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Short contribution

Efficacy and bycatches of white sticky roller tapes for masstrapping of apple sawfly *Hoplocampa testudinea*

D. Betz[1] and N. Haag[1]

Abstract

Mass trapping with white sticky tapes (WST) showed high efficacies in controlling the apple sawfly, Hoplocampa testudinea Klug (Hymenoptera: Tenthredinidae) in organic apple production (Brouwer et al. 2024). To recommend it as a standard tool in Germany, more research is required concerning the efficacy for different apple varieties, the practicability and the potential negative side effects, i.e. bycatches of non-target arthropods. In this study, the efficacy of WST in reducing oviposition in flowers and fruit infestations in 4 apple varieties were tested in 2024 and 2025. In addition, the catches of H. testudinea and the bycatches were assessed. Although infestation levels varied strongly among years and apple varieties a reduction up to 89% for oviposition and 100% for fruit infestation was observed for Boskoop and Elstar, respectively. As for the bycatches a mean of 1233 arthropod individuals were counted per 1 m tape, with 90% belonging to the order of Diptera. The numbers of bycatches could not be put in relation to the total amount of present arthropods in the orchard. This also applies to the mean numbers per tape of the beneficial groups, namely bees (0.5), hoverflies (0.8), lacewings (0.2) and parasitoid wasps (10).

Keywords: *Hoplocampa testudinea*, white sticky roller traps, “Catch it”, mass trapping

Introduction

The apple sawfly *Hoplocampa testudinea* Klug (Hymenoptera: Tenthredinidae) is a serious pest in apple production. Control methods in German organic apple production are few and focus on the use of Quassia extract only. As for mechanical tools, the labour intensive hand removal of infested fruits is a common practice but the reduction potential is insufficient as a stand-alone method. Single-row exclusion nets are challenging as the egg laying phase coincides with the pollination period (own trials). *H. testudinea* is univoltine. Adults emerge shortly before the first bloom (BBCH 59), flying only during daytime. They start laying eggs in the flowers within 24 hours of emergence and finish egg laying before the end of bloom (BBCH 65-69). The female average life span was found to be 24.3 days at 10.5 °C and 7.0 days at 20.5 °C (Vincent *et al*. 2016). Adults respond to white colour similar to the blossom which is widely used for monitoring with traps, most frequently with white cross sticky traps type Rebell® and in recent years also for mass trapping with WST (Brouwer *et al.* 2024). Mass trapping has become a promising tool for controlling apple sawflies due to the limited flying period. Nevertheless, the efficacy of WST for different apple varieties, as well as crucial factors such as flowering and sawfly phenology, requires further focus. Furthermore, the practicability and especially the side effects, i.e. bycatch, must be investigated further. In this study, the efficacy for 4 apple varieties, the catches of *H. testudinea* and bycatches on the WST were tested over a two years period.

Material and Methods

In 2024 and 2025, the WST were examined at Landwirtschaftliches Technologiezentrum Augustenberg (LTZ) in a conventionally managed apple orchard, sized 1.2 ha, and consisting of 20 rows, each with a maximum of 160 trees with different varieties. Before

[1] Landwirtschaftliches Technologiezentrum Augustenberg (LTZ), DE-76227 Karlsruhe, doris.betz@ltz.bwl.de

blooming (Mid-March), next to every 4th – 5th tree one WST type “Catch-it” (Biofa GmbH) of 1 m length was hung vertically at wires by folding the tape around at the ends and fixing it with staples. This resulted in a treatment plot of 0.4 ha with 260 m tape in total (650 m tape/ha) distributed among approx. 900 trees. The control plot was at the opposite side of the rows with similar size. The middle part between treatment and control served as buffer zone. Because adult sawflies could fly between plots it was necessary to choose a trial set up with plots of sufficient size. Infestation data were collected in single rows of the varieties Boskoop, Elstar, Wellant and Gala in both years and Karneval in 2024. The first and the last 8 trees of each plot were not considered. Numbers of caught sawflies on WST (both sides) were counted in the field on 3 May 2024 and on 12 May 2025. At BBCH 69, flowers were assessed for oviposition punctures via counts on samples of 100 (2024) and 250 (2025) flower bundles per treatment and variety. Single flowers (in total 9.770 in 2025) were examined under a stereo microscope and the typical oviposition scars on the outer fruitlet receptacle were counted, not the laid eggs. Fruit infestation was assessed visually in the field on 100 fruit bundles (resulted in approx. 350 – 460 single fruits) per treatment and variety at BBCH 72-74. Numbers of single fruits with secondary damage showing entry and exit holes were recorded. Although it is not typical for this kind of trial designs, the ABBOTT formula was chosen to allow comparisons with efficacy of insecticides. Concurrently, the flight of *H. testudinea* was monitored with white Rebell® sticky traps in Boskoop and Elstar in the treatment and control plot, respectively. The bycatches on WST were examined on both sides of 3 tapes in 2024 and 4 in 2025. To allow a first evaluation of the numerous bycatches, the arthropods were not determined on species level but were classified in groups shown in Figure 2.

Results

The average number of *H. testudinea* caught per WST over all apple varieties was 8.4 in 2024 and 4.8 in 2025, resulting in total catches of 2183 on 260 tapes in 2024 and 1238 in 2025. The numbers varied between varieties (table 1, not all varieties are shown).

Table 1: Average numbers of *H. testudinea* caught per WST in 2024 and 2025 in selected varieties.

Apple variety	*H. testudinea*/ WST	
	2024	2025
Boskoop	7.1	4.5
Elstar	1.6	2.3
Gala	6.0	5.2
Wellant	4.4	5.6

For flower assessment in 2024 only in Karneval a difference between control and treatment plot was observed, with 23 and 0 oviposition scars, respectively. The results of 2025 showed varying efficacies of the WST, depending on apple variety, see table 2.

Table 2: Single flowers with oviposition scars in % and efficacy (ABBOTT) in 2025.

Apple variety	WST	Control	Efficacy (ABBOTT) in %
Boskoop	0.3	2.9	89
Elstar	0.9	3.6	76
Gala	1.5	3.0	52
Wellant	0.6	2.6	75

Fruit infestation differed also among apple varieties (table 3) with 0 in Boskoop and up to 26 in Elstar in the control in 2024. In 2025 fruit infestation was generally low with a maximum

of 3.3 % in Elstar in 2025. Extreme low infestation levels were recorded in Boskoop and Gala, hence no efficacies (ABBOTT) were calculated in table 3.

Table 3: Fruit infestation and efficacy (ABBOTT) in %.

Apple variety	WST 2024	Control 2024	WST 2025	Control 2025	Efficacy (ABBOTT) in % 2024	2025
Boskoop	1	0	0	0.3	infestation low	infestation low
Elstar	2	26	0	3.3	92	100
Gala	0	1	0	0.8	infestation low	infestation low
Wellant	3	7	0.7	1.3	57	50
Karneval	5	23	-	-	78	-

During both years, the monitoring showed relatively low numbers of sawflies caught during the flight season (Figure 1, only data from 2025 are shown). However, catches on Rebell®-monitoring traps were considerably lower in the WST plot (max. 2) compared to the control plot (max. 18) on both varieties. Flight peaks were reached during BBCH 62-66.

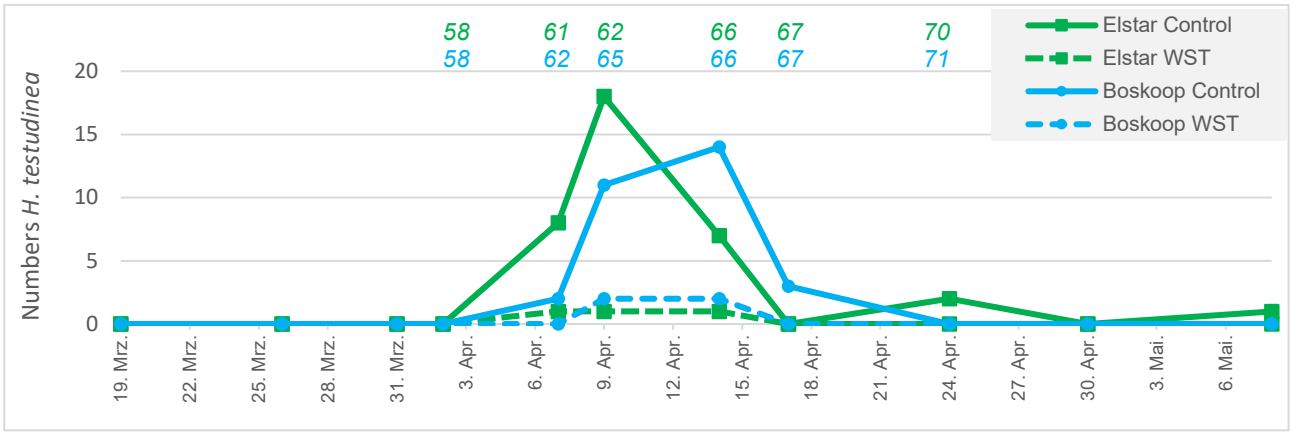

Figure 1: Monitoring of flight of *H. testudinea* on 4 Rebell®-Monitoring traps in 2 apple varieties (numbers of sawflies/ trap) in 2025. Coloured numbers indicate BBCH per apple variety.

The percentage of bycatches according to groups are shown in Figure 2. In total numbers, a mean of 1233 arthropods on 1 m WST was recorded.

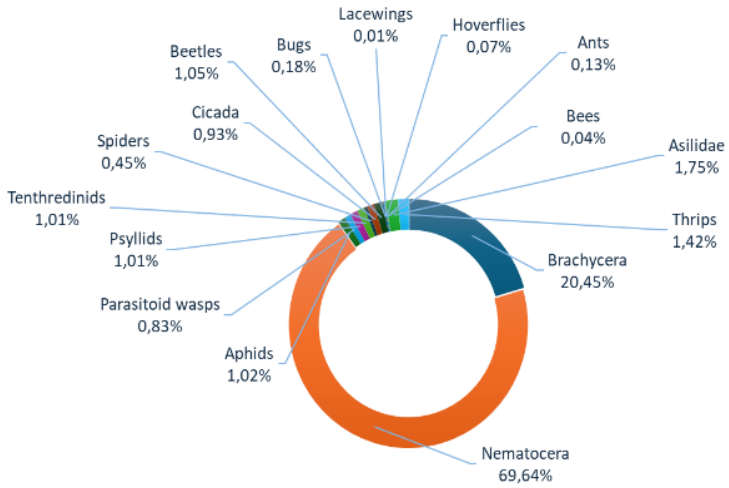

Figure 2: Bycatches on WST in selected groups in % (mean values from 2024 and 2025).

The order of Diptera was predominant. A total of 977 and 738 of the suborder Nematocera were counted on one WST (1 m, both sides) in 2024 and 2025, respectively. For Brachycera

the numbers were 314 (2024) and 190 (2025). Together the 2 suborders made approximately 90% of the total catches. The group was not identified further except for predatory flies of the family Asilidae since they can be considered as beneficials. In 2025 a mean of 21.5 Asilidae per WST were counted. For other beneficials like lacewings and hoverflies 0.2 and 0.8 per WST, respectively, were caught during both years. Additionally, 0.4 ladybugs, 10 parasitoid wasps, 5.6 spiders and 0.5 bees were caught.

Discussion

The efficacy of the WST and the fruit infestation varied strongly between apple varieties. Vincent *et al*. (2019) concluded that "…differences in damage levels between apple cultivars are often due to the reaction of the apple saw fly to factors varying among cultivars such as flower density and colour, flowering period and fruit set". The efficacy of reducing oviposition punctures was up to 89 % in Boskoop in 2025. Given the high reduction in fruit infestation up to 100 %, it should be noted that the infestation level was low. Presumably, the apple sawfly occurrence was generally low and the fruit set was very good in 2025, hence a minor infestation was spread across high numbers of flowers and fruits. Nevertheless, a noticeable effect was seen in Elstar, as efficacies reached 76 % (oviposition scars) and 100 % (fruit infestation), while catches of saw flies on WST was lowest. Furthermore, the efficacy could be demonstrated by the high catches on the monitoring Rebell®-traps in the control. Efficacy levels in present trials and in trials of Brouwer *et al.* (2024) could be compared with the ones of Quassia extract reported by Kienzle *et al.* (2006). However, according to the relative low catches on monitoring traps and infestation levels, the damage could have been tolerable. Since WST have to be installed as a preventive measure, it is not possible to decide based on damage thresholds. Another negative side effect are the numerous bycatches of over 1000 arthropods on 1 m WST. Although, the importance of bycatches was overestimated, since the WST hung longer (approx. 6 weeks) than the necessary 4-week flight period of *H. testudinea*. Beneficials like bees, lacewings, hoverflies and ladybugs were found in very low numbers only. However, only the absolute catches could be shown, not the relative numbers compared to the real numbers of beneficial insects present in the orchard. In this study, aphids were controlled with the chemical insecticide Teppeki®, which could be a reason for the low numbers of some beneficial groups. An overall ecological assessment cannot be provided by this study and need further research. More negative aspects are the quantity of plastic waste, as well as the high labour and material costs. The time required for hanging up the WST was approx. 11 hours/ha and a vertical wire is a prerequisite. The price increased in 2025 and amounted to 474 €/ha. Probably, the costs could be reduced as data from Brouwer *et al.* (2024) showed comparable efficacies with half tape lengths.

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