Efficacy of different insecticides and a repellent against the European pear sucker (*Cacopsylla pyri*)

Wirkung verschiedener Insektizide und Repellentien gegen den Gemeinen Birnenblattsauger (*Cacopsylla pyri*)

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Abstract

The efficacy of different insecticides (neem, pyrethrin, spinosad, and rotenone) and a repellent (kaolin) applied with different strategies (single or repeated applications) against the over-wintering pear suckers (*Cacopsylla pyri*) and nymphs of the first generation was tested in a field trial in Switzerland in spring 2003.

Rotenone, the only admitted product in Swiss organic agriculture, showed good effects. But, since Rotenone is toxic for non-target insects we looked for an alternative. The application of spinosad (Audienz) in combination with rape oil (Telmion) as well as the application of pyrethrum showed similar efficacy as rotenone. Neem had no or a very low impact on the pear sucker populations. The repellent kaolin (Surround® WP) showed the best efficacy against the European pear sucker: triple application of kaolin before blossom was most efficient. Since kaolin is not toxic for beneficials this product might be an alternative to rotenone.

Keywords: *Cacopsylla pyri*, insecticide, rotenone, neem, pyrethrin, spinosad, kaolin, Surround® WP, particle film technology

Introduction:

The European pear sucker (*Cacopsylla pyri*), which appears in 4-6 generations each year, is one of the main pests of pear. In February / March the overwintering adults start feeding and oviposition. The nymphs of the first generation are sucking inside the blossoms. Normally, the first and second generation do not cause economic damage due to their low numbers. The numerous nymphs of the third generation reside on leaves in a droplet of honeydew. Damage is caused by the large amounts of honeydew leading to sooty moulds on fruits and by the sucking of the nymphs causing an exhaustion of the tree and crop losses. Severe infestation can cause a partial leaf fall during August.

The only registered product against the pear sucker in Swiss organic agriculture is rotenone, which is highly toxic to many beneficial insects such as anthocorid bugs, the natural enemies of *Cacopsylla*. The aim of this study was to evaluate the efficacy of different organic insecticides (neem, pyrethrin, spinosad) and the repellent kaolin product Surround® WP in order to find an alternative to rotenone.

Material and Methods:

The studies were conducted in an orchard in western Switzerland (Aubonne) in spring 2003 (February-May) on the pear varieties Conference and Harrows. The different treatments are given in Table 1. The experimental design included seven replications (three on variety Conference, four on variety Harrows) per treatment with four trees each. For the neem treatment only four replications on Harrows were installed since neem has phytotoxic effects on the variety Conference. All products were applied by a high-pressure hand gun to drip coverage (insecticides) or near drip coverage (Surround). The neem and Surround treatments were applied at the beginning of the flying period of the

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over-wintering adult pear suckers (stage 51-52 BBCH = bud swelling). All other insecticide treatments were focussed on the larvae of the first generation at stage 66-69 BBCH (petal fall).
To control the activity of the adult pear suckers, beating tray samples were taken at four dates between end of February and end of May. The infestation with nymphs on the blossoms and the young shoots was visually monitored at four dates in April and May. The data were analysed by a two-way ANOVA and a Tukey HSD test ($\alpha = 0.05$) using JMP Version 4.0.2.

Table 1: Treatments applied in the field trials in Aubonne in 2003.

label	**product name**	**active matter**	**concentr.**	**number of treatments**	**applied at stage (BBCH)**
control	**control**	untreated			
neem 1x	**NeemAzal-T/S**	neem	0.3%	1x	52-**53**
neem 2x	**NeemAzal-T/S**	neem	0.3%	2x	52-**53 &** 54-**56**
Surround 2x	**Surround® WP**	kaolin	30kg/1000l	2x	51-**53 &** 54-**56**
Surround 3x	**Surround® WP**	kaolin	30kg/1000l	3x	51-53 at 7d interval
Surround 6x	**Surround® WP**	kaolin	30kg/1000l	6x	51-53 3x at 7d interval & 66-69 3x at 7d interval
pyrethrum 1x	**Pyrethrum FS**	pyrethrin	0.05%	1x	66-**67**
pyrethrum 2x	**Pyrethrum FS**	pyrethrin	0.05%	2x	66-**67 & 68-**69
rotenone 2x	**Sicid**	rotenone	0.5%	2x	66-**67 & 68-**69
spinosad 2x	**Audienz**	spinosad	0.03%	2x	66-**67 & 68-**69
spinosad/oil 2x	**Audienz Telmion**	spinosad rape oil	0.03% 1%	2x	66-**67 & 68-**69

Results:

The adult pear suckers of the over-wintering generation were monitored by beating tray samples (Table 2). At the end of February the pear sucker were already active. The flying period of the over-wintering adults declined after mid-March and stopped at the end of March.

Table 2: Mean number of adult European pear sucker (*Cacopsylla pyri*) during the first flying period. Beating tray samples were taken in the neighbourhood of the experimental site in Aubonne (1 sample = 100 beatings on 33 branches).

Dates of sampling	**number of samples**	**Mean number of adult psyllids/sample**
26th Feb 03	4	56.5
05th Mar 03	3	94.0
12th Mar 03	3	32.0
20th Mar 03	2	2.5

At the beginning of the first flying period neem and Surround were applied. All other insecticide treatments were focussed on the larvae of the first generation. Therefore, during the first visual control (23rd April) only the neem treatments with one and two applications ("neem 1x", "neem 2x") and Surround treatments with two and three applications ("Surround 2x", "Surround 3x") could be assessed. The results are shown in Figure 1. The number of nymphs on 50 blossoms or young fruits, respectively, was monitored. Compared to the untreated control both Surround treatments significantly reduced the number of nymphs, whereas neem had no effect.

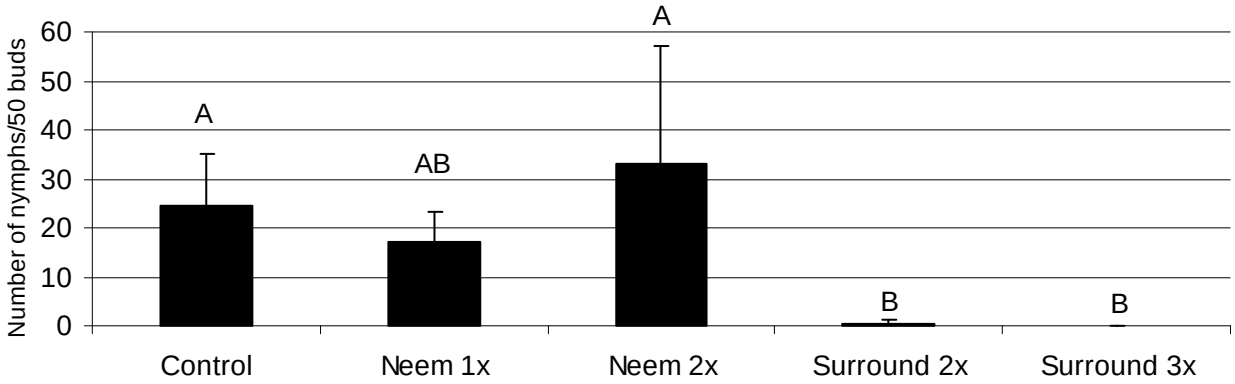

Figure 1: Effects of neem and Surround treatments before bud burst on the mean number of *Cacopsylla* nymphs of the first generation monitored on 23rd April 2003. Statistical analyses: two-way ANOVA ($p<0.0001$); different letters show significant differences (Tukey HSD test, $\alpha=0.05$).

For the second visual control (6th May 2003) all treatments could be evaluated but the treatment Surround with 6 applications ("Surround 6x") was only treated five times at this moment. The results are presented in Table 3. Again, all Surround treatments showed the best results, whereas no differences could be detected between them. The treatments "spinosad/oil 2x" and "rotenone 2x" also had a lasting and significant efficacy. However, both treatments showed slightly more pear sucker nymphs than the trees treated with Surround. The treatment "spinosad 2x" (without additive) was less efficient than the combined "spinosad/oil 2x" but the differences were not significant. No differences in efficacy could be detected between the two neem treatments as well as between the two pyrethrum treatments. Whereas, compared with the untreated control, "neem 2x" had a significant effect, "pyrethrum 2x" not.

Table 3: Effects of different insecticide and kaolin treatments on the mean number of *Cacopsylla* nymphs on 6th May 2003 and on 21st May 2003 (two-way ANOVA $p<0.0001$ (6th May), $p=0.0004$ (21st May); Tukey HSD test $\alpha=0.05$: treatments with different letters are significantly different).

	6th May 2003		**21st May 2003**	
Treatments	Larvae/50 blossoms		Larvae/20 shoots	
control	48.29	A	35.29	AB
pyrethrum 1x	33.86	AB	11.29	B
pyrethrum 2x	35.00	AB	7.00	B
neem 1x	18.00	ABC	35.00	AB
neem 2x	17.25	BC	76.50	A
rotenone 2x	15.14	BC	6.86	B
spinosad 2x	16.57	BC	29.29	AB
spinosad/oil 2x	7.00	BC	9.57	B
Surround 2x	0.71	C	5.57	B
Surround 3x	0.00	C	0.71	B
Surround 6x	0.14	C	6.71	B

Two weeks later (21st May), visual controls of the pear shoots showed different results: no significant differences could be detected between the control and any treatment (Table 3). However, the best results were achieved with "pyrethrum 2x", "rotenone 2x" and the different Surround treat-

ments. These results should be treated with care, since many adults were noticed during the visual control. This, on the one hand, could indicate that oviposition and in consequence larval development of the 1st generation was not completed. On the other hand, the 1st and 2nd generation could already have started to overlap.

During the last visual control (28th May 2003) the treatment "Surround 6x" could still be recognised by the white coated trees. But the young leaves at the top of the shoot were not protected by the Surround coating. Thus, on these parts of the tree most of the eggs were found. At this date the generations of the pear sucker were clearly mixed: adults, different larval stages, and eggs were observed on the leaves and on the top of the shoots. For this reason it was difficult to collect representative data. Moreover, the mobile adults probably moved between the different treatments. Therefore, the results of this visual control are not shown.

At the beginning of May the rows next to the trial were treated twice with Surround in a bigger, more practice like experiment. The results are given in Figure 2. In the treated area clearly less pear sucker eggs were laid and as a result also less nymphs were counted. However, this type of experiment without replicates does not allow statistical analysis.

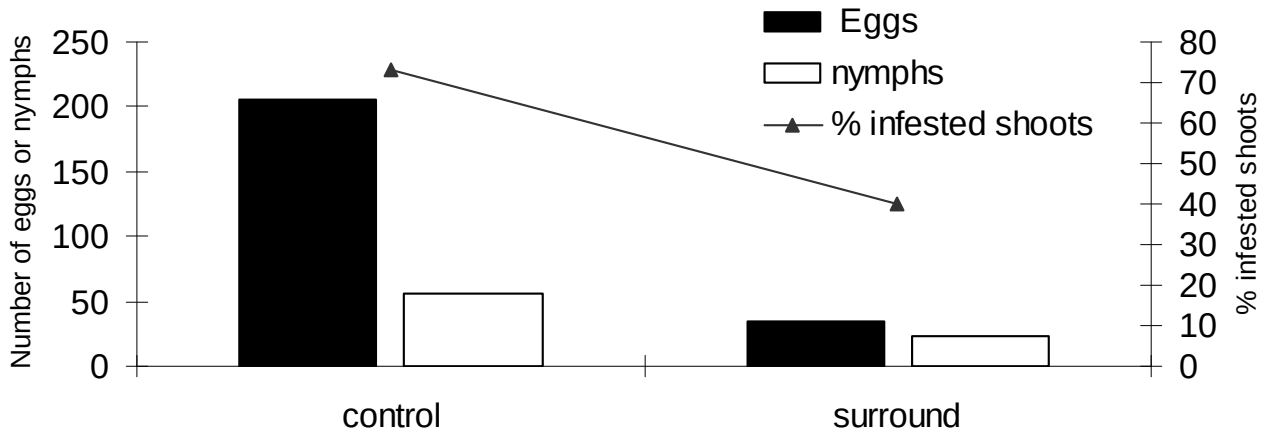

Figure 2: Number of *Cacopsylla* nymphs and eggs and infestation rate (%) on shoots on 28th May 2003 in Aubonne.

Discussion:

At the beginning of the flying period of the over-wintering adult pear suckers (stage 51-52 BBCH = bud swelling) the neem treatments were applied with the idea to kill the adults and/or to reduce the females' fertility. Surround applied at the same time should have hindered the female pear suckers to lay their eggs on the unattractive, kaolin coated leaves and shoots. All other insecticide treatments were focussed on killing the larvae of the first generation at stage 66-69 BBCH (petal fall).

Rotenone, the only registered product against pear suckers in Swiss organic agriculture, showed good effects. Thus, a suitable product to control the European pear sucker is available. But, since rotenone is toxic to beneficials an alternative for this product is desirable.

Neem had no or a very low impact on the pear sucker populations. Since neem was applied against the adults in order to kill them or to reduce females' fertility, it is possible that new, fertile insects

migrated from the untreated rows aside into the treated plots. To get more meaningful data for this slowly working insecticide, trials should be done on bigger plots.

Audienz (active matter: spinosad) in combination with Telmion (rape oil) showed a slightly better efficacy than spinosad without additive. The efficacy of spinosad/oil is similar to the efficacy of the registered rotenone and should be registered for the control of the European pear sucker. Since the young fruits of some Telmion treated trees showed russeting, the concentration of this additive should be re-evaluated in separate tests.

Pyrethrum was applied at two dates: 23rd April and 29th April. During the visual control of the 6th May no effect could be seen, whereas two weeks later an efficacy comparable to the efficacy of rotenone was observed. This retarded effect of the contact insecticide cannot be explained.

Surround showed the best efficacy against the European pear sucker in this trial. No significant differences were found between the differently repeated treatments with Surround. It might be concluded that the triple application before blossom had the best efficacy. An increased efficacy with additional applications after blossom could not be proven. Since the adults are quite mobile and since the plots were small, it could not be verified if the reduction of the population in spring is sufficient to keep the pear sucker under the economic threshold during the whole year. This question should be clarified in a more practice-like experiment on a bigger surface. Since Surround is not toxic for beneficials this product might be an alternative to rotenone. Similar results with Surround treatments against *Cacopsylla* are described by PASQUALINI ET AL. (2002), who achieved a 99 to 100% reduction of eggs and nymphs by two applications in February / March. GLENN ET AL. (1999) and COUPARD (2001) also showed a significant reduction of eggs and nymphs. According to GLENN ET AL. (1999) the adults get heavily coated with kaolin particles within 24 hours and appeared preoccupied by attempts to remove these particles from their body, unable to feed or to oviposit. Especially the tarsal segments were covered with kaolin particles. COTTRELL ET AL. (2002) noticed that black pecan aphids were not able to stay on the underside of surround treated leaves due to dusty tarsi, which led to a reduced mobility.

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