Showcasing use of spinosad and mating distruption products for controlling leafrollers (Lepidoptera: Tortricidae) in an organic apple orchard in Latvia.

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Abstract

Lack of pest control options is a limiting factor in organic apple production in Latvia. At the moment, there are only two products for controlling arthropod pests that are allowed to be used in organic apple production. A large plot demonstration trial was set up in an organic apple orchard to showcase additional plant protection products that are commonly used in organic orchards elsewhere in European Union. The orchard assessed had a history of heavy pre- flowering infestations of Hedya nubiferana (Haworth). Spinosad (Tracer 480, Dow AgroScience) and a tortricid mating disruption product (RAK 3+4, BASF) were used. Lepidopteran larval feeding damage before flowering and flight activity of H. nubiferana, Archips podana (Scopoli) and Archips rosana (Linnaeus) were assessed. Larval feeding rate was lower in demonstration plot where spinosad was used pre flowering than in control plot were azadirachtin was used at the same time. Mating disruption product, even though not marketed towards control of H. nubiferana, caused almost complete pheromone trap exclusion for H. nubiferana males in treated area. Catches of A. podana were insignificant in all orchard and there were no A. rosana registered in the orchard during observations, regardless of the ample supply of alternate host plants available for those two species. Demonstration trial showed the benefits of using a broader spectrum of pest control agents in control of H. nubiferana in organic apple growing compared to the current practice in Latvia.

Keywords: Organic agriculture, *Malus x domestica*, tortrix moths

Introduction

Apple is the most important fruit crop grown in Latvia. The demand for organic produce in the market is growing, however the lack of pest control options is a limiting factor in organic apple production. At the moment there are only two products for controlling arthropod pests that are allowed to be used in organic apple production: azadirachtin and mineral oil. A large plot demonstration trial an organic apple orchard was deemed necessary to showcase additional plant protection products that are commonly used in organic orchards elsewhere in European Union. Mating disruption is used widely all over southern and central Europe mainly to control codling moth, but also for various leafrollers. Spinosad is used to control various, mostly lepidopteran larvae on a wide variety of crops and has shown high efficacy for a product compatible with biological farming.

Material and Methods

Trial was located in an organic apple orchard in the southern central part of Latvia, close to Lithuanian border growing multiple varieties of eating apples. A plot of 1 ha was established in variety Auksis, which is a commonly grown and highly demanded variety. In the demonstration plot arthropod pests were managed using spinosad and tortricid mating

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disruption products in addition to regular local practice. In the rest of the orchard arthropod pests were managed according to the local legislation and decisions of the owner of orchard.

Table 1: Plant protection products used in the general orchard and demonstration plot on the demonstration trial site in 2019.

Orchard part	Date	Plant protection product	Rate	Active substance	Primary reason for use/ target
general orchard	April 26	NeemAzal T/S	2.5 l/ha	azadirachtin 10 g/l	bud damage by tortrix larvae
	May 30	NeemAzal T/S	2.5 l/ha	azadirachtin 10 g/l	aphid infestation
demonstration plot	April 26	Tracer 480 SC	0.15 l/ha	spinosad 480 g/l	bud damage by tortrix larvae
	May 23	RAK 3+4	500 dispensers/ha	3.82% E8,E10-dodecadienol, 4.1% Z11-tetradecenylacetate, 1.9% n-tetradecyl acetate	mating disruption for codling moth
	May 30	NeemAzal T/S	2.5 l/ha	azadirachtin 10 g/l	aphid infestation

At BBCH 58-61 in four spots in the orchard – central parts of demonstration plot, plantation of variety Auksis outside the demonstration plot and plantations of varieties Gita and Kovaļenkovskoje- 20 inflorescences from five adjacent trees each were assessed for living tortricid larvae and lepidopteran feeding damage (figure1).

Figure 1: Arrangement of sampling sites in the orchard. The large marked area is the demonstration plot. Sampling points: 1- variety Auksis within demonstration plot, 2- variety Gita in general orchard, 3- variety Kovaļenkovskoje in general orchard, 4- variety Auksis in general orchard.

Transparent glue traps (RAG traps, manufacturer Csalomon) with pheromone dispensers (manufacturer Csalomon) for three tortricid species were placed roughly around the same four spots used for inflorescence assessments (figure 1) seven to ten meters apart. Traps for green budworm moth *H. nubiferana* and fruit tree tortrix *A. podana* were placed on 6th of June, but for filbert leafroller *A. rosana* on the 20th of June according to recommendations

of E. Ozols (1963). Trap catch was counted twice a month until 16th of August and traps were serviced according to manufacturer instructions.

Results

Variety Auksis appeared to be the most susceptible to lepidopteran larvae attack out of all three varieties observed. Larval feeding damage in variety Auksis was more than six fold lower in demonstration plot where spinosad was used pre flowering than in the same variety were azadirachtin was used at the same time and about five fold lower than in the rest of the orchard in average. No living larvae were found after the spinosad treatment (figure 2).

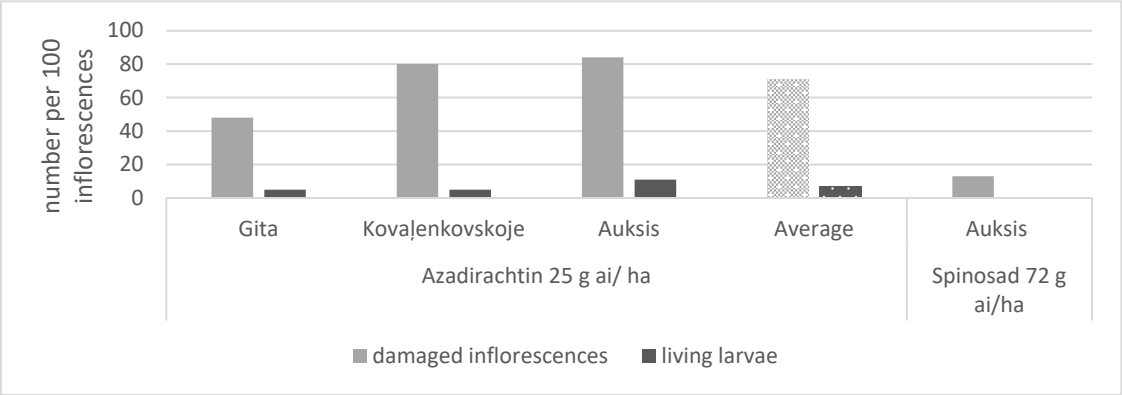

Figure 2: Number of damaged inflorescences and living tortricid larvae per 100 inflorescences on 7th of May 2019, after the applications of pre-flowering plant protection products according to variety and plant protection product used.

Trap catches of *H. nubiferana* peaked on the first assessment and declined steeply after that. Mating disruption product, even though not marketed towards control of *H. nubiferana,* caused almost complete pheromone trap exclusion for *H. nubiferana* males in treated area (figure 3). Catches of *A. podana* were insignificant in all orchard and there were no *A. rosana* registered in the orchard during observations.

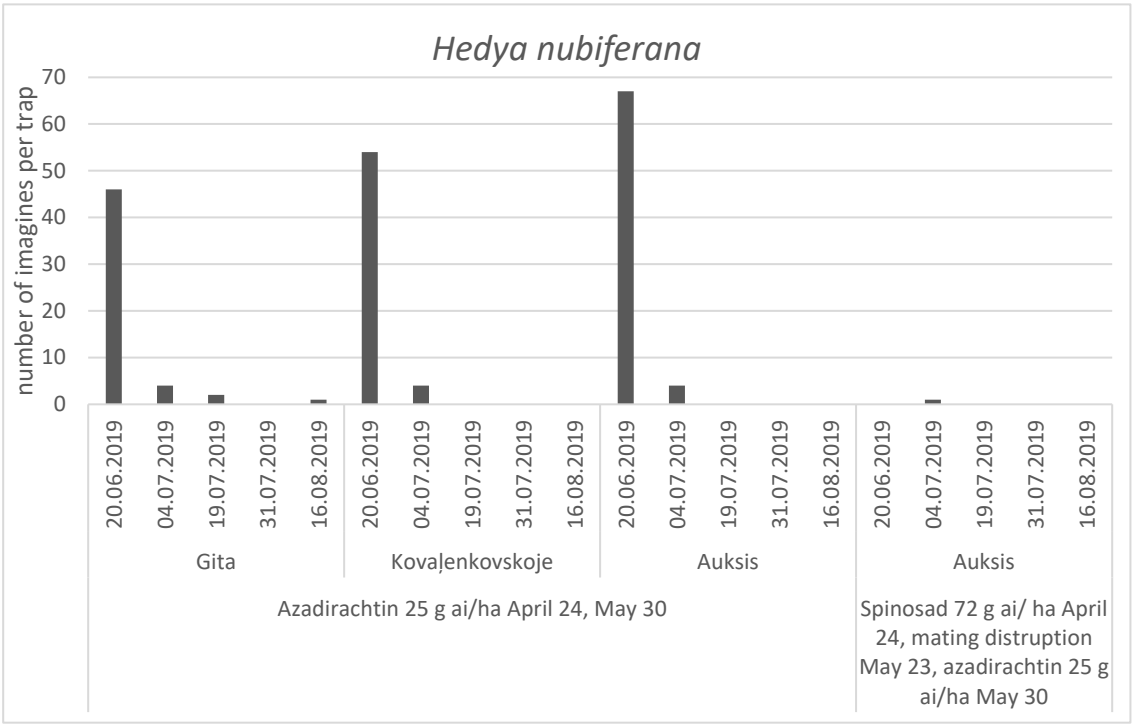

Figure 3: Number of *H. nubiferana* males caught in a pheromone trap in two week period during summer of 2019.

Discussion

Demonstration trial showed the benefits of using a broader spectrum of pest control agents in control of *H. nubiferana* in organic apple growing compared to the current practice in Latvia. Spinosad showed superior control of tortricid larvae compared to the only currently available product azadirachtin, which is crucial for protecting inflorescences in the early stages of development to ensure plentiful bloom and good fruit set.

Apparently the suggested time for beginning of flight of *H. nubiferana* was later as the actual beginning of flight. It is very likely that to assess full flight dynamics traps should be set out in the beginning of May. Interestingly *A. podana* and *A. rosana* were not prevalent in the orchard, even though the orchard was surrounded by a filbert hedge and there was a forested area bordering southern edge of the orchard providing ample supply of suitable alternative host plants.

It is unclear how effective is the particular mating disruption product in supressing the *H. nubiferana* population for the following year, but the level of trap exclusion shows high potential. Suspected compound responsible for this effect is E8,E10-dodecadienol (Arn *et al.* 1974). Observations must be continued in the next vegetation season to assess the level of control achieved.

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