Methods in Chemical Ecology : Efficient tools in Forensic Sciences

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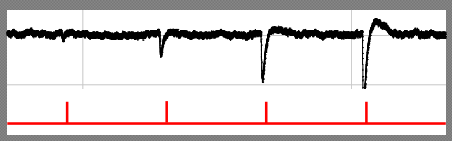
INTRODUCTION

Chemical Ecology is a ecological science that focuses on chemical communication between living organisms, including insects. The mains steps in such a research are (1) the isolation of the volatile organic chemicals (VOCs) from the organism under investigation (e.g. a dead body), (2) the study of the perception of these odorant molecules by the tested insect (e.g. blowflies) and (3) the investigation of the behaviour induced when VOCs are perceived. Whereas insects have demonstrated their utility in Post-Mortem Interval evaluation, our interests are focused on the use of insects and VOCs as bio-indicators in the ecosystem of a dead body.

Electroantennography (EAG)

An EAG device comprises a couple of microelectrodes that record a difference of potential produced by an insect antenna when stimulated with an active organic volatile chemical, like the ones emitted by a dead body. Living fly (or any coprophagous insect) can be mounted and connected to the EAG. This technique allows the scientist to demonstrate the VOCs that are used by the insect under investigation to locate its oviposition or feeding site.

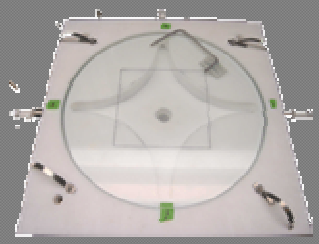


Whereas an EAG device is quite bulky, some setups are portable and can be used in the field. An insect is placed inside de portable system, and the electrical response produced by the antenna is recorded where the experimenter stood. The EAG response is proportional to the concentration of the odorant molecules released by the sought body.

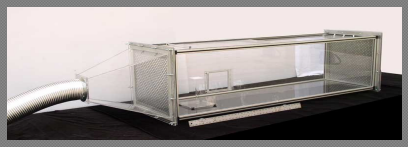
These EAG setups (and the insect placed inside) could be used as bio-indicators to locate the odour source (e.g. a dead body) in a wide area.

Bio-assays

Olfactometers are scientific setups that allow the study of an insect behavior toward different stimuli, including odorant chemicals. They can be of various shapes and sizes, depending of the insect under investigation and the corresponding type of behaviour. Behavioral assays are usually conducted after having identified an EAG active chemical, to elucidate the impact it may have on insects.



The four-arm olfactometer allows the study of the behaviour of an insect exposed to four odour sources, one being usually the EAG active odour and the three others being controls.



The wind tunnels are also commonly used with flying insects to observe their behaviour when exposed to odorant stimuli.

PERSPECTIVES

The environment around a dead body is characterised by a broad rang of necrophagous insects and volatile organic chemicals associated with the body decomposition. Both odorant chemicals and colonial insects may differ with the biotope. Insects use odour to orientate toward sites appropriate for their offspring fitness, a dead body in the cases of blowflies or Silphid beetles[1]. Whereas the discovery of a dead body can be difficult according to the site under investigation (e.g. forest), insects could be efficient allies of forensic scientists, once their ecology is better understood.

[1]Dekeirsschieter Jessica (2007) Étude des odeurs émises par des carcasses de porc (*Sus domesticus* L.) en décomposition et suivi de la colonisation postmortem par les insectes nécrophages Mémoire de fin d'études. Faculté Universitaire des Sciences agronomiques de Gembloux.