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Effects of autumn kaolin, pyrethrin, and ladybird larvae (*Adalia bipunctata*) applications on the spring populations of the rosy apple aphid (*Dysaphis plantaginea*) in an experimental apple orchard (cv. Glockenapfel)

- Questions: Effects of different strategies (insecticide treatment, physical barrier, biocontrol) to control autumn forms of *Dysaphis plantaginea*
- Question 1: Efficacy of pyrethrum, kaolin, and larvae of *A. bipunctata* to control *Dysaphis plantaginea*
- Question 2: Date of application and number of applications for a valuable efficacy
- Experimental site:
- FiBL, Ackerstrasse, CH-5070 Frick (Switzerland)
- Treatments:
- *A. bipunctata* (L2, 10/tree) on 1st Oct. 2002
 - *A. bipunctata* (L2, 10/tree) on 8th Oct. 2002
 - *A. bipunctata* (L2, 10/tree) on 15th Oct. 2002
 - *A. bipunctata* (L2, 10/tree) on 1st + 8th Oct. 2002
 - *A. bipunctata* (L2, 10/tree) on 1st + 15th Oct. 2002
 - *A. bipunctata* (L2, 10/tree) on 8th + 15th Oct. 2002
 - Surround® on 26th Sept. 2002
 - Surround® on 26th Sept. + 7th + 16th Oct. 2002
 - Surround® on 26th Sept. + 2nd + 9th + 16th Oct. 2002
 - Pyrethrum FS on 2nd Oct. 2002
 - Pyrethrum FS on 9th Oct. 2002
 - Pyrethrum FS on 15th Oct. 2002
 - Pyrethrum FS on 9th + 15th Oct. 2002
 - Control
- Variety:
- Glockenapfel M26

Experimental design:	<ul style="list-style-type: none">• Experimental orchard with 144 7-year old and 2 meter high trees. The orchard is arranged in 12 rows of 12 trees and subdivided in three 3 blocks, each containing 48 trees. Within each block treatments were replicated three times and randomly assigned to the 48 trees.
Application technique:	<ul style="list-style-type: none">• Insecticides: high-pressure hand gun• Larvae of <i>A. bipunctata</i>: by paintbrush
Method of control:	Visual controls in autumn 2002 and in spring 2003. Number of aphids (fundatrices in spring) are recorded on the total of each tree in spring and autumn.
Dates of control:	<ul style="list-style-type: none">• 24th October 2002• 16th April 2003
Statistical analysis:	One-way ANOVA
Management of crop:	None

Results and Discussion

Results for the kaolin product Surround®

Single and repeated treatments with the kaolin product Surround® WP in autumn 2002 led to a significant reduction in number of hatched fundatrices of rosy apple aphid in the screening orchard in spring (see Figure 1). Both treatments with repeated applications showed a slightly but not significantly better effect than the single treatment.

Surround® WP does not kill the aphids, but has a repellent and barrier effect. This barrier effect must work for the period during which the gynoparae (aphids giving birth to females) return to the apple trees because they decide whether a tree is suitable for the survival of females and the spring generation. Any undesirable substance for the survival of females will hinder their landing and make them leave the tree. It might be that kaolin particles have a disturbing effect on females and males upon contact.

In most cases, however, trees with gynoparae present in autumn had aphids in spring and the mean number of fundatrices in all Surround® WP treatments was above the commonly accepted threshold of 1 fundatrix per 100 buds. Therefore, application technique and timing for Surround® WP must be better adapted to the return flight of the rosy apple aphid in terms to reduce the number of hatching fundatrices in spring below the economic threshold.

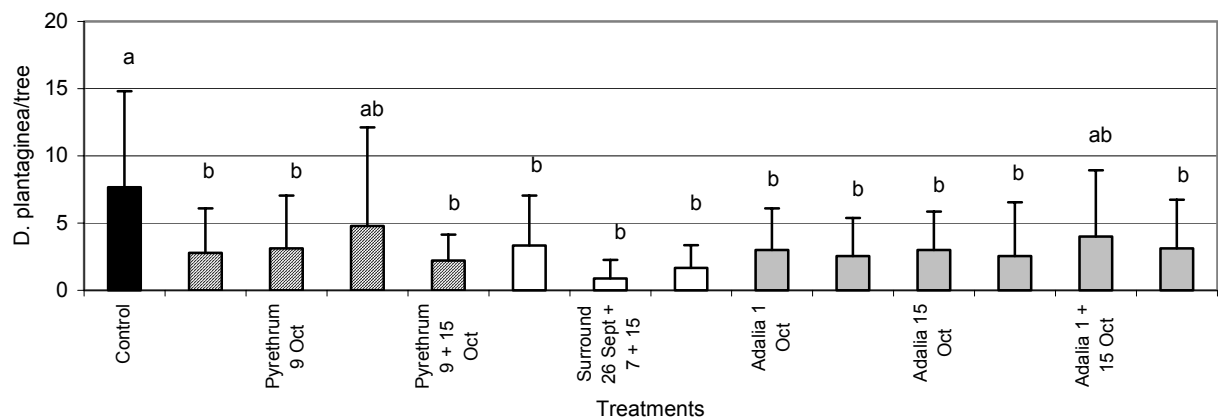


Figure 1: Effects of different autumn treatments with Pyrethrum FS (hatched), Surround® WP (white), and larvae of *Adalia bipunctata* (grey) on the mean number of fundatrices of *Dysaphis plantaginea* in the experimental orchard at Frick in spring 2003. Comparison of the different treatments by one-way ANOVA; treatments with different letters are significantly different ($P < 0.05$; Student's t-Test).

Results for the pyrethrin product Pyrethrum FS

Comparing the different types of single and repeated treatments, there is no answer whether single or repeated treatments with Pyrethrum FS have a better efficacy (see Figure 1). The two single autumn treatments on 2nd and 9th of October and the repeated treatment (9th and 15th October) had a similar and significant effect on the spring population of the rosy apple aphid in this screening orchard trial. The single treatment on 15th of October had no significant effect anymore which confirms previous trials done by KEHRLI ET AL. (2001) where treatments after mid October had no effect on the number of aphids in spring.

Pyrethrin products are contact insecticides and work immediately upon application. The efficacy drops within a short time and application should be repeated if new aphids (gynoparae) are landing on the apple trees. Therefore, the knock-down effect of this type of product against autumn forms of the rosy apple aphid will depend on a perfect timing of the application in order to kill at least all females before they can lay their eggs.

Results for the release of larvae of the ladybird beetle *A. bipunctata*

The larvae of the ladybird beetle *A. bipunctata* are very effective predators of aphids. They are usually observed on apple trees during late spring and summer, a time when the rosy apple aphid has already damaged the apple trees. Augmentative releases of reared *A. bipunctata* larvae during early spring showed a significant reduction of the rosy apple aphid but the few aphids left might still be able to build up new colonies (WYSS ET AL., 1999). Releases in autumn, however, showed a new possibility to control the rosy apple aphid by eliminating gynoparae, females, or males. First results showed a significant reduction of fundatrices in spring when larvae were repeatedly released in autumn (KEHRLI ET AL., 2001).

In this new trial the results of KEHRLI ET AL. (2001) could be confirmed: with the exception of one, all single and repeated releases with larvae of *Adalia bipunctata*

showed a significant reduction of fundatrices in spring. Compared to the results of Kehrlí et al. the efficacy of the larvae in autumn was not that evident in our trial. The most important factor for this reduced efficacy was for sure the cold and rainy weather conditions in autumn 2002. Despite the significant reduction of fundatrices hatched in spring the number was still above the economic threshold.

We might conclude that larvae of *A. bipunctata* have an impact on the autumn forms of the rosy apple aphid but the question is if the larvae's efficacy could be improved by a better timing of the releases in autumn in terms to push the aphids below the economic threshold. We think that timing will not much improve results but, instead of larvae adult ladybirds might lead to better results. New trials will be done to show the efficacy of adult *A. bipunctata* to control the autumn forms of the rosy apple aphid.

References

- WYSS, E., VILLIGER, M., HEMPTINNE, J.-L., & MÜLLER-SCHÄRER, H. (1999). Effects of augmentative releases of eggs and larvae of the ladybird beetle, *Adalia bipunctata*, on the abundance of the rosy apple aphid, *Dysaphis plantaginea*, in organic apple orchards. *Entomologia Experimentalis et Applicata*, 90, 167-173.
- KEHRLI, P., & WYSS, E. (2001). Effects of augmentative releases of the coccinellid, *Adalia bipunctata*, and of insecticide treatments in autumn on the spring population of aphids of the genus *Dysaphis* in apple orchards. *Entomologia Experimentalis et Applicata*, 99, 245-252.

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