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# VELUTINA TASK FORCE

## Spain, 28th - 29th June 2018

Universidad del País Vasco | Euskal Herriko Unibertsitatea

Bizkaia basalan

neiker tecnalia

# PROGRAM & ABSTRACT

**Local Organizers**:

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We would like to welcome you to the University of the Basque Country, on the occasion of this meeting and thank you for your participation.

**Acknowledgements**

The organizers would like to thank:

University of the Basque Country

The Association AVISPA ASIATICA

*Cover photograph (by RUBEN PEREZ LLARENA - Association AVISPA ASIATICA)*

# PROGRAM

**28th June 2018**

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|---|---|
| 09:00-09:45 | BUS from Hotel Gran Bilbao to University of the Basque Country |
| 10:00-10:30 | Participant registration and poster set up |
| 10:30-10:40 | Welcome address (*Daniela Laurino* and *Mar Leza Salord*) |
| 10:40-11:30 | *Chunsheng Hou* - Occurrence and molecular phylogeny of honey bee viruses in hornets in China |
| 11:30-11:50 | Coffee/snack break - poster session |
| 11:50-12:30 | *Ana L. García-Pérez* (NEIKER) - Activities on the management and control of invasive yellow-legged hornet (*Vespa velutina*) in the Basque Country |
| 12:30-12:50 | *Riccardo Maggiora* - Modern Radar Techniques Help Saving Beekeeping Economic and Cultural Heritage from *Vespa Velutina* Threat |
| 12:50-13:00 | Discussion |
| **13:00-15:00** | **Lunch (in the University)** |
| 15:00-15:20 | *Mar Leza Salord* - Three years controlling the yellow-legged hornet (*Vespa velutina*) a new predator of honeybees in the Balearic Islands |
| 15:20-15:40 | *Simone Lioy* - *Vespa velutina* in Italy: an update on the management activities and on the impact of the species on honey bee colonies and biodiversity |
| 15:40-16:00 | *Franco Mutinelli* - A surveillance program to assess the presence and spread of *Vespa velutina* in north-east Italy |
| 16:00-16:20 | *Peter Kennedy* - In search of the invader: British experiences and developments in hunting for the nests of *Vespa velutina* |
| 16:20-16:40 | *Paola Manozzo Hernández* - The sting of the Asian hornet (*Vespa velutina*): types of reactions and how to act |
| 16:40-17:00 | Coffee/snack break - poster session |

| | |
|---|---|
| 17:00-17:20 | *Sara Fernández de Bobadilla* - The Invasion of yellow-legged hornet (*Vespa velutina*) in the Basque Country (Spain): socioeconomic effects on apiculture sector |
| 17:20-17:40 | *Eric Darrouzet* - Chemical communication and selective traps for the invasive hornet *Vespa velutina nigrithorax* |
| 17:40-18:00 | *Sandra Roias* - Effectiveness of electric traps for the defence of honeybees against the invasive predator *Vespa velutina* |
| 18:00-18:20 | *Iñaki Etxebeste Larrañaga* - A phenological model for the spring trapping of *Vespa velutina* |
| 18:20-18:40 | Discussion |
| 19:00-20:00 | BUS from University of Basque Country to Vizcaya Bridge |
| 20:00-20:30 | BUS From Vizcaya Bridge to Hotel Gran Bilbao |
| 21:30 | Social dinner at Hotel Gran Bilbao<br>https://www.hotelgranbilbao.com/restaurante<br>(It is not included in the registration fee. The social dinner will cost 33 €/each. Confirmation is required before 4th June 2018 in order to book.) |

**29th June 2018**

| | |
|---|---|
| 09:00-09:45 | BUS from Hotel Gran Bilbao to University of the Basque Country |
| 10:00-13:30 | Visit to BASALAN |
| **13:30-15:00** | **Lunch** |
| 15:00-16:30 | Technical visit to *Vespa velutina* infested area |
| 16:30-18:30 | General Discussion and Proposal |

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## Table of Abstracts

## Posters

Differentiating between gynes and workers in the invasive hornet *Vespa velutina* (Hymenoptera, Vespidae) in Europe. (p.27)

- ✓ Porporato M., Laurino D., Lioy S., Milanesio D., Saccani M., Maggiora R.
  Harmonic radar tracks *Vespa velutina* flight to nests. (p.28)

**Activities on the management and control of invasive yellowlegged hornet (*Vespa velutina*) in the Basque Country (Nothern Spain).**

Barandika J.F.[1], Ortega-Araiztegi I.[1], Ugarte E.[1], Galartza E.[2], Carreras J.[3], Moreno I.[3], Galera A.[4], Mendiola I.[5], Garcìa-Pérez A.L.[1]

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The invasive yellow-legged hornet (*Vespa velutina*) was introduced in Spain (Navarra and the Basque Country) in 2010. The remarkable invasive success of this species is explained by its good adaptation to climatic and environmental conditions in South Western Europe. The prediction maps made by French researchers indicated a clear expansion of this invasive species in the north of the Iberian Peninsula, a fact that has been probed in recent years. Regarding the progression of *V. velutina* in the three provinces of the Basque Country, in Gipuzkoa began expanding in 2011 and in Bizkaia and Araba was first detected in 2012. Since then this invasive species has progressively increased and the maximum number of nests removed has been reached in 2016. In 2017 a slight

decrease was observed indicating that likely, the advance of the invasion has reached its maximum in this territory. The teams in charge of the identification and removal of nests (Provincial Councils - Diputaciones Forales - or institutions in which these activities are delegated) have recorded data referring to geographical coordinates, the type of location of the nests, the height in the tree and type of tree, size, presence of larvae, etc. giving an idea of the changes in the nets settlements along invasion progressed. Apiculture in the Basque Country is the main affected sector due to the predating habits of the Asian hornet. Capture of founding queens using traps with food attractants in the surroundings of the apiaries is one of the strategies used by beekeepers in spring to mitigate the impact of Asian hornet in honeybee production. In general, homemade traps and attractants are used since not specific *V. velutina* attractants are commercially available. These traps have an important impact on the biodiversity of the environment, since they have an attractive power for a great variety of insects, especially those included in Order Diptera. The queens of *V. velutina* start their activity earlier than other autochthonous vespids, being *V. velutina* queens captures earlier in the season much higher than other vespids but, as the season progresses, the difference becomes smaller, and captures of native vespids (*V. crabro* among others) increase greatly. In conclusion, the use of traps in this period of the year must be minimized and the period of traps settlement must be supervised by competent environmental Authorities. The control of Vespidae populations in other parts of the world has been based on the use of protein baits to which a biocide is incorporated, reducing significantly wasp populations. In this sense several studies have been done in collaboration with Beekeepers' Association from Gipuzkoa, using minced meat with a biocide. In one of these field studies, around 70 beekeepers participated in a controlled synchronized trial. After application of the bait, a significant decrease in the number of Asian hornets was observed immediately. These promising results indicated that this kind of devices are necessary to preserve beekeepers safety, avoiding biocide manipulation, and with the aim

of applying when population of workers are at highest and when gynes started their activity. These procedures must be also supervised by the Administration or Authorized institutions to minimize uncontrolled use of biocides, and avoiding collateral damage in other insects, birds, and in the biodiversity. The best strategy of control may combine chemical control, nest removal and other methods currently under investigation.

**Chemical communication and selective traps for the invasive hornet *Vespa velutina nigrithorax*.** Darrouzet E.[1], Wycke M.A.[1], Gévar J.[1]

[1]University of Tours, IRBI UMR CNRS 7261, Parc de Grandmont, 37200 Tours, France

The yellow-legged hornet, *Vespa velutina nigrithorax*, was accidentally introduced to southwestern France near 2004. The species subsequently successfully established itself in France and Europe. The hornet now occurs across more than 80% of France and is currently colonizing neighboring countries. Since, the species preys on several insect, and the domestic honeybees, *Apis mellifera*. Beekeeping operations are directly affected by *V. velutina* predation, with some beekeepers reporting colony losses. The species presents also a risk to human health. Accidents have occurred, some of which have resulted in death, when people have accidentally approached the hornet's nests. Different traps were used to protect apiaries. However, these traps are non-efficient and non-selective. We thus analyzed the chemical signature (cuticular hydrocarbons or CHCs) and alarm pheromone of French hornet population. These different pheromone compounds were analyzed in GC-FID and identified in GC-MS. Our goal is to use these compounds to increase trap efficiency and selectivity and to protect biodiversity.

**Occurrence and molecular phylogeny of honey bee viruses in hornets in China.**

Diao Q.[1/2], Wang X.[1/2], Wu Y.[1/2], Zhao H.[3], Li F.[1/2], Deng S.[1/2], Darrouzet E.[4], Hou C.[1/2]

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Since honey bee viruses were considered it closely correlated with colony collapse disorder (CCD), viruses vector had drawn the great concern such as one of important vector of honey bee viruses, *Varroa destructor*. However, little is known about the occurrence and prevalence of honey bee pathogens in bee predator like hornet. With the rapid exchange of queen and bee products, hornet has become a vital threat to beekeeping. In this paper, we investigated the occurrence of 14 honey bee viruses and 11 other pathogens including bacterial, fungi and parasites in five hornet species of 13 regions of China and one region of Canada. The results showed that all hornet species had infected honey bee viruses and most of them carried *Apis mellifera* filamentous virus (AmFV), deformed wing virus (DWV) and Israeli acute paralysis virus (IAPV), even was

infected more than 4 viruses in one specie. Surprisingly, LSV was found first in pupae of Beijing hornet. Among other pathogens, honey bee bacterial, American foulbrood (AFB) was main bacterial in seven region samples. Phylogenetic analysis on AFB, AmFV, DWV and IAPV indicated that all of sequence of current study was attributed into one cluster except DWV were relatively scattered. Moreover, there was different between honey bee and hornet in phylogeny. These results could serve as a basis for investigating further transmission and origin of honey bee pathogens, especially potential damage on social insects. This is the first report of detection of LSV in hornet in China.

**A phenological model for the spring trapping of *Vespa velutina*.**

Etxebeste Larrañaga I.[1], Moreno I.[2], Carreras J.[2]

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The yellow-legged or Asian hornet (*Vespa velutina nigrithorax*) is believed to first arrived in Europe in 2004. Despite the control efforts, 14 years later the Asian hornet has expanded through France, Spain, Portugal, Italy and UK. The early deployment of attractant baited traps during spring is regarded as one of the most effective control methods. As overwintering foundress queens emerge from hibernation this kind of traps could potentially reduce their number, and hence help slowing the expansion of the species. As in many other poikilothermic organisms, the emergence of hornets can be studied in regard of the accumulation of environmental heat by phenological models. Such models can greatly improve the timing of control methods such as springtrapping. Local authorities in the Basque Country install over

500 traps aimed to capture emerging Asian hornet queens. Traps are checked regularly and during those visits caught individuals are tallied. This way by using the data collected by the Biodiversity and Landscape department of the province of Araba during spring 2017 we were able to build a spatial degree-day model that has been used in 2018 to plan the trapping campaign. Furthermore, the data collected during 2018 will be incorporated to the adjusted model as well as used for model evaluation purposes. The modelling process as well as on-going results of the 2018 campaign are presented and discussed.

**The invasion of the yellow-legged hornet (*Vespa velutina*) in the Basque Country (Spain): socioeconomic effects on apiculture sector.**

Etxegarai O.[1], Fernández de Bobadilla S.[1], Sánchez-Famoso V.[1], Galartza E.[1], Marín-Barcaiztegui C.[1], Barandika J.F.[1]
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The aims of this poster are two. On the one hand, it shows the progress of a research about beekeeping sector in the Basque Country (Spain). On the other hand, it analyses some structural and key production variables that have been affected because the invasion of the *Vespa velutina* hornet. The sector has been analysed through beekeepers' associations (APIAL, BAMEPE, GEE), the research center NEIKER and the University of the Basque Country UPV/EHU, with Basque Country Government benefits. We support our analysis using data gathered directly from 183 beekeepers in the 3 territories of the Basque Country. The questionnaires have been handed out to beekeepers by their associations. Questionnaire design has different sections such as beekeeper profile and apiculture activity between others. For the analysis of our aims we use both descriptive analysis and structural equation modelling. With this research we pretend not only to identify some threats and strengths, but also to fill some gaps in the knowledge of apiculture

sector. We also suggest some policies and recommendations on how to improve and support the beekeeping activity.

## A surveillance program to assess the presence and spread of *Vespa velutina* in north-east Italy.

Flaminio B.[1], Montarsi F.[1], Barbujani M.[1], Mazzucato M.[1], Ferré N.[1], Granato A.[1], Mutinelli F.[1]

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Introduction

The Asian hornet *Vespa velutina* appeared in Europe in 2004, probably introduced from China. After the first detection in France, it spread to Italy in 2012, and was reported in Veneto Region (northeastern Italy) in 2016. With the aim to assess the presence and spreading of this invasive alien species in the area, a surveillance program has been activated by the Regional Agriculture Department in collaboration with the National Reference Centre for Beekeeping of the Istituto Zooprofilattico Sperimentale delle Venezie.

Materials and methods

Geospatial data were analyzed in order to select the apiaries to be involved in the program, and a statistical analysis of their distribution was performed. In this area a cell-divided grid was

defined and the number of apiaries for each cell was calculated; three classes of apiaries density per cell were defined (high, medium and low apiary density/cell). Cells with high apiary density were considered as a sampling unit, whereas medium and low apiary density cells were grouped together (two and four cells respectively) standing for a sampling unit. Overall, 229 cells were defined: 117 with high density and 112 with medium-low density grouped. In each of them, an apiary was selected as target where to place wasp traps (TapTrap®) to monitor the presence of the Asian hornet. The results were recorded in a database specifically created. Moreover, a web application was implemented with a "mobile first" approach, easy to use by smartphone and tablets, in order to quickly collect and share field and geospatial data.

Results and conclusion

In total, 230 apiaries were monitored by traps and 1,728 apiary visits were recorded (on average 7.5 visits/apiary). None of the monitoring sites revealed *V. velutina*. It is clear, however, that the monitoring for the presence of this invasive alien species in the regional territory requires a protracted application beyond a single bee season in order to consolidate the result achieved. According to Regulation (EU) No.1143/2014, it is necessary to activate and maintain monitoring systems able to detect the arrival, presence and establishment of invasive alien species in Member States, such as *V. velutina*, expressly mentioned in the subsequent regulation (EU) No.2016/1141.

## In search of the invader: British experiences and developments in hunting for the nests of *Vespa velutina*.

Kennedy P.[1]

[1]Environment & Sustainability Institute, University of Exeter Penryn. United Kingdom

*Vespa velutina* was first recorded in the Channel Islands and on the UK mainland in 2016. On the UK mainland, the authorities and agencies initiated a previously prepared Contingency Plan, based largely on prior experience by other European countries, to locate the suspected nest; learning from that experience greatly benefitted similar efforts in response to sightings in 2017. In the Channel Islands, proximity to the French coast has limited opportunity to keep the threat contained but has energised authorities, beekeepers and the public to report hornets and locate nests as quickly as possible. I will present a summary of British attempts to locate *V. velutina* nests as quickly as possible, as well as present initial results from our attempts to use off-the-shelf technologies (handheld radar and radio-telemetry) to track workers back to their nests.

**Three years controlling the yellow-legged hornet (*Vespa velutina*) a new predator of honeybees in the Balearic Islands.**

Leza M.[1], Herrera C.[1], Colomar V.[2]

[1]Laboratory of Zoology, University of Balearic Island, Palma de Majorca, Spain
[2]Consortium for the Recovery of the Fauna of the Balearic Islands (COFIB)

The first detection of the yellow-legged hornet, *Vespa velutina nigrithorax*, in Majorca (3667 km$^2$, Balearic archipelago, situated 176 km off the mainland) was in 2015, when only one secondary nest was found in the northwest of the island. Here we present the first detection of *V. velutina* in the westernmost Mediterranean islands and the methodology used to achieve the eradication of this predator. During 2016, nine nests were found and removed from August to November and in 2017 this number grew up until twenty nests from June to October. During 2015 and 2016 all nests were

detected in evergreen tree species (pines, holm oaks, and common cypress) in the ‘‘Serra de Tramuntana’’, a mountain range located in the northwest of the island of Majorca. However, in 2017 one of the nests was located 20 km like maximum distance from the first nest located in 2015, through the mountains to the foot of the mountain. In order to detect the nest, feeding points with protein attractant (raw fish) were set in the area in order to locate and follow adults approaching the traps. Flight routes of observed adult hornets from two or three feeding points were followed by drawing a triangulation on the map that allowed location of the nest by visual inspection. (2) Visual observation in the apiaries around the island and active monitoring in natural zones carried out by fifty-four environmental Agents throughout the island. (3) Public awareness and environmental education. It is the first report on an island of destroying nests as a means of controlling the spread, a scenario very different to mainland Europe.

## *Vespa velutina* in Italy: an update on the management activities and on the impact of the species on honey bee colonies and biodiversity.

Lioy S.[1], Laurino D.[1], Manino M.[1], Porporato P.[1]

[1]Department of Agricultural, Forest and Food Sciences, University of Turin, Largo Paolo Braccini 2, 10095, Grugliasco (Turin), Italy

The yellow-legged hornet *Vespa velutina* Lepeletier 1836 is an invasive alien species in Europe that is colonizing Italy and many other countries at impressive speed. This hornet preys honeybees and other native insect species (e.g. wild bees, other wasp species), thus creating serious economic impacts on beekeeping, risks for biodiversity and pollination services associated with wild bees activity. Moreover, *V. velutina* creates colonies of great size in urban areas more frequently than native hornet species do, so

citizens could be exposed to this hornet with more probabilities. Because of the issues posed by this hornet, Europe has classified *V. velutina* as an invasive alien species of union concern (IAS Regulation – EU 1143/2014), and member states should act to prevent, contain and limit its spread. Within this contest, the European LIFE STOPVESPA project is acting in Italy since 2015 to contain the spread of *V. velutina* and to establish an Early Warning and Rapid Response System. Data on nest distribution recorded in these years are indicating that the species is spreading in Italy at a mean spread rate of 18.3 ± 3.3 km/year, and this value seems to be even lower in years 2016 and 2017, indicating that control activities have contributed, among other factors, to limit the spread of the species.
Besides to control activities, the LIFE STOPVESPA project has studied in these years the impact of *V. velutina* on both honey bee colonies and wild bees, to fill the lack of quantitative data on the impact of *V. velutina*. Here we present preliminary data on multiannual activities on these issues.

## Modern Radar Techniques Help Saving Beekeeping Economic and Cultural Heritage from *Vespa Velutina* Threat.

Maggiora R.[1], Saccani M.[1], Milanesio D.[1]

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The *Vespa velutina* is quite smaller than the Spanish hornet (*Vespa crabro*) and the composition of the poison of both is similar. There is no evidence that the risk of their sting is greater than of the other vespid species. There are no more *V. velutina* sting cases registered

The yellow-legged Asian hornet (*Vespa Velutina*) is an invasive specie, indigenous of the South-East Asia, but quickly spreading in other continents. Because of its exponential diffusion and its serious threat to the local honeybee colonies and to humans as well, restraint measures are mandatory. Among them, a radar system, capable of tracking the flying trajectory of these insects once equipped with a small passive transponder, can be very effective for locating the nests destined to be destroyed. Harmonic radars already demonstrated their effectiveness in tracking insects flying at low altitude and on flat terrain. We developed an innovative harmonic radar, implementing the most advanced radar techniques, capable to cover a large field of view and capable to track hornets up to a range of 500 m. Here we show the details of the radar system and the results obtained during the first field tests demonstrating its usefulness as a restrain measure.

## The sting of the Asian hornet (*V. velutina*): types of reactions and how to act.

Manozzo Hernández L.P.[1]

than any other hymenoptera´s. In Spain, approximately 3% of the population is allergic to wasp and bee poison. Between 15 and 20 people could die each year for this cause. We reviewed Spanish guides published by scientific associations about hornet sting and the reactions caused. *V. velutina* principally can produce four types of reactions. It depends on whether you are nonallergic and on if you received one or more stings, symptoms depend on the amount of poison inoculated. Or if you are allergic and the reaction is a mild or local reaction, or a severe and generalized reaction named: anaphylaxis. In Spain, from a strictly medical point of view, there is no reason to generate social alarm with the appearance of this vespid. The reactions to the sting and the mode of action are the

same as for other vespids. It is important to know what types of reactions can happen, because two of these are potentially mortal. Knowing how to act can save lives.

## Effectiveness of electric traps for the defence of honeybees against the invasive predator *Vespa velutina.*

Rojas-Nossaa S.[1], Calviño-Cancela M.[1]

[1]Evolutionary Ecology and Conservation Lab. Departament of Ecology and Animal Biology. University of Vigo. 36200-Vigo, Pontevedra. Spain.

High predation pressures of *Vespa velutina* on honeybee hives produce the loss of products and the weakening of the colonies that often ends with their collapse. Different methods have been used for the protection of apiaries. Additionally some methods, such as baited traps, commonly produce very high capture rates of nontarget taxa rising environmental threats. For these reasons, we aim to study: 1) The effectiveness and selectivity of electric traps for the capture of *V. velutina* in apiaries; and 2) the behavioural responses of honeybee colonies protected with electric traps. We selected 10 apiaries in the coastal area of the province of Pontevedra (Northwest Spain). Within apiaries 10 hives were arranged in line, with a maximum distance of 1 m between each other. The entrances were facing the same direction. In each apiary an electric trap was installed perpendicularly in front of the central hives. Captured individuals were collected weekly during 5 weeks between August and September 2017. Then, individuals were identified and counted in the laboratory. We made observations and video recordings to assess hunting and predation rates and honeybees' activity and defensive behaviour. These were made in front of each experimental hive (10 hives near the trap and one control far from the trap) before and after 5 weeks of installing the trap.

The proportion of *V. velutina* over the total individuals captured was 68.2%. Captures of non- target taxa was low both in terms of the proportion of individuals and the diversity of groups captured in comparison with baited traps. Electric traps caused a significant reduction in hunting and predation rates. The activity of honeybees was significantly higher in the hives located near the trap. Electric traps represent an improvement of control methods to protect apiaries helping honeybees to cope with this new invasive predator.

## Posters

### Sex attractants in the invasive population of *Vespa velutina nigrithorax*.

Cappa F.[1], Cini A.[1/2], Pepiciello I.[1], Petrocelli I.[1], Inghilesi A.[1], Anfora G.[3], Dani F.R.[1], Bortolotti L.[4], Wen P.[5], Cervo R.[1]

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Due to its huge invasion potential, habitat flexibility and specialization in honeybee predation, the alien invasive hornet *Vespa velutina* represents a high-concern species under both an ecological and economical perspective. In the light of the development of specific odorant attractants to be used in mass trapping, we used an integrated approach including behavioural assays and chemical and electroantennographic analyses to investigate the possibility that in the invasive population of *Vespa velutina nigrithorax* reproductive females emit pheromones to attract males, as it has been demonstrated to occur in a Chinese noninvasive sub-species. We focused on the sex pheromone identified in the sternal glands of the non-invasive sub-species and on venom volatiles because of their volatility, which could guarantee longrange attraction, and their potential species-specificity, which could decrease non-target species bycatches. Behavioural assays in the laboratory showed that males respond to sternal glands secretion, but do not respond to venom volatiles or to the synthetic sex pheromone. While electroantennographic analyses suggest that males do perceive female venom volatiles, sexual attraction on a chemical basis is not mediated by them, as a) they differ neither in quality nor in quantity between reproductive females and workers; b) male antennal response is not different between workers and gynes venom volatiles and finally c) males

are not attracted by venom volatiles compared to controls. Our results, showing that males are attracted by female sternal glands secretion, similarly to the non-invasive subspecies, but not by venom volatiles, provide a valuable first step to understand the reproductive biology of *V. velutina nigrithorax* in its invasive range and to develop effective and sustainable management strategies for the species. Further research should aim at investigating the actual attractiveness of both the extracted and the synthetic pheromones in the field.

## Strategies for the sustainable management of *Vespa velutina* in the North of Portugal developed under the project GESVESPA (POSEUR-03-2215-FC-000008).

GESVESPA consortium[1]

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INIAV coordinates an integrated research program aimed at implementing the "Action Plan for the Surveillance and Control of the Asian Wasp in Portugal", in relation to active surveillance, monitoring and control. This is carried out in collaboration with regional SI & ID institutions, the Intermunicipal Communities, FNAP and DGAV. The intervention area covers NUTS NORTE and adjacent counties of the NUTS CENTER in an area that spans 2,262,548 hectares. Under the umbrella of the National Beekeeping Federation and participation of 12 associations of beekeepers, a

monitoring network was set up consisting of 356 “Veto-Pharma” entomological traps, situated in 178 sentry apiaries.
From October 2016 to December 2017, 2546 samples were collected, providing important information on the life cycle of the species in Portugal. Different traps and bait types were tested, and their efficacy and side effects on local entomofauna were studied. Combat strategies were developed for the destruction of nests by physical methods, under the coordination of the 4 Intermunicipal Communities covering an area of 879,080 hectares within 35 municipalities. Equipment specifically designed for the Gesvespa project was developed, including 35 incineration kits and 70 sets of individual protection equipment. Surveys of beekeepers are under way to assess the impact on beekeeping and biodiversity, with the coordination of IPVC and FNAP. From 2015 to 2017, a total of 20 training actions were carried out coordinated by the DGAV and involving 832 participants. Genetic studies of *Vespa velutina* were carried out by IPB and are being finalized, and will soon be published.
The SOS Vespa Platform was established under the management of ICNF, with the collaboration of INIAV (http://www.sos.pt), and aims to support the identification and control of *Vespa velutina* in Portugal. Through online georeferencing of nests, this WebSIG platform enables communication between local authorities (in particular civil protection), the public and central administration, and is also a tool for decision making. This WebSIG is a free and collaborative application of the Asian wasp, using online georeferencing and a map server to register sightings of nests or wasps. When a sighting is recorded, an automatic warnings signal is sent via the platform to local administrators so they can act more quickly and appropriately on the destruction of nests. Since its implemention in January 2006, about 12180 nests and 1006 wasp sightings have been registered on the platform. Each record is validated by the platform's local administrator and can be seen by the public only after validation. About 9168 (75%) of the nests have already been destroyed by local authorities. A brochure as well as

a 7-minute video are being prepared for dissemination of results and promoting public awareness.

**Detection of replicative deformed wing virus (DWV) in the European hornet (*Vespa crabro*, L.) and the yellow-legged hornet (*Vespa velutina*, Lepelieter).**

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Within the research network Stopvelutina in October 2016, in a destroyed nest of *Vespa crabro* L., some queens showed deformed wings. The abdomen and the thorax of asymptomatic and symptomatic specimens were analysed for Deformed Wing Virus (DWV) and they were found positive for the virus by strand specific RT-PCR, indicating active replication. This finding confirms the ability of the virus to infect not only bees but also wasps, suggesting a possible trans-mission route by ingestion of infected honey bees by hornet's larva.
In order to investigate the possible infection of DWV in *Vespa velutina*, in 2017 hornets were sampled in front of the apiaries in May (early season) and July (mid-season), while newly-emerged males and females were sampled in November (late season). By strand specific RT-PCR replicative DWV was detected in workers sampled in July and in the newly-emerged specimens collected in October, proving that DWV can infect the alien Asian hornet. This is the first report of DWV infection in *V. velutina*.
The presence of replicating DWV with overt infection in *V. velutina* leads to hypothesize a possible role of DWV in a natural re-

equilibrium of the relationship between prey and the alien predator, or even the development of a system to protect healthy honey bee's colonies through the use of naturally highly infected bee colonies as possible prey for the predator.

## Differentiating between gynes and workers in the invasive hornet *Vespa velutina* (Hymenoptera, Vespidae) in Europe.

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In the Vespinae, morphological differences of castes are generally well-marked, except for some Vespa species, where it is difficult to distinguish between future queens and workers in autumn-winter colonies. Individual weights have widely been used as a distinguishing factor but recently cuticular hydrocarbon profiles seems to be the definitive tool, although much more expensive and time-consuming. Parameters such as size (mesos- cutum width), wet and dry weight were analysed, throughout several colonies, to differentiate female castes (workers and gynes) in the hornet *Vespa velutina* in Europe. These parameters were compared to cuticular hydrocarbon profiles. The results showed that in late autumn, but not earlier, populations are divided into two size groups, which, based on their CHC profiles, can be hypothesized to correspond to workers and gynes. This differentiation mirrored a good separation by size that proves to be more accurate than weight (wet and dry).

The size limit between workers and gynes is established at a mesoscutum width of 4.5 mm.

## Harmonic radar tracks *Vespa velutina* flight to nests.

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Harmonic radars have been used to track the flight of various insect species. Within the LIFE14 NAT/IT/001128 STOPVESPA project - Spatial containment of *Vespa velutina* in Italy and establishment of an Early Warning and Rapid Response System - a harmonic radar prototype has been developed for tracking the invasive hornet *Vespa velutina*. The radar is characterized by a vertical polarization of the radiated field and advanced processing techniques able to suppress clutter and improve target detection. The radar is capable to cover 360° in the horizontal plane and a large field of view in the vertical plane (20°). It allows to follow the tracks of the hornets tagged with a 12.3 mm wire antenna and a diode (12.1 mg) up to 470 m.
The harmonic radar has been used in autumn 2017 in the westernmost part of Liguria (Italy), where *V. velutina* is present since 2012, and allowed the detection of three nests that were immediately destroyed. The radar will be used in 2018 for the control of *V. velutina* diffusion in Italy, but it could find use in several other fields of entomological research and pest management.