





PRESS RELEASE

## Bats are key to pest control in agriculture

- Scientists from the University of the Basque Country and the Doñana Biological Station – CSIC has studied a colony of bent-winged bat in the southern Iberian Peninsula
- This colony of bats can eliminate up to 60,000 of processionary moths every night during August and September



Bent-winged bats . Photo: Elena Tena

**Seville, 19<sup>th</sup> December 2023.** Bats have an important role in the control of agroforestry pests. It is the conclusion of a new study led by the University of the Basque Country (UPV/EHU) and the Doñana Biological Station – CSIC, in which researchers have studied the diet of a bent-wing bat colony in the in the southern Spain.



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*Miniopterus schreibersii* is the most gregarious cave bat in Europe, forming colonies of up to tens of thousands of individuals. In addition, it is a species with an important flight capacity with a roosting area extending up to more than 30 km from the refuge. This colony in particular, shelThe San Cristóbal colony in particular, throughout the study period, counted between 3000 and slightly more than 7000 individuals. This colony is known to hunt at least as far as the southern half of Doñana National Park with some frequency.

"This large colony can exist and maintain itself in such a humanized area due to the characteristics of the species, which is an aerial hunter of open spaces," says Carlos Ibáñez, a researcher at the Doñana Biological Station. "This means that it does not depend on the type of plant substrate and also has a great capacity for movement. Although the environment is highly humanized, it is heterogeneous and offers sufficient alternative resources over time" Two thirds of the surface area is devoted to a wide variety of agricultural crops, in addition to urbanized areas. The rest is made up of patches of natural vegetation including protected areas, such as the Bay of Cadiz Natural Park and the southern part of the Doñana National Park.

The study was based on the metabarcoding analysis of the DNA of prey remains in bat fecal samples. As a result, the scientific team identified slightly more than 160 arthropod species in the diet of these bats, of which 39 were identified as pest species. The bulk of their diet was composed of 24 species, of which 11 were pest species, mostly moths that, in the caterpillar stage, affect different crops and forest stands (pine and oak or cork oak forests). Also, among these species were the green bugs that affect cotton and a good number of fruit and vegetable species.

In the diet of these bats, two prey that are vectors of pathogens were also detected. One of them is the common mosquito, *Culex pipiens*, which is a vector of the Nile fever virus, among others, with cases of human infection in the area. The second is *Neophilaenus campestris*, which is a vector of the phytopathogenic bacterium *Xylella fastidiosa*, which is considered a serious global threat to agriculture in Europe.

The composition of the diet varies throughout the year, as there is a succession of peaks in the availability of different prey. In turn, the most consumed insects are associated with different habitats and crops. This means that bats use the different habitats available for hunting and vary them over time. In this way, when foraging, bats can target successive population explosions of pests that affect different crops or forests.

## The role of the bat colony in pine processionary control

After identifying the species consumed by the bats, the team quantified the pest consumption by the colony considering their daily intake, the size of the colony and the proportion of each prey species in the diet at each time. In total, between May 11 and October 10, the colony had consumed a total of 1,610 kg of insect pests. More than 90% corresponded to 10 species. To get an idea of the significance of these figures, the team focused on the specific case of the pine processionary (*Thaumetopoea pityocampa*), a well-known pest typical of pine forests.

In the study area, pine forests only accounted for less than 3% of the land area used by the colony. The pine forests mostly form small copses and even occupy gardens in urbanized areas. The largest stands are found more than 25 km away, for example, in the Doñana National Park. The processionary moth has only one reproductive cycle per year, which means that they are only available during a specific period. In this area, they reach the maximum number of flights between the second half of August and the first half of September. "In these weeks, they were the main prey by far, with appearances in more than 90% of the samples, despite the reduced surface area of the pine forest," comments Carlos Ibáñez. "At this time the colony reached its maximum size with 7,200 individuals, partly due to the incorporation of young birds that



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began to fly independently in July, but also to the incorporation of individuals from shelters located further east". The population increase was probably associated with the abundance of processionary moths.

On these dates, in a single day, the colony consumes up to 6 kg of processionary moths. As each moth weighs 0.1 g, this means about 60,000 moths or processionary moths. In the whole season they would eliminate about 173 kg of pine processionary, which is equivalent to 1,730,000 moths. As there are about 10,000 ha of pine forest, they eliminate about 173 imagos/ha.

This colony is legally protected. M. schreibersii is a Vulnerable species (CEEA) and the refuge is in the Natura 2000 Network as a ZEC (ES120030 Cuevas de la Mujer y de las Colmenas). "However, but this does not ensure its long-term conservation," says researcher Carlos Ibáñez. "Among the threats are the possible change of use of the enclave, the protection of the cavities where it spends the winter, such as the Hundidero-Gato and Motillas complexes, with increasing pressure from active tourism activities in its interior and the high number of wind farms in its vital area."

## Reference:

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