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Trapping apple sawfly *Hoplocampa testidunea* on white sticky tapes in 2025 in three regions in Germany using different application methods

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Abstract

The apple sawfly Hoplocampa testudinea *Klug (ASF) is a significant pest in apple production. One approach tested in recent years is mass trapping during the flight using white sticky tapes (WST), installed between the horizontal wires of the trellis-system. However, where supporting wires are absent or dense tree canopies hinder installation, there is a strong demand for an alternative attachment method. This alternative should enable a simple, time-saving installation and help reduce workload peaks shortly before flowering. Moreover, there is strong interest in assessing the impact of such measures on key beneficial insect groups, and honeybees, since beehives are established shortly before apple flowering and remain often even after flowering in the orchards. In 2025, trials comparing a standard and an alternative treatment with installation on wooden in-line posts were conducted across three regions in Germany. ASF flight activity, egg laying, catches and bycatches were monitored.*

The results based on one year suggest that effective reduction of infestation is possible under high infestation pressure. No trend toward reduction was observed under low infestation pressure. Overall catch rates per tape were significantly higher in the standard treatment (Ø 12.2 vs. Ø 7.8 ASF) but catch rates per m² were comparable. The alternative treatment was more time-efficient (10 h/ha vs. 20 h/ha) and cost-effective (€206/ha vs. €586/ha). Bycatch was dominated by Diptera (flies, mosquitoes). Honeybee catches were low, with 1.2 individuals per m² in the standard treatment compared to 0.5 in the alternative treatment.

Keywords: *Hoplocampa testudinea*, apple sawfly, mass trapping, catches, bycatches.

Introduction

The apple sawfly (ASF) is one of the most important pests in organic apple orchards, emerging from the soil in spring shortly before apple flowering, with a high potential for fruit damage. *Quassia amara* is traditionally used for ASF control. As part of the toolbox for the control of this pest in recent years mass trapping on white sticky tapes has been investigated. The tapes are intended to catch emerging ASF before oviposition. Helsen et al. (2020) tested the potential of white rectangular and round plates coated with insect glue for this purpose in the Netherlands in 2016 and 2018–2019. In field trials conducted between 2021 and 2023 in the Netherlands, Denmark, Belgium and Switzerland, mass trapping using white sticky roller tapes, attached to two horizontal wires of the trellis system, proved successful (Brouwer et al., 2024) and was recommended for practical application (Brouwer, 2022). In Germany in 2023, we conducted a trial in an apple orchard to mass trap apple sawflies, with an impact on bycatches (Esenova, 2023). In German organic fruit production, practitioners are interested in the use of white sticky tapes, however, the practical feasibility and the bycatches are discussed. Moreover, where supporting wires are not available or

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dense tree canopies make installation difficult, there is a clear need for an alternative attachment method. This alternative should enable simpler and time-saving installation, helping to alleviate workload peaks during the critical period shortly before flowering. Additionally, the relevance of the bycatches on key beneficial insects and on honeybees should be determined.

Material and Methods

Trials were conducted in the spring of 2025 in three German organic apple-growing regions: the Altes Land in northern Germany, Rhine Valley in western Germany and at Lake Constance in southern Germany, with three sites per region. The selection of sites was based on known infestation prevalence or infestation in the previous year. Each site represented one replicate, and there was a total of 9 sites. Each site had a control without sticky tapes, and a standard treatment with sticky tapes applied using the trellis wires as recommended in Brouwer 2022, and eight sites had an alternative installation by attaching the tapes to wooden in-line posts in the tree rows. The deployed sticky tapes had a width of 0.15 cm. While direction of the tapes in the standard treatment was dependent on the direction of the trellis wires, direction of tapes in the alternative treatment was dependent on accessibility of the wooden in-line posts and thus differed between tapes. The minimum plot size was 30 m in length and 15 tree rows in width.

In the standard treatment, one tape was installed every 5 m per row, corresponding to approximately 600 tapes per hectare. Tape length in this treatment varied between orchards (0.5-2.4 m) based on wire spacing but was consistent within each orchard. Accordingly, the sticky surface varied between orchards, 90 to 432 m²/ha.

In the alternative treatment, tape density was determined by the spacing of wooden in-line posts, which was 10 m per row corresponding to approximately 300 tapes per hectare. Tape length varied between orchards (0.9-1.5 m), as a result the sticky surface varied between 40.5 to 67.5 m²/ha.

Sticky tapes were installed at green bud stage (BBCH 56) and were removed following fruit fall after bloom (BBCH 71). At removal, nine randomly selected sticky tapes per treatment and site were taken to assess catches and by-catches. For monitoring the ASF flight, commercial cross-shaped white sticky traps (Rebell Bianco, Agroscope, CH) were also deployed at BBCH 56 in the control, with observation of catches 2-3 times per week. At the end of bloom (BBCH 69), flower clusters were checked by variety for oviposition scars (Lake Constance) and eggs (Rhine Valley, Altes Land). Differences in catches and by-catches were statistically analysed. For this we used Generalized Mixed Linear Models (GLMM) with contrasts on estimated marginal means.

Results and Discussion

Flight activity. Using monitoring traps, the first activity of ASF was recorded on the pink bud stage (BBCH 57) in the south, on the hollow ball stage (BBCH 59) in the west and on the first open flowers stage (BBCH 60) in the north. ASF catches peaked in the regions at different BBCH stages in West at BBCH 65 (Ø 51.7), North at BBCH 67 (Ø 17.2), and South at BBCH 69–71 (Ø 6.67).

Infestation monitoring of flower clusters. Effective reduction was achieved under high infestation pressure (>5% in control) at three sites in the northern and western regions (Table 1). At low infestation pressure, observed at two sites in the western region, reduction was recorded in the standard treatment compared to the control (0.9% vs. 2.1%), but less in the alternative treatment (1.7% vs. 2.1%). At very low infestation pressure under 2% on

three sites in the southern region and one in the northern region no clear effects could be observed.

Table 1: Infestation level in percentage according to infestation class. Proportion of flower clusters with egg laying in regions west and north and damaged fruit short after hatching in the region south. Per location 1200-1500 flower clusters or fruits per treatment were assessed. Means are displayed.

Class infestation	Region	n (sites)	Control	Standard	Alternative
≤5%	North	1	0.8	0.8	NA
≤5%	South	3	1.3	1.8	0.6
≤5%	West	2	2.1	0.9	1.7
>5%	North	2	14.1	6.9	9.4
>5%	West	1	28.7	0.2	2.0

Catch of apple saw fly and bycatches. The catch rate of the ASF per sticky tape was significantly higher in the standard treatment compared to the alternative treatment (Table 2). However, on a per square meter of sticky tape basis, the alternative treatment was as effective as the standard treatment. The difference in catch rates arises because the standard uses both sides of the tape, whereas the alternative treatment sticks one side to the posts, halving the usable sticky area per metre. It should be noted that both treatments had impacts on non-target organisms. Among the five taxonomic groups examined, Diptera (flies and mosquitoes) accounted for the highest proportion of by-catches (Table 2). In the southern region, parasitoids were abundant during treatment, with a high proportion identified as *Aphelinus mali* Hald. There was no significant difference in catch rates between the two treatments (p=0.17). Ladybirds were found in small numbers per sticky tape, with *Exochomus quadripustulatus* L. as the most common trapped species. Significantly fewer ladybirds were caught per sticky tape and per m² in the alternative treatment. Both treatments appeared to be unattractive to honeybees. Since honeybees use olfactory stimuli in addition to visual stimuli in their search for food (Mas et al. 2020), they may have been repelled by the strong smell of the sticky tapes. In summary, however, since we do not know the total population of these non-target groups and thus the share trapped, we cannot draw conclusions about the ecological impact of the traps.

Table 2: Catch of apple sawfly and bycatches per sticky tape and per m² of surface area. Displayed are estimated marginal means (emmean). 1 Data basis from regions north, south and west. 2 Data basis from regions south and west. 3 Data basis from region south. Abbreviations: Std. = Standard, Alt. = Alternative, p.m.v. = predicted mean values.

Taxa	per Tape Std.	per tape Alt.	p	per 1 m² Std.	per 1 m² Alt.	p	per 1 ha Std. p.m.v.	per 1 ha Alt. p.m.v
ASF[1]	12.2 a	7.8 b	0.0001	42.3 a	46.2 a	0.71	9,203	2,948
Diptera[2]	1,251 a	836 b	0.02	7,664 a	8,031 b	0.02	825,002	272,914
Parasitoids[3]	35.8 a	33.9 a	0.82	230 a	362 a	0.17	28,262	13,311
Ladybirds[2]	1.9 a	0.9 b	0.01	9.23 a	5.8 b	0.05	1,601	378
Honeybees[3]	0.3 a	0.06 a	0.35	1.2 a	0.5 a	0.35	139	13.6

Predicted mean values per hectare indicate that the standard treatment achieved approximately three times higher catch rates of ASF compared to the alternative treatment (Tab. 2) This is attributed to both a higher density of deployed traps and the larger capture surface area, resulting from adhesive sides on both sides of the sticky tapes.

Optimal catch efficiency according to hanging height. The hanging height of the sticky tapes was recorded at three sites in the southern region. Optimal catch efficiency for apple sawflies was achieved at a height of 1.6 to 2.3 m. In the standard treatment, the hanging height is determined by the available trellis wires. In the alternative treatment, which is attached to wooden posts, the height can be better controlled, helping to prevent traps from being mounted too low and thus improving catch efficiency.

Time required and costs for setup and removal. The estimated costs for installing and removing the sticky tapes, calculated per hectare, are as follows: For the standard application, costs (excluding labour) amount to € 586/ha, including € 425/ha for sticky tape rollers and € 161/ha variable costs for machines (KTBL). The total time required is estimated at 20 hours per hectare, which can be further optimized or reduced by experienced practitioners. In the alternative treatment, time needed for installation and removal is approximately half that of the standard treatment, at around 10 hours per hectare. Total costs (excluding labour) include only the costs for sticky tape rollers and amount to € 206/ha. Variable costs for machines were not calculated, as no machine was used; the installation was done manually.

Conclusion

Sticky tape treatments proved effective for controlling ASF under high infestation pressure, while effectiveness at low infestation levels was limited or inconsistent. The catch efficiency per m² is approximately equal for both treatments. However, the standard treatment was overall more effective due to its double-sided trapping surface and higher attachment density (every 5 m). The alternative treatment uses existing wooden in-line posts and is installed every 10 m, reducing both time and material costs, but has only a one-sided trapping surface. The choice of treatment depends on the local conditions: If a wire system is available to support the sticky tapes, the standard treatment is preferable. If there is no wire system available, alternative treatment can help to control ASF. Bycatch of beneficial insects were primarily parasitoids (especially *Aphelinus mali*) and, with low catches per tape, ladybirds. The impact on honeybees was low; the tapes appeared unattractive to this group, possibly due to their strong odour. The catch numbers of the respective taxonomic groups were predicted for 1 ha, which provides a good estimate of the extent to which they are affected. However, a conclusive assessment of ecological impacts was not possible, as the total population of non-target organisms and the proportion of individuals caught remain unknown.

The need to deploy the sticky traps in a narrow time window with high cost and manpower input leads to a limited applicability and acceptance of this method in practice. The alternative application methods tested reduce the cost but also the catch efficiency per tape, because only one of the two sticky sides of the tape can be used for trapping, as the other side sticks to the posts. Moreover, the appearance and the infestation pressure of the sawfly is often not predictable so that the need for an intervention cannot be estimated correctly before the emergence of the adults.

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