Winter treatments against the woolly apple aphid (*Eriosoma lanigerum*): products and timing of applications

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Abstract

*In organic apple growing the woolly apple aphid (*Eriosoma lanigerum*) is still an unsolved problem. Various approaches to use beneficial insects were not really effective. Only winter treatments with mineral oils showed partial and fluctuating success.*
In 2006 and 2007 field trials were carried out to evaluate the efficacy of winter treatments to control woolly apple aphids. The efficacy of several products (different mineral oils, lime sulphur, and lime sulphur + mineral oil) was tested in comparison to an untreated control, and possible side effects on the population of predatory mites were investigated. The study furthermore aimed at establishing the best timing of the application against the target pest.

Keywords: apple, organic farming, woolly apple aphid.

Introduction

In organic farming the woolly apple aphid is very difficult to control due to its biology (Van Frankenhuyzen et al., 2002) and its protective mechanisms. This pest is therefore becoming a major problem especially in orchards, which have been under organic management for several years. Even though measures aimed at supporting beneficials and releases of natural enemies such as the parasitoid *Aphelinus mali* and earwigs provided good control in some cases, the efficacy of these control strategies is strongly related to specific climatic and local conditions, and can therefore not be ensured (Hetebrügge et al., 2006; Scheer et al., 2006). Applications of contact insecticides during the summer months show short-term and limited efficacy because of the tough waxy covering (colonies resemble tufts of wool) and the considerable reproductive potential of the woolly apple aphid. Furthermore, negative side effects of the treatments on beneficials can not be excluded. Anticipating the application of the treatments to early spring may be useful, because aphids are not yet protected by their waxy covering and the development of the summer generations has not yet started (Häseli et al., 2006).

Material and Methods

To investigate the efficacy in suppressing the woolly apple aphid of different products, applied just prior to and after the beginning of inflorescence emergence vegetative growth, several open-field trials were conducted in 2006 and 2007. To ensure that the sprays would reach also aphids hiding in bark crevices, all treatments were applied with a spray gun.

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Study sites:

Trials were conducted in two different apple orchards.

Study site 1:
Location: Tramin (South Tyrol – Italy)
Cultivar/Rootstock: Morgenduft / M4,
Row x plant spacing: 4 x 5 m
Year of planting: 1987
Experimental design: 3 randomized blocks of 8 trees each (2 buffer trees included)

Study site 2:
Location: Montiggl (South Tyrol – Italy)
Cultivar/Rootstock: Braeburn/M9
Row x plant spacing: 2.7 x 0.8 m
Year of planting: 1996
Experimental design: 3 randomized blocks of 7 trees each (2 buffer trees included)

Data assessment

Assessments on woolly apple aphids:
Due to the differences among study sites and pest pressure, different assessment methods were used: in study site 1 (Tramin) the development of new woolly apple aphid colonies was evaluated on former sites of aphid infestation, while in study site 2 (Montiggl) the number and size of new aphid colonies was assessed in a previously selected area of each tree in order to determine the aphid infestation projected to the entire tree volume.
Assessments on predatory mites:
In study site 1, within each plot, 25 leaves were collected and the number of spider mites and predatory mites present on the leaves was determined according to Boller's method.

Tested products and timing of application

Table 1: summary of the treatments tested in 2006 and 2007 in the different study sites (active ingredient, formulated product, producer, applied rate, phenological stage of the target crop, and application date; LS=Lime sulphur)

Year	Study site	Active substance	Formulated product	Producer	Rate (l/hl)	Phenological stage (BBCH)	Applic. date
2006	Tramin	Lime sulphur	Calcium	Solfotecnica	25 l	50	23.03.2006
		LS + Mineral oil	Calcium + Oliocin	Solfotecnica + Bayer	13.5 l + 2.5 l	50	23.03.2006
		Mineral oil	Oliocin	Bayer	2.5 l	50	23.03.2006
		Rape oil product	Insect 23	Ligno Tec	2.5 l	50	23.03.2006
		Sulphur-oil product	Polithiol	Cerexagri	6 l	50	23.03.2006
		Mineral oil	Oliocin	Bayer	2.5 l	57	12.04.2006
		Untreated control	-	-	-		-
2007	Tramin	Lime sulphur	Polisolfuro di Calcio	Polisenio	25 l	52	13.03.2007
		LS + Mineral oil	Polisolfuro di Calcio + Oliocin	Polisenio + Bayer	13.5 l + 2.5 l	52	13.03.2007
		Mineral oil	Oliocin	Bayer	2.5 l	52	13.03.2007
		Rape oil product	Insect 23	Ligno Tec	2.5 l	52	13.03.2007
		Sulphur-oil product	Polithiol	Cerexagri	6 l	52	13.03.2007
		Mineral oil	Oliocin	Bayer	2.5 l	57	05.04.2007
		Untreated control					
2007	Montiggl	Lime sulphur	Polisolfuro di Calcio	Polisenio	25 l	51	03.03.2007
		LS + Mineral oil	Polisolfuro di Calcio + Oliocin	Polisenio + Bayer	13.5 l + 2.5 l	51	03.03.2007
		Mineral oil	Oliocin	Bayer	2.5 l	51	03.03.2007
		Rape oil product	Insect 23	Ligno Tec	2.5 l	51	03.03.2007
		Sulphur-oil product	Polithiol	Cerexagri	6 l	51	03.03.2007
		Untreated control					

Results

At the study site 1 (Tramin) the same treatments were compared in 2006 und 2007. In both years the treatments lime sulphur + mineral oil, rape oil product, and sulphur-oil product showed highest efficacy in reducing woolly apple aphid infestations, while treatments where only lime sulphur and only Mineral oil was applied at BBCH 50 showed lower efficacies, especially in 2006 (Fig. 1). A slight reduction of the aphid infestation compared l was observed when mineral oil was applied alone at the pink bud stage (BBCH 57) in 2006, but not in 2007. A slight reduction of the aphid infestation compared to the untreated control was observed when mineral oil was applied alone at the pink bud stage (BBCH 57) in 2006, but not in 2007.

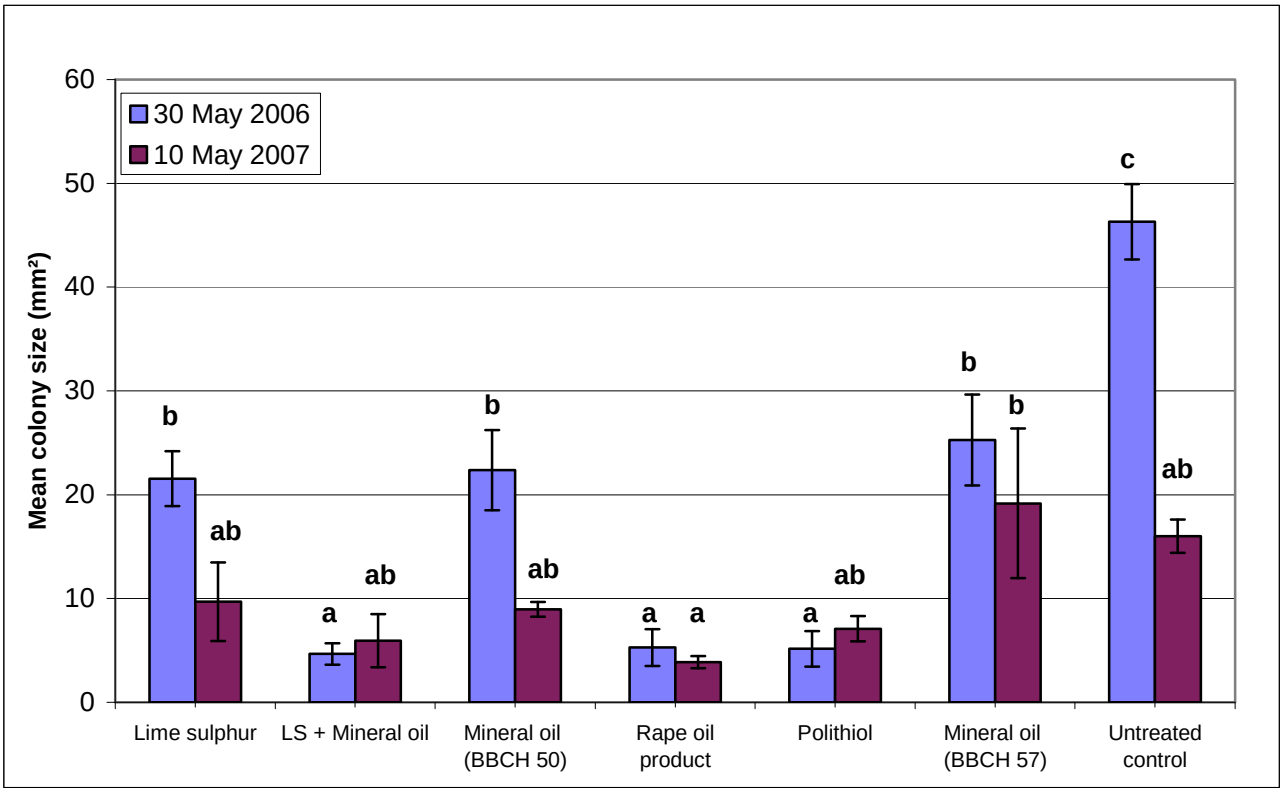

Figure 1: woolly apple aphid infestation (mean colony size in mm²) in study site 1 (Tramin) in 2006 and 2007 in the different treatments. Statistics: One-way ANOVA, Tukey's Post-Hoc repeated comparison p=0,05

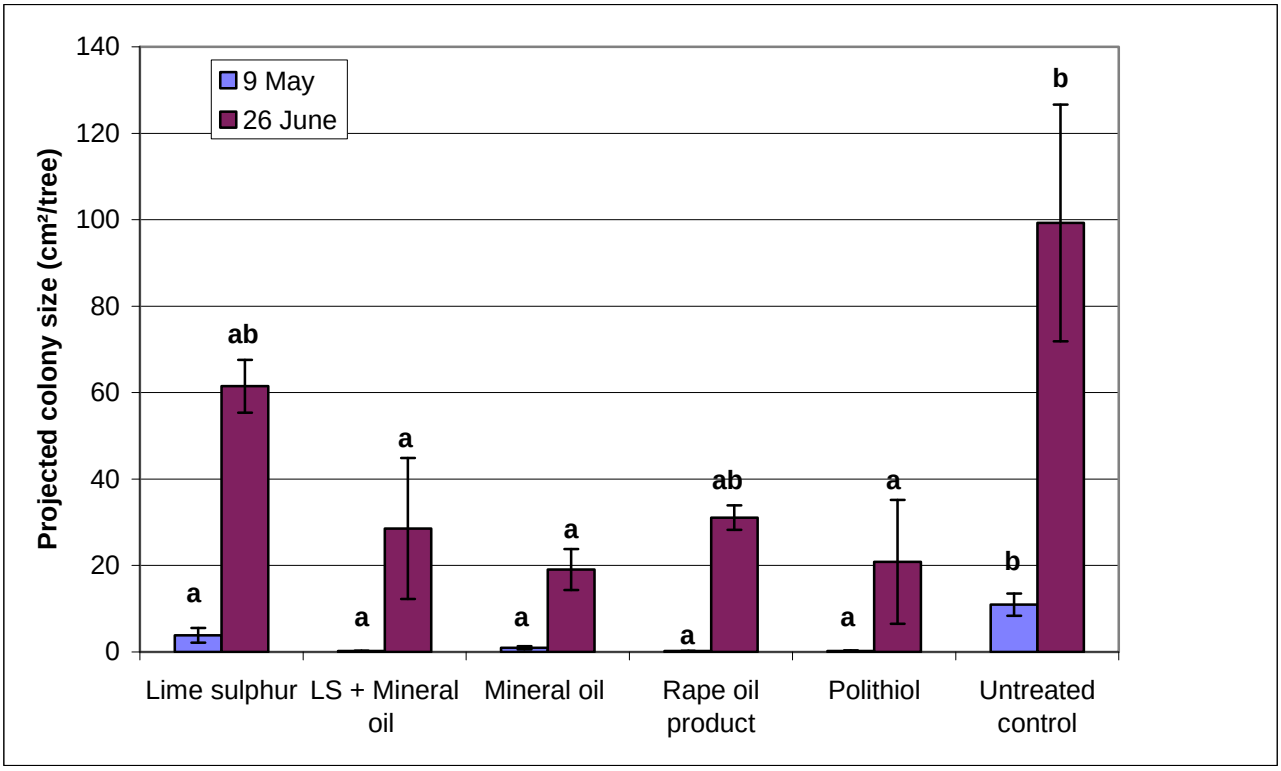

Figure 2: woolly apple aphid infestation (mean projected colony size/tree) in study site 2 (Montiggl) on 9 May and 26 June, 2007. Statistics: One-way ANOVA, Tukey's Post-Hoc repeated comparison p=0,05

In 2007, two aphid infestation assessments were conducted in study site 2 (Montiggl), one at the beginning of May and one at the end of June. In May, the infestation level was generally low in all plots, untreated control plots included, but it increased in June (Fig. 2). On both assessment dates, the treatments lime sulphur + mineral oil, mineral oil, rape oil product, and sulphur-oil product showed good and comparable efficacies in reducing woolly aphid infestations, while lime sulphur alone was again less effective than the other treatments.

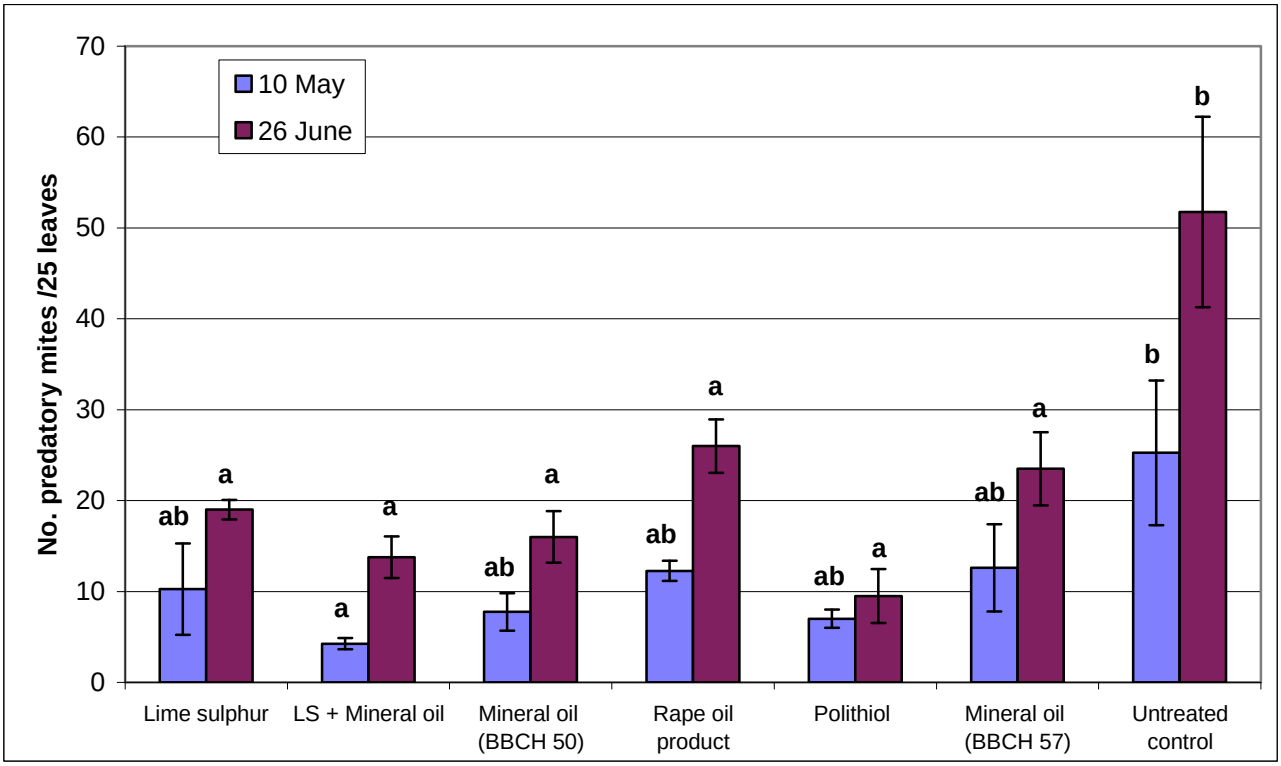

Figure 3: number of predatory mites/25 leaves in study site 1 (Tramin) in the different treatments in 2007. Statistics: One-way ANOVA, Tukey's Post-Hoc repeated comparison p=0,05

All treatments negatively affected the population of predatory mites (Fig. 3). Four months after the first treatment application (assessment date: 26 June 2007), in all the treated plots the population of predatory mites was still considerably lower than in the untreated control plots. The side effects of only mineral oil on the population of predatory mites were less harmful when the product was applied at the pink bud stage than when applied at inflorescence emergence**.**

Discussion

The trials conducted in 2006 and 2007 evidenced a good and promising efficacy in reducing woolly apple aphid infestations of tank mixtures of mineral oil with sulphur and rape oil based products. The early application of the treatment (just prior to bud burst) seems to be of sound importance to ensure acceptable efficacy values. At this phenological stage, the overwintering aphids are already active, but their waxy covering is not yet adequately developed.

In the randomized trials the treatments were applied per hand with the spray gun. In 2007 in one side (Klotz) a practical experience (applying lime sulphur and oil with a transverse current blower) were carried out to compare the results in the randomized trail with a practical application technique. As expected the results were good, although the efficacy was something lower than in the randomized plots.

In case of high pest pressure and favourable climatic conditions, the woolly apple aphid populations increased during spring in all plots, but infestation levels were considerably lower in the treated plots than in the untreated control plots. Even though all treatments showed strong negative side effects on the population of predatory mites, the presence of harmful spider mites was negligible in all plots.

References

Hetebrügge K., Fieger-Metag N., Kienzle J., H. Bathon, Zebitz C.P.W, J. Zimmer. (2006). Biological Control of Woolly Apple Aphid (*Eriosoma lanigerum* Hausm.) with *Aphelinus mali* Hald. Proceeding to the 12th International Conference on Cultivation Technique and Phytopathological Problems in Organic Fruit-Growing. Fördergemeinschaft Ökologischer Obstbau e.V. Weinsberg. 36 – 42.

Scheer C., Trautmann M. (2006) Versuch zur Regulierung der Blutlaus mittels Ohrwurmansiedlung [Trial to control woolly aphid by earwigs]. Proceeding to the 12th International Conference on Cultivation Technique and Phytopathological Problems in Organic Fruit-Growing. Fördergemeinschaft Ökologischer Obstbau e.V. Weinsberg. 43 – 44.

Van Frankenhuyzen A., Stigte H. (2002). Schädliche und nützliche Insekten und Milben an Kern- und Steinobst. Ulmerverlag

Häseli A. , Wyss E. , Weibel F. , Zingg D. (2000). Control of the aphid (*Eriosoma lanigerum*) in organic apple cultivation. Experience from three years of experiments using direct and indirect measures. / 9ter Internationaler Erfahrungsaustausch über Forschungsergebnisse zum Ökologischen Obstbau. Fördergemeinschaft Ökologischer Obstbau e.V. Weinsberg. 45-52.

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