach suggested the animals consumed a meal prior to the poisoned meal. Fragments of *Chaerophyllum hirsutum* (Fam. Umbelliferae) or hairy chervil which is associated with *Fagus sylvatica* or common beech and soil containing high levels of nitrogen were also found in the stomach. Other species found were cosmopolitan plant species, from all over the Park.

ENTOMOLOGICAL ANALYSES

Amongst the gut contents of the bears one firefly larvae (*Lampyris noctiluca* L., Coleoptera: Lampyridae) was found (Pic.6) [7,8].

Fireflies are carnivorous during the larval stage and they live in high humidity environments where they can easily find snails and slugs, which are their food source. These molluscs are an agricultural pest and farmers use specific chemicals for their control. Prior to chemicals being used fireflies were common in cultivated fields, but with the application of chemicals their presence has become more localized.

CONCLUSIONS

Botanical analyses confirmed that the last meal of the bears had been in a beech wood forest with soil high in nitrogen, but this data was not that useful in restricting the area of the crime scene because 60% of the Park is covered by this tree species.

However, the presence of a firefly larvae in the area associated within the zone surrounding the place of ingestion excluded the agriculture areas and shifted the investigation to those forest areas. Following the examination of these environments the person responsible was placed in custody.

This case demonstrates that the entomofauna at specific localities is sometimes important, and can help to pinpoint where the crime took place.

Furthermore, it demonstrates that investigators need to also think laterally because you never know what might be “useful evidence”

