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Short contribution

Monitoring of the success of extensive strategies and the use of sexual disorientation in small organic orchards of the Bologna Apennines

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Abstract

In the small organic orchards of the Bologna Apennines in Emilia Romagna in Italy the effect of the main pest and disease control strategies was monitored. Currently codling moth (Cydia pomonella) is the main pest and disease problem. The sexual disorientation dispenser, Ecodian® with pheromone (E,E)-8,10- Dodecadien-1-ol (Codlemone), has been monitored in 7 orchards located from 50 to 700 m above sea level, with the aim of totally, or at least partially, reducing the use of many insecticides including CpGV. Organic protocols for protection of codling moth have not always been effective, even when integrated with sprays. The effectiveness of this method has been quite variable: in some locations, pheromone has allowed to maintain rather low fruit damage percentages at harvest; in others it was necessary to integrate with spray applications to protect the orchard from attack of third generation of Cydia pomonella.

Scab susceptibility is also being monitored and, in addition to the well-known resistant varieties, others show a good tolerance.

Finally, the farmer participatory approach proved to be a very interesting practice, able to give us useful feedback for improving the protocols that can be tested in the coming years.

Keywords monitoring, codling moth, sexual disorientation, small orchard, scab

Introduction

In recent years mating disruption has been widely used in fruit orchards for various species: apple, peach, plum. Anyway, experience shows that for *Cydia pomonella* it is necessary to have a continuous area larger than 3/4 hectares to be effective. Organic orchards, in Emilia Romagna hills and mountains, are generally small and isolated. In this area with much biodiversity and non-intensive agriculture, scab infection is not so widespread. Furthermore, using resistant apple varieties and old tolerant ones (Buscaroli *et al*., 2022), as well as agroecological and permacultural practices (Dallavalle *et al*., 2024), a strategy of protection with lower spray application is sufficient to achieve good production without damage by fungal diseases. Instead, *Cydia pomonella* is widespread in every area. Generally, this pest gives rise to 3 generations in this area. Some agroecological practices, such as bird nests in the fields, hedges and laying hens, are not enough to control infestation. Now the organic-by-protection strategy requires applications of CpGV *(Cydia pomonella* Granulovirus) for the 1st generation, Spinosad and CpGV *for* the 2nd. The other solution is Alt Carpo® net. However, this measure involves a significant investment with a clear impact on the landscape. A sexual disorientation (SD) passive dispenser, Ecodian®, with (E,E)-8,10-Dodecadien-1-ol (Codlemone) has already been experimented 20 years ago (Rama F. *et al*., 2000) with very good results. With this method, the hook shape and biodegradable dispensers are applied to individual trees, creating a network of very tight meshes. The modus operandi is that of false trails. The amount of pheromone per dispenser is low, allowing the moth to arrive but still become disoriented. It therefore appears to be one of

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the few dispensers suitable for small, isolated orchards in Italy. However, it is still little used, partly due to limited commercial interest and a lack of experimental evidence. Therefore, a monitoring trial was conducted.

Material and methods

Seven small organic farms were chosen in 2025 (Tab.1). All the farms have very diverse apple and pear orchards with many varieties for every species following holistic principles. The dispenser used, Ecodian®, is a Mater-Bi® biodegradable material. It is impregnated with (E,E)-8,10- Dodecadien-1-ol (Codlemone) pheromone. Considering different tree densities of the orchards, 4-6 dispensers/tree were used (Table 1 and 3). The dispensers were applied around the 15th of May in each orchard farm. In three orchards 2 CpGV sprays were applied before dispenser application, and when the damaged fruits recorded were more than 2-3/tree, the applications were restarted with Spinosad.

Every week the attacked fruits were monitored through visual check of approximately 100 fruits in 5 different plots of each orchard. The presence of scab (*Venturia sp*.) in the fruits was also monitored and the sensitivity of the different varieties to both apple scab and codling moth (CM) was assessed as an average result in the different orchards, using a 0-4 scale (Table 2).

This monitoring also aimed to test a participatory approach involving producers, who were trained to directly monitor the progress of the infestation and assess the damage.

Table1: Location of apple orchards included in the experimental trial

	Orchard location	altit. m.s.l.	S ha	root stock	density	training system	tree height (m)	spray treatment	
								before dispenser	after dispenser
1	Imola	55	0.21	M9	4 x 2	spindle	3		
2	S. Arcangelo	60	0.24	M9	4 x 2	spindle	3.5	CpGV	Spinosad
3	Croara	150	0.1	seed.	5 x 4	vase	4		
4	Montecalvo	300	0.05	seed.	5 x 4	vase	4		
5	Malfolle	550	0.5	M111	5 x 4	vase	4	CpGV	Spinosad
6	Oreglia	600	0.9	seed.	5 x 4	vase	4		
7	Cereglio	700	0.40	M111	3.5 x 2	hedge	3.5	CpGV	Spinosad

Results

The first damage on the fruits appeared in the second half of July except for orchard 6 where damage was already observed in June. In orchard 1 even by harvest time damage remained very low (2% of damaged fruits) and showed very good results with no need to use insecticide. A rather satisfactory effectiveness was seen in orchard 4. In orchards 2 and 7, in which spray treatments with CpGV and Spinosad were also applied, the damage was very limited at harvest; while in orchard 5, despite using sprays treatment too, damage was still high. Orchard 6 and 3 showed the worst results with fruit damage percentages of 28.2 and 25% respectively (Table 3).

Scab infection in spring 2025 was quite low. Observations in each farm for the main apple and pear varieties included in the orchards showed specific susceptibility (Table 2) as in previous trials (Buscaroli C., 2022). For CM, less damage was observed on earlier and later varieties. This is one of the reasons why early varieties, in particular pears, are much used by organic farms. In apple and pear cooking varieties with very hard flesh, damage was lower. But sometimes lower susceptibility is evident in other varieties for no clear reason.

Table 2: Scab and codling moth susceptibility of some varieties monitored

Species	Variety	Apple and pear Scab*	Codling Moth*	harvest data
Apple	Rosa romana	3	2	15/10
	Abbondanza rossa (red flesh)	4	3	15/10
	Durello	1	3	20/9
	Lavina	1	4	1/10
	Decio	1	1	25/10
	Renetta Canada	4	4	10/9
	Boskoop	1	3	15/9
	Goldrush	0	3	1/11
Pear	Moscatella	2	1	10/7
	Carmen	3	1	20/7
	Angelica	3	3	25/8
	Scipiona	2	2	15/10
	Volpina	1	1	15/10
	Ossa	1	1	15/10
	Pere Curé	2	1	15/10
	Abate Fétel	0	3	5/9

*Scale intensity of infestation: 0 = no; 1= low; 2= medium; 3 = medium-high; 4= high.

Table 3: Damage from codling moth in monitored orchard

	Orchard	N dispenser/ha	Walnut at the border	First damage appearance date	Fruit damage % at harvest
1	Imola	5000	no	September 5	2.0
2	S. Arcangelo R.	5000	no	July 20	2.5
3	Croara	2000	no	July 15	25.0
4	M.Calvo	2500	no	July 25	7.0
5	Malfolle	2500	no	July 20	10.0
6	Oreglia	2000	yes	June 19	28.2
7	Cereglio	5714	yes	July 16	4.2

Table 4: Comparative costs between use of dispensers and treatments

Orchard density	Costs	Costs Euro/ha	
		Dispensers	Treatments
700 trees/ha	supplies	154	300
	labor and machines	120	250
	TOTAL	***274***	***550***
1250 tree/ha	supplies	265	300
	labor and machines	120	250
	TOTAL	***385***	***550***

The cost of SD increases proportionally with the orchard density. While a more common strategy with organic sprays (3-4 CpGV sprays for first generation, Spinosad 3 times, and CpGV for the second) is costant (Tab.4). The potentially lower cost of using dispensers compared to common strategies involving the use of biological sprays (in addition to the problem of CM resistance to CpGV), could represent a preferable strategy for farmers in

terms of saving time and costs of repeated interventions, without any environmental impact from pesticides and any specific equipment.

Discussion

By applying agroecological practices, exploiting the local biodiversity and the wide varietal assortment of individual fruit species (especially the older, more hardy varieties and the newer resistant ones), the small organic orchards of the Apennines manage to keep infestation levels of the main pathogens and parasites very low. *Cydia pomonella* however remains a fairly unsolved problem, considering among other things the risk of resistance of CpGV, as well as the desire to avoid the use of insecticides altogether. The use of SD could be an opportunity for small farms. The preliminary trial results were quite variable, but with some positive cases. Orchards where the results were lower appeared to be linked to the presence of walnut trees at the edges of the fields, although dispensers have also been placed on the walnut trees. The best results were achieved with the higher number of dispensers (5000/ha).

We consider this a preliminary experience, partly because unfortunately, this year it was not possible to position the dispensers earlier, on different dates in the different areas, because of agrochemical company distribution problems. This factor that will be explored next year, along with the possibility to replace the dispensers as soon as the effects of the initial installation begin to wear off, i.e., after approximately 50-60 days. The cost of the SD method is absolutely feasible for small orchards with 700 trees/ha density, considering that it requires 4-6 dispenser/tree, even for double application. For 1250 trees/ha density, the cost becomes high but lower than sprays treatments. It could be better to use only one application integrated with some sprays.

Finally, the farmer participatory approach proved to be a very interesting practice for two reasons. Firstly, it increased growers' knowledge and awareness of the survey methodology and secondly, it provided useful feedback for the purpose of redesigning improved protocols that can be tested in the coming years.

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