Vespa velutina and other invasive invertebrates species

22-23 March 2019
Turin, Italy

LOCAL ORGANIZER CONTACT FOR FURTHER INFORMATION

Dr. Daniela Laurino

Dr. Simone Lioy

Dr. Marco Porporato

DISAFA, University of Turin

Department of Agriculture, Forest and Food Sciences (AGRIFORFOOD) - Observatory of Apiculture

Largo Paolo Braccini 2, 10095 Grugliasco TO, Italy

Tel: 0116708525 - 8584

Email: daniela.laurino@unito.it

simone.lioy@unito.it

marco.porporato@unito.it

www.vespavelutina.eu

Vespa velutina and other invasive invertebrates species

Torino - 22 March 2019

Aula Magna Cavallerizza, via G. Verdi 9

08:30 - 09:00	**Conference Registration**
09:00 - 09:15	**Conference Opening**
09:15 - 10:00	EU initiatives to hinder the diffusion of Invasive Alien Species and pollinators decline ***A. Salsi, M. Montero-Ramirez***
10:00 - 10:45	Invasive Alien Species as a main threat to biodiversity: impacts, responses and management - ***P. Genovesi, L. Carnevali***
10:45 - 11:15	**Coffee Break & Poster Display**
11:15 - 11:35	Does appearance really matter? The perception of Invasive Alien Species shaped by the species attractiveness - ***S. Bertolino***
11:35 - 12:15	An update on small hive beetles - ***P. Neumann***
12:15 - 12:35	Velutina Task Force: 3 years of activities - ***D. Laurino***
12:35 - 14:00	**Lunch**
14:00 - 14:20	The containment strategy for *Vespa velutina* in Italy: an integrated approach ***M. Porporato, S. Lioy***
14:20 - 14:40	*Vespa velutina*: An update on control and contingency planning in the UK ***D. Fouracre***
14:40 - 15:00	Monitoring the invasion of *Vespa velutina* and development of control measures to limit its impact in Belgium - ***K. Schoonvaere***
15:00 - 15:20	Encouraging results after four years controlling the yellow-legged hornet *Vespa velutina nigrithorax* (Hymenoptera: Vespidae) in Mallorca - ***M. Leza Salord***
15:20 - 15:40	Asian hornet in Europe. What does the future hold? - ***X. Feás***
15:40 - 16:00	Is it possible for small islands to control an invasive species? - ***B. Hogge***
16:00 - 16:30	**Coffee Break & Poster Display**
16:30 - 16:50	Does *Vespa velutina* impact on native insects? - ***L. Carisio***
16:50 - 17:10	An innovative harmonic radar system for tracking flying insects: the case of *Vespa velutina* - ***R. Maggiora***
17:10 - 17:30	Tracking Asian hornets (*Vespa velutina*) to their nests with radio-telemetry ***P. Kennedy***
17:30 - 17:50	Immune characterization of *Vespa velutina* and *Vespa crabro*: a comparison across caste and sex - ***F. Cappa***
17:50 - 18:10	The use of *Vespa velutina* chemical communications to control this invasive species - ***E. Darrouzet***
18:10 - 18:30	Effect of *Vespa velutina* queens trapping on honey bee colonies development ***A. Manino, A. Romano***

With the patronage of the University of Turin

Vespa velutina e altri invertebrati invasivi

Torino - 23 Marzo 2019

Aula Magna Cavallerizza, via G. Verdi 9

08:30 - 09:00 **Registrazione Partecipanti**

09:00 - 09:15 **Saluti delle Autorità**

09:15 - 09:45 **La normativa comunitaria e nazionale sulle specie invasive: effetti sulla gestione della *Vespa velutina***
Piero Genovesi, Lucilla Carnevali, Valentina La Morgia
Istituto Superiore per la Protezione e la Ricerca Ambientale - Progetto LIFE ASAP

09:45 - 10:05 **Proposta di piano di gestione della *Vespa velutina* in Italia**
Simone Lioy
Università degli Studi di Torino - Dipartimento di Scienze Agrarie, Forestali e Alimentari

10:05 - 10:25 **Attività del Progetto LIFE STOPVESPA**
Marco Porporato
Università degli Studi di Torino - Dipartimento di Scienze Agrarie, Forestali e Alimentari

10:25 - 10:45 **Radar armonico per il tracciamento del calabrone asiatico**
Riccardo Maggiora, Daniele Milanesio, Maurice Saccani
Politecnico di Torino - Dipartimento di Elettronica e Telecomunicazioni

10:45 - 11:00 **L'azione delle Associazioni apicoltori nella lotta alla *Vespa velutina***
Samuele Colotta
Associazione Regionale Produttori Apistici Del Piemonte - Aspromiele

11:00 - 11:40 **"LIFE for the BEES" - Documentario sulla *Vespa velutina***
Progetto LIFE STOPVESPA

11:40 - 11:55 **Programma di azione della Regione Liguria per contrastare la *Vespa velutina***
Regione Liguria - Assessorato all'Agricoltura, Sviluppo dell'entroterra e delle zone rurali

11:55 - 12:10 **Programma di azione della Regione Piemonte per contrastare la *Vespa velutina***
Giorgio Ferrero
Regione Piemonte - Assessore all'Agricoltura, Caccia e Pesca

12:10 - 12:30 **Interventi del Pubblico**

12:30 - 13:15 **Cocktail di saluto**

Con il patrocinio dell'Università degli Studi di Torino

Surname	Name	Country
Allavena	Sonia	Italy
Avagnina	Alessandra	Italy
Balzola	Luigi	Italy
Barbiso	Andrea Mario Alberto	Italy
Bergamino	Cinzia	Italy
Berrino	Giovanni	Italy
Bertolino	Sandro	Italy
Bianchi	Ettore	Italy
Bigio	Gianluigi	Italy
Bonci	Piergiorgio	Italy
Bortolotti	Laura	Italy
Bricarello	Matteo	Italy
Capello	Michela	Italy
Cappa	Federico	Italy
Caracciolo	Daniela	Italy
Carisio	Luca	Italy
Carnevali	Lucilla	Italy
Charles	Rebecca	UK
Cilia	Giovanni	Italy
Colotta	Samuele	Italy
Conti	Riccardo	Italy
Costamagna	Silvio	Italy
Crespo	Nazareth	Portugal
Croce	Luca	Italy
Crupi	Alfredo	Italy
Cuttini	Davide	Italy
Darrouzet	Eric	France
Decante	Damien	France
Di Marco	Elisa	Italy

Surname	Name	Country
Feas	Xesus	Spain
Felicioli	Antonio	Italy
Ferrero	Valter	Italy
Fiz	Simona	Italy
Fiz	Daniela	Italy
Formigoni	Franco	Italy
Fouracre	David	UK
Fraccaro	Elena	Italy
Genovesi	Piero	Italy
Ghidotti	Silvia	Italy
Hogge	Robert	UK
Ingegno	Barbara	Italy
Kennedy	Peter	UK
La Morgia	Valentina	Italy
Laurino	Daniela	Italy
Leza	Mar	Spain
Lioy	Simone	Italy
Lo Presti	Caterina	Italy
Longhi	Roberto	Italy
Maggiora	Riccardo	Italy
Maia	Miguel	Portugal
Manino	Aulo	Italy
Maritano	Umberto	Italy
Martelli	Francesca	Italy
Massari	Antonio	Italy
Milanesio	Daniele	Italy
Montero - Ramirez	Manuel	European Commission-EASME
Mora	Alfredo	Italy
Mosquera Mosquera	Jose Fernando	Colombia

Surname	Name	Country
Mutinelli	Franco	Italy
Neumann	Peter	Switzerland
Nikolaos	Emmanouel	Grecee
Palazzi	Francesco	Italy
Paradiso	Federica	Italy
Pereira	Enrique	Portugal
Pizzoni	Maria Grazia	Italy
Poma	Arianna	Italy
Porporato	Marco	Italy
Portocarrero	Marco	Portugal
Puch	Roberto	Spain
Reggi	Nicola	Italy
Rizzioli	Barbara	Italy
Romano	Andrea	Italy
Rossi	Iva	Italy
Salaroglio	Andrea	Italy
Salsi	Angelo	European Commission-EASME
Sanfilippo	Calogero	Italy
Schoonvaere	Karel	Belgium
Scursatone	Giuseppe	Italy
Straffon Diaz	Sara	Messico
Tha	Cristina	Italy
Trapasso	Tania	Italy
Valdolivi	Fabrizio	Italy
Vesco	Umberto	Italy
Viscardi	Alessandro	Italy
Zagni	Fabrizio	Italy

Table of Abstracts

Oral presentations

Posters

EU initiatives to hinder the diffusion of Invasive Alien Species and pollinators decline

Salsi A., Montero-Ramirez M.

European Commission, Executive Agency for Small and Medium-sized Enterprises (EASME), Unit B.3. - LIFE and CIP Eco-Innovation. Brussels, Belgium

The diffusion of Invasive Alien Species (IAS) and the decline of pollinators are two main issues that must be handled for the conservation of nature and biodiversity in Europe. IAS represent one of the main threats to biodiversity and their risk of diffusion may increase due to increased global trade, transport, tourism and climate change. On the other hand, pollinators are a group of animals of primary importance, mainly insects like bees, hoverflies, butterflies, moths and beetles, which contribute to pollinate crops and wild plants and that are facing a decline in occurrence and diversity in the last decades.

As a Party to the Convention on the Conservation of European Wildlife and Natural Habitats, EU has undertaken to take all appropriate measures to ensure the conservation of the habitats of the wild flora and fauna. In this regard, of primary importance are the EU Biodiversity Strategy, which aims to halt the loss of biodiversity and ecosystem services, and the EU Pollinators Initiative. Different EU instruments, as the LIFE Programme, are available to support actions for the conservation of wild flora and fauna and actions to prevent the establishment and diffusion of IAS.

Invasive alien species as a main threat to biodiversity: impacts, responses and management

Genovesi P., Carnevali L.

ISPRA - Istituto Superiore per la Protezione e la Ricerca Ambientale
Via Brancati, 48 - 00144 Roma

Biological invasions are growing at an unprecedented pace in all regions of the world, in all environments and among all taxonomic groups, with no signs of a saturation effect. The available data show that the number of invasive alien species is forecast to increase in the future among all taxonomic groups; in addition, due to climate change many areas and habitats will become more suitable for a greater number of aliens species. As a result, the impacts caused by this global threat are expected to continue to increase unless more stringent prevention and response measures are rapidly enforced.

To respond to this global problems the European Union as well as Italy have adopted legal tools aimed at strengthening the prevention of new invasions, to improve the capacity to rapidly respond to incursions and to apply more effective management strategies. At the same time, several projects, including the Life ASAP coordinated by ISPRA, are working at increasing the awareness of Italians on the issue of biological invasions, because a stronger support from the society is essential for tackling this problem.

♂ Does appearance really matter? The perception of Invasive Alien Species shaped by the species attractiveness

Bertolino S. [1], Avagnina A. [2], Lioy S. [2]

[1]Department of Life Sciences and Systems Biology, University of Turin, Via Accademia Albertina 13, 10123 Turin, Italy
[2]Department of Agriculture, Forest and Food Sciences, University of Turin, Largo Paolo Braccini 2, 10095 Grugliasco (Turin), Italy

Biological invasions are commonly recognized as one of the leading causes of biodiversity loss and ecosystem alteration. Reducing or halting biological invasions is a challenging task that could be pursued by acting at different levels: prevention of new introductions, early warning and rapid response, eradication strategies or control and management plans. Nowadays the scientific community and the legislative framework certainly support actions against invasive species. However, public opinion is not always in agreement with the above mentioned strategies, adopting often double standards for attractive and charismatics taxa or non-charismatics taxa. For example, action plans for controlling birds or mammals are less appreciated than invertebrates or fishes control plans. This double standard attitude, shaped by species appearance, could lead to generate oppositions to projects that are developing activities to control charismatic invasive species and on the other side generate support to control plans for invasive non-charismatic species.

In a media-saturated society, the information reported by the press could be considered as an indicator of the public attitude and consequently an indirect instrument to evaluate public opinion towards control plans for invasive alien species. Therefore, a qualitative and quantitative media content analysis has been used to assess the public attitude towards the management of two invasive alien species, the charismatic Eastern grey squirrel Sciurus carolinensis (controlled within the LIFE EC-SQUARE project) and the non-charismatic Asian yellow-legged hornet *Vespa velutina* (controlled by LIFE STOPVESPA).

A total of 432 news were analyzed, 166 concerning S. carolinensis and 266 concerning *V. velutina*. The numbers of news per projects correspond to a mean of one news every 8.8 days along the four years of the LIFE EC-SQUARE project and a mean of one news every 5.5 days for the LIFE STOPVESPA project. In general, the management of S. carolinensis generated an initial opposition to the project, especially in the city of Genoa, despite the proposed management solution was based on the surgical sterilization of squirrels and not on their live-trapping and euthanasia as in the other regions. Instead, the management of *V. velutina* was always supported by public opinion, and the media contributed to increase the spread of information. In some cases, the media generated alarmism on the non-charismatic species (using exaggerated words with respect to the real danger, e.g. killer wasp). In both projects, specific communication campaign were necessary: in one case to gain support to the management activities, in the other case to

spread correct information about the real danger of the species and morphological identification characteristics.

An update on small hive beetles

Neumann P.

Institute of Bee Health, Vetsuisse Faculty, University of Bern and Agroscope, 3003 Bern, Switzerland

Small hive beetles (SHBs) are parasites of social bee colonies endemic to sub-Saharan Africa. They have become an invasive species and have now established populations on all continents except Antarctica. Outside of their native range they can cause considerable damage to apiculture and may also endanger wild bees, thereby creating demand for better mitigation. The talk will give an overview on recent research, including novel evidence for the global spread via apicultural trade, the role of solitary communal nesting bees as alternative hosts as well as the previously overlooked role of flowers for SHB survival. In summary, enhanced border control for trade of beehive products combined with improved control, taking into account the role of wild bee reservoirs and flowers, appears prudent to limit the future impact of this invasive species.

Velutina Task Force: 3 years of activities

Laurino D.

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

The Velutina Task Force is one of the eight Task Forces of COLOSS (Prevention of honeybee COlony LOSSes), an international, non-profit association headquartered in Bern (Switzerland) that is focused on improving the well-being of bees at a global level. COLOSS is composed of scientific professionals that include researchers, veterinarians, agriculture extension specialists and students that cooperate to better understanding the reasons why bee populations are threatened in today's world.

The Velutina TF set off during the 11th Annual COLOSS Conference in the 2015, in Slovenia. Subsequently six meetings were organized in Europe and presently there are 59 Velutina TF members from 19 different countries in the world.

Velutina TF scientific objectives were to monitor the spread of *V. velutina* in Europe and Asia; to assess *V. velutina* impact on honeybees and the rate of colony losses resulting from the action of this pest; to study *V. velutina* biology, ethology, and ecology either in its natural range or in invaded areas; to develop sound control methods.

☙ The containment strategy for *Vespa velutina* in Italy: an integrated approach

Lioy S., Laurino D., Manino A., Porporato M.

Department of Agriculture, Forest and Food Sciences, University of Turin, Largo Paolo Braccini 2, 10095 Grugliasco (Turin), Italy

The Asian yellow-legged hornet *Vespa velutina* is an invasive alien species established in Italy since 2012. *V. velutina* preys honey bees and other native insect species, generating impacts on beekeeping, biodiversity and ecosystem services associated with pollinators. The presence of nests in the environment generates concern among citizens and important economic costs for nest destruction. Because of the impacts associated with *V. velutina* presence, this hornet was included in the first black-list of invasive alien species of union concern (IAS Regulation - EU 1143/2014), and European countries should act to prevent, contain and limit its spread.

The European LIFE STOPVESPA project is acting in Italy since 2015 to contain the spread of *V. velutina* and establish an early warning and rapid response system for the species. The integrated strategy developed by the project is based on the following tasks:

i) increase the monitoring network with the involvement of beekeepers and other stakeholders;
ii) develop a strategy for the management of *V. velutina* reports and the containment of the species;

iii) limit the spread of the species by nest detection and destruction;
iv) develop a harmonic radar prototype for tracking hornets and detect nest position.

The monitoring network in Liguria and Piedmont was extended from 40 to 1,691 monitoring stations by 2018, with the involvement of beekeepers and their Associations. The containment strategy allowed detecting the position of more than 2,000 nests in the years 2015-2018; 86% of the detected nests (1,733) were destroyed directly by LIFE STOPVESPA trained teams and civil defence teams that were collaborating with the project. The efficacy of the containment strategy increased in the years, thanks to the increase of the percentage of nests destroyed before the reproductive period. The strategy contributed to reduce the spread rate of the species thus limiting its diffusion. The harmonic radar prototype is capable of tracking hornet flights and detect nests position, and its use in outbreaks was fundamental to detect the positon on *V. velutina* colonies.

⁰⁸ *Vespa velutina*: An update on control and contingency planning in the UK

Fouracre D.

National Wildlife Management Centre, National Agri-Food Innovation Campus, Sand Hutton, York, YO41 1LZ

Vespa velutina (Asian hornet) was first discovered in the UK in September 2016 and since that time we have detected 5 further incursions into the country. The Animal and Plant Health Agency (part of the UK government) is the responsible agency for preventing the establishment and spread of *V. velutina*, and we have an established contingency plan for dealing the threat. During this talk we will present the details of the situation so far in the UK (detailing what has been discovered, and where), as well as outlining our plans for dealing with the Asian hornet- from early detection through to nest destruction.

We will also provide a policy context, outlining how our on-the-ground actions are linked to UK Government's Non-native Species and Bee Health policy areas.

This talk will be presented by David Fouracre, who is part of the national response team for Asian Hornet, providing data management and modelling support to our contingency work. David has worked on Asian Hornet modelling since 2015, and has been involved in the response to each of the UK incursions so far. He is a geographic information specialist, and the discipline lead for wildlife

epidemiology and modelling with the Animal and Plant Health Agency.

♂ Monitoring the invasion of *Vespa velutina* and development of control measures to limit its impact in Belgium

Schoonvaere K.[1], Adriaens T.[2], de Proft M[3], Hautier L.[3], Branquart E.[4], Laget D.[1], C. de Graaf D.[1]

[1]Honeybee Valley, Ghent University, Krijgslaan 281, block S33, 9000 Gent, Belgium;
[2]Research Institute for Nature and Forest (INBO), Havenlaan 88 bus 73, B-1000 Brussel, Belgium;
[3]Centre wallon de Recherches agronomiques (CRA-W), Département Sciences du Vivant Unité Protection des Plantes et Écotoxicologie, Bâtiment Balachowsky, Chemin de Liroux 2, 5030 Gembloux, Belgium;
[4]Invasive Species Unit, Service Public de Wallonie, Avenue Maréchal Juin 23, Gembloux, Belgium

Accidental introduction of the yellow-legged hornet *Vespa velutina nigrithorax* in France in 2004 resulted in rapid spread and dispersal to neighboring European countries within the next decade. In Belgium, the first nest was reported in 2016 although the first observation of an individual male hornet dates from 2011. Since 2016, the invasion front extended further north with an increase in the number of detected and eradicated nests. Eight nests were found and destroyed in 2017 although most were detected late in season at which point

founder queens had managed to escape. In 2018, 61 nests were detected (55 promptly destroyed) of which 23 (38 %) were neutralized before the onset of autumn thanks to active surveillance in early summer. Meanwhile, significant progress was made in developing appropriate control measures to oppose the spread of the Asian hornet. These strategies can be split in three major components: (i) raising awareness among beekeepers, schools, nature enthusiasts and the public on *Vespa velutina* and its identification, (ii) monitoring of the invasion using an online portal for reporting occurrences of hornets and nests alongside citizen science activities to search for hornets, and (iii) outlining and implementing a rapid response protocol for nest destruction by the fire brigade. Passive surveillance is organized by stimulating the reporting of opportunistic observations by naturalists, beekeepers and the public. Active surveillance is organized with beekeepers and nature enthusiast that engage as sentinels for hornet detection. Field-based actions such as targeted searches to find nests in the vicinity of hornet reports, common ivy bioblitzes and awareness raising in nature reserves and facilities with educational apiaries, complement the active surveillance network. As the feasibility of eradication and spread limitation of this invasive insect are deemed very low, a long term control strategy aiming at mitigating hornet impact by reducing nest densities, offers a more realistic prospect in Belgium.

♂ Encouraging results after four years controlling the yellow-legged hornet *Vespa velutina nigrithorax* (Hymenoptera: Vespidae) in Mallorca

Leza M.[1], Mayol J.[2]; Garneria I.[2]; Picò G.[3]; Marqués A.[1]; Herrera C.[1]; Colomar V.[3]

[1]Dpt. Biologia, Facultat de Ciències, Universitat de les Illes Balears. Ctra. de Valldemossa, km 7.5. Palma (Illes Balears)
[2]Servei de Protecció d'Espècies. Conselleria de Medi Ambient, Agricultura i Pesca. Govern de les Illes Balears. C/ Gremi de Corredors, 10. Palma (Illes Balears)
[3]Consorci de Recuperació de la Fauna, Illes Balears (COFIB). Ctra. Sineu km 15, CP: 07142 Santa Eugènia (Illes Balears)

The yellow-legged hornet, *Vespa velutina nigrithorax*, is an Invasive Alien Species (IAS) introduced in Mallorca in 2015. From October 2015 to November of 2018, an intensive survey was implemented which followed strategies: (1) Spring trapping of queens. (2) During summer and autumn, traps baited with a sucrose or protein attractant (raw fish) were located in the areas/nearby areas where previously the hornet has found, in order to detect the presence of adults. (3) 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. (4) Visual observation in the apiaries around the island and active monitoring in natural zones carried out by beekeepers and fifty-four environmental Agents throughout the island. (5) Public

awareness and environmental education. An important community information task was carried out. Moreover, the general public had access to an emergency 24-hour phone number they could call or send a message for notifications. A total of 30 secondary nests were detected and removed during the three fists years of invasion and none of them during the last year 2018. Considering the presumably early stage of the invasion, the size of the island and the promising results obtained, we consider that this species could be eradicated if resources and a specific program for eradication in Mallorca are implemented in coordination with all involved partners.

☙ Asian hornet in Europe. What does the future hold?

Feás X.

Universida de Santiago de Compostela (USC) - Spain

The *Vespa velutina* (Vv) is a highly aggressive predator posing a significant threat to honey bees and other insects. In Northern Spain (Galicia) Vv spread from 2 to 10'642 nests in 4 years. Evidence shows that other countries previously invaded have failed at attempts to prevent and control their advance. The Vv should be a worrying concern for all, not just beekeepers because other productive sectors as fruticulture and silviculture are greatly affected, as well as human health and activities. Of the 237,973 calls managed

by emergency services in 2017 20% were Vv related. More knowledge of the ecology and behaviour of this invasive pest is essential to provide an effective management program for its control. The talk will look at the different experiences of combating the pest in other countries, in order to find possible methods to control its expansion and to mitigate the negative effects in the beekeeping sector and environmental as a whole.

♂ Is it possible for small islands to control an invasive species?

Hogge R.

Jersey Beekeepers Association

Vespa velutina nigrithorax was first observed in Jersey, a small island off the coast of France, in 2016. Located just 22 km from Normandy and 52 km from Brittany, Jersey can be reached by French populations of this invasive hornet with little effort. Consequently, Jersey and other Channel Islands are attempting to control the hornet population by involving & encouraging the public in reporting sightings, spring trapping, collection of primary nests, tracking and destruction of secondary nests. A British Crown Dependency, Jersey has constitutional rights for self-government and judicial independence. Jersey is also not part of the EU but, via

a special relationship, is treated as if it is part of the EU. These distinctions permit beekeepers on Jersey some flexibility, with government oversight, to explore a variety of control approaches. The presentation will cover details of various methodologies applied, including how these need to be modified near water-catchments and other environmentally sensitive areas.

In areas where use of insecticide for nest destruction is precluded, a method of live nest removal has been employed. This was initially done in daylight, leading to some tertiary nests being produced by escapees. These nests have proven to be drone-producing. I will discuss their value, how to recognize them, and their potential importance to the dynamics of the *V. velutina* population. I will also discuss the potential attractiveness of nest remnants and how this may be utilized in future.

☙ Does *Vespa velutina* impact on native insects?

Carisio L., Bianchi E., Lioy S., Porporato M.

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

The Asian yellow-legged hornet (*Vespa velutina*) is an invasive alien species that is spreading among countries of SW Europe since its introduction in France 15 years ago. Invasive species are known to

be a serious threat to ecosystems in many ways, affecting ecological processes of high relevance for the society. *Vespa velutina* is a fierce predator of honey bees, but can also hunt wild pollinators and overthrow local wasps. This may pose a threat to pollination service, crucial for agricultural activities and environmental health, and disrupt food chains in which social wasps play a fundamental role. While a considerably effort was devoted to assess biological traits and invasion dynamics of the Asian yellow-legged hornet, information about the impacts on local insects communities, particularly pollinators, are still scanty. This study aims to address this gap through field surveys undertaken within the framework of the LIFE STOPVESPA project. We investigated, by means of baited bottle baited traps, the abundance of hornets, wasps and wild pollinators in two areas of Liguria, north-west Italy, either inside and outside of the colonized range of the Asian yellow-legged hornet. Furthermore, flower visiting insects were sampled in the invaded range using pan traps. This study highlight that *V. velutina* nest density have a clear effect upon insect communities (significant decrease in wild bees and diurnal butterflies abundances) besides to the influence of climatic factors and landscape features.

[08] An innovative harmonic radar system for tracking flying insects: the case of *Vespa velutina*

Maggiora R., Milanesio D., Saccani M., Bottigliero S.

Politecnico di Torino, Dipartimento di Elettronica e Telecomunicazioni (DET), Torino, Italy

Harmonic radars can be generally used to track very small and lightweight passive tags; they have been adopted to track various insects for almost 30 years now. In most of the cases, their usage was motivated by the entomological interest in better knowing the habits of the observed insect; in our application prevails the need of protecting the environment from invasive species, like *Vespa Velutina*. In the past decades not a lot of engineering resources have been invested with the aim of improving what was basically considered a mere tool in the hands of entomologists. The goal of this work is to show how modern radar techniques, the progresses in the available hardware and a three years long development effort helped us to build and test an harmonic radar system with considerably improved performances. The prototype herein described is able to track the flight of tagged *Vespa velutina* specimen in real time, up to 500 meters with a quite large field of view in elevation, and can be therefore adopted also in harsh environments.

♂ Tracking Asian hornets (*Vespa velutina*) to their nests with radio-telemetry

Kennedy P.[1], Ford S., Poidatz J., Thiery D., Osborne J.

[1]University of Exeter - United Kingdom

Vespa velutina (Asian hornets) are voracious predators of bees, and are the latest emerging threat to managed and wild pollinator populations in Europe. To prevent establishment or reduce the rate of spread of *V. velutina*, early detection and destruction of nests is considered critical. Detection is difficult as their large nests are well hidden and flying hornets are difficult to follow over long distances. To meet this challenge, we explored how existing technologies may be adapted to improve the efficiency of finding hidden nests. We tracked individual *V. velutina* workers flying back to their nests using radio telemetry for the first time. We describe conditions under which tagged hornets could be tracked, leading us to previously undiscovered nests in areas of differing terrain. We also discuss current limitations with the technology. This fast, effective method offers a valuable tool in managing this emerging threat to beleaguered pollinator populations in areas where *Vespa velutina* have recently become established.

♂ **Immune characterization of *Vespa velutina* and *Vespa crabro*: a comparison across caste and sex**

Cappa F.[1], Cini A.[1], Meriggi N.[1], Pepiciello I.[1], Petrocelli I.[1], Cervo R.[1]

[1]Università degli studi di Firenze, via Madonna del Piano 6, 50019, Sesto Fiorentino (FI)
[2]Centre for Biodiversity and Environment Research, University College London, Gower Street, London WC1E 6BT UK

Understanding the major mechanisms that allow an alien species to become invasive is crucial for limiting the impact of invasive alien species. The evolution of improved competitive ability (EICA) hypothesis is widely evoked to explain the establishment and proliferation of an alien species in a newly colonized region. EICA postulates that an alien species introduced to a new area likely experience a decrease in population regulation due to lack of natural enemies from its native range, leading to a rapid spread, both numerically and geographically, of the invader. Thus, in the absence of natural enemies, invaders might shift the allocation of resources from defence to growth and reproduction resulting in a competitive advantage over native species occupying similar ecological niches. Here, we compare the immune competence of different castes and sex of the invasive Asian hornet, *Vespa velutina*, and the native European hornet, *Vespa crabro*, by means of a bacterial challenge to assess if the EICA hypothesis might play a role in the ecological success of *V. velutina* in its invasive range. Interestingly, our results

demonstrate that immune response differ between the two species with an opposite pattern with respect to caste: in *V. crabro*, workers were more immunocompetent than in *V. velutina*; conversely, sexuals of both sexes were more resistant to bacterial challenge in the invasive species compared to the native one. The higher pathogen resistance in reproductives of the Asian hornet, especially in spring foundresses, do not seem to support the predictions of EICA; nonetheless, such increased immunity in the reproductive caste might represent a key factor contributing to the ecological success of this invader.

♂ Using *Vespa velutina* chemical communications to control the invasive species

Darrouzet E.

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

Preliminary study showed that few yellow-legged hornet (Vespa velutina nigrithorax) were introduced in France, probably only one queen, and the French population was consequently inbreeded as several colonies produce diploid males. In this condition, we analyzed and identified compounds from the chemical signature (cuticular hydrocarbons or CHCs) and the alarm pheromone of such

inbreeded hornet population, to determine whether these chemical communication systems were affected or not. For example, hornets have specific CHCs profiles according to their gender, their caste and their colony, in spite of inbreeding conditions. We tested these compounds to develop efficient and selective traps.

♂ Effect of *Vespa velutina* queens trapping on honey bee colonies development

Romano A., Capello M., Lioy S., Manino A., Porporato M.

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

The Asian yellow-legged hornet, *Vespa velutina*, was accidentally introduced in France in 2004 and rapidly colonized most of Western Europe including Italy since 2012. This hornet is causing several impact on beekeeping, especially in high-density colonized areas where its massive predation towards honey bees could contribute to colony losses. Consequently, beekeepers in Europe are trapping *V. velutina* hornets nearby apiaries, to limit or decrease the impact that this species may cause to honey bee colonies.

Within the LIFE STOPVESPA project, the methodology of *V. velutina* queen spring trapping was tested to understand the relationship between spring catches of queens and colony

development of *Apis mellifera*, so as to assess the impact of *V. velutina* and the effectiveness of queens trapping in decreasing the impact of this species on honey bee colonies.

For this reason, experimental apiaries (trapped and control apiaries) were established and managed in 2017 and 2018 in a high-density colonized area of Liguria. For each trapped apiary, 40 bottle traps for hornets were placed within a radius of 700 m from the apiary. The catches were taken from March to June of both years and the trapped insects periodically verified. Honey bee colonies were managed in both years and the strength of each colony (56 colonies in 2017 and 65 in 2018) was assessed from June to December, both in trapped and control apiaries. A LMMs analysis showed significant differences of honey bee colony development between trapped and control apiaries (2017: $F_{1,54} = 5.23$; $p < 0.05$; marginal $R2 = 0.25$; conditional $R2 = 0.44$; 2018: $F_{1,63} = 9.05$; $p < 0.01$; marginal $R2 = 0.35$; conditional $R2 = 0.46$). Honey bee colonies in trapped apiaries showed a lesser impact by *V. velutina* (2017: EMMs = 79.11; SE = 5.24; 2018: EMMs = 71.73; SE = 4.01) than honey bee colonies in un-trapped apiaries (2017: EMMs = 59.97; SE = 6.52; 2018: EMMs = 53.98; SE = 4.33), indicating that *V. velutina* queen spring trapping allows to decrease the impacts on honey bee colonies. Besides this benefit, attention should be paid to by-catch of other native insect species.

Posters

[08] StopVelutina reporting system: insights from a 4-year experience

Bortolotti L.[1], Barbujani M.[2], Cappa F.[3], Cervo R.[3], Cini A.[3], Felicioli A.[4], Iannone A.[1], Mutinelli F.[2]

[1]CREA - Centro di ricerca agricoltura e ambiente, Bologna, Italy
[2]Istituto Zooprofilattico Sperimentale delle Venezie, Legnaro (PD), Italy
[3]Dipartimento di Biologia, Università di Firenze, Italy
[4]Dipartimento di Scienze Veterinarie, Università di Pisa, Italy

The StopVelutina reporting system is active since 2015 to collect reports from beekeepers and citizens about the presence of *Vespa velutina* in Italy. It includes different reporting ways: an online form on StopVelutina website, the StopVelutina facebook page, different institutional mail address for each region and, since 2017, a whatsapp number.

To date the total number of reports is around 1300, with an increasing trend from 2015 to 2018. Among the different reporting systems, the users preferred online form, followed by Whatsapp, institutional mail address and Facebook.

The highest number of reports occurred between August and October, followed by the period May-July, according to the seasonal trend of hornets' cycle and their predation activity in the apiaries.

The reports during the winter period concern the finding of empty nests, which become evident with the fall of the leaves of trees.

According to the limited spreading in Italy (*V. velutina* is well established in only two provinces of Liguria region and in one of Piedmont it is reported only sporadically) the reports of *V. velutina* are a very low percentage of the total reports. Most of the erroneous reports regards the common hornet, *Vespa crabro*, while a smaller number, but in constant increase, concerns the oriental hornet, *Vespa orientalis*. Other frequently reported insects are Scolia and Megascolia spp., social (Vespula and Dolichovespula genus) and parasitoid (Sphecidae, Eumenidae and Pomplidae) wasps.

In 2016 and 2017 the StopVelutina reporting system was able to intercept the new outbreaks of *V. velutina* respectively in Veneto and Tuscany regions, thus favouring a rapid inspection of the sites and, when possible, nest searching and destruction. In conclusion, the results of these first years of StopVelutina reporting system implementation allowed tuning the dissemination and signalling protocols in order to improve citizens' participation and data reliability.

Invasive alien bee species: damage or resource? The case of two Asiatic Megachile species

Bortolotti L., Bogo G., Flaminio S., Quaranta M.

CREA - Centro di ricerca agricoltura e ambiente, Bologna, Italy

In the last decades the number of unintentionally introduced non-native insect species increased enormously, due to the augmenting international trade. In many cases the introduction of alien insect species represents a severe damage for local flora or fauna, especially when they act as pests, parasites or predators. In the case of bees, the potential impact of non-native species is difficult to quantify, since they are usually considered beneficial insects for their role in pollination of wild and cultivated plants. On the other hand, they can play a negative impact through the transmission of pathogens and parasites to native bee species, the competition for nesting sites or floral resources, spread of alien weeds (exotic bees exhibit marked preferences for flowers of exotic plants) and the alteration of plant-pollinator networks.

Among non-native introduced bees, the family Megachilidae and in particular the genus Megachile is the most represented group in terms of number of species. The reason is that they nest in stems, twigs and wood cavities and thus can be easily transported within these vegetative parts. Recently two Asiatic Megachile species of the subgenus Callomegachile were reported in Europe: *M. sculpturalis* and *M. disjunctiformis*.

M. sculpturalis was already present in the US since the 1990s and it rapidly spread across the country and to Canada. In Europe it was observed for the first time in France in 2008, then in Italy in 2009, in southern Switzerland in 2010 and in 2015 in Germany and Hungary. In Italy it is present throughout the northern regions until Tuscany. *M. disjunctiformis* was noted for the first time in Europe in 2011 and 2016 near Bologna, Italy; then in 2017 three specimens, one female and two males, were captured in three different locations and identified (the first report outside its origin areal until now), and in 2018 it was observed in five locations around Bologna, in one of which he nested together with *M. sculpturalis*. Nesting habits and possible competition between the two species will be discussed.

♂ **Beer or not beer? Comparison of the attractiveness and selectivity between two types of traps and baits as a control tool for the invasive *Vespa velutina***

Capello M., Romano A., Lioy S., Manino A., Porporato M.

Department of Agriculture, Forest and Food Sciences, University of Turin, Largo Paolo Braccini 2, 10095 Grugliasco (Turin), Italy

The Asian yellow-legged hornet, *Vespa velutina*, is an invasive predator of honeybees that was accidentally introduced in Southwest France in 2004, an event followed by impressive colonisations of

several areas within Western Europe. The invasion of *V. velutina* represents a multiple threat for biodiversity, economic activities and human health. Nowadays is not available a unique control method that is effective in limiting its spread and decreasing its impacts, consequently some European countries have adopted integrated control strategies based on the use of different techniques, such as nest destruction and trapping of hornets. However, the use of the latter method is controversial and its selectivity towards *V. velutina* could be low, depending also on the kind of traps and baits. Many models of traps have been proposed since the introduction of *V. velutina* in Europe, homemade or commercial traps, with various shapes and different baits mixtures. To date, none of the suggested combination has proved to be totally selective towards *V. velutina*.

Aim of this study is to compare the effectiveness of two proprietary traps (Tap Trap© and VespaCatch by Veto-pharma©) and two types of baits (lager beer and VespaCatch Attractant by Veto-pharma©), focusing on two factors: i) the attractiveness towards *V. velutina*, ii) the selectiveness towards no targets insects. The two types of traps were combined with the two types of baits (four combinations), and testes in two areas of Liguria, characterized by high density of *V. velutina*, during spring and autumn 2018, for a total of 144 individual samples.

The season and the type of bait show significant effects on *V. velutina* capture rates. During spring, beer was significantly more attractive than VespaCatch Attractant (GLMM: EMMs Beer = 0.06, SE = 0.23; EMMs VespaCatch = -0.89, SE = 0.35). Instead, in

autumn VespaCatch Attractant is more effective than beer (GLMM: EMMs Beer = -0.67, SE = 0.31; EMMs VespaCatch = 1.25, SE = 0.21) and its effectiveness is maximized with its proprietary trap (GLMM result of the interaction effect of Veto-pharma trap and bait: EMMs = 1.17, SE = 0.26). The four combination of traps catch also different species and taxa besides to *V. velutina*, such as European hornet *Vespa crabro*, Vespula spp., Polistes spp., Lepidoptera, some Apidae and Diptera, which are the main trapped group. Future analyses on no-target species abundancies in the environment correlated to the number of trapped insect is necessary to understand the effect of these methods on the biodiversity.

☙ Wild bee communities across *Vespa velutina* invasion gradient

Carisio L., Bianchi E., Lioy S., Manino A., Porporato M.

Department of Agriculture, Forest and Food Sciences, University of Turin, Largo Paolo Braccini 2, 10095 Grugliasco (Turin), Italy

Researchers suggested that a mass species extinction may be under the way and the phenomena is consequence of human activities. Until now, agricultural and landscape simplification has been often reported as a cause of the decline in wild bees abundance and species richness in Europe. More rarely alien species were credited

as significant species loss driver. Since 2004, the alien invasive Asian yellow-legged hornet (*Vespa velutina*) is spreading throughout Europe and it is potentially a new threat for wild bees because of its diet spectrum. In Italy *V. velutina* is expanding in the Liguria region following the coast line from the France border to East and thus setting a predation pressure gradient through the region. In 2016 and 2017 we monitored wild bees communities in 6 study areas at different gradient of yellow-legged hornet's density. We explored which genera are more likely threatened considering *V. velutina* annual life-cycle. The effect of *V. velutina* presence on wild bee functional groups was tested using GLMs. The survey leads to collect 1678 specimens belongings to 150 wild bees species. We found 25 species not previously reported in Liguria region and among them one (Andrena asperrima Pérez 1895) was never found before in Italy. Significant *V. velutina* predation intensity appears to overlap with late summer flying wild bees, in particular with species of the genera Colletes, Hylaeus, and Ceratina. GLMs estimates indicated that *V. velutina* presence negatively affects the abundance of small and medium wild bees and richness of smaller ones.

Modeling *Vespa velutina nigrithorax* dispersion and dynamics in Northern Portugal. 2013 model updating

Crespo N.[1,3], Aranha J.[1,2,3]

[1]Department of Forestry Sciences and Landscape Architecture (CIFAP), University of Trás-os-Montes and Alto Douro, 5000-801 Vila Real, Portugal
[2]Centre for the Research and Technology of Agro-Environmental and Biological Sciences, University of Trás-os-Montes and Alto Douro, 5001-801 Vila Real, Portugal
[3]Project GOVESPA "Control and minimization of losses of invasive species *Vespa velutina nigrithorax* (*Vespa velutina*) in beekeeping production", Portugal

Vespa velutina nigrithorax dispersion in Northern Portugal began in the county of Viana do Castelo, where the first nests were detected in 2012, and have been spreading to neighbouring counties at an alarming rate. According to records made to date, this invasive species is already present throughout the north coast and lowland of the interior. Wasp nests were also reported in the central zone of mainland Portugal but in reduced numbers. Although no great expression, it is still worrying given to this species high dispersion rate.

In 2013 a *Vespa velutina nigrithorax* dispersion model was developed and presented in Viana do Castelo County and created a wasp invasion Susceptibility Map for North Portugal to (Aranha *et. al.*, 2013; Aranha and Crespo, 2017). Attending to a high number of records and diversity of invaded territories, it is important to adjust the dispersion models to the morphological and anthropic

characteristics of the various territories in order to create regional invasion susceptibility maps.

♂ *Vespa velutina*, research activities at Campus Terra (Lugo). Looking for research partners

Feás X.

Universida de de Santiago de Compostela (USC) - Spain

Research activities related to *Vespa velutina* carried out in Campus Terra (University of Santiago de Compostela) will be presented. Dr. Xesús Feás has a keen focus of the invasive *Vespa velutina* (Vv) and methods for controlling the species (www.vespavelutina.co.uk). His work related to Vv includes: Synthesis of sexual pheromones involved in insect mating, developing a toxic bating, Obtaining venom and micro CT images, testing commercial traps, devices to protect apiaries and extraction and characterization of chitin.

☙ Invasion, impact and biological control of the box tree moth, *Cydalima perspectalis*, in Europe

Kenis M., Nacambo S., Seehausen L.

CABI, Delémont, Switzerland

The box tree moth, *Cydalima perspectalis*, is an insect of Asian origin that recently invaded most of Europe, Turkey and the Caucasus. It probably arrived on traded ornamental plants from Asia around 2005. Since then, it has become a major pest of ornamental box trees in gardens, but it also represents a serious threat to native Buxus spp. in Europe and elsewhere in particular when it acts in conjunction with the box blight *Cylindrocladium buxicola*, an invasive fungal pathogen from Asia. On ornamental box trees, the moth can be controlled by insecticides, preferably biopesticides such as Bt and, in many cases, box trees can be replaced by other, similar bushes. Consequently, the economic impact of the pest is now considered rather minor. In contrast, on wild box trees, control measures are much more problematic and stands of *Buxus sempervirens*, the common European box tree, are quickly disappearing. It could also threaten *Buxus balearica*, a rare endemic species occurring at a few sites on the Mediterranean coast. Furthermore, 43 fungi, 3 chromista and 18 invertebrates are known exclusively from *Buxus* spp. and could disappear with the eradication of their host tree. In some regions, box has a high cultural and religious value, and the social impact of its disappearance is not negligible. Only natural enemies

will be able to save box stands, either by the adaptation of native natural enemies or by the release of Asian species. Preliminary studies have allowed the selection of two Asian parasitoids as candidate biocontrol agents, but further investigations are needed to assess their potential and the risks posed to non-target species.

Replicative Kashmir Bee Virus and Black Queen Cell Virus in *Vespa velutina* (Lepelieter 1836)

Mazzei M.[1], Cilia G.[1], Forzan M.[1], Lavazza A.[2], Mutinelli F.[3], Felicioli A.[1]

[1]Department of Veterinary Science, Viale delle Piagge 2, University of Pisa, Pisa, Italy
[2]Virology Unit, Istituto Zooprofilattico Sperimentale della Lombardia e dell'Emilia Romagna "Bruno Ubertini", Via Antonio Bianchi 7/9, 25124 Brescia, Italy
[3]Centro di Referenza Nazionale per l'Apicoltura, Istituto Zooprofilattico Sperimentale delle Venezie, Viale dell'Università 10, 35020 Legnaro (PD), Italy

Vespa velutina specimens were collected and identified as newly-emerged or hunters; the latter were caught during their predatory activity in front of the apiaries. All specimens were sampled during the 2017 beekeeping season in Liguria region (north-western Italy) in order to monitor their possible infection with the most diffused honey bee viruses: Black Queen Cell Virus (BQCV), Kashmir Bee Virus, (KBV) Slow Paralysis Virus (SPV), Sac Brood Virus (SBV),

Israeli Acute Paralysis Virus (IAPV), Acute Bee Paralysis Virus (ABPV), Chronic Bee Paralysis Virus (CBPV).

Total RNA was extracted from each specimen and RT-qPCR protocols were applied to ascertain the presence of honey bee viruses. Only KBV and BQCV genomes were detected in *V. velutina* specimens. Positive RT-qPCR samples were further tested by a strand specific RT-PCR to detect the presence of the replicative viral strand. Replicative genomic strains were detected for KBV and BQCV hunters and newly-emerged specimens, ascertaining that these viruses can effectively replicate in the alien Asian hornet.

Sequence analysis performed comparing KBV and BQCV Italian sequences to those available on GenBank, indicated high similarity with other European genetic viral strains.

The presence of both BQVC and KBV in newly-emerged specimens, confirm the possibility of viral co-infection in *V. velutina*, as previously described in honey bees and other hosts.

Our finding, along with the recently reported DWV infection in *V. velutina* specimens, suggests a role of those RNA viruses in the epidemiological picture between the prey (*Apis mellifera*) and the alien predator (*V. velutina*).

EU and Italian national regulation on invasive alien species: the case of *Vespa velutina* in Italy

Mutinelli F.

Istituto Zooprofilattico Sperimentale delle Venezie, Legnaro (PD), Italy

An alien species is an organism introduced outside its natural past or present distribution range by human agency, either directly or indirectly. This implies an active movement facilitated by humans and covers both intentional and unintentional movements of species. Those alien species that cause negative impacts on biodiversity, socio-economy or human health are considered as invasive (CBD, 2002).

V. velutina should be considered under the Regulation (EU) N. 1143/2014 on the prevention and management of the introduction and spread of invasive alien species. This Regulation seeks to address the problem of invasive alien species in a comprehensive manner so as to protect native biodiversity and ecosystem services, as well as to minimize and mitigate the human health or economic impacts that these species can have. Three types of interventions are foreseen: prevention, early detection and rapid eradication, and management. Eventually, *V. velutina* has been included in the list of invasive alien species of Union concern adopted by Commission Implementing Regulation (EU) 2016/1141. Recently, Commission Delegated Regulation (EU) 2018/968 provided methodologies for risk assessments in relation to invasive alien species.

In Italy, the Italian Ministry of Environment with Decree 15 December 2017, n. 230, updated the national Italian legislation to Regulation (EU) N. 1143/2014. Accordingly, the Ministry of Environment and ISPRA, its technical-scientific body, have the full competence on this topic. Since the first detection, actions have been taken in the framework of LIFE project, StopVelutina programme and at regional level based on Regulation No 1308/2013. The Ministry of Health has no competence on it and the Ministry of Agriculture can promote research activity on its spread and possible control based on the detrimental impact of *V. velutina* on honeybee industry. Actions are expected about management of this invasive alien species according to the new Italian national regulation.

The experience of LIFE STOPVESPA reporting system up to 2018

Porporato M., Laurino D., Romano A., Capello M., Avagnina A., Manino A., Lioy S.

Department of Agriculture, Forest and Food Sciences, University of Turin, Largo Paolo Braccini 2, 10095 Grugliasco (Turin), Italy

In order to manage the expansion of *Vespa velutina* in Italy, the LIFE STOPVESPA Project developed an Early Warning and Rapid Response System in the project area (Liguria and Piedmont regions),

continuing the activities already started in 2012 by the bee research unit of DISAFA. Pivotal points of this system were intensive networking and communication activities together to monitoring and control actions in the colonized areas. Beekeepers and more generally the public were constantly informed about the importance of reporting the presence of *V. velutina* nests or individuals. To collect their reports, several tools were provided to the citizens: a mobile phone number, an email address, a reporting form available on the project webpage (www.vespavelutina.eu) and social media webpages. In Liguria, at regional level, an institutional phone number and email address were also established. The involvement of firefighters, civil defence units, and local police allowed to collect other *V. velutina* reports.

A four-step approach was adopted: 1) each report was verified for species identification; 2) after adult confirmation, a Vespa Emergency Team was activated to delimit the area, establish intensive monitoring network and discover nest position with the use of the harmonic radar; 3) after nest confirmation, trained teams were activated for nest destruction; 4) data were finally recorded and analysed. Trained teams were operative 7 days a week and were able to remove the colonies within 24/48 hours.

As a result of the dissemination activities during the project, thousands of reports were collected, managed and analysed in these years, with an increasing trend since 2012. The highest number of reports arrived on the mobile phone number (3,382 calls) and WhatsApp account (1,671 messages), while a lesser number of

reports from email and webpages (757 reports). Considering online reports, 36% were sent from Liguria where *V. velutina* is well established, 13% from Lombardy and 10% from Piedmont, followed by other Italian regions. *V. velutina* is highly confused with native species: 84% of the reports received by e-mail related to other species such as the European hornet *Vespa crabro*, the Oriental hornet Vespa orientalis or other Vespoidea such as *Vespula* spp, *Dolichovespula* spp., *Megascolia* spp., but also other insects including some Diptera. Analysing mobile phone reports, the situation is similar and most of the misidentifations are related to *V. crabro* and *Megascolia* spp. In 95% of phone reports and 53% of online reports, species identification was possible since people were able to provide photographic documentation.

The dissemination activity raised citizens' awareness and participation; the analysis of the records highlighted that a large part of the public needs to be more informed about species identification, in order to improve data reliability. To help citizens to recognize *V. velutina*, the project edited different materials (e.g. flyers, brochures, leaflets, videos) that are available on the project webpage and citizen are constantly encouraged to send good quality pictures. The rapid and efficient response given to this problem must be taken into consideration for the future management of *V. velutina* in Italy, to assure an efficient management strategy in compliance with the EU Regulation 1143/2014 and its implementation by the national law.

✉ Detection of Asian hornet (*Vespa velutina*) colonies using harmonic radar

Viscardi A.[1], Capello M. [1], Romano A. [1], Porporato M. [1], Lioy S. [1], Laurino D. [1], Saccani M.[2], Milanesio D. [2], Maggiora R. [2]

[1]Department of Agriculture, Forest and Food Sciences, University of Turin, Largo Paolo Braccini 2, 10095 Grugliasco (Turin), Italy
[2]Department of Electronics and Telecommunications, Polytechnic University of Turin, Corso Duca degli Abruzzi 24, 10129 Turin, Italy

The Asian yellow-legged hornet (*Vespa velutina*) is an invasive alien species that represents a serious threat to European pollinators. Its fast expansion throughout Europe indicates that efficient control measures are needed. The detection and destruction of colonies at the invasion front or outbreaks, before the emerging of reproductive individuals, actually represent the main countermeasure against the expansion of this pest, but nest detection is often difficult as they usually are well hidden in vegetation and often located inside tree canopies. During summer 2017 and 2018, a harmonic radar developed within the LIFE STOPVESPA Project has been successfully used in nest-detection operations in Liguria region, Italy. The method consists of tracking the flights of foraging hornets in order to detect the position of the colonies they came from. The rotary radar unit is equipped with two different antennas; the emitting antenna emits a signal that is doubled by a passive transponder glued dorsally on the hornet's thorax, and successively detected by the receiving antenna. The radar detection range could

reach 470 meters in open field and flat terrain, but geomorphological constraints and obstacles reduce the above mentioned value. A user-friendly software allows real-time geolocation and registration of tracks. The small dimension and lightweight transponder provides various advantages in terms of maintenance of flying capabilities, allowing tagged hornets to continue successfully their foraging activities, enabling operators to track both nest-returning and outgoing flights. The flying success after tag attachment is high and can reach values of 100%; this represent an advantage during operations in invasion fronts, where the number of foraging hornets in apiaries is low. The detection of hornet colonies may need movements of the radar unit, particularly in complex topographic contexts in order to overstep geomorphological constraints that limit signal reception. Nests are easily detected when some tracks converge in a single point; subsequently a team provides for the visual identification of nests position. The maximum error in the track position is less than ± 2 m. The harmonic radar has been successfully used in Liguria and the finding of 3 previously undiscovered nests in invasive outbreaks zones, thus demonstrating the high potential of the harmonic radar in containing *V. velutina* spread.

LIFE14 NAT/IT/001128 STOPVESPA - Realized with the contribution of E.C.