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Biological aphid control in loquat orchards

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SUMMARY – Loquat culture is almost a biological pest managed crop, except for scab control that needs some sprayings during the crop year. However, the crop under mesh, that has some advantages in terms of fruit quality, results in an increase of the aphid populations from the end of spring to the beginning of summer. The main species is *Aphis spiraecola.* This study aims at knowing the effect of parasitoids and predators as an alternative to pesticide sprays. This species has a few known natural enemies, there is no known pesticide resistance. No parasitism was observed by *Aphidius. Aphidoletes* as a predator was the most abundant species. A generation lasts 3.5 weeks, hence the potential effects of predation were not observed at the end of July. A decrease in the aphid population was observed in both plots, the one studied and the control. Population size was about 2-4 larvae of *Aphidoletes* per shoot. The second species in terms of abundance was *Scimnus*, the population size was about 2-3 larvae per shoot. Additionally, 2-3 larvae from *Crysopa* per shoot along with eggs layers were observed. Larvae from sirphides and *Propilea* were observed too. According to the results the spread of beneficial insects should be done by mid May, which is the end of the harvest season and the season when the first aphid colonies are observed. *Aphidius* has no effect in the biological control of this aphid. The high cost of the biological alternative compared to the spraying of dimetoate makes this approach not viable at the present time. Despite these results the authors believe that similar studies should be conducted towards an effective and economic possible biological control of this pest.

Key words: Parasitoids, predators, pesticides.

RESUME – *"Contrôle biologique des pucerons dans les vergers de néfliers". La culture de néfliers est quasiment une culture à contrôle biologique des ravageurs, sauf pour ce qui est de la tavelure qui nécessite quelques pulvérisations pendant la période de culture. Cependant, la culture sous maille, qui présente quelques avantages en termes de qualité du fruit, entraîne une augmentation des populations de pucerons depuis la fin du printemps jusqu'au début de l'été. La principale espèce est* Aphis spiraecola. *Cette étude vise à connaître l'effet des parasitoïdes et prédateurs comme alternative aux pulvérisations de pesticides. Cette espèce présente quelques ennemis naturels connus, et il n'y a pas de résistance connue aux pesticides. On n'a pas observé de parasitisme par* Aphidius. Aphidoletes *comme prédateur était l'espèce la plus abondante. Une génération dure 3,5 semaines, de là que les effets potentiels de prédation n'aient pas été observés jusqu'à la fin juillet. Une diminution de la population de pucerons a été observée dans les deux parcelles, la parcelle étudiée et la parcelle témoin. La taille des populations était d'environ 2-4 larves de* Aphidoletes *par pousse. La deuxième espèce en termes d'abondance était* Scimnus, *la taille de population étant de 2-3 larves par pousse. En outre, on a observé 2-3 larves de* Crysopa *par pousse en même temps que des couches d'oeufs. Des larves de* Syrphidae *et* Propilea *ont été également observées. Selon ces résultats, la dissémination d'insectes bénéfiques devrait être effectuée vers la mi-mai, qui est la fin de la période de récolte et la saison où l'on observe les premières colonies de pucerons.* Aphidius *n'a pas eu d'effet sur le contrôle biologique de ce puceron. Le coût élevé de l'alternative biologique comparée à la pulvérisation de diméthoate rend cette approche non viable actuellement. Malgré ces résultats les auteurs pensent que des études semblables devraient être menées visant une lutte biologique efficace et économiquement possible contre cet insecte.*

Mots-clés : *Parasitoïdes, prédateurs, pesticides.*

Introduction

The loquat culture is almost a biological pest managed crop, except for the scab control that needs some sprayings during the crop. However, the crop under mesh that has some advantages in terms of quality of the fruit results in an increase of the aphids populations since the end of the spring to the beginning of the summer. The main species is *Aphis spiraecola*. This species is poliphagous and is

located in warm climates, being a common species in all the Mediterranean basin. It is a pest for citrus species (*Rutaceae*), *Rosaceae* species (*Malus, Pyrus* and *Prunus*) and ornamental species (*Spiraea, Crataegus, Cotoneaster*). It affects to other species too as V*itis, Pitosporium* and *Viburnum.*

The species is holocycle dioica. There is a primary host (the plant on the foundress colony is born) and a secondary host (the species where the different generations grow during summer). The primary hosts are species from *Spiraea* genera and most of the secondary hosts are those species where the aphids develop a pest. In the Southern East of Spain, there are aphid generations during the whole year on citrus.

On citrus the aphid populations increase during spring along with the development of new shoots. As the shoots get lignified the populations decrease. New shoots always can result in increasing of the aphid populations. When the conditions are worst on citrus the aphids can survive on weeds. As a result in our area there are about 40 generations per year.

This pest stops the shoot development and produces leave curling, this fact are very important in young trees. On citrus this species is a medium efficient "tristeza" virus vector.

The objective of this study is to know the effect of parasitoids and predators as an alternative to pesticide sprays. This species has a few known natural enemies, there is no known pesticide resistance.

Material and methods

The study was conducted in a 6000 m^2 plot under mesh, the control plot was 4000 m^2. The plant material consisted on 12 years old trees of cultivar 'Algerie' grafted on loquat seedlings, distributed on 7 x 7 m. The natural enemies used are shown in Table 1.

Table 1. Beneficial insects: date of spreading and quantity

Insect	June 22	June 30	July 14	Total	Units/1000 m^2
Aphidius colemani	4000	4000		8000	1500
Aphidoletes aphidymiza	16000	16000		32000	5330
Crysopa carnea	4000	–	4000	8000	1500

The control plot received two sprayings of 0.2% dimetoate 40% EC using 4000 liters per ha (8 liters of dimetoate 40% EC/spraying). The first spraying was made on June 10 when 50% of shoots were infested. A second spraying was made on June 30. The natural enemies were spread on June 22, at this moment aphids colonies were completely settled and 100% of the shoots were infested.

The spread of *Aphidius* was made as adults. *Aphidoletes* was spread in pupa phase in bottles containing 100 units. *Crysopa* was spread in sets of 500 L2 larvae.

Results and discussion

Results from the plot with beneficial insects

No parasitism was observed by *Aphidius. Aphidoletes* as predator was the species most abundant. A generation lasts 3.5 weeks, hence the potential effects of predation were not observed yet at the end of July. A decrease of aphids population was observed in both plots, the one studied and the control. Population size was about 2-4 larvae of *Aphidoletes* per shoot.

The second species in terms of abundance was *Scimnus*, the population size was about 2-3 larvae per shoot. Additionally, 2-3 larvae from *Crysopa* per shoot along with eggs layers were observed. Larvae from sirphides and *Propilea* were observed too.

Results from the control plot

Parasitism by *Aphidius* was not present and the rate of predation was lower than that in the preceding plot.

Table 2 shows the cost of biological control. The cost of spraying was about 320 euro per ha. However the cost of the biological control was 1200 euro per ha, which did not include the labor cost. The cost of the biological control is the main weakness of this alternative.

Table 2. Insect cost per species in euro

Species	Amount	Euro/unit	Total	Unit/m^2	Euro/m^2
Aphidius colemani	8000	0.02	160	1.33	0.03
Aphidoletes aphidymiza	32000	0.01	320	5.33	0.05
Crysopa carnea	8000	0.03	240	1.33	0.04

Conclusions

According to the results the spread of beneficial insects should be done at the middle of May, which is the end of the harvest season and the time when the first aphid colonies are observed.

Aphidius has no effect in the biological control of this aphid.

The high cost of the biological alternative compared to the spraying of dimetoate makes this approach no viable at the present time. Despite of these results the authors believe that similar studies should be conducted towards an effective and economic possible biological control of this pest.