# Control of the apple sawfly *Hoplocampa testudinea* Klug in organic fruit growing

## Zur Regulierung der Apfelsägewespe im Ökologischen Obstbau

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**Abstract**

The best application technique and application data for the treatments with Quassia extract against the apple sawfly *Hoplocampa testudinea* Klug were tested. The spraying solution was distributed best on the receptacle of the blossom – the place where the sawfly larvae feed before the enter the blossom – when the treatment was effecttuated at fading blossom with a high amount of water (about 500 l/ha/mTh). The addition of T/S forte, a wetting agent, could also improve the efficacy of Quassia treatments in a lower dose. Thus, it is recommended to apply in fading blossom with addition of T/S forte and high amounts of water to obtain the best effect. If the conditions for applications are good and the infestation is not too high, the normally recommended dose of 6 g/ha/mTh can even be reduced.

**Keywords:** Sawfly, *Hoplocampa*, Quassia, application technique

### Introduction

Traditionally, in organic fruit growing the apple sawfly *Hoplocampa testudinea* Klug is controlled by the use of extracts of Quassia wood. Several questions concerning the quality of Quassia (active ingredients) necessary for a good efficacy and its effect on the eggs or larvae of the sawfly were answered in a project of BOEL financed by the German BMVEL? in 2002 and 2003 (KIENZLE et al., 2004). Still, questions remained open about the best application date, the best application modalities (application technique) and the possibility to reduce the concentrations, which means also the cost, if these two parameters were optimized. This was topic of a second project of BOEL during the years 2004 and 2005.

In the first project, it was shown, that it is of main importance that the active ingredients are placed in a kind, that the larvae can ingest them easily: possibly on the receptacle of the blossom. Thus, the interest was focused towards the best application technique and the optimal shape and condition of the blossom (open or closed, fresh or fading) during application. In 2004, a marker was added to the spraying liquid to show its distribution on the blossom using different amounts of water per ha at different flowering stages. Parallel, the efficacy of treatments before blossom, at full blossom and fading blossom was compared in field trials.

According to the results of 2004, the possibility to reduce the concentrations of Quassia and the effect of the addition of a wetting agent was tested in 2005 in a couple of on-farm-trials.

### Material and Methods

The field trials in 2004 took place at different locations in different regions of Germany. The trials in organic orchards had a randomised block design with 4 replications per treatment (6-12 trees per replication).

The substances were applied with a motorized knapsack sprayer. The primary and the secondary infestation were assessed at two different times, controlling 50 fruit clusters in each replication for infested fruits.

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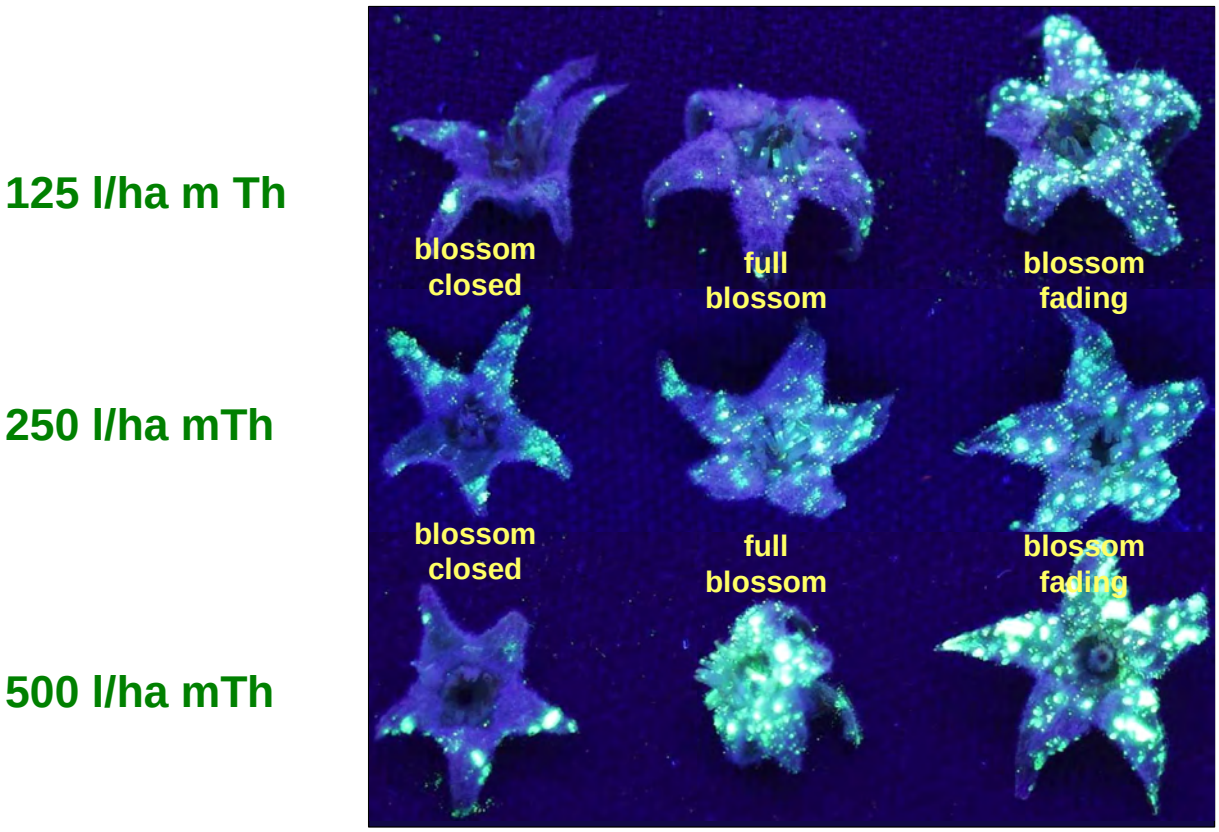
To study the distribution of the spraying water on the blossom, apple trees were sprayed with Yellow Flourescent Pigment EC before blossom, in full blossom and when blossom was fading at the DLR Ahrweiler In each case, an amount of water of 125 l/mTh/ha (jet AVI 015), 250 l/mTh/ha (jet DG 03) and 500 l/m Th /ha (jet DG 05), respectively, was applied.
When the blossoms had dried, the samples were taken.
The field trials in 2005 were conducted comparing Quassia extract with 3 g/ha/mTh Quassin with 6 g/ha/mTh Quassin. In some trials the wetting agent T/S forte was added to the amount of 3 g/ha/mTh Quassin with the amount of 1,5 l/ha/mTh. In all these trials 500 l/ha/mTh spraying liquid were applied (jets DG 05) with the sprayer of the farmer. Most trials had two repetitions, each of them at larger plots. In Saxony and in Jork there was only one big plot per test.
In an additional trial in Jork 3 g/ha/mTh Quassin was compared with 6 g/mTh Quassin with a low (335l/ha, jets Albuz AVI 80-015) and a high (1250 l/ha, jets DG Teejet 8005 VS) amount of water (2,5 m tree height).

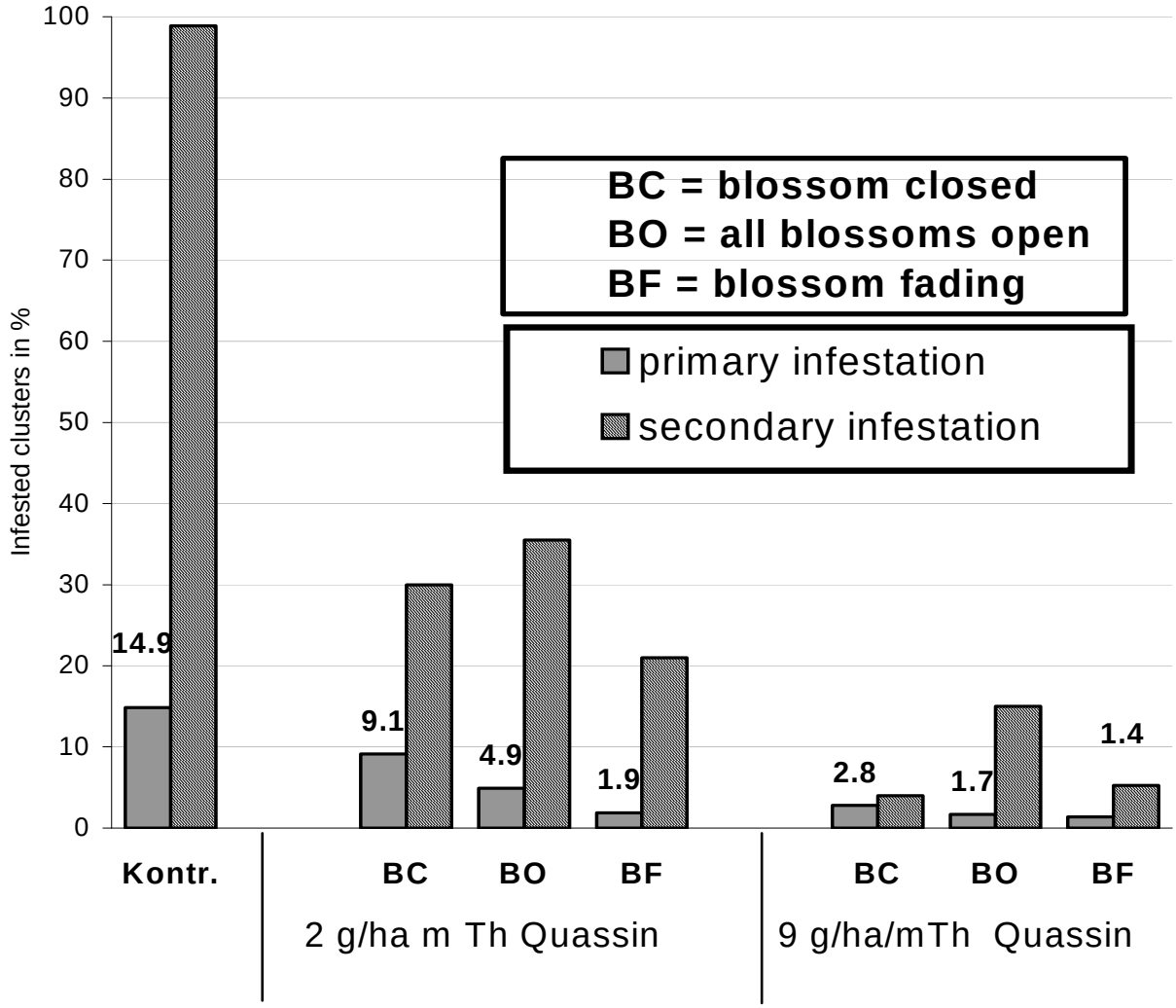
**Results**

Most of the flourescent marker and, thus, of the spraying solution was found on the receptacle of the blossom when the blossom was fading and when the amount of water was highest (500 l/ha/mTh) (graph 1).




**Graph 1:** Distribution of the flourescent marker on the blossoms at different blossom stages with different amounts of spraying solution per ha

In the field trials, the efficacy of a low amount of Quassin was best when applied when the blossom was fading (graph 2). With very high amount of Quassin there was no difference between the blossom stages (graph 2).

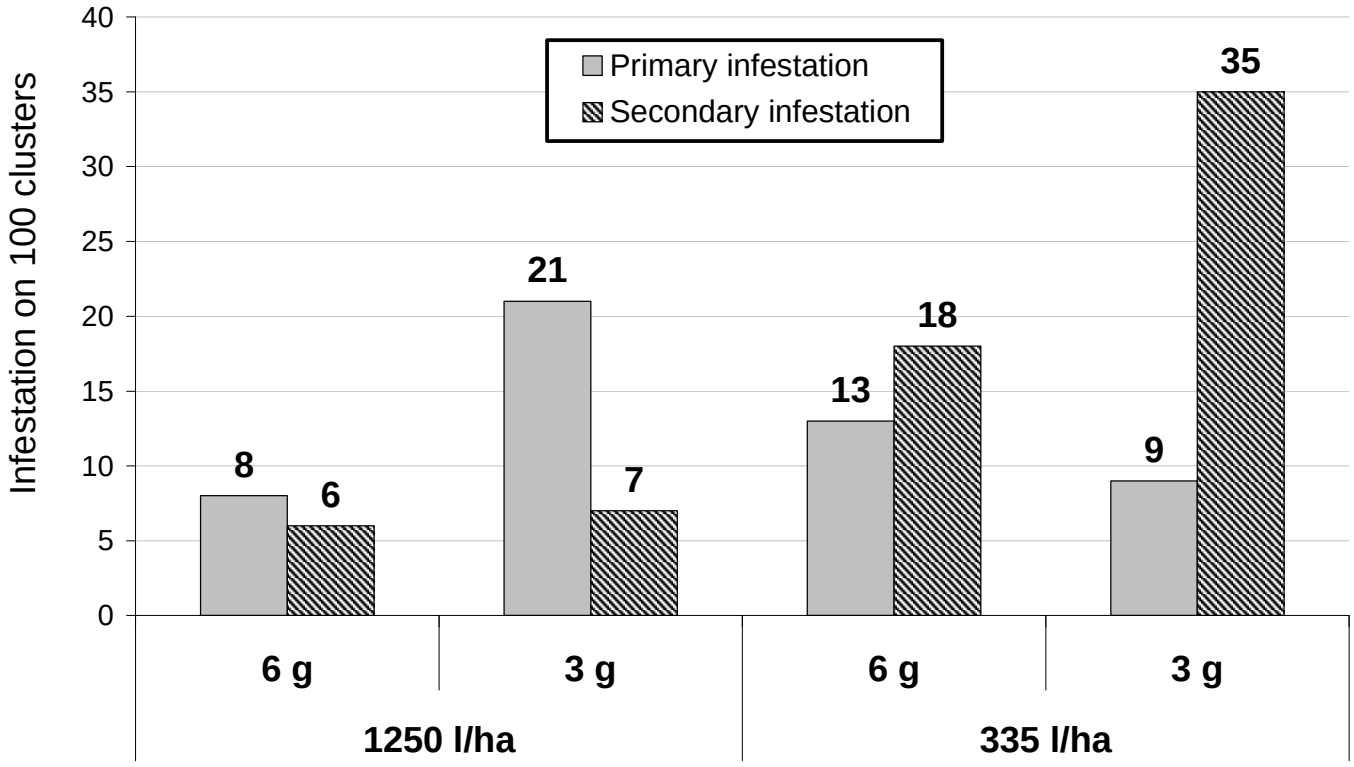



**Graph 2:** Primary and secondary infestation when Quassia extract was treated in different concentrations at three blossom stages in the region of Saxony.

In the on farm trials it should be verified, whether with high amounts of water (500 l/ha mTh) it should be possible to reduce the amount of Quassin per ha from 6 g/ha/mTh to 3 g/ha/mTh without loss of efficacy. This was possible in some trials, but in most trials a rather considerable loss of efficacy (about 10 % to 15 %) was stated when the dose was reduced to 3 g/ha/mTh (table 1). The addition of T/S forte showed very good results, in these cases the effect of 3 g/ha/mTh was nearly as good as 6 g/ha.
Nevertheless, a higher amount of water improves the efficacy as shown in graph 3. Although in this case, the primary infestation in the plot with 3 g/ha/mTh and a low amount of water was lower than with the high amount of water, the secondary infestation showed a clear result.

**Table 1:** Primary (PI) and secondary infestation (%) in the on farm tests in the different regions in 2005: Comparision of 3 g/ha/mTh, 6 g/ha/mTh and the addition of TS forte applying 500 l/ha/mTh

| Region | 3 g/ha/mTh | | 6 g/ha/mTh | | 3 g/ha/mTh + T/S forte1,5 l/mTh | | Control | |
|---|---|---|---|---|---|---|---|---|
| | PI | SI | PI | SI | PI | SI | PI | SI |
| Lake Constance 1 | 4.7 | 4.5 | 3.0 | 1.5 | 1.7 | 2.5 | 16.4 | 49.0 |
| Lake Constance 2 | 8.7 | 11.0 | 3.7 | 3.5 | 1.7 | 1.5 | -- | -- |
| Lake Constance 3 | 13.5 | 3.5 | 14.5 | 1.0 | -- | -- | 53.0 | 21.0 |
| Lake Constance 4 | 9.0 | 7.5 | -- | -- | 5.5 | 5.0 | 25.0 | 17.0 |
| Palatinate | 5.52 | 4.62 | 3.54 | 2.86 | | | 14.54 | 10.18 |
| Jork | 21.0 | 7.0 | 8.0 | 6.0 | -- | -- | -- | -- |
| Saxony | 5.0 | 1.5 | 3.0 | 0.5 | -- | -- | 22.0 | 9.5 |




**Graph 3:** Comparison of high and low amount of water per ha with low (3 g/ha/mTh) and high (6 g/ha/mTh) doses of Quassin in a field trial in Jork.

## Discussion

The distribution of the spraying solution seems to play an important role regarding the efficacy of the treatments. Field trials show best efficacy when treated when blossom is fading and with a high amount of water per ha. This corresponds to the best distribution of the Quassia extract on the receptacle of the blossom. A certain effect of the treatment even if the blossom is closed can be explained by the fact, that ca. 30 % of the sawfly larvae enter the blossom feeding on the sepals (Dicker, 1953) which are covered with Quassia even when the blossom is closed during the treatment.

In laboratory trials (Kienzle et al., 2005) it could be shown that the apple sawfly does not select between parts of the plant treated and untreated with Quassia extract. Thus, even if the distribution of Quassin is not complete, the probability that the larva ingests some Quassia when it enters the blossom is the higher the better is the distribution. The addition of the wetting agent T/S forte gave very promising results. However, it must be considered that these are one year results so that they should not give reason to too much optimism.

It has to be considered that the treatment against the apple sawfly takes place in a period with wether conditions that are often adverse. Long rainy periods during blossom have been rather frequent in the last years (2002, 2005). In this case, it may be unwise to wait until the blossom is fading because the larvae may hatch while it is still raining and the application is not possible. In some years, the larvae hatch before the blossom is fading, so that the treatment must be done in full blossom.

Thus, based on the results it will be recommended to the organic farmers to use 6 g/ha/mTh of Quassin when the infestation is high and the conditions for the application are not optimal. If the infestation is lower and the conditions are good, the dose can be reduced.

Furthermore, it will be recommended to add T/S forte to the spraying liquid to improve the efficacy. T/S forte corresponds mainly to the formulation of NeemAzal-T/S. This means, that the properties as russeting and thinning problems are largely tested so that it can even be applied in the critical period of fading blossom without problems with russeting to expect.

Considering that for the regulation of the Rosy apple aphid in the last years it would have been more effective to split the treatment at red bud stage in two treatments (one at red bus stage, one at fading blossom), the discussion of the combination of NeemAzal-T/S and Quassia for the sawfly control is again interesting. The combination gives a better effect of the Quassia extract and an additional security for the secondary infestation of the sawfly in case of problems with the Quassia treatment.

Thus, under certain conditions it may be economically more interesting to use reduced doses of Quassia in combination with NeemAzal-T/S.

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## Literature

Dicker, G.H.L. (1953) Some notes on the biology of the apple sawfly, *Hoplocampa testudinea* (Klug). The Journal of Horticultural Science Vol. XXVIII: 238-245

Kienzle, J.; Zimmer, J.; Klopp, K.; Maxin, P.; Yamada, K.; Bathon, H.; Zebitz, C.P.W.; Ternes, P.; Vogt, H. (2004): Control of the apple sawfly *Hoplocampa testudinea* Klug in organic fruit growing and possible side effects of control strategies on *Aphelinus mali* Haldeman and other beneficial insects. In. Proceedings of the 11th International Conference on cultivation Technique and Phytopathological Problems in Organic Fruit Growing, Weinsberg, 2004: 7-14

Kienzle, J.; Zimmer, J.; Klopp, K.; Maxin, P.;Rank, H.; Bathon, H.; Zebitz, C.P.W (2005): Neue Ergebnisse zur Regulierung der Apfelsägewespe im Ökologischen Obstbau. Öko-Obst 1/2005: 6-8.