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# Enhancement of the Green Lacewing Chrysoperla carnea (Stephens), by providing artificial facilities for hibernation

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## Summary

In the present paper the development and function of a "Green Lacewing Chamber" is described, which represents a suitable place for hibernation of Green Lacewing, Crysoperla carnea (Stephens) in nature. This hibernation chamber can be used by farmers, ecologists and private persons to stimulate population establishment of Lacewing as a common predator in the field.

## Introduction

Chrysoperla carnea (Stephens) is one of the most abundant Chrysopid species inhabiting diverse agroecosystems and a well-known, efficient polyphagous predator. Its effectiveness as an aphid predator has been studied on many crops by several authors. Besides aphids the larvae also feed on spider mites and other insect eggs.

Like many insect species C. carnea hibernates in the adult stage and thus starts seeking for suitable hibernation sites in the beginning of fall. Cracks in trees, shrubs, barns, roof woodracks and houses are common places for overwintering (Eglin, 1940; Gepp, 1967; Ickert, 1968). Due to several factors however, such as cold, wind, too high temperatures inside houses, spiders as natural enemies mortality during hibernation is considerably high reducing the population built up during summer (Killington, 1937; Honek, 1977; These losses have to be taken into account as mortality ranges between 60-90% and even higher (Şengonca und Frings, 1987). Therefore the enhancement of the green lacewing during hibernation is of great importance (Frings und Şengonca, 1988).

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By providing or preparing suitable and favorable facilities for hibernation the survival rate of the green lacewing during this period could be increased. For this purpose an artificial hibernation facility, the Green Lacewing Chamber, was developed providing the lacewing in nature with more favorable conditions during hibernation. The present paper describes the construction of the chamber, its attractiveness and suitability for C. carnea.

## Materials and methods

The Lacewing Chamber consisted of a box measuring 25 to 35 cm square. The front and bottom side had louvered slats, 3 cm apart, through which the adults could enter (Fig.1). The lid of the box could be removed, so that the content could be checked. In the first week of

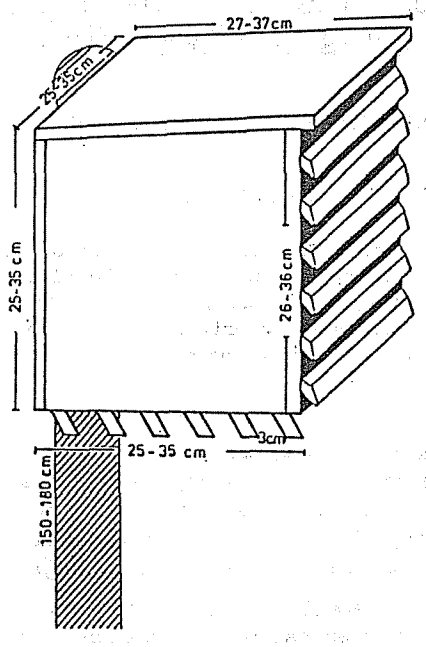


Fig. 1. Construction of the green lacewing chamber

September the boxes were placed on posts at a height of 150-180 cm in southwest direction on harvested barley fields without intercrop at the Recearch Station Klein-Altendorf near Bonn. The boxes had a light brown colour and were mainly filled with straw. The posts were 4 m apart and the experiments had 4 replicates. The experiment on testing different materials for the interior was replicated 6 times.

To determine the most suitable material for the Lacewing Chambers boxes made from plywood and plastic were tested. The surface was roughened with a rasp to provide a better hold for the insects when landing. For the test of different materials to be placed inside, the boxes were

partitioned into 3 sections, which were filled with foliage, hay or straw. A gap of 1 cm was left in the dividing walls so that the lacewings could choose and change between the different materials.

The attractiveness of different colours was studied using boxes painted in green, white, brown and red. To determine the optimal placement as related to wind direction the boxes were placed with the front side facing north, south, east and west, respectively.

The experiments were evaluated twice, in early (December) and the end of winter (April) to assess the mortality occurring the winter.

## Results

Collecting of C. carnea in the Green Lacewing Chamber

Of the different materials used for constructing the boxes the plywood proved to be superior. As shown in Figure 2A a mean number of 397.5 lacewings were present in the wooden boxes as compared to only 128.0 in the plastic ones. The test of the materials packed inside revealed straw to be most suitable, as 65.7 individuals were recorded there compared to a mean of only 2.0 and 2.8 found in the foliage and hay, respectively (Fig. 2B).

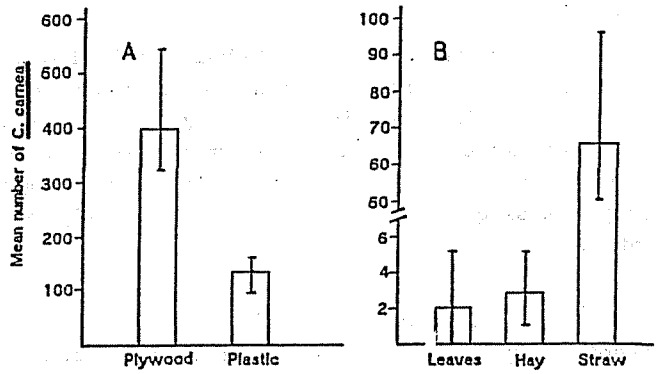


Fig. 2. Mean number of collected Chrysoperla carnea adults in the lacewing chamber made of different material (A) and with different material placed inside (B)

The different colours of the boxes did not result in significant differences in attractiveness to C. carnea. In the white boxes a mean of 447.3 individuals, in the brown ones 418.8 and in the red ones 422.3 lacewings were collected. The green boxes only harboured a mean of 336.0 lacewings.

Strong air movements and circulations inside the boxes lead to migrations of the C. carnea. Therefore the boxes placed away from the main wind direction proved to be most suitable. Since in Klein-Altendorf the wind mainly is coming from south-west, the chambers placed north and east contained a mean of 84.0 and 81.8 lacewings, respectively,

whereas in the ones placed towards west and south a mean of only 63.0 and 34.5 individuals were found (Table 1).

Within the chambers 94% of the lacewings were recorded to aggregate in an area at least 4 cm distant from the louvered slags.

Table 1. Mean number of collected Chrysoperla carnea adults in lacewing chambers placed towards different wind directions

| Direction placement | No. of replicates | Number of collected C. carnea Mean | Min. | Max. |
|---|---|---|---|---|
| North | 4 | 84.0 a | 77 | 90 |
| South | 4 | 34.5 b | 20 | 40 |
| West | 4 | 63.0 a | 45 | 85 |
| East | 4 | 81.8 a | 62 | 100 |

(Means followed by the same letter are not significantly different (Duncan multiple range test))

Hibernation of C. carnea in the Green Lacewing Chamber

The experiments showed that the chambers could harbour more than 500 C. carnea adults. Mortality during hibernation was very low, since there almost was no difference in mortality in early and the end of winter. In the plastic chambers the mean mortality was 0.3% in early and 2.2% in the end of winter (Table 2). In the higher populated wooden boxes mortality was slightly higher, with 3.8% in early winter and 4.5% in the end of winter.

## Discussion

The present study revealed that as in nature wooden material is preferred for hibernation by green lacewing, since the wooden chambers were more readily accepted by C. carnea.

Straw proved to be the most suitable material to be put inside the boxes. Because of the great dust production hay was not appropriate and the foliage did not provide enough hollow space for the adults to hide.

The comparision of different colours of the boxes did not show any clear, consistent differences in attractiveness to C. carnea. Only green apparently is less attractive than the other colours. Because of warming up faster the darker colours, red and brown are to be recommended, however.

Table 2. Percent mortality of Chrysoperla carnea during hibernation in plastic and wooden green lacewing chambers

| Lacewing chamber made of | Mortality in % | | | | | |
|---|---|---|---|---|---|---|
| | Early winter | | | End of winter | | |
| | Mean | Min. | Max. | Mean | Min. | Max. |
| Plastic | 0.3 | 0 | 0.7 | 2.2 | 0 | 4.2 |
| Plywood | 3.9 | 1.1 | 7.1 | 4.5 | 2.3 | 5.6 |

When approaching the chambers the lee-side was preferred by C. carnea. The wind blowing directly into the slots caused such strong air movements that the lacewings were disturbed. C. carnea then changes hibernation sites until an optimal site has been found as described by Geep (1967).

The hibernation chambers shoud be placed in the field starting in the beginning of September, according to be prevailing weather conditions. The colonization of the chambers reaches its maximum in October and then slowly decrease until mid-November. The chambers can be placed in fields planted with intercrops, fallow fields as well as in low growing wild flora and rangeland. Since the silhouette of trees or shrubs disturbs the lacewings in their orientation towards the chambers, the placement in forests, orchards or gardens is less favorable.

In all experiments the mortality of C. carnea in the chambers was very low and remained so even during the hard winter 1986/87 with temperatures of -21°C. Natural enemies were only present in low numbers inside the chambers. Some arachnids were found, which however, had a much lower activity than in natural sites.

The developed lacewing chambers provide a favorable and safe hibernation site for C. carnea, so that the population can pass the winter in higher density. If necessary or more advantageous the chambers can be removed from the fields in December and stored in cool, sun- and rain protected buildings like storehouses and barns during the winter periods. The mobility of the chambers is a great advantage as it allows to collect the lacewings in those areas where they are known to occur in high numbers and to transfer them to areas where an early occurence of insect pests is expected. The lacewing chambers are not only very suitable for practical use in agriculture, but should also be used by naturalists, ecologists and private persons, as are bird nest boxes, to generally enhance this polyphagous predator. This would greatly contribute to an early and rapid increase of the C. carnea population in nature.

## Résumé

Enrichissement de Chrysoperla carnea (Stephens)à l'aide d'un logement artificiel d'hibernation

Ce texte décrit la mise au point d'un logement pour les crysopes constituant pour ces derniers un abri d'hibernation favorable dans les conditions naturells. Pendant les expériences, du bois-contre plaqué a donné les meilleurs résultats comme matériel utilisé pour construir. D'autre part la paille s'est montrée comme meilleur matériel à l'intérieur. La comparaison des couleurs rouge, marron et blanche n'a pas montré de différences significatives. Seuls les caisses verts ont été beacucoup moins fréquentées. Les abris facés sous le vent ont été préférés. Dans ces caisses la mortalité ne depassait pas 4,5% à la fin de l'hiver.

## Özet

Altın gözlü avcı böcek Chrysoperla carnea (Stephens)'nın kışlama esnasında desteklenmesi

Bu çalişmada , Altın gözlü avcı böcek Chrysoperla carnea (Stephens)'nın doğada kışlama esnasında barınabilmesi için geliştirilmiş suni bir kışlak, Chrysoperla evi' nden bahsedilmektedir. Yaklaşık 25-35 cm boyutlarındaki, önü ve altı jaluzi şeklindeki bir kutudan ibaret olan bu ev, yaz sonundan itibaren Eylül-Kasım ayları arasında tarlalarda 150-180 cm yükseklikteki direklere asılmaktadır. Bu sıralarda kışlak arayan C. carnea erginleri bu evleri bulmakta ve orada kışı geçirmek üzere toplanmaktadırlar.

Denemeler Chrysoperla evinin konstruksiyonunda süntadan yapılmış ve içi kuru buğday saplarıyla doldurulmuş olanının en çok Altın gözlü avcı böceği cezbettiğini göstermiştir. Beyaz, kahverengi ve kırmızı ile boyanan Chrysoperla evleri arasında önemli bir fark görülmemekle beraber, yeşille boyanan evde en az altın gözlü avcı böcek toplanmıştır. Özellikle arkası rüzgar yönünde olan evler tercih edilmiş ve bu evlerde ölüm oranı kış sonunda en fazla %4.5 dolayında kalmıştır. Dolayısiyle bu Chrysoperla evleri doğada yaz sonundaki yüksek C. carnea populasyonunun gelecek yıla çok az ölümle ulaşabilmesine yardımcı olabilecek çok uygun bir kışlak olduğunu göstermiştir.


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