



Vespa velutina - © Gilles San Martin

Roadmap to control "Invasive Hornets"

Introduction

Invasive alien species are among the five most important direct drivers of global species decline¹. The costs incurred between 1980 and 2019 are estimated at \$1.208 billion worldwide, equivalent to those from environmental disasters². Social wasps are known as successful invasive species worldwide^{3,4}, that, as social apex predators, can have a significant impact on local ecosystems⁵.

This policy brief analyses the spread and threats posed by invasive hornets, particularly *Vespa velutina* and *Vespa orientalis*, to the European environment, public health, and economy. We also examine the factors that led to the current epidemiological situation, and propose recommendations for action at different governance levels.

We acknowledge the presence of *Vespa bicolor* and *Vespa soror* in the European territory, either currently or historically. However, data on their ecological and societal impacts are scarce.

An underestimated problem: the spread and impact of invasive hornets

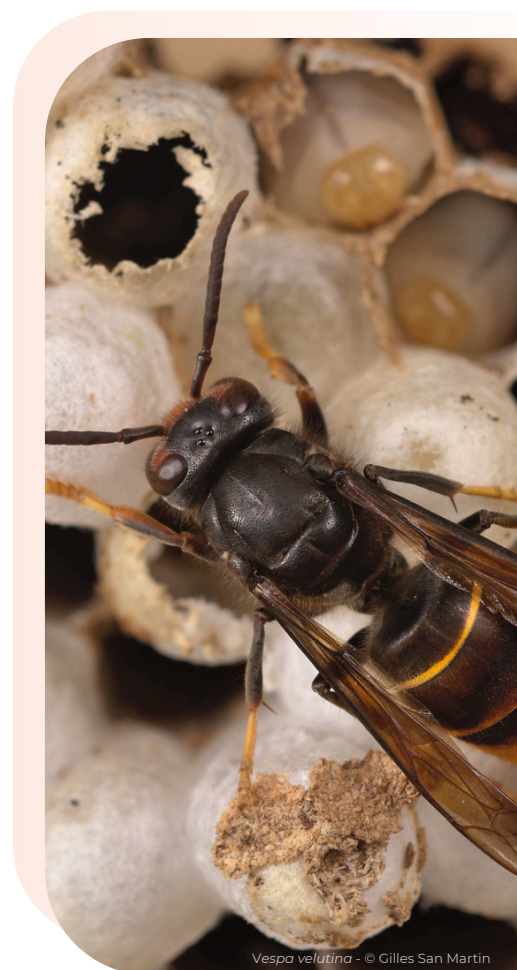


Spread of hornets

To date, *Vespa velutina* has been detected in 16 European countries. In most of these, a population has now become established. As an opportunistic generalist and social organism, *V. velutina* is highly adaptable to diverse environmental conditions. This high level of flexibility has even surprised scientists. Its proliferation is therefore only limited by adverse climatic conditions. However, longer seasons due to climate change appear to favour the spread of this species. So far, the high nest densities reported in some European areas also indicate relatively low intraspecific competition⁶.

Furthermore, *Vespa orientalis* - a species that occurs naturally in some areas of southern Europe - has expanded its range into new regions and Member States. This species is well adapted to warm, semi-arid and arid conditions.

Local efforts have been deployed to try to control their spread, including surveillance and nest removal. Unfortunately, authorities have often failed to establish the necessary networks with local people to remove nests. In addition, removal has not been professionalised everywhere, and in some cases, it remains a task that weighs heavily on beekeepers' shoulders.



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Impact on biodiversity

To understand the pressure that the presence of *V. velutina* exerts on ecosystems, it's useful to know that an average colony requires approximately 11 kg of prey per year to survive and thrive (not taking into account the energy requirements of the larvae's metabolism). Consequently, in areas where the density of hornet nests reaches 20 per square kilometre, the total food requirement is above 220 kg of insects. Studies report effects on ivy pollination due to the displacement of other pollinators⁷ and on bumblebee colony development.⁸ A study across three European regions by Pedersen et al.⁹ identified 1,449 different taxa in the hornet's diet. Of the 50 most prevalent species in this diet, 43 were pollinators, and all of the top 10 most hunted species were pollinators.

Unfortunately, the impact of the neo-invasive *V. orientalis* on ecosystems has so far received little scientific attention. However, negative effects can also be assumed for this species.

Impact on beekeeping

Damage to beekeeping caused by *V. velutina* has been reported in heavily infested regions. Damage can also be caused by the fact that even a few individuals in front of the beehives can decrease the colony's flight activity. This is especially evident in late summer, when hornets' activity is at its peak while bees are stocking up for the winter. In a national survey in France in 2024, *V. velutina* was the most cited reason as explanation by beekeepers for winter 2023/2024 colony losses, 22% of respondents.¹⁰ From the direct field experience of French, Italian, and Spanish beekeepers, we have learned that where wasps are present in large numbers, hive losses increase exponentially (by as much as 30%).^{6,11,12} A recent survey in Galicia estimates that beekeepers spend between 14% and 21% of the value of honey production on control of *V. velutina*.¹³

Moreover, the presence of *V. velutina* at high densities has already changed beekeeping practices, adding steps to technical routes and rendering breeding and queen mating impossible in some areas.

Additionally, beekeepers in many affected regions spend considerable time and money detecting and destroying nests, which are often located high in the canopy. Nest destruction is the most effective method for preventing the establishment of *V. velutina*, especially in newly colonised areas. However, as it is difficult to locate all the nests in time, additional measures and methods are required to successfully control this species and prevent damage.

V. orientalis is also known for being a notorious danger to bee colonies,¹⁴ and beekeepers in Andalusia (Spain) are already experiencing some attacks on their apiaries (Molero, *pers. comm.*).

Due to the lack of systematic data collection, regional differences in infestation levels lead to differing opinions regarding the dangers posed by (neo)invasive vespids. In some cases, the lack of visible damage in the early stages of colonisation leads to a misjudgment of the potential impact of these species.

Impact on agriculture

The impact of (neo)invasive hornets on agriculture can be direct or indirect. Indirectly, as already mentioned, *V. velutina* has been shown to prey on a wide diversity of insects,⁹ which contribute to a functional ecosystem that supports farming by providing pollination, pest control, and nutrient recycling.¹⁴ Additionally, depending on local population density, fruit and wine production can be directly affected by invasive insects.^{16,17} Above all, increased autumn and winter losses of bee colonies due to *V. velutina* can, in turn, lead to fewer colonies being available for pollination in spring.

Impact on Human Safety

To date, there is some evidence from public health authorities suggesting that *V. velutina* poses a threat to human health.¹⁸ Furthermore, there are cases in the literature that warrant continued attention to this issue. However, the evidence for increased human mortality cases associated with *V. velutina* in Spain appears unfounded, undocumented, or understudied.⁹ Hornets might pose a safety concern for humans, particularly in highly touristic areas or public places (schools, playgrounds, golf courses), where there is a high density of *Vespa* spp. active nests. In the event of an allergic reaction, their stings can cause more severe reactions than those of smaller, common wasp species and can be fatal if a systemic reaction, such as anaphylaxis or poisoning, occurs.

An increase in anaphylactic shock and the treatment of allergies caused by Asian hornet stings has been reported in both Spain²⁰ and Portugal.²¹ In these regions, stings from *V. velutina* account for 75% of allergic reactions to hymenopterans. While the annual death toll from hornet stings in Galicia is fortunately low, it exceeds the statistically expected figures.²⁰ Furthermore, a higher incidence was observed in regions where *V. velutina* is prevalent.¹⁸

In addition, and in line with the previous section, *V. velutina* could pose a health risk to harvest workers and tourists in wine-growing regions, for example, due to its sometimes massive presence.



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Reasons for the failure of adequate control

As previously mentioned, *V. velutina* is highly adaptable. However, we have also identified several structural problems that facilitate the spread of *V. velutina* and other (neo)invasive vespids, hindering their eradication or effective management. Based on experience with *V. velutina*, the question arises: how effective is invasive-species control in the EU overall? *V. velutina* teaches us many lessons in this regard.

Authorities and regulations

1. Despite the provisions of the EU Regulation 1143/2014²² on invasive species of Union concern, there is no uniform approach among Member States.
2. Not only among Member States but also within them, there is generally no uniform approach, as regional and local authorities are responsible for combating invasive species.
3. There is no coordinated exchange of information between the authorities of the Member States in the fight against invasive hornets. As a consequence, almost every Member State is reinventing the wheel in the fight against *V. velutina* and other (neo)invasive vespids.
4. EU Regulation 1143/2014 places obligations on EU Member States regarding the management of *V. velutina*. However, due to inadequate implementation of the EU regulation at the national level and in accordance with the national constitution, national governments are not always able to ensure that the regions comply with these obligations.
5. Internal disputes: Environmental authorities are generally responsible for combating invasive species. However, they often consider honeybees to be the responsibility of the ministries of agriculture. The latter, in turn, points out that *V. velutina*, as an invasive species, falls within the remit of the environment ministries. The task of protecting beehives from (neo)invasive vespids is therefore often postponed. We should remember that, in the early stages of the invasion by *V. velutina*, the issue was often considered minor because it affected the often-neglected sector of beekeeping. Furthermore, in various cases, competent authorities refuse to carry out the tasks assigned to them under EU regulations, particularly those aimed at minimising economic damage and risks to human health.



Vespa velutina - © Gilles San Martin

Allocated resources and field interventions

6. If the costs of nest removal are passed on entirely to the property owners (farmers or citizens), most nests will be left hanging.
7. The possibility of a cost-benefit analysis, permitted under EU Regulation 1143/2014, is sometimes misused to completely reject any measures to combat *V. velutina* and *V. orientalis*.
8. Lack of funding for hornet monitoring, nest detection, and nest removal: if early action is delayed, combating an invasive species becomes expensive. Some regions lack effective monitoring systems. As a result, the response to the invasion sometimes came far too late. In some cases, efficient reporting platforms are still lacking. When there are many reports, the responsible employees quickly become overwhelmed. In addition, many platforms do not provide the public with a clear overview of the occurrence of the invasive species.
9. Following the end of the eradication phase and the transition to Article 19 of EU Regulation 1143/2014, some competent authorities are ignoring that this article requires measures to minimise not only risks to biodiversity but also economic damage and risks to human health. No appropriate management is carried out, although "population control" is defined in Article 3 (14) as "any lethal or non-lethal action applied to a population of invasive alien species, [...] to keep the number of individuals as low as possible, so that, while not being able to eradicate the species, its invasive capacity and adverse impact on biodiversity, the related ecosystem services, on human health or the economy, are minimised."
10. The location and removal of nests are laborious, costly, and often time-consuming tasks. It is particularly important to locate nests before new queens and drones emerge. However, in general, too many nests are discovered too late, by the time the new queens have already spread. This allows the population to rebuild itself in the following year.
11. Although funds are available to combat invasive species, there is no priority for funding the control of invasive hornets by the authorities, who often rely on beekeeping (via National Beekeeping Programmes) and local funding.

Biocides for combating invasive vespids

12. There is a lack of sustainable biocides to neutralise *V. velutina* and *V. orientalis* nests.
13. In some cases, theoretical preparations for combating an invasive species may have been put in place, and control plans may even have been drawn up - but it then becomes apparent that there is a lack of practical preparations for an emergency.
14. There is sometimes a problem in finding companies willing to apply for biocide authorisation. Control of invasive hornets is a problem little felt by society, yet it has serious and obvious consequences for the beekeeping sector. Therefore, it is of no economic interest to biocidal companies.

We would recommend

Governance that actually works

EU level

- Recognise that invasive vespids are a problem for society as a whole and not just a problem for beekeeping.
- Recognise the threat posed by the neoinvasive species *V. orientalis* in some regions, even though it is a native species in some Member States.
- Ensure that Member States and regions comply with the requirements of EU Regulation 1134/2014. We call on the European Commission to issue guidelines to harmonise the National implementation of this Regulation.
- We welcome the EU Commission's announcement of its willingness to establish a dedicated platform (under Article 22 of Regulation (EU) 1143/2014) to enable authorities, experts, and stakeholders to share data and best practices. This should include national management plans, control methods and authorised agents, public awareness initiatives, monitoring and reporting systems and the data they generate, current research projects and the data they generate, and indicators of success. We now call on the EU Commission and Member States to implement the platform.
- Provide adequate financial support for nest removal in Member States. Since *V. velutina* and *V. orientalis* are venomous insects and pose a problem for society as a whole, beekeeping subsidies should not be the sole source of financing for this purpose, as is often the case today. Given the varied impacts of invasive hornets across sectors (e.g., agriculture, public health, tourism), additional funding should be allocated from other budgetary posts to develop an integrated financial approach to the problem.
- The Commission should conclude joint procurement and framework contracts at the EU level to lower local authorities' costs for purchasing control equipment (e.g., drones/thermal cameras, radio-tag kits, protective gear).



National level

- Establish a National Vespa Coordination Unit, including relevant stakeholders (environment, agriculture, health, and civil protection), to draft a national action plan that lives up to its name. Special attention should be paid to integrating the people who have already been working in the control field.
- Review/Audit the national implementation of the EU regulation and, where possible, enforce its requirements at the regional level.
- Where a Member State's constitution prevents the establishment of a binding national control plan, the competent regions should be required to draw up a binding control plan. The management plans of the regions must take into account the requirements of Article 19 of EU Regulation 1143/2014. They may cover the following points:
 - Monitoring strategy,
 - Intervention measures,
 - Cooperation obligations between authorities, local authorities and associations,
 - Reporting procedures,
 - Procedures for prioritising nests,
 - Measures to raise public awareness.
- The national government should define binding target indicators which the regions must set out in their management plans.
- The national government should set monitoring standards that every federal state/region must comply with scientifically recognised methods.
- The national government should set up a national coordination office. Its responsibilities should include the following:
 - coordinating cooperation between the various national and regional ministries,
 - compiling a nationwide overview of the situation, for example, by managing a national platform that collects and presents up-to-date information on the reporting situation in the various regions,
 - collecting and disseminating relevant information on *V. velutina* and *V. orientalis* to state authorities and stakeholders,
 - producing information materials for public relations work.
- *V. orientalis* should be classified as an 'invasive species' in Member States or regions where it does not occur naturally. It should be recognised as a threat to biodiversity and society, causing economic damage to some productive sectors. In Member States where it has so far only been considered native in certain areas, it should be classified as 'neoinvasive'.
- National governments should provide adequate financial support for implementing the national action plan.

Regional/local level

- Ensure that control of *V. velutina* and *V. orientalis* is primarily left to professional pest controllers (private or public), who are specially trained to manage these species. It should not be borne mainly by beekeepers or citizens.
- Legal clarity is required for access to private land and for action: rapid-entry permissions (with safeguards) should be guaranteed to pest controllers appointed by the relevant authorities to destroy nests on private land.
- One operational lead per territory (like the “hornet air-traffic controller”): coordinates call-outs, triage, nest destruction, and data entry.
- Local/regional authorities create stakeholder groups (e.g., citizens, hunters, farmers, beekeepers) to help with the surveillance of invasive hornets.
- Support the management of nest destruction by introducing effective IT. The platform should make it easy to report nests, provide Open and FAIR^a data and verify the correctness of the reports (see below). Furthermore, effective IT should simplify the creation of overview maps, the direct assignment of tasks for nest removal and the tracking of their status (nest removed or not).
- Build networks to streamline on-the-ground operations and reduce the need for long-distance travel.
- Mutual-aid agreements between neighbouring regions (hornets ignore administrative borders with heroic indifference).

Surveillance

- Financial resources need to be made available for extensive monitoring.
- Involvement of all local stakeholders, from farmers to beekeepers, from forest rangers to citizens, to implement monitoring according to specific guidelines.
- Support the development of a high-quality reporting platform for *V. velutina* and other (neo)invasive species. This platform should use AI to largely automate the verification of reports based on mandatory photos²⁵. This speeds up report processing, increasing citizens' satisfaction with reporting and reducing employees' workload. Since citizen reports play an essential role in combating invasive species, the reporting platform must be attractive and user-friendly. It should also provide an accurate, up-to-date overview of reports across regions and the country as a whole. A uniform standard for a reporting platform within the EU would be desirable.

a. Findable Accessible Interoperable Reusable

Awareness-raising, training and behavioural change

- Since “citizen science” is an important, if not the most important, factor in monitoring invasive species, it should be promoted through information campaigns. Provide resources to support awareness-raising actions for municipalities, gardeners, hunters, waste management staff, construction workers, farmers, and citizens. One possibility would be to declare an “Invasive Species Day” or, in the case of *V. velutina*, a “Velutina Week” in the spring to locate queens and their embryo nests that can still be removed easily and usually free of charge or at least at low cost.
- Promote the use of the official reporting platform to ensure that:
 - Sightings are verified, and other insect species are not mistaken for *V. velutina*;
 - Reports are not only submitted to unofficial platforms, which often means they are not made known to the authorities.
- Spread a single message: **“Don’t panic. Don’t poke. Do report.”**
- Inform medical doctors, schools, farmers and field workers, etc., about the possible dangers posed by *V. velutina*.



Control

- We welcome the European Commission's plans to fund a *V. velutina*/Invasive hornets research project through the Horizon Europe programme in 2027. Research must produce results that can be effectively applied in practice to combat the hornets. Scientific studies should aim to:
 - facilitate the detection of nests using appropriate, affordable and widely applicable means;
 - develop appropriate, sustainable biocidal active substances for controlling *V. velutina* and *V. orientalis* and bring them to market approval insofar as they fall under the legal regulations for biocides;

b. Some active ingredients are already authorised in some Member states for nest destruction. However, there is concern about the impact of their use in the environment, mainly in the case of neutralised nests that are not removed. Furthermore, there is concern about the use of biocides based on neonicotinoids/fipronil given their persistence in the environment and bioaccumulation in the food chain. Authorities, researchers and relevant industry should explore the possibility to achieve a European authorisation of SO₂ or pyrethrum as a biocide category 18, ensuring clear information of application and precautions during its use.

- review the Trojan horse method^f for killing nests without having to find them. This requires environmentally friendly agents and approaches to avoid unintended negative impacts on biodiversity. It is necessary to establish species-specific toxicological parameters and compare them with those of species likely to feed on dead hornets and on eliminated nests, to minimise any impact on wild species. Residue studies will be conducted on nests destroyed by the insecticides under study;
- develop effective attractants/baits or decoy nests for trapping queens of *V. velutina* or *V. orientalis*;
- evaluate traps for efficiency, effectiveness, and selectivity. However, this must be done more broadly than before. Different new trap types should be tested in sufficient numbers under various conditions, at different times of year, and for different purposes (intercepting queens vs intercepting workers). The bycatch should be examined under the different tested conditions, distinguishing between other invasive species, pests, common species and protected species;
- determine over a longer period of time whether the interception of queens in spring actually leads to a significant decrease in nest numbers;
- assess the efficacy of the so-called electric harps as control tools;
- explore the possibility of integrating individuals of invasive hornets into novel food Regulation^{23,24}, shifting the concept of these invasive species from nuisance to food/feedstuffs, creating added value in their control.



Conclusion

Invasive hornets represent a structurally underestimated, cross-sectoral risk in Europe, and their effective management requires a shift from fragmented, reactive approaches to a coordinated, well-funded, and professionalised EU-wide system integrating surveillance, control, data sharing, and research.

c. Trojan methods" to neutralise Vespa nests

The term "Trojan methods" refers to procedures that involve capturing *Vespa* workers near apiaries (or other locations), treating them, and releasing them to deliver an insecticide molecule to the nest, allowing for its neutralisation without the need to identify it directly. This control system is currently prohibited in Europe because no molecules are authorised for this use. However, it has been experimentally applied in two countries, Italy and Spain, under the names "Method-Z" and "Remote Nest Neutralisation", respectively. The two methods differ in the type of active ingredients used for the experiments. These projects aimed to evaluate the effectiveness of these methods in neutralising *V. velutina* nests and their impact on reducing the presence of hornets and their predation on beehives. Since the active ingredients used in both methods are adulticidal, the treatment does not affect the pupae in the cocoon, which hatch and return to prey on the apiaries. Therefore, with these two methods, repeated treatment is necessary. These methods may pose an environmental threat, given the inability to identify the locations of the destroyed nests. In general, good pest control practice would entail removing the nest soon after it is destroyed to avoid insecticidal residues being disseminated in the wild. To conduct trials on Trojan methods, a provisional research authorisation must be obtained from the competent national authority, and methods for locating the nests (before or after treatment) should be developed. The use of these methods needs to be done by the agents involved in pest control.

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