



## Earwig abundance monitoring in orchards

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### **Objectives of the method/protocol:**

This protocol aims at evaluating the abundance of earwigs (mainly *Forficula auricularia* and *Forficula pubescens*) at orchard level. Earwigs are generalist predatory arthropods which are natural enemies of various pomefruit pests (woolly apple aphid (Mueller et al 1988), apple aphids (Carroll & Hoyt 1984; Dib et al 2010), codling moth (Knight et al 1997)) and pear psylla (Shaltiel & Coll 2004). As they are mainly active at night, this method permits to evaluate their numbers during the day when they are not active.

### **Brief description of the method/protocol:**

Earwig numbers are regularly counted in earwig shelters installed on the tree trunk within the orchard, then released onto the soil at the same place.

### **Possible uses of this method/protocol:**

The method permits to survey earwig dynamics along the season and/or to compare earwig abundance between two or more orchards.  
It can be adopted to evaluate the effect of cultural practices on this arthropod group.

### **Method/protocol:**

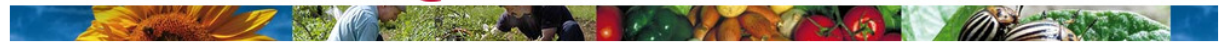
Shelters are made of plastic tube (diameter 4 cm, height 5 cm) filled with a roll of corrugated cardboard. A plastic cap avoids wetting the cardboard when raining. Shelters are painted in white to limit temperature increase when exposed to the sun. Each shelter is tied onto the tree trunk at about 1 -1.2 m height (or at the top of the trunk if the tree is small). Depending on the experiment and the orchard size, 15 or more shelters are installed per orchard (0.5 ha in our experiment). The distribution of shelters within each orchard is related to the aim of the experiment, but edges are generally avoided (see disadvantages below). At regular intervals according to the objectives of the experiment (each week in our experiment), each shelter is opened above a box coated with anti-adhesive to prevent earwigs escaping before they are counted (a large-edged anti-adhesive pan can be used!). When counting, the following categories of earwigs can be easily distinguished: species, males/females, young stages if the information is needed beside the overall abundance of the earwig group. Earwigs are then released *in situ* onto the soil and the shelter is replaced in the tree.

### **Advantages/disadvantages of the method/protocol:**

The method is easy to carry out. Short training to recognise earwig species and categories is necessary when this information is needed.

The method permits extensive sampling in numerous orchards.

Other arthropod groups can also be observed, among which some spider groups such as Salticidae etc.



Young earwig nymphs living on the ground early in the season are not monitored. The method can be only used to monitor earwig stages foraging in trees (approximately from mid-April onwards in Southern France).

There is no information on the interception distance of a shelter. Moreover, as earwigs emit aggregation pheromones, there is no information on the relationship between the overall abundance of earwigs in the orchard and numbers in shelters.

Lastly, this method is to be used in sites offering similar possibilities to shelter; for instance, it cannot be used to compare woods and orchards because sheltering possibilities are far higher in woods, therefore decreasing earwig numbers in shelters. Similarly, old orchards offering natural shelters (e.g. trunks with many bark crevices) cannot be compared to young orchards with smooth trunks.

### References or examples of studies carried out by using this method/protocol:

Simon S, Brun L, Guinaudeau J, Sauphanor B (2011) Pesticide use in current and innovative apple orchard systems. *Agron Sust Developm* 31, 541-555

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Mueller TF, Blommers LHM, Mols PJM (1988) Earwig (*Forficula auricularia*) predation on the woolly apple aphid, *Eriosoma lanigerum*. *Entomol Exp Appl* 47, 145-152

Shaltiel L, Coll M (2004) Reduction of pear psylla damage by the predatory bug *Anthocoris nemoralis* (Heteroptera: Anthocoridae): The importance of orchard colonization time and neighboring vegetation. *Biocontrol Sci Technol* 14(8), 811-821



Earwig shelter tied onto the tree trunk



Corrugated cardboard rolled inside the shelter



Earwig in a rosy apple aphid colony