Extended Practice Abstract Nº 14

Effect of bat *Pipistrellus* spp. in the biological control of *Lobesia botrana*

Challenge

Lobesia botrana (grapevine moth) is a major pest in viticulture worldwide. This pest can be effectively controlled with pheromones; however, this method only works when the vineyard is over 5 ha and is an expensive treatment (€100–300/ha depending on dose).

Solution

Increasing the biological control of *Lobesia botrana* could be a solution for small producers in areas with low pressure from this pest. Installing bat boxes is of particular interest in Mediterranean viticulture where non-irrigated vineyards are abundant. Water scarcity makes it difficult to successfully introduce biodiversity to help beneficial insects in this agricultural system. Therefore, bats are the most suitable predators to increase the biological pest control of *Lobesia botrana* in Mediterranean viticulture.

Benefits

A reduction of *Lobesia botrana* levels in vineyards with high bat population levels (40–60 bats per hectare).

Applicability box

Theme
Biodiversity
Natural resource conservation
Pest management
Grapes

Context
Climatic limitation

Application time
Although the best time is between late September and early November, bat boxes can be installed throughout the year

Required implementation time
It depends on the number of bat boxes, the equipment and the workers available. For example, 20 bat boxes on 10 poles across a 10-hectare area take 4 hours with 4 workers and 1 digger.

Period of impact
This depends on the initial bat population. In our conditions, we see an effect on the pest 5 years after bat boxes were installed.

Equipment
Pole (5 m height; 12 cm diameter), bat box, digger

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Practical recommendation

- Choose a proper model of bat box, otherwise, bats will not use them. They need a gap between 1.7 and 2 cm wide.
- Distribute the bat boxes around the crop. Try to install 2 bat boxes per hectare.
- Use high-quality materials to build your bat box. You can protect a wooden box with an external aluminium sheet to extend its lifetime.
- Install the bat box on a pole and insert it between 70 and 100 cm into the ground. The height of the bat box is an important parameter. Make sure the bat box is positioned 4 m above the ground. The orientation of the bat box generally does not matter, although if it is installed in a cold climate, try to install it facing south or west.
- If the bat box is installed in a warm climate, avoid installing it on the wall of a building that faces south or west. Bats can die inside the bat boxes during a heat wave.
- If the colony includes 20–150 bats, avoid disturbing them. This is particularly important during breeding time, which takes place between May and July.
- The entrance of the bat box should not be more than 2 cm wide.

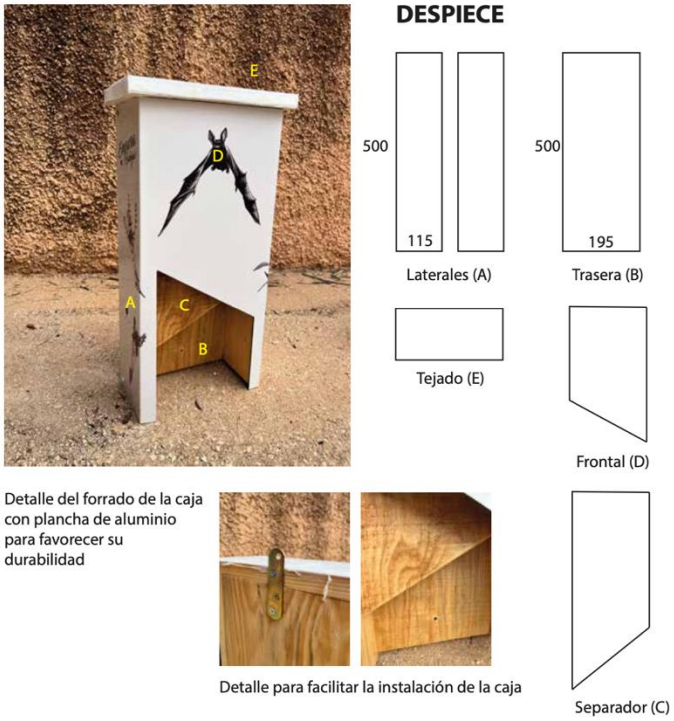

Figure 1: Example of a bat box protected with an aluminium sheet.

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Existing materials

Videos

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https://www.youtube.com/watch?v=Nk7b4LNgtqQ&t=257s
https://www.youtube.com/watch?v=qkpqLmjVCNI
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https://www.youtube.com/watch?v=e6PYtaObJgs

Web links

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Contact information

Publisher: Juan Martínez Barberá
CV-590 Km 51,1, 46810, Enguera, Valencia
+34 664 613 791
Author(s): Juan Martínez Barberá
Contact: j.martinez@bodegasenguera.com
Project partners: Instituto Cavanilles de Biodiversidad y Biología Evolutiva (ICBIBE), AVA-ASAJA, Bodegas Enguera.

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Extended Practice Abstract Nº 14

Simplified cost/benefit analysis

Effect of bat *Pipistrellus* spp. in the biological control of *Lobesia botrana*

Introduction – presentation of ex-ante and ex-post situation

Lobesia botrana (grapevine moth) has always been present in the southern part of the province of Valencia and the northern part of Alicante, in Spain. In organic and conventional farming, this pest is controlled with pheromones. These pheromones are distributed in the vineyard with emitters that release them throughout the season. Although this is a very effective treatment to control *Lobesia botrana*, it can only be used in vineyards over 5 ha and it is expensive. There is increasing interest among organic farmers in using bats to control the grapevine moth because bats are voracious insectivores and have been shown to be able to control this pest in the Mediterranean region. The use of bats to control this pest is beginning to have an impact in some of the vineyards where farmers are not using any other treatments for controlling the pest. These vineyards have a density of 15 bats/ha.

Economical costs and benefits

The project took place in the southern part of the province of Valencia. Costs are calculated per hectare.
In the ex-ante situation, installation costs occur every year, while in the ex-post situation, costs occur every 7 years, the duration of the bat boxes and poles in the vineyard.

Legend
Estimated indicator
Measured indicator

	Ex-ante	Ex-post
Installation materials *Pheromones 250 emitters/ha* *2 bat boxes/ha and 1 pole/ha*	€100	€160
Installation labour	€10	€6.25
Total	**€110**	**€166.25**
COMPARISON	Global reduction of 79% of the cost:	

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Environmental costs and benefits

Energy	Not measured but a positive impact can be considered: 
Slight energy saving as there is no need for transport across the vineyard to install the pheromones.	
Water	Unmeasured impact: 
No direct relationship between the practice and the indicator in question.	
Soil	Unmeasured impact: 
No direct relationship between the practice and the indicator in question.	
Air	Unmeasured impact: 
No direct relationship between the practice and the indicator in question.	
Biodiversity	Indicator improving > 75% 
To better understand the effect of bats in the vineyard, bat detectors are put in place monthly from March to October. Bat abundance and diversity have increased significantly thanks to the bat boxes. The vineyards have increased their bat density from none to 15 bats/ha on average.	

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Extended Practice Abstract Nº 14

Project on introducing bats in vineyards in the biological control of *Lobesia botrana*

Short description of the project

The general objective of the project is to determine the effect of bats in the biological control of *Lobesia botrana.* The specific objectives are:

- Establish bat boxes in the vineyard and monitor the bat population in the shelter.
- Monitor bat activity in vineyards with and without bat boxes.
- Monitor the population of and damage from *Lobesia botrana* in the vineyard.
- Determine bat activity in the vineyards using ultrasound recorders.
- Determine bat diet using DNA barcoding analysis.

Benefits

One bat can eat between 1,000 and 3,000 insects per night, and their capacity to control pests such as *Chilo suppressalis* in the Mediterranean region has been demonstrated.

Stage of implementation

The project ended in 2022 but we still monitor bat activity in the vineyards.

Key data box

Theme
Biodiversity
Natural resource conservation
Pest management
Grapes

Context
Climatic limitation

Duration
2019–2022

Partners involved
Instituto Cavanilles de Biodiversidad y Biología Evolutiva (ICBIBE), AVA-ASAJA, Bodegas Enguera

Budget
€233,735

Particularity
DNA barcoding for bat diet analysis

Main achieved or expected results

1. Since the 157 bat boxes were installed in 2019, the bat population has been growing year on year, reaching a peak of almost 1,000 bats in August. The occupation rate is still around 80%.

2. Bat activity is higher in vineyards with bat boxes, reaching more than 300 passes per recorder per night. Bats live and hunt 500 metres around the bat box.

3. *Lobesia botrana* is among the bats' diet, but they also eat other pests such as *Thaumetopoea pityocampa*, *Bactrocera oleae*, *Prays oleae* and *Cydia pomonella.* No parasitoids or pollinators were found in the bats' diet.

4. The dissemination activities of this project include the creation of two wines in homage to the bats. The winery allocates part of the profits from these wines to bat conservation activities. Moreover, over the past 2 years, the winery has held around 50 bat nights, sharing the project with more than 1,200 people.

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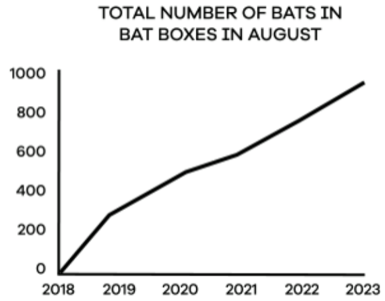

Figure 1: Evolution of the total number of bats in August

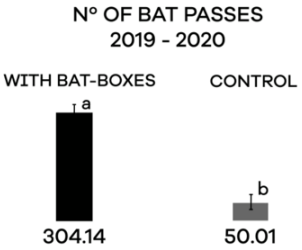

Figure 2: Bat activity in vineyards with and without bat boxes

Figure 3: Bat species detected

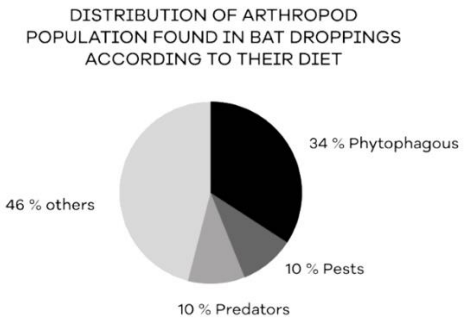

Figure 4: Distribution of arthropods found in bat droppings according to their diet

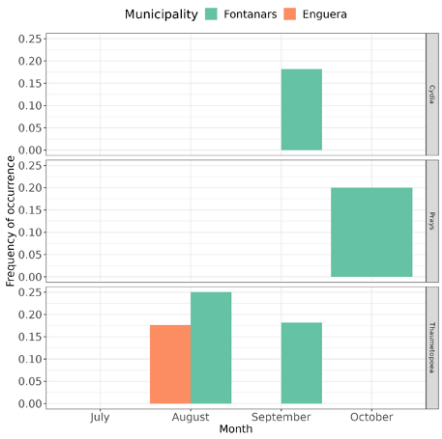

Figure 5: Frequency of pests 16W in bats' diet

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Figure 6: Consensus Identity Lobesia botrana *found in bat droppings*

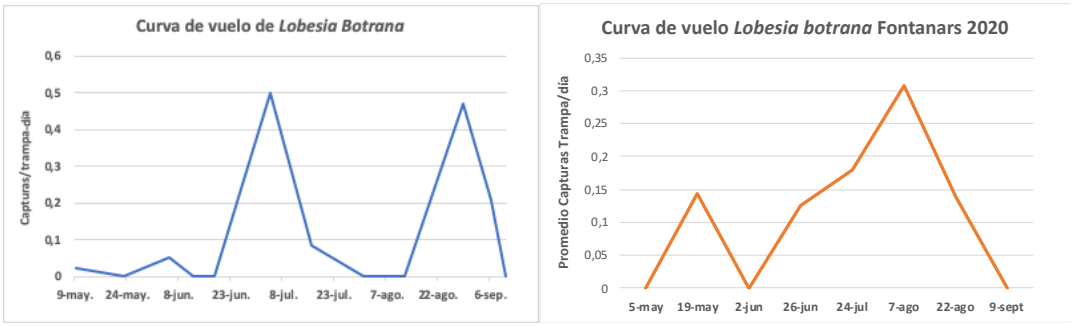

Figure 7: Lobesia botrana *adult curve in 2019 and 2020*

Fig 8: Installing and repairing bat boxes

Figure 9: Dissemination activities ('bat nights')

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Figure 10: Presentation of the results of the project and the wine Aliats ('allies') as a tribute to the bats.

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Existing materials

Videos

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https://www.youtube.com/watch?v=qkpqLmjVCNI
https://www.youtube.com/watch?v=ckAthWa6qbI&t=1s
https://www.youtube.com/watch?v=e6PYtaObJgs

Web links

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Contact information

Publisher: Juan Martínez Barberá
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