

Bees under debate: between beekeeping and biodiversity

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“Honey bees are often celebrated as a flagship species, yet in recent years they have become the centre of a debate: could they pose a threat to wild pollinators? The scientific community has not reached a consensus, and the risk of unfairly blaming them is real”

Competition between managed and wild and pollinators

Competition is a **biological phenomenon** that occurs when two or more organisms use the same limited resources, such as food, nesting sites, or light. It can occur between individuals of the same species (**intraspecific competition**) or between different species (**interspecific competition**). Although the term may carry a negative connotation in everyday language, it is a natural form of interaction between organisms, like other well-known interactions such as predation, symbiosis, and parasitism.

From an ecological and evolutionary perspective, **competition drives diversity and adaptation**. It stimulates species' evolutionary processes, the differentiation of ecological niches, and the optimisation of foraging strategies, contributing to ecosystem stability and resilience. In other words, competition is not inherently a problem but is part of the **normal functioning of nature**.

In recent years, the topic of competition between managed honey bees and wild pollinators has become a hotly debated issue. In some protected areas, the presence of hives has been limited or prohibited, creating tensions between beekeeping communities and park managers. Recent examples include **Aix-en-Provence** in France and the **island of Giannutri** in Italy, where local decisions sparked discussions about the balance between beekeeping and the protection of wild pollinators. These cases highlight **the importance of basing management decisions on scientific data and sustainable beekeeping practices**, rather than on alarmist perceptions or generalisations.

In the context of honey bees and wild pollinators, competition mainly involves **the shared use of floral resources**, such as nectar and pollen, and **the transmission of diseases**. By contrast, competition for nesting sites or materials is generally little considered, probably because it is largely independent of beekeeping and of the presence of honey bees. Intensive beekeeping, with very high hive densities, can have a significant local impact. However, in Europe, where honey bees and wild pollinators have coevolved in heterogeneous, in flower-rich and heterogeneous environments, each species tends to occupy its own niche, reducing negative effects. Balanced management of beekeeping and the surrounding environment further limits these impacts.



A honey bee and a Anthidium, a wild bee, feeding on the same flowers of Vitex agnus-castus. @Laura Bortolotti

In this context, **beekeeping plays a positive role** for biodiversity. In 2018, the European Commission adopted the EU Pollinators Initiative, the first European framework aimed at countering the decline of wild pollinators, with long-term goals set for 2030 and concrete short- and medium-term actions. Beekeepers have actively contributed to the initiative, participating in awareness campaigns, monitoring, and sustainable habitat management. The initiative aims to improve scientific knowledge of pollinator declines, address the main causes, and strengthen collaboration among all stakeholders.

Although the focus is on wild pollinators, the actions undertaken **also benefit managed pollinators**, particularly honey bees, complementing existing initiatives supporting beekeeping and colony health. Practical measures promoted by beekeepers include creating and maintaining flower-rich meadows, hedgerows, and flowering margins, actions that increase food resource availability and support colony productivity. In this sense, beekeeping is not a “problem” but **can become part of the solution**, promoting landscapes and practices that enhance overall biodiversity.

Competition for floral resources



A butterfly feeding on nectar of a crucifer flowers, while a honey bee and a Xylocopa are also arriving at the same flowers. @Laura Bortolotti

Competition for food resources mainly concerns floral resources, **nectar and pollen**, but cannot be fully understood without considering the environmental context in which it occurs. Resource availability varies **according to the landscape** (more or less complex, rich or poor in semi-natural habitats) **and seasonality**, as the abundance and diversity of blooms change throughout the year. In heterogeneous environments, with a good variety of plants and flowering periods spread over time, competition tends to be limited.

Several studies confirm that the intensity of competition among pollinators is strongly influenced by the environmental context and the temporal distribution of blooms, emphasising the importance of understanding resource partitioning to grasp local ecological dynamics. In Sweden, Herbertsson et al. (2016) analysed the effect of hive presence on bumblebee communities in both homogeneous and heterogeneous agricultural landscapes. In complex and heterogeneous landscapes, no significant differences were observed between sites with and without managed honey bees. By contrast, in simplified, homogeneous landscapes, the presence of hives was associated with

a negative effect on wild bumblebees, highlighting how the environmental context plays a key role in modulating the intensity of competition.

Similar results were reported by Ropars et al. (2022) in southern France, which examined competition between honey bees and wild bees from March to June. In this case, interspecific competition was high in early spring, when blooms were scarce and poorly diversified, but gradually decreased until becoming negligible by early summer, likely due to the increasing abundance and diversity of flowering plants, allowing for a more effective partitioning of resources.

An often overlooked aspect is that, in general, **intraspecific competition is stronger** than interspecific competition because it involves organisms with the exact ecological requirements. This is particularly true for honey bees. The study by Ropars et al. (2022) also shows that, while competition between honey bees and wild pollinators decreased over the season, competition among honey bees remained high throughout the observation period. **High hive densities therefore increase pressure on resources, with direct consequences for beekeepers:** weaker colonies, reduced growth, greater susceptibility to pathogens, and ultimately lower production. **Managing hive density and available resources in a balanced way** not only protects wild pollinators but is also an investment in the health and productivity of managed honey bees.

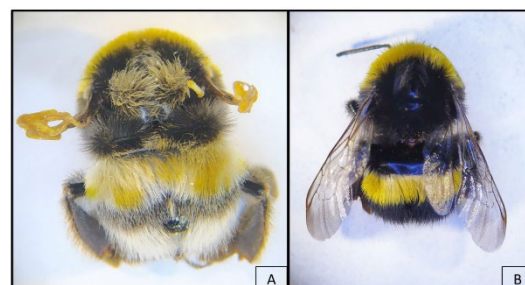
Pathogen transmission and spillover

Another aspect often mentioned in the debate concerns the transmission of pathogens between managed honey bees and other pollinators. Honey bees host numerous viruses, bacteria, and parasites and, due to their abundance and wide distribution, can potentially act as a reservoir of microorganisms in the environment. In this context, the term **spillover** is frequently used to indicate the possible transfer of pathogens from honey bees to other pollinator species that share the same floral resources.

However, the issue is more complex than it may seem. Most available studies only document the presence of “honey bee” pathogens in wild pollinators, without investigating potential negative consequences in terms of reduced individual fitness or population decline. It is therefore important to emphasise that presence does not necessarily mean effect. Few studies have experimentally assessed the effects of these pathogens on species other than honey bees. For example, Dolezal et al. (2016) administered an inoculum containing four *Apis mellifera* viruses to two species of wild bees, without observing negative effects. Similar results were obtained by Tehel et al. (2020), who inoculated three *A. mellifera* viruses into bumblebees, finding no significant impact on their survival.

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This does not mean the issue can be ignored. In the case of Deformed Wing Virus (DWV), negative effects have been documented in bumblebees and hornets (Forzan et al., 2017; Cilia et al., 2021), although these are limited and not generalised situations. At the same time, there remain major gaps in knowledge regarding the actual effects of these microorganisms on wild species. Moreover, speaking generically of “honey bee pathogens” can be misleading: it is more accurate to refer to them as “**honey bee-associated pathogens**”, simply because honey bees have historically been the most studied species. Only in recent years has research begun systematically investigating the presence and role of these pathogens in other bees and, more broadly, in pollinators. We therefore do not know the original situation, nor which species first hosted these microorganisms.



Two *Bombus terrestris* individuals: A) with wing deformities caused by Deformed Wing Virus (DWV), B) with normal wings. From: Cilia et al., 2021. <https://doi.org/10.3390/vetsci8070117>

Once again, beekeeping management plays a central role. Colonies whose health and *Varroa* infestation levels are **adequately monitored** help to maintain overall pathogen load in the environment under control, while simultaneously improving the health and resilience of the colonies themselves. At the same time, the environmental context also influences pathogen dynamics: several studies suggest that pollinator-friendly environments, rich in floral resources and structurally complex, reduce individual stress and may **limit disease transmission**.

Sustainable management for honey bees and biodiversity

As we have seen, both competition for food resources and pathogen transmission can be mitigated through sustainable management of beekeeping and the landscape. On one hand, **colonies that are regularly monitored** for *Varroa* infestation levels and overall health reduce pathogen load in the environment, benefiting both honey bees and wild pollinators, while improving colony productivity. On the other hand, **heterogeneous environments**, rich in hedgerows, small woods, flowering margins, and semi-natural habitats, provide abundant and diverse blooms spread over time, promoting ecological niche partitioning, reducing pressure on resources, and supporting colony health.

Some practical strategies to promote sustainable coexistence include:

- Distributing hives evenly **to avoid overcrowding**;
- Planning **regular health monitoring** to keep viral loads in the environment low;
- Maintaining and increasing **landscape complexity** with hedgerows, small woods, flowering margins, and semi-natural habitats;
- Increasing the **diversity and abundance of floral resources** with species that flower at different times and exhibit diverse floral forms.

In summary, careful and integrated management not only reduces competition and health risks but also turns beekeeping into an ally of biodiversity. Rich, diverse, and well-managed environments simultaneously benefit wild pollinators and honey bees, improving colony health and productivity as well as ecosystem resilience.



In a balanced context, all species benefit, allowing sustainable and productive coexistence.

A diverse flowering strip characterised by a variety of species and flower forms. It enriches the landscape and provides functional resources for a wide range of pollinators. @Stephan Eickschen



BEE-GUARDS: observing pollinators to assess potential competition

The European **BEE-GUARDS** project (www.bee-guards.eu) aims to steer European beekeeping towards **more resilient, sustainable, and ecologically responsible** practices, grounded in robust scientific evidence and capable of protecting **all pollinators**, both managed and wild. The project investigates how different abiotic factors, including climate and beekeeping management practices, influence beekeeping resilience across multiple interconnected levels, from individual bees to colonies, and up to landscapes and society as a whole.

Funded by the **Horizon Europe** programme, BEE-GUARDS brings together **27 partners from 16 countries**, including universities, research centres, beekeeping associations, and companies, integrating scientific research, innovation, and practical knowledge.

Among its various activities, the project also includes a **citizen science** component, structured around three initiatives:

- **WikiBEEdia** (www.wikibeedia.eu), a multilingual online beekeeping encyclopaedia;
- an activity aimed at **beekeepers**, focused on *Varroa* monitoring and management;
- an activity open to everyone which, through **observing pollinators on flowers**, collects information on which species visit which plants and at what times of the year, helping to improve our understanding of how floral resources are used and shared among different species.

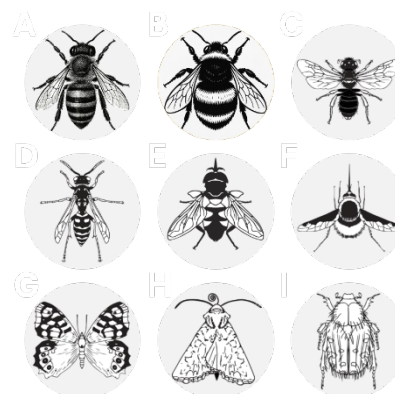
Registration for the **practical activities** (*Varroa* monitoring and pollinator observation) is available at the following link: <https://ec.europa.eu/eusurvey/runner/BeeGuardsCitizenScienceRegister>

Taking part in pollinator observation is simple: just scan the QR code, observe flower visitors on your balcony, in your garden, or in any green space, and record which and how many pollinators you see. You can participate wherever you like, whenever you like, and as often as you like.

Each observation provides valuable data and contributes to a better understanding of floral resource use, supporting the development of more balanced strategies for coexistence between wild and managed pollinators.



The most active observers will receive a prize at the end of the project!



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