Nachrichtenbl. Deut. Pflanzenschutzd., **55** (10), S. 242–244, 2003, ISSN 0027-7479.


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# The Waipuna Hot Foam System – a chance for *Cameraria ohridella* control?

**Das Waipuna-Heißdampfverfahren – eine Chance zur Bekämpfung von *Cameraria ohridella?***

Jona F. Freise[1]) und Werner Heitland[2])

## Abstract

The Hot Foam Method of Waipuna GmbH was originally developed for weed control based on thermal treatment. The suitability of this method for the control of *Cameraria ohridella,* an invasive pest on horse chestnut, *Aesculus hippocastanum*, was tested by treatment of the autumn leaf litter containing the hibernating pupae in a garden. Leaf litter arranged in different layers of thickness (10, 20, and 30 cm) in open wire baskets (diameter: 0.6 m), were treated with heated organic foam. In addition, leaf litter in different parts of the garden were treated with this organic foam.

The foam heated up the leaf litter to approx. 80 °C. Temperatures of 30–40 °C in the leaf litter were maintained for more than two hours. A significant reduction of living pupae inside the leaf litter was observed with more than 90 % of the pupae killed.

**Key words:** *Cameraria ohridella*, *Aesculus hippocastanum*, Waipuna Hot Foam Method

## Zusammenfassung

Das Waipuna-Heißdampfverfahren, ursprünglich entwickelt zur Unkrautbekämpfung, wurde im Frühjahr 2003 in ersten Versuchen auf seine Eignung zur Bekämpfung der Rosskastanien-Miniermotte (*Cameraria ohridella*) getestet. Herbstlaub, eingebracht in offenen Drahtkörben (Laubhöhe 10, 20, 30 cm), sowie frei herumliegendes Laub wurden dabei mittels einer mobilen Station über eine Düse mit heißem Wasser behandelt, dem eine Zuckerlösung zugefügt wurde. Der sich dabei bildende Schaum erreicht anfänglich eine Temperatur von ca. 80 °C. Selbst 2 Stunden nach Behandlung konnten im Laub noch Temperaturen von 30–40 °C nachgewiesen werden. Durch diese Behandlung wurden in dem behandelten Herbstlaub mehr als 90 % der überwinternden Puppen abgetötet. In Kombination mit anderen Verfahren (z. B. Pheromonfallen) könnte sich die Waipuna-Methode zur Kontrolle von *C. ohridella* eignen, besonders an Standorten, wo Restlaub nicht oder nur schwer entfernt werden kann.

**Stichwörter:** *Cameraria ohridella*, *Aesculus hippocastanum*, Waipuna-Heißdampfverfahren

## 1 Introduction

Ever since the horse-chestnut leaf miner, *Cameraria ohridella* (Deschka & Dimic 1986), has become a publicly well discussed pest attacking the white flowering horse-chestnut trees, *Aesculus hippocastanum*, in Europe during the last 15 years, people have been looking for possible and feasible methods for a sustainable control of this pest. So far neither biotechnological (e.g. using pheromone baited sticky traps) nor permitted chemical approaches (e.g. using insecticides) resulted in any success. Experience showed that the only recommendable method is the area-wide complete removal of the the horse-chestnut autumn foliage where the pupae of *C. ohridella* hibernate before emergence in the following spring (e.g. FREISE, 2001; GILBERT et al., 2003; KEHRLI and BACHER, 2003). After collection, the foliage must then be disposed of either via waste incineration or compost plants to destroy the pupae by heat. The temperatures reached in small compost heaps in the back garden does not suffice to kill

Fig. 1. Waipuna mobile station.

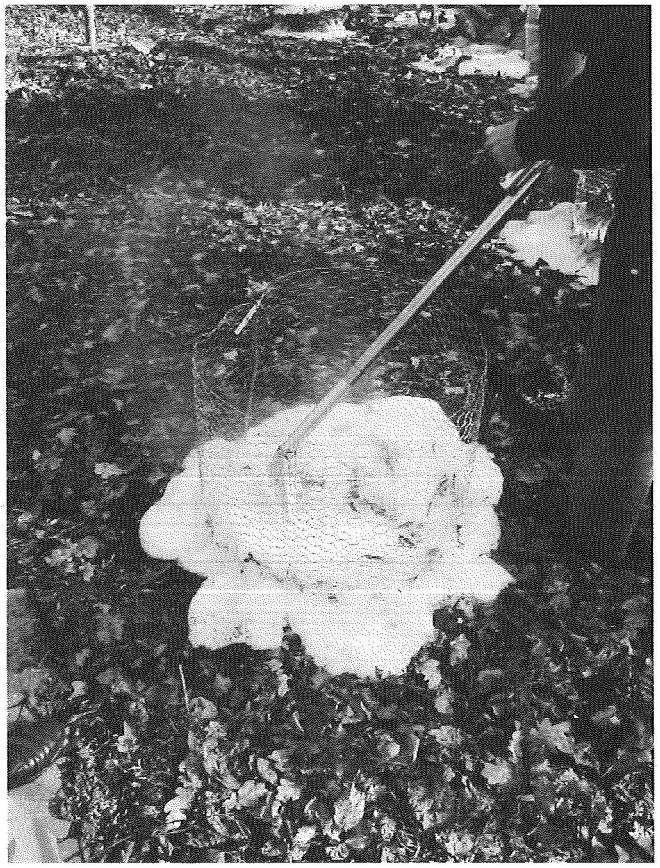

Fig. 2. Treatment of leaves with organic hot foam.

the pupae of *C. ohridella*. A serious drawback for a consequent implementation of this procedure is the high labour input and subsequent costs. Furthermore the removal of autumn foliage from below shrubs or of leaves banked against fencelines is not feasible.

First results of a treatment of litter deposits with the the Waipuna® Hot Foam System (www.waipuna.com), working with high temperatures of ca. 98 °C carried to the target by water and foam, and its potential effect of killing the pupae of *C. ohridella* in the horse-chestnut foliage are presented.

## 2 Material and Methods

The experiments were made in a private garden in Freising (40 km north-west of Munich) in spring 2003. In this garden four 40 year old horse chestnut trees had been heavily attacked by *C. ohridella* during the previous years.

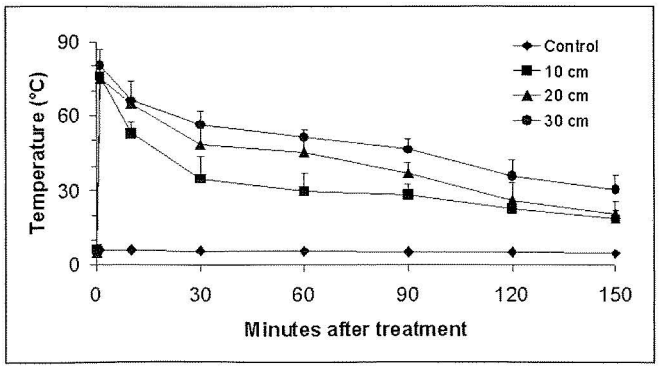


Fig. 3. Average temperature (+ sd) of leaf litter in the wire baskets treated with organic foam in dependence of time.

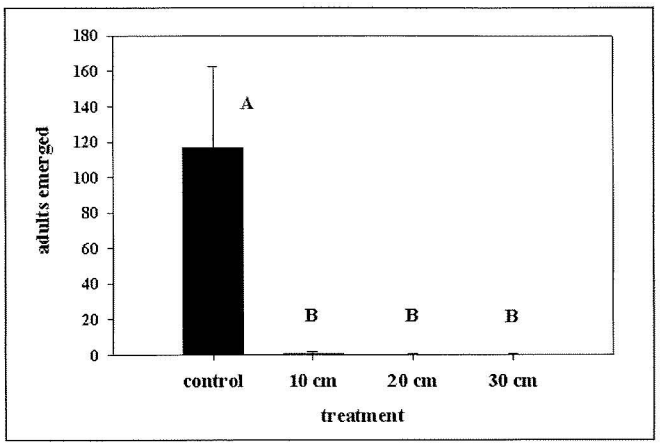


Fig. 4. Average number of emerged adults per 100 g foliage dry mass (+ sd) from leaf litter in wire baskets treated with organic foam. Bars that share a common letter are not statistically significant from each other at $p < 0.05$. Scheffe's post-hoc test after one way Anova.

### 2.1 The Waipuna Hot Foam System

The Waipuna System, originally designed for weed control, includes a diesel-powered, computer controlled boiler that delivers a mixture of corn and coconut sugars added to boiling hot water (0.9 litre sugar mixture/182 litres water) through a supply hose (Figure 1). The system generates a biodegradable foam at 98 °C (compare QUARLES 2001). This foam produces a thin film that prevents the heat from immediately dissipating as the hot water is released.

### 2.2 Treatments

On 28 March 2003 the *C. ohridella* infested autumn foliage of the trees in the above-mentioned garden was collected from one part of the premises and then thoroughly blended. From this foliage heap a group of five bottom- and topless round wire baskets (diameter 0.6 meter) each were filled with leaves to a height of 10 cm, 20 cm and 30 cm respectively. The remaining leaves were divided into five heaps and considered as control. The Waipuna System was applied to the foliage in each of the 15 wire baskets for 2 minutes at the longest (Figure 2). During a 150 minute period following the treatment, the temperatures in the baskets and in the control were recorded. After 24 hours the samples were taken to the laboratory and incubated in a climatic chamber at constant conditions (25 °C, 75 % rel. hum., dark/light: 8h/16h). The emerging *C. ohridella* adults were counted. The experiment was finished in July 2003 after no moths emerged anymore.

In addition 25 small plots in the garden covered with infested foliage were treated with the hot foam on 10 April 2003, shortly before the emergence of *C. ohridella* started. According to the level of foliage litter layer thickness, these plots were classified according to the following scheme (5 replicates per variant): 1) level ground, ca. 10 cm foliage, 2) level ground, ca. 20 to 30 cm foliage, 3) foliage banked against a fenceline, up to 30 cm foliage, 4) foliage under shrubs, ca 5 to 10 cm foliage, and 5) control. 24 hours after the treatment with the Waipuna System the foliage was brought to the laboratory and was handled as described above.

## 3 Results and Conclusions

In the first experiment the temperatures in the treated heaps reached up to 80 °C (Figure 3). After 10 minutes the temperature was still far above 50 °C and dropped during the next two hours to ca. 18 °C and ca. 21 °C in the baskets with a 10 cm and a 20

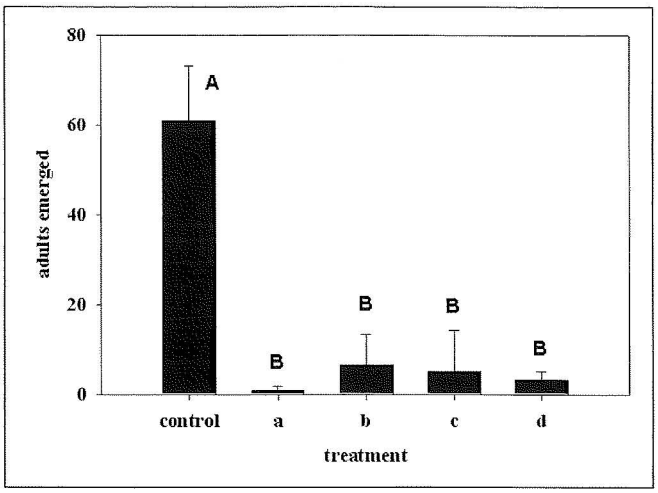


Fig. 5. Average number of emerged adults per 100 g foliage dry mass (+ sd) from leaf litter treated with organic foam. Treatments: control; level ground, ca. 10 cm foliage (a); level ground, 20 to 30 cm foliage (b); foliage banked against a fenceline, up to 30 cm foliage (c); foliage under shrubs, 5 to 10 cm foliage (d). Bars that share a common letter are not statistically significant from each other at $p < 0.05$. Scheffe's post-hoc test after one way Anova.

cm foliage layer, respectively, whereas in the third treatment the average temperature was still ca. 30 °C. In comparison, the temperature of the control heap stayed all the time between 4 and 6 °C.

From the control of the first experiment about 116 *C. ohridella* moths emerged per 100 gram foliage dry mass (Figure 4). In contrast, not even one moth emerged from 100 gram foliage dry mass of the treated samples.

The same tendencies in the numbers of adults emerged were observed in the second experiment (Figure 5). The average number of moths deriving from the control heaps was with ca. 60 per 100 gram foliage dry mass significantly higher than that from any other treatment. However, it seems that the number of emerged *C. ohridella* moths may be higher at particular conditions, like thick foliage layers and foliage banked against a fenceline.

Random dissections of the foliage in both experiments showed that almost all pupae in the treated samples were dead. As expected, not only the pupae of *C. ohridella* were killed but also other insects in the leaves, like hibernating parasitoids of *C. ohridella*. But usually these parasitoids occur in very low numbers, resulting in parasitism rates below 5 % (FREISE, 2001) with no influence on the population dynamics of the moth.

The results of these small scale experiments suggest the suitability of the Waipuna System for killing the pupae of *C. ohridella* hibernating in the foliage litter. There is no need for collecting and deposing of the autumn foliage, because the procedure can be applied at the treatment side. Moreover, the effectiveness of the Hot Foam Method can be easily improved by raking the foliage from the fencelines. The method can be applied any time after leaf fall in autumn and before the emergence of *C. ohridella* in spring, if weather conditions are suitable (no snow etc.). According to representatives of Waipuna GmbH the damage inflicted by the hot foam to bushes and trees is none or very small, if the method is applied correctly. In addition, surrounding grass tends to regrow after the damage and shows no sign of the treatment in the following spring.

Large scale application of insecticides to control the horst chestnut leafminer moth are not acceptable due to environmental concerns and the practical infeasibility in inhabited surroundings, especially if several treatments per season are needed. Therefore, other, more sustainable possibilities of controlling the horse-chestnut leaf miner for its mainly socio-economic impact have to be developed. However, control methods will only find acceptance if they result not only in a statistically significant but a visible reduction of leaf damage. The Waipuna System might be, at least at certain locations, one possibility which, however, still has to prove its feasibility and effectiveness in large scale trials. Like any other pest management method the Waipuna System should be used in a complete IPM program including other measures like e.g. special pheromone trapping techniques.

## Acknowledgements

The authors wish to thank the European Community (project CONTROCAM No. QLK5-CT-2000-01684 of the 5th Framework Program of European Community) and Klinge Pharma GmbH for their financial support. The author's are gratefull to C. FLICK, M. OBERLOHER and E. STURM for technical assistance and to Dr. ANNETTE HERZ for pre-reviewing the manuscript.

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