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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 on-farm apple orchard (cv. Topaz)

- 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:
 - M. Gschwind, Ittentalhof, 4312 Magden (Switzerland)
- Treatments:
 - *A. bipunctata* (L2, 20/tree) on 9th Oct.
 - *A. bipunctata* (L2, 20/tree) on 15th Oct.
 - *A. bipunctata* (L2, 20/tree) on 2nd Oct. + 9th Oct.
 - *A. bipunctata* (L2, 20/Baum) on 9th Oct. + 15th Oct.
 - Surround on 1st Oct.
 - Surround on 1st Oct. + 8th Oct. + 15th Oct.
 - Pyrethrum FS on 8th Oct.
 - Pyrethrum FS on 15th Oct.
 - Pyrethrum FS on 2nd Oct. + 8th Oct.
 - Pyrethrum FS on 8th Oct. + 15th Oct.
 - Control
- Variety:
 - Topaz, two rows 3 years old and one row 6 years old
- Experimental design:
 - The commercial orchard consisted of 3 rows, each with hundred apple trees. The trees were approximately 3.5 meters high. Each of the three tree rows was treated as a block with three replicates in each. Each replicate consisted of 2 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 are recorded on 50 flowering buds/treatment in spring and on 50 leaves/treatment in autumn.
Dates of control:	<ul style="list-style-type: none"> • 24th October 2002 • 15th April 2003
Statistical analysis:	One-way ANOVA
Management of crop:	None

Results and Discussion

Results for the kaolin product Surround®

A repeated treatment with the kaolin product, Surround® WP, in autumn 2002 led to a significant reduction in number of hatched fundatrices of rosy apple aphid in spring in the commercial orchard (see Figure 1). The single treatment with Surround® WP had a certain effect but it was less reliable than the repeated 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

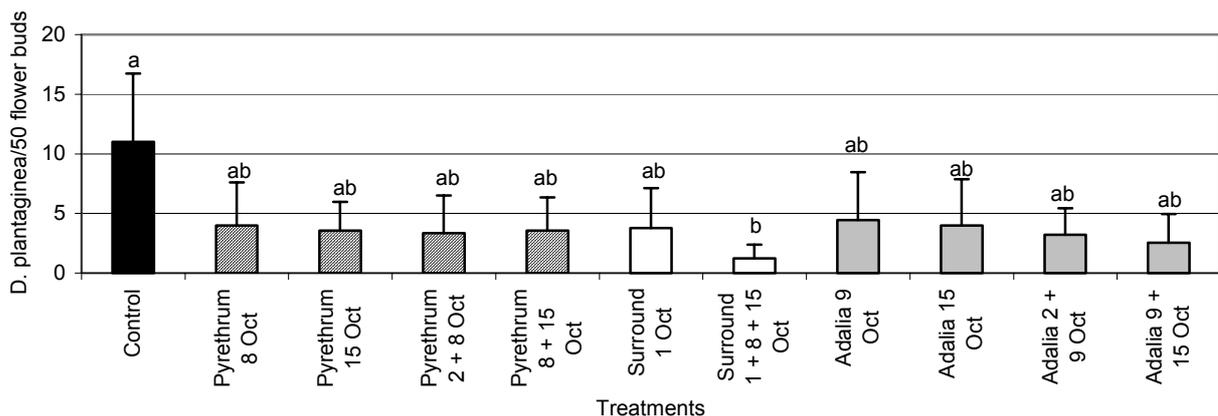


Figure 1: Effects of different autumn treatments with Pyrethrum FS (hatched), Surround® WP (white), and larvae of *Adalia bipunctata* (grey) on the mean number of fundatrices of *D. plantaginea* in the commercial orchard at Magden in spring 2003. Comparison of the different treatments by one-way ANOVA;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

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.

Results for the pyrethrin product Pyrethrum FS

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. Anyhow, comparing the different types of single and repeated treatments, there is no answer whether shorter intervals or more treatments would lead to a better knock-down effect (see Figure 1). All four types of autumn treatments with Pyrethrum FS had a similar and not significant effect on the spring population of the rosy apple aphid in this on-farm trial.

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 not be confirmed: all single and repeated releases with larvae of *Adialia bipunctata* had no significant effect on fundatrices in spring. However, a tendency of reduction of the aphids in spring could be shown but due to the generally low number of aphids results were not that evident.

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 their 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.

Acknowledgement

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