



Two sources and two kinds of trace evidence: Enhancing the links between clothing, footwear and crime scene



Patricia E.J. Wiltshire^{a,b,*}, David L. Hawksworth^{b,c,d}, Judy A. Webb^e, Kevin J. Edwards^{a,f}

^a Department of Geography and Environment, School of Geosciences, University of Aberdeen, Elphinstone Road, Aberdeen AB24 3UF, UK

^b Mycology Section, Royal Botanic Gardens, Kew, Surrey TW9 3DS, UK

^c Departamento de Biología Vegetal II, Facultad de Farmacia, Universidad Complutense de Madrid, Plaza Ramón y Cajal, Madrid 28040, Spain

^d Department of Life Sciences, The Natural History Museum, Cromwell Road, London SW7 5BD, UK

^e 2 Dorchester Court, Blenheim Road, Kidlington, Oxford OX5 2JT, UK

^f Department of Archaeology, School of Geosciences, University of Aberdeen, Elphinstone Road, Aberdeen AB24 3UF, UK

ARTICLE INFO

Article history:

Received 11 April 2015

Received in revised form 20 May 2015

Accepted 27 May 2015

Available online 6 June 2015

Keywords:

Palynology

Mycology

Taphonomy

Rare forensic marker

Exotic plants

Comparator samples

ABSTRACT

The body of a murdered woman was found on the planted periphery of a busy roundabout in Dundee, United Kingdom. A suspect was apprehended and his footwear yielded a similar palynological (botanical and mycological) profile to that obtained from the ground and vegetation of the crime scene, and to that of the victim's clothing. The sources of palynomorphs at the roundabout were the *in situ* vegetation, and macerated woody mulch which had been laid on the ground surface. The degree of rarity of individual forensic markers, the complexity of the overall profile, and the application of both botanical and mycological expertise, led to a high level of resolution in the results, enabling the exhibits to be linked to the crime scene. The suspect was convicted of murder. The interpretation of the results allowed conclusions which added to the list of essential protocols for crime scene sampling as well the requirement for advanced expertise in identification.

© 2015 Elsevier Ireland Ltd. All rights reserved.

1. Introduction

Palynology¹ and mycology² have been demonstrated to provide powerful trace evidence³ in criminal investigations [1–3]. Plants and fungi belong to different biological kingdoms. All spores and pollen grains are involved in the reproduction of individual species, but plants and fungi exhibit different kinds of production and dispersal of these entities which, in the forensic context, can be exploited as independent sets of trace evidence. Through experimental work [4,5], and repeatedly through casework [1–3], palynomorphs⁴ retrieved from items such as footwear, clothing,

and hair, have been shown to provide evidence linking objects to one another, and to specific locations. The presence of various taxa⁵ in a palynological assemblage⁶ will, when quantified, allow the construction of a palynological profile⁷. For taphonomic⁸ reasons, that profile will be related not only to the vegetation growing at a site, but also to plants long dead or removed, and those derived from some distance away from the place [6]. Each location yields a unique palynological profile, with the differences varying both spatially and temporally over small distances [7]. The value of palynological profiles lies in the large numbers of different trace components contained within them. They often amount to several hundred, and this contrasts starkly with some other classes of trace evidence, such as fibres and glass, where an assemblage may only consist of one or two types [8,9]. In the case of synthetic objects and materials, such as glass, fibres, and paint, population databases are

* Corresponding author at: Department of Geography and Environment, School of Geosciences, University of Aberdeen, Elphinstone Road, Aberdeen AB24 3UF, UK. Tel.: +44 1372 272087; fax: +44 1372 272087.

E-mail address: patricia.wiltshire1@btinternet.com (Patricia E.J. Wiltshire).

¹ Palynology: The study of pollen, plants spores, fungal spores, other fungal bodies, and any microscopic entities found in palynological preparations.

² Mycology is the study of all kinds of fungi, including mushrooms, mildews, blights, moulds, lichens, and the yeasts

³ Trace evidence: A proxy for an object, living organism, or place. It may consist of molecular, fluid, or particulate material transferred between two or more entities which have had contact.

⁴ Palynomorph: Pollen, plant and fungal spores, and other microscopic entities found in palynological preparations.

⁵ Taxon (plural Taxa): A term used in biology for any rank or group in the classification of organisms such as family, genus, species, or morphological type.

⁶ Palynological assemblage: The whole range of palynomorph taxa found in a sample.

⁷ Palynological profile: The various proportions of all palynomorph taxa in a sample.

⁸ Taphonomy: The sum total of factors which determine whether a palynomorph will be found at a certain place at a certain time.

available for direct comparison with an unknown. Practising palynologists will also have access to extensive databases of appropriate reference material and distributions.

Databases of palynological *profiles* relevant to forensic study are, however, probably unattainable as every place will offer specific ranges of physico-chemical conditions and will, as a result, be occupied by particular biological communities. With regard to any component capable of contributing trace evidence (e.g. soil, plants, animals, fungi, prokaryotes⁹), there will be differences in identity and abundance of the source material and, hence, potential for transfer. The cumulative experience of ecologists has confirmed the high degree of palynological variability inherent even within a single site and, although places may have degrees of similarity in their profiles, so far, each location has proved to be unlike any other. In forensic contexts, material from several ecosystems may be mixed, and this added complexity makes a place even more discernible than would otherwise be the case. Whatever its nature, trace evidence picked up from any site will provide proxy information for the place from which it was derived. Such complex information can add strength to a proposition that objects have contacted specific places. In the case presented here, palynology and mycology proved invaluable, and provided the only probative forensic evidence.

2. Background

A woman went missing in Dundee in late February 2010. She was last seen on CCTV footage, taken two weeks before her discovery, walking with a man in an area about 50 m from a major roundabout near the city centre. Police were able to identify the man from the CCTV recording and he was duly apprehended. He admitted that, on the night that the offence was committed, he had been with the woman in a nightclub, and that he had walked with her some distance after they had left the place. He claimed that he had said goodbye to the woman while she was alive and well, and had no knowledge of her whereabouts. He had been staying temporarily with an associate, and police found a pair of shoes that had been put under the associate's bed. Two weeks after the disappearance, the SAM (Scent Article Methods) dogs were deployed from Dyfed-Powys Police Dog Section in an attempt to find the woman. The dogs followed a trail from the nightclub to the north verge of the roundabout, and this resulted in the woman's body being found. It was lying very close to the base of the wall which retained the terraces above the site. The dogs later led investigators to a garage and, by inspection of CCTV footage, it was established that the suspect had visited that site.

The corpse was well hidden by the stems and leaves of *Hedera helix* plants that had been stripped away from the wall by the assailant in order to cover the body. It was well hidden from view, and its position meant that it was only likely to be found by municipal workers during garden maintenance at the roundabout edge. The body was lying face down and had been stripped of clothing below the waist. The victim's fingernails were broken and the body had scavenger injuries, but it was in a good state of preservation because of the low temperatures in the preceding weeks. Photographs of the corpse *in situ* showed extensive fungal growth on the hands and face, and this supported her having been dead for at least two weeks [cf. 10].

The shoes found under the associate's bed had been borrowed by the suspect, and he had worn them to the nightclub. Importantly, they had not been worn since that night; the associate was annoyed because they had been taken without permission, and he had hidden them under his own bed. These

shoes, therefore, had not accumulated any additional trace evidence after they had been worn by the suspect on the single occasion. It has been found that dominant elements in any transferred profile on footwear are those of the last palyniferous¹⁰ place contacted [5]. Also, trace material transferred during that single wearing would be likely to dominate any profile of trace evidence [4]. Police did not recover any other items from the suspect, and only the shoes that were recovered from the lodgings were available for analysis and comparison.

The environs of the deposition site consisted of a long, curved area planted by Dundee City Council (Fig. 1) with both native and exotic trees, shrubs, and climbers. The Council had also laid mixed, woody mulch beneath the shrubs and trees over a wide area. This consisted of shredded woody material from a large number of sources (gardens, plantations, and parks), and each batch was unique (Dundee City Council officer, pers. comm.). The palynological profile of the mulch, therefore, would also have been unique to the crime scene.

The suspect stated that he had never walked on the area of ground where the body was found. This testimony could be tested by analysing trace evidence from his footwear and comparing it with that obtained from the clothing and shoes of the victim, as well as that from comparator samples collected from the crime scene. Dissimilarity between respective palynological profiles might support the hypothesis that his testimony was true, while similarity might support the alternative hypothesis that it was false. The two hypotheses were tested by the palynological results.

3. Methods

3.1. Crime scene

The police had divided the crime scene into a grid of squares, each 50 cm × 50 cm. A sample of soil, leaf-litter, or leafy detritus was taken from each square. A large number was collected, but analysis of them all was deemed to be prohibitive because of limitations in the available resources. A palynological "picture of place" could be gained by analysing those samples from immediately at, or adjacent to, a deposition site, and from offender approach and exit paths; because of the large number of samples collected, this was possible. A list was made of all plant species observed during one visit to the location in March 2010 (Table 1). This was not exhaustive, but included as many flowering and sporulating plants as were observable at the time.

3.2. Other pertinent sites

It was pertinent to examine any place known to have been frequented by the suspect, and the police provided intelligence for four locations that might have contributed palynomorphs to the suspect's feet. These were visited, and lists made of all obvious plant species. The sites included: the place where the suspect had been staying at the time of the offence; the area around the nightclub where the couple had met and spent time together; a garage, known to have been visited by the suspect; and a taxi pick-up place where the suspect is known to have stood. The latter was opposite the garage where he had been caught on CCTV, and adjacent to a public area planted with lawn and banks of flowering shrubs.

3.3. Laboratory methods

It was considered essential to compare the suspect's footwear with not only the ground at the crime scene, but also with the

⁹ Prokaryote: An organism whose DNA is not bounded by a membrane, e.g. bacteria.

¹⁰ Palyniferous: Containing or covered in palynomorphs.

Download English Version:

<https://daneshyari.com/en/article/95348>

Download Persian Version:

<https://daneshyari.com/article/95348>

[Daneshyari.com](https://daneshyari.com)