



Estimation of coccinellid populations in wheat fields by capture

Method/protocol submitted by:

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Objectives of the method/protocol:

Quantification and characterisation of population stages of coccinellids in wheat fields.

Brief description of the method/protocol:

Cereal crops are infested by various pests, notably aphids. Coccinellids are largely aphidophagous, so it can be useful to quantify their populations on crop to estimate their impact on aphids and other pests.

The estimation method by capture presented here is aimed at quantifying the populations of coccinellids at different life stages in wheat fields.

Possible uses of this method/protocol:

Quantitative ecological studies, including plant protection topics.

Method/protocol:

- Observation unit:

In our study the observed area has a surface of 25 sqm. It is represented in the field by a square, 5m by 5m, which can be delimited by stakes.

- Material:
 - A small portable insect vacuum
- Sampling and counting of the insects:

The counting method is an adaptation of the method of De Lury, known as "successive capture method", used by Laurent M. et Lamarque P. (1974) for the study of fish populations

The sampling can be carried out by 1 or 2 observers. The insects are collected with a small portable vacuum.

The first observer explores the whole 25 sqm plot and collects all the life stages for each studied species: eggs, larvae and adults (C1 in the formula of the following paragraph). He/she walks along



the rows of the crop, and observes the plants as well as the soil (clumps of earth are turned over to look for lays if necessary).

When the first observation is finished, the same observer, or the second one if the observation is carried out by 2 people, does the same thing. He/she begins at the opposite side of the plot compared to the first observer. All the eggs, larvae and adults left by the first observer are collected (C2 in the formula of the following paragraph).

The collected individuals are thus counted by observation (1 or 2), species and life stage.

They can be released in the centre of the plot at the end of the sampling session.

- Estimation of the population number:

The equations for the estimation of population numbers from this sort of captures come from Seber G.A.F. and Le Cren E.D. (1967). They are based on the following assumptions:

- the efficiency of research and capture are identical for the 2 successive observations
- there is no strong migration in the plot during the observations. Multiple successive captures giving decreasing population numbers allows to verify this assumption.
- the relationship between the sum of the individuals collected during the successive surveys and the number of individuals collected at each survey is linear. The verification of this assumption implies to carry out multiple successive observations at least once in the plot.

The number of individuals of a given species and life stage **in the 25 sqm plot** is calculated as follows:

$$P = C1^2 / (C1 - C2)$$

With

P : total number of individuals of the species and the life stage in the plot,

C1: number of individuals of the species and the life stage collected at the time of the first observation,

C2: number of individuals of the species and the life stage collected at the time of the second observation.

This formula is valid only if

$$D > 16$$

with

$$D = C1^2 * (C1 - C2)^2 / [C2^2 * (C1 + C2)]$$

Example of use: if you counted 24 adults of *C. septempunctata* at the time of the first observation of the plot, and 10 adults of *C. septempunctata* at the time of the second observation of the plot, the estimation of your number of adults of *C. septempunctata* in the plot is $24^2 / (24 - 10) = 41$ individuals.



- Useful comparison:

The following table presents the range of efficiency E for 2 successive captures performed during 2 years on 192 sampling plots each year. For each life stages and studied species, the limits of the interval are the 2 annual averages of the efficiencies, calculated by the formula: $E = (C1+C2) / P$. The table allows the user of this protocol to compare his/her efficiency to a reference.

N.B: the studies this table is based on were realised in particular conditions (contact the author for details), and the results might not be generalised to all contexts.

Example of use in the same situation as the previous example: 34 adults of *C. septempunctata* were counted. The estimation of the total population by the formula is 41 individuals. The efficiency is thus $34/41 = 83\%$, which corresponds well to the range in the table.

Don't hesitate to contact the author if you perform similar studies: your values can complete the available data!

Species / life stage	Range of efficiency for 2 successive captures
<i>Coccinella septempunctata</i>	
Adults	[70.9-84.9]
Stage 4 larvae	[54.4-80.2]
Stage 1-3 larvae	[66.1-86.1]
Eggs	70.1
<i>Adonia variegata</i>	
Adults	[56.5-61.4]
<i>Propylea quatuordecimpunctata</i>	
Adults	[76.4-82.5]

Range of efficiency for 2 successive captures: annual averages obtained on studies of 192 plots during 2 years

Advantages / Disadvantages of the method:

This method requires 20 to 30 minutes per 25 sqm plot and for 2 observations. The information obtained is rich, concerning a wide range of species and life stages.

The method is not destructive for the insects (if released), and slightly destructive for the crop.

It requires good identification abilities of the experimenters.

None of the correlations between capture efficiency and temperature, rainfall or prey density were proved significant.

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

Lapchin L. *et al.* (1987). Coccinellids (Coleoptera: Coccinellidae) and syrphids (Diptera: Syrphidae) as predators of aphids in cereal crops: a comparison of sampling methods. Can. Ent. 119: 815-822.

Iperti G. *et al.* (1988). Sequential sampling of adult *Coccinella septempunctata* L. in wheat field. Can. Ent. 120: 773-778



Laurent M. et P. Lamarque (1974). Utilisation de la méthode des captures successives (De Lury) pour l'évaluation des peuplements piscicoles. Ann. Hydrobiol. 5: 121-132.

Seber, G.A.F., and E.D. Le Cren (1967). Estimating population parameters from catches large relative to the population. J. anim. Ecol. 36: 631-643.