Rapid visual estimation of the populations of aphid *Aphis gossypii* (adults and mummies) on cucumber in greenhouse, at the leaf scale

Method/protocol submitted by:

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Objectives of the method/protocol:

Quantifying the populations of *Aphis gossypii* on cucumber, at the leaf scale. The impacts of parasitoid populations are also estimated thanks to the observation of the parasitized aphids (mummies).

Brief description of the method/protocol:

This protocol presents a visual non destructive estimation method based on abundance classes to quantify populations of *Aphis gossypii* on cucumber plant, leaf by leaf.

Possible uses of this method/protocol:

Micro-spatial characterisation of populations in ecological studies of hosts-parasitoids relationship. A simplified method for pest monitoring in IPM context is avalaible (please contact the author).

Method/protocol:

- Sampling of the plants:

The number of observed plants is generally determined by the time available for the experiment.
The estimated observation time for one leaf is <5 seconds for a cucumber plant with 50 leaves. The observation time for one plant is thus <4 minutes (to be adapted to the context of the experimentation!). For instance, if you have 60 minutes available to carry out the experimentation, the number of plants you will be able to sample is 60/4 = 15
If no further information on the pest distribution is known, a uniform grid based on the number of plants to be observed is generally advised to determine the localisation of the plants.

- Observation of the insect populations:

On each sampled plant, each leaf is observed during 2 to 3 seconds and is then assigned to one of the abundance classes presented below, considering the estimated number of adult aphids or mummies. Please note that this observation method is NOT a detailed counting of the number of aphids/mummies.

In case of mixed populations, a distinct observation by species is recommended.

Leaves of the observed plants are numbered on the notation sheet and missing leaves are noted. Other details such as presence of other pests or beneficials, weather conditions or particular interventions on the crops are also indicated in the notation sheet.

- Abundance classes:

The visual abundance classes are presented below:

Class 1	Absence of adult aphids/mummies
Class 2	1 to 3 adult aphids/mummies
Class 3	4 to10 adult aphids/mummies
Class 4	11 to 30 adult aphids/mummies
Class 5	31 to 100 adult aphids/mummies
Class i	$10^{(i-2)}/2$ < number of adult aphids/mummies < $10^{(i-1)}/2$

Advantages / Disadvantages of the method/protocol:

The adult aphids and the mummies are counted simultaneously, which reduces the observation time. This observation time can be considered as minimal for this level of precision.

As the plant is detailed leaf by leaf, local variation and population transfers can be studied during a longer time period, allowing –for example- behaviour studies.

A statistical model allows calibrating the observed abundance classes, and provides population numbers by leaf and for the whole plant (please contact the author for details).

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

Lapchin L., Boll R., Rochat J., Geria A..M., Franco E. (1997): Projection pursuit nonparametric regression used for predicting insect densities from visual abundance classes. Environmental Entomology, (26), 4 : 736-744