

Aliem: le specie aliene un rischio per la biodiversità, Genova 11/10/19

UNIFI per Aliem: strategie di monitoraggio e controllo su specie di interesse

Rita Cervo, Federico Cappa, Alessandro Cini, Alberto Inghilesi

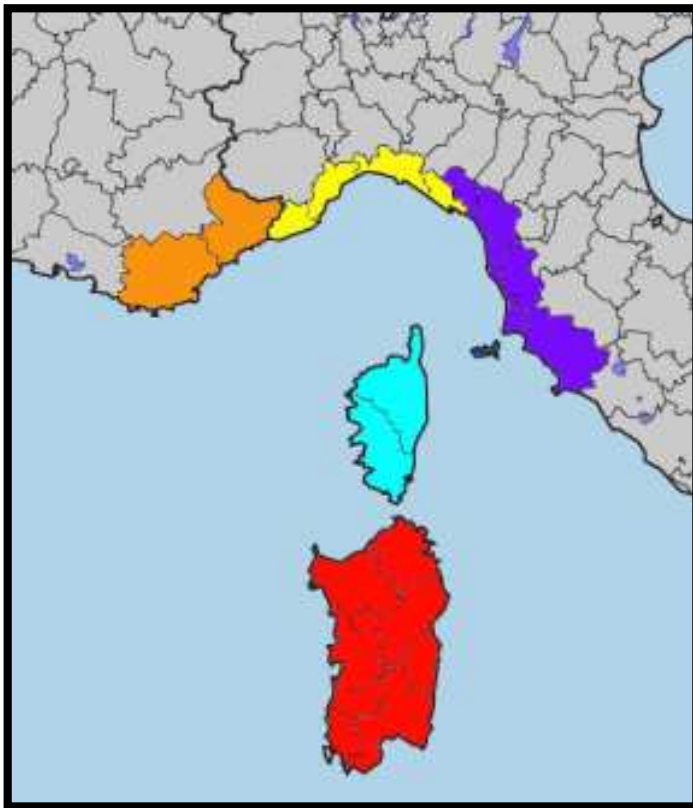


ALIEM

Start: January 2016

Duration: 3years

Focus: Alien Invasive Species

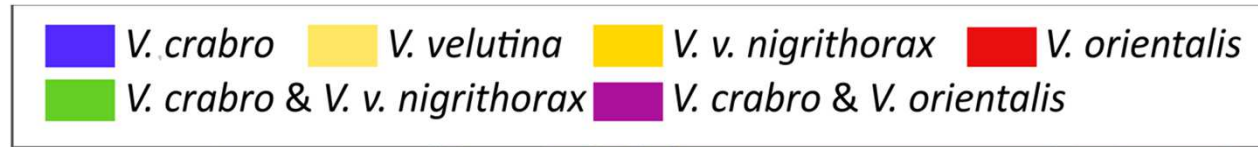


Action pour *Limiter les risques de diffusion des espèces Introduites Envahissantes en Méditerranée*

- Joint and coordinated approach to face the threats of alien invasive species
- Create a **shared governance programme** in the regions involved in the project
- Create a shared **platform to collect, exchange and analyze data**

Vespa velutina invasion

- Eusocial Hymenoptera
**especially successful
invasive alien species**
(Moller 1996)



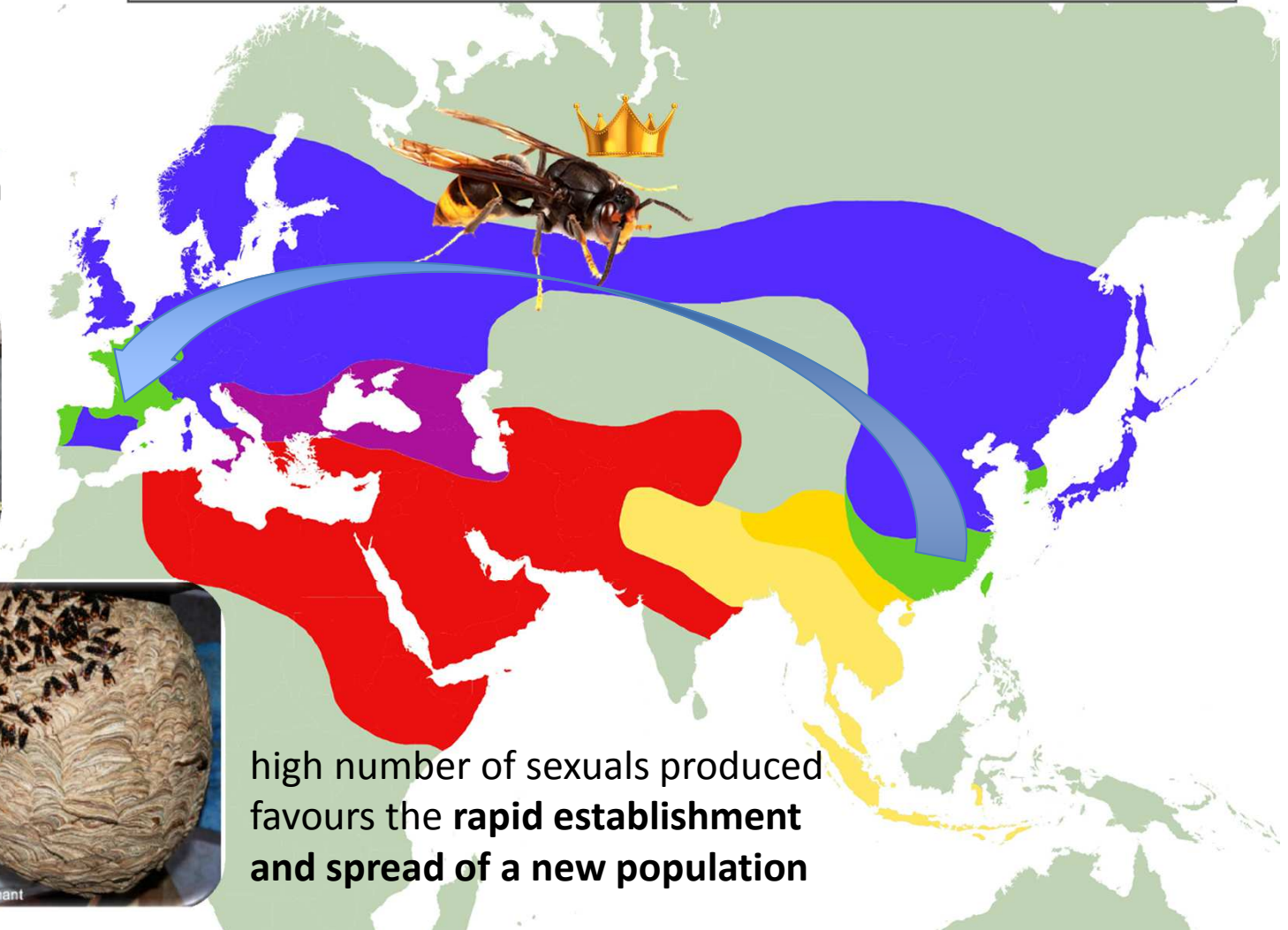
- a single mated
queen can start a
new colony



- Colony
defended by
hundreds of
workers

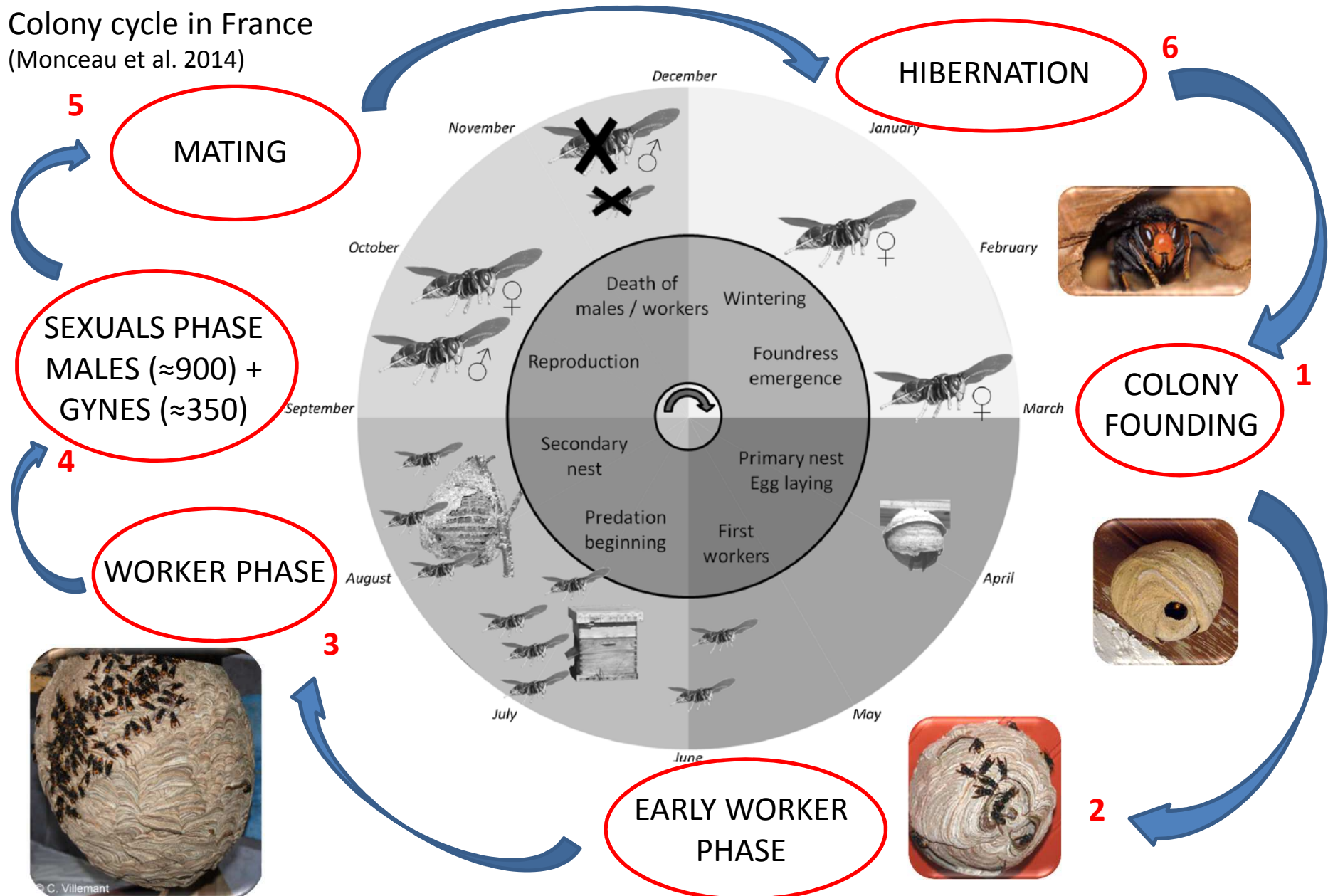


high number of sexuals produced
favours the **rapid establishment
and spread of a new population**

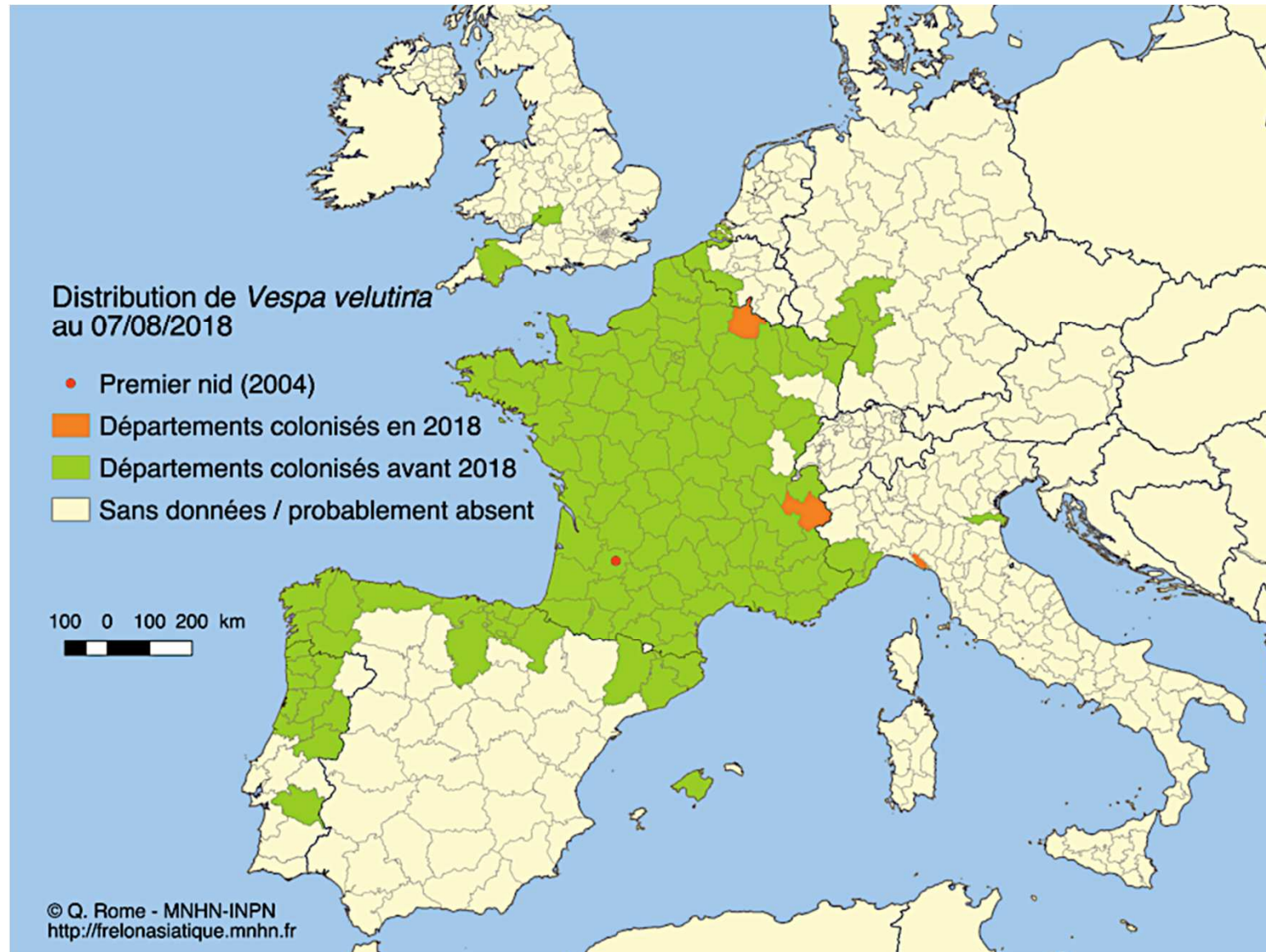


Vespa velutina nigrithorax: colony cycle

Colony cycle in France
(Monceau et al. 2014)



Current distribution in Europe



Vespa velutina nigrithorax: after 14 years...

Biol Invasions (2015) 17:2357–2371
DOI 10.1007/s10530-015-0880-9



ORIGINAL PAPER

Reconstructing the invasion and the demographic history of the yellow-legged hornet, *Vespa velutina*, in Europe

M. Arca · F. Mougel · T. Guillemant · S. Dupas · Q. Rome · A. Perrard · F. Muller · A. Fossoud · C. Capdeville-Dulac · M. Torres-Leguizamón · X. X. Chen · J. L. Tan · C. Jung · C. Villemant · G. Arnold · J.-F. Silvain

Insect science

Insect Science (2014) 00, 1–10, DOI 10.1111/1367-7917.1201

ORIGINAL ARTICLE

Spatial distribution of *Vespa velutina* individuals hunting at domestic honeybee hives: heterogeneity at a local scale

Karine Monceau^{1,2,3}, Olivier Bonnard^{1,2}, Jérôme Moreau³ and Denis Thiéry^{1,2}

JOURNAL OF APPLIED ENTOMOLOGY

J. Appl. Entomol.

ORIGINAL CONTRIBUTION

Caste differentiation and seasonal changes in *Vespa velutina* (Hym.: Vespidae) colonies in its introduced range

Q. Rome¹, F. J. Müller¹, A. Touret-Alby², E. Darrouzet², A. Perrard^{1,2} & C. Villemant¹
J Pest Sci (2014) 87:1–16
DOI 10.1007/s10340-013-0537-3

REVIEW

Vespa velutina: a new invasive predator of honeybees in Europe

Karine Monceau · Olivier Bonnard · Denis Thiéry

Competition between the native and the introduced hornets *Vespa crabro* and *Vespa velutina*: a comparison of potentially relevant life-history traits

ALESSANDRO CINI^{1,2,3,4}, FEDERICO CAPPA^{1,2}, IACOPO PETROCELLI^{1,2}, IRENE PEPICIELLO¹, LAURA BORTOLOTTI² and RITA CERVO^{1,2} ¹Dipartimento di Biologia, Università di Firenze, Firenze, Italy and ²CREA - Unità di ricerca di apicoltura e bachicoltura, Bologna, Italy

RESEARCH ARTICLE

Olfactory Attraction of the Hornet *Vespa velutina* to Honeybee Colony Odors and Pheromones

Antoine Coubo¹, Karine Monceau², Olivier Bonnard^{1,2}, Denis Thiéry^{2,4}



Contents lists available at ScienceDirect

Biological Conservation

Journal of homepage: www.elsevier.com/locate/bcon

Predicting the invasion risk by the alien bee-hawking Yellow-legged hornet *Vespa velutina nigrithorax* across Europe and other continents with niche models

Claire Villemant^{1,2}, Morgane Barbet-Massin³, Adrien Perrard⁴, Franck Muller⁴, Olivier Gargominy⁵, Stéphane Llaurens⁶, Pierre-André Crochet⁷

Can parasites halt the invader? Mermithid nematodes parasitizing the yellow-legged Asian hornet in France

Claire Villemant¹, Dario Zuccon², Quentin Rome¹, Franck Muller¹, George O. Poinar Jr³ and Jean-Lou Justine¹

Apidologie

© INRA, DIB and Springer-Verlag France, 2014
DOI: 10.1007/s13592-014-0297-y

Scientific note

A scientific note about a parasitoid that can parasitize the yellow-legged hornet, *Vespa velutina nigrithorax*, in Europe

Eric Darrouzet, Jérémy Gèvar, Simon Dupont



Behavioural Processes

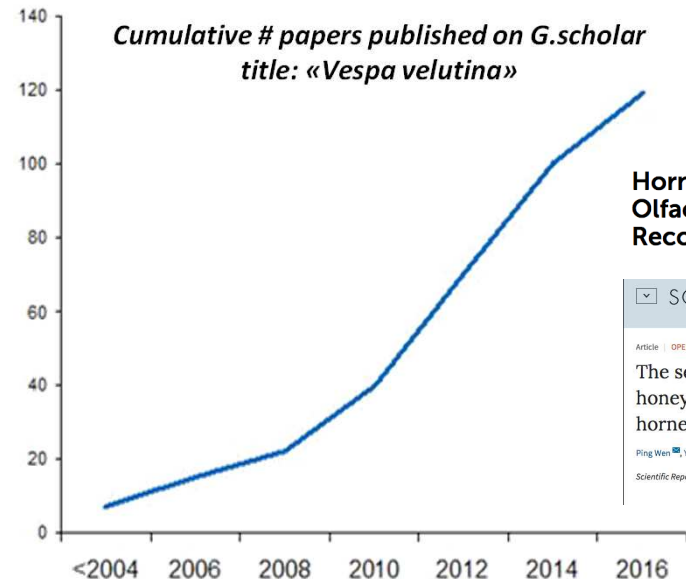
Journal homepage: www.elsevier.com/locate/beproc

Defensive behaviour of *Apis mellifera* against *Vespa velutina* in France: Testing whether European honeybees can develop an effective collective defence against a new predator

Marangela Arca^{1,2,3}, Alexandros Papachristoforou^{1,2,3,4}, Florence Mougel^{1,2}, Agnès Bortolotto^{1,2}, Karine Monceau^{1,2}, Olivier Bonnard^{1,2}, Pascal Tardif¹, Denis Thiéry^{1,2}, Jean-François Silvain¹, Gérard Arnold^{1,2}

Chasing the queens of the alien predator of honeybees: A water drop in the invasiveness ocean

Karine Monceau^{1,2}, Olivier Bonnard^{1,2}, Denis Thiéry^{1,2}



frontiers
in Neuroanatomy

Hornets Have It: A Conserved Olfactory Subsystem for Social Recognition in Hymenoptera?

SCIENTIFIC REPORTS

Article | OPEN | Published: 11 October 2017

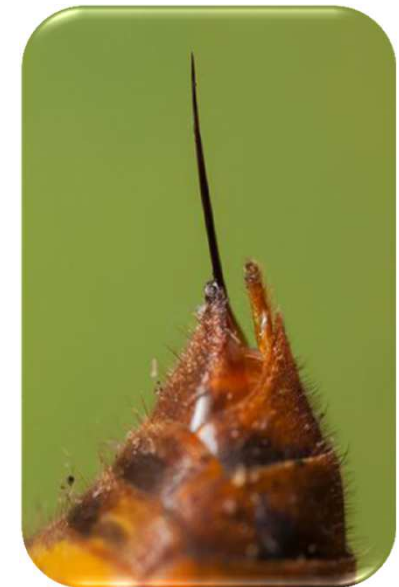
The sex pheromone of a globally invasive honey bee predator, the Asian eusocial hornet, *Vespa velutina*

Ping Wen¹, Ya-Nan Cheng, Shi-Hao Dong, Zheng-Wei Wang, Ken Tan² & James C. Nieh

Scientific Reports 7, Article number: 12956 (2017) | Download Citation &

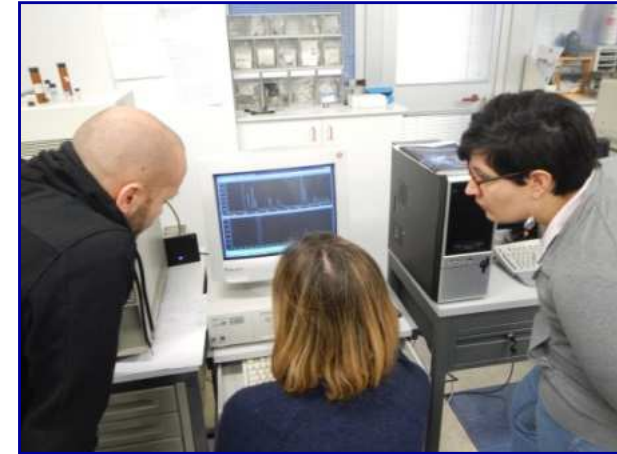
...ever-growing body of knowledge, but still gaps!

- **Lack of reliable estimates of *V. v. nigrithorax* ecological impact** on native pollinators populations and **economic impact** on beekeeping activities (Monceau *et al.* 2014) and **lack of effective methods of control!**



Unifi for ALIEM: research on V. velutina

- a. Competition with native species, ecological impact and resistance to pathogens
- a. Sex attractants for selective mass-trapping
- b. Microbiome V.v. and V. c.



CHEMICAL ANALYSIS (GC-MS)



BEHAVIOURAL ASSAYS



IMMUNE CHALLENGE ASSAYS
MICROBIOME CHARACTERIZATION



ELECTROPHYSIOLOGICAL
APPROACH (EAG e EAD)

Vespa velutina: competition with native species

Competition between the native and the introduced hornets *Vespa crabro* and *Vespa velutina*: a comparison of potentially relevant life-history traits

ALESSANDRO CINI,^{1,*,†} FEDERICO CAPPA,^{1,†} IACOPO PETROCELLI,^{1,†} IRENE PEPICIELLO,¹ LAURA BORTOLOTTI² and RITA CERVO^{1,‡}
¹Dipartimento di Biologia, Università di Firenze, Firenze, Italy and ²CREA - Unità di ricerca di apicoltura e bachicoltura, Bologna, Italy

Immune Challenge -> injection of *E. coli*
-> **bacterial clearance** evaluation

V. crabro = 52

V. velutina = 69

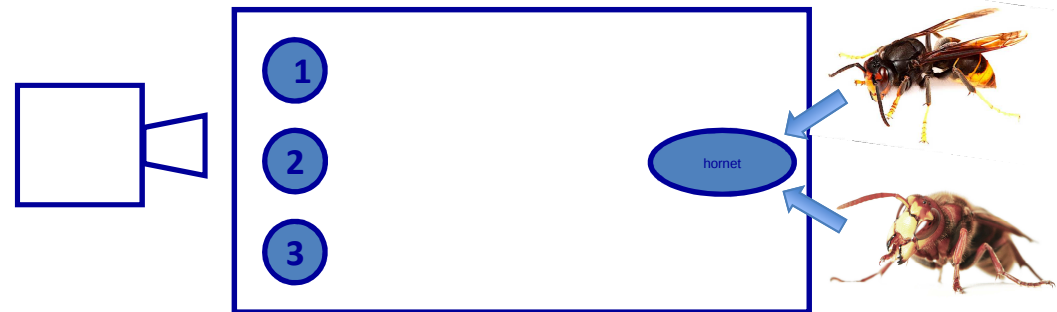


FOOD BAIT

1. Meat, Fish, Honeybee ($V_v = V_c = 31$)
2. Honeybee vs Polistes ($V_v = 34, V_c = 31$)
3. Meat vs Fish ($V_v = V_c = 28$)
4. Honey, Candy, Grapes ($V_v = 34, V_c = 28$)

FOCAL INDIVIDUAL

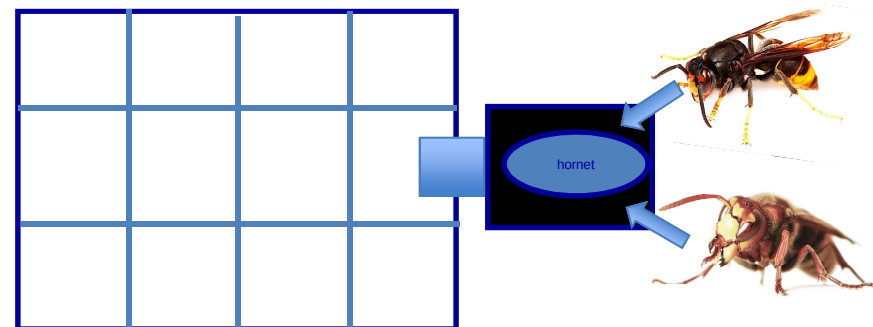
V. Velutina
V. crabro



Boldness/Explorative behaviour

FOCAL INDIVIDUAL

V. Velutina = 22
V. Crabro = 21

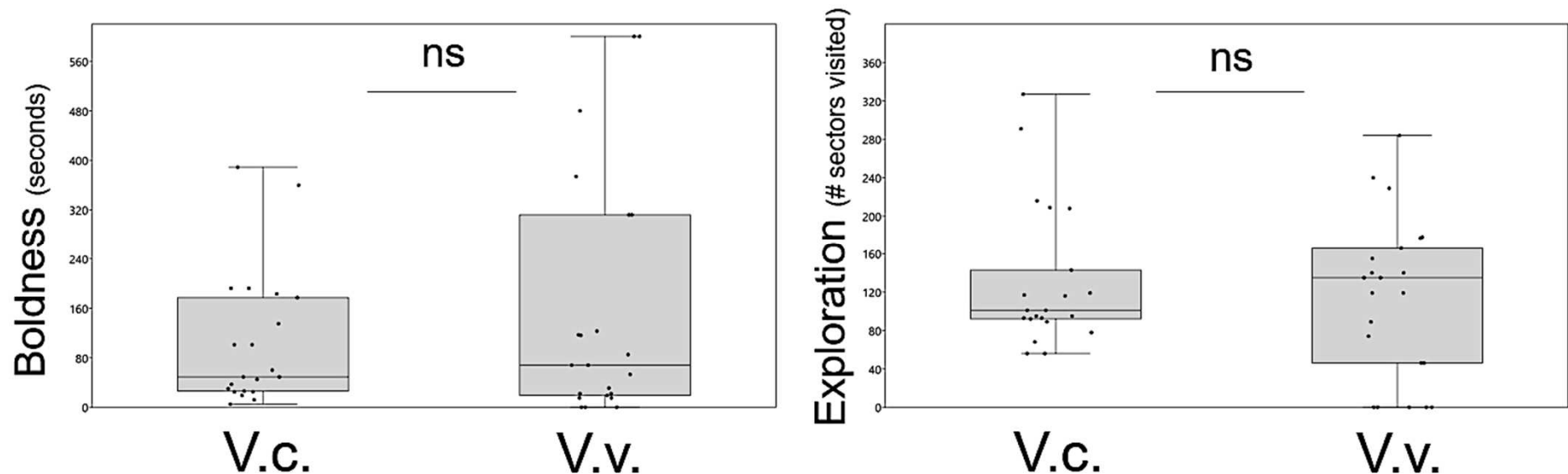


Vespa velutina: competition with native species

Competition between the native and the introduced hornets *Vespa crabro* and *Vespa velutina*: a comparison of potentially relevant life-history traits

ALESSANDRO CINI,^{1,*} FEDERICO CAPPA,^{1,†} IACOPO PETROCELLI,^{1,†} IRENE PEPICIELLO,¹ LAURA BORTOLOTTI² and RITA CERVO¹ ¹Dipartimento di Biologia, Università di Firenze, Firenze, Italy and ²CREA - Unità di ricerca di apicoltura e bachicoltura, Bologna, Italy

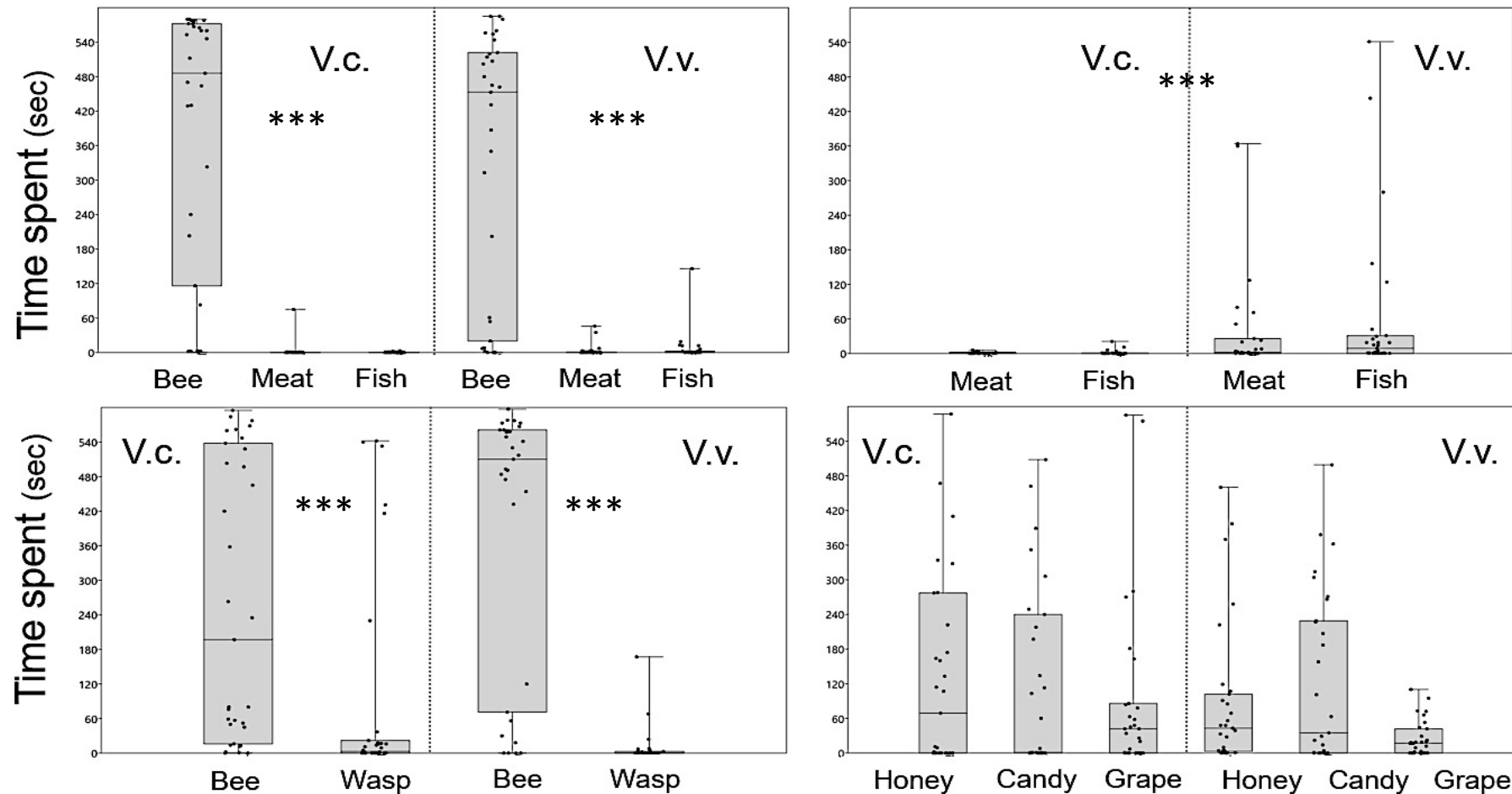
Boldness/Exploration



No difference in *boldness* or explorative behaviour between workers of the two species

Vespa velutina: competition with native species

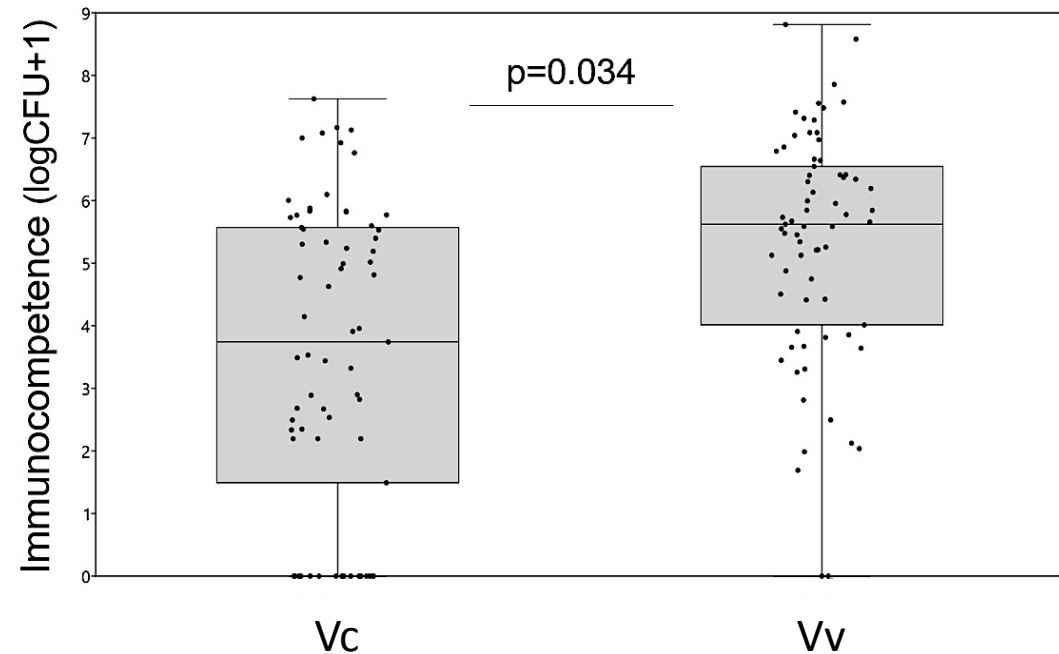
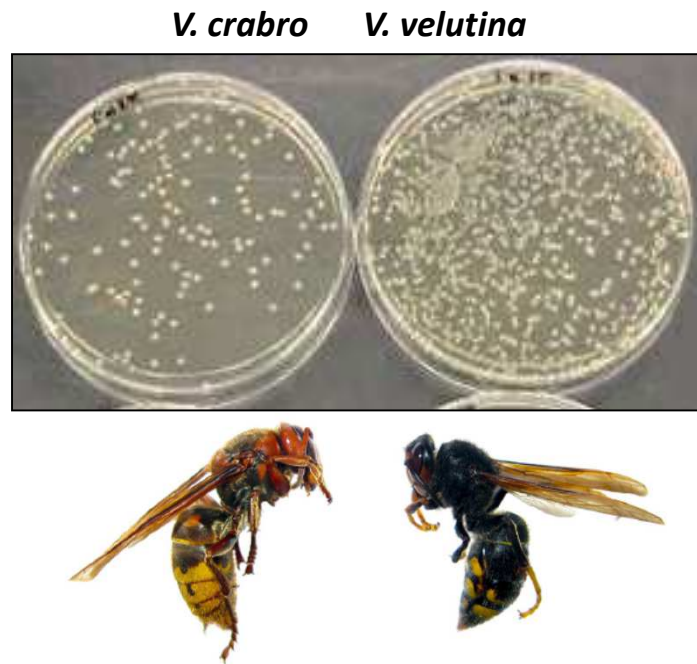
Food exploitation



Marked preference for bee prey in both species. V.v. more generalist in the absence of the preferred prey

Vespa velutina: resistance to pathogens

Pathogen resistance



- **Higher bacterial clearance in *Vespa crabro* workers**
...but opposite trend with sexuals
(males, gynes and spring foundresses)!!!
In preparation

Female body size, weight and fat storage rather than nestmateship determine male attraction in the invasive yellow-legged hornet *Vespa velutina nigrithorax*

FEDERICO CAPPA^{1,2}, ALESSANDRO CINI^{1,2}, IRENE PEPICIELLO¹, IACOPO PETROCELLI¹
and RITA CERVO¹



Stimuli:

Females and Males

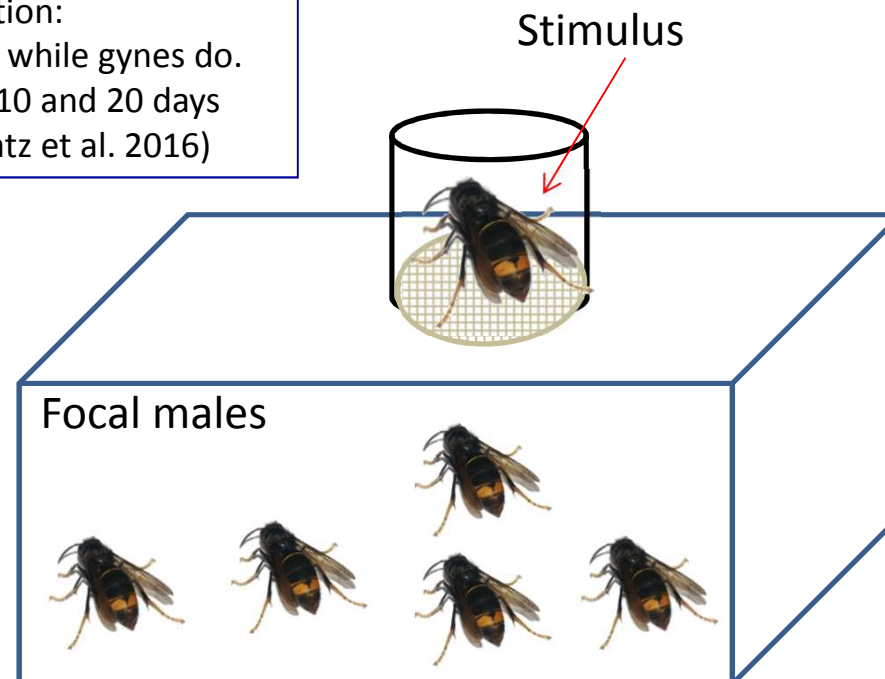
Females:

- Nestmate or non-nestmate
- Workers or reproductives (gynes)

Caste: confirmed by dissection:
workers have no fat bodies while gynes do.

Focal males age: between 10 and 20 days
(sexually mature, see Poidatz et al. 2016)

29 five-male
groups, from 3
colonies, 172 trials
of 10 minutes



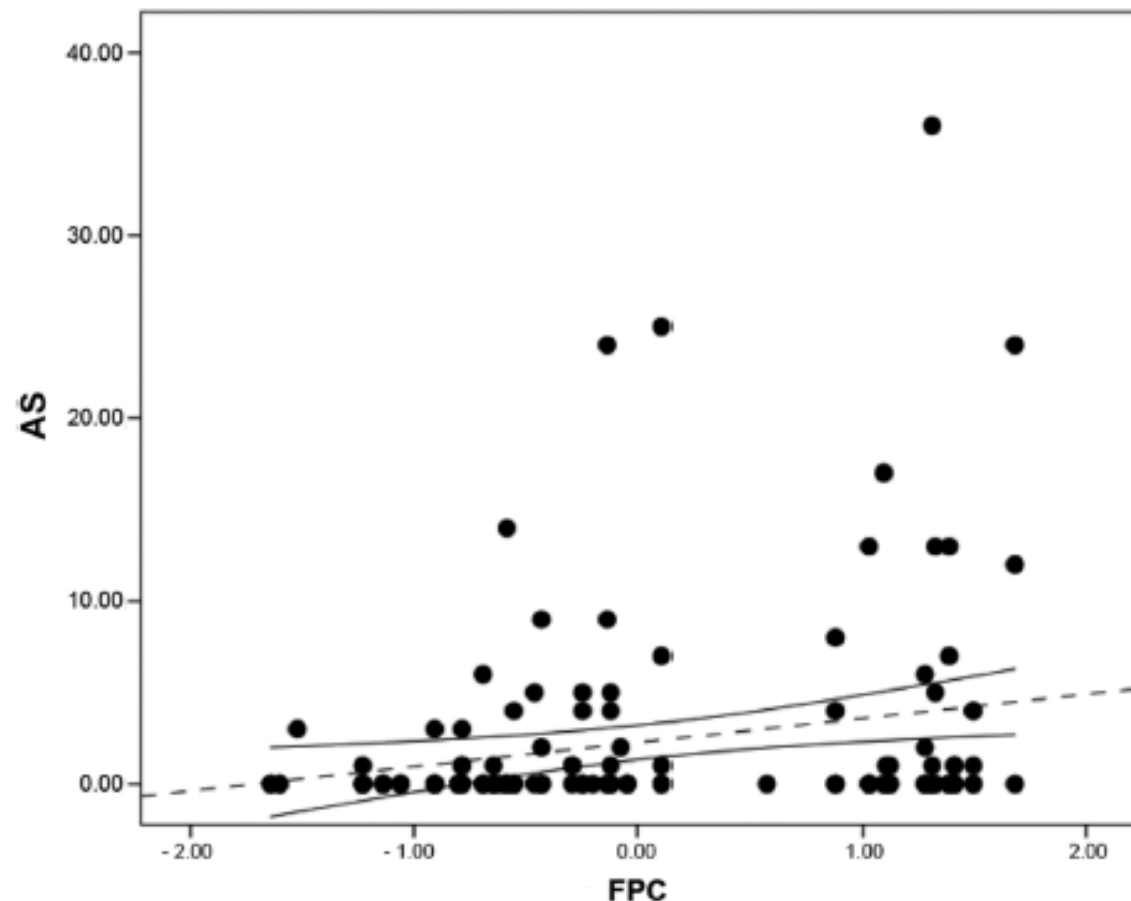
In press, available online

Female body size, weight and fat storage rather than nestmateship determine male attraction in the invasive yellow-legged hornet *Vespa velutina nigrithorax*

FEDERICO CAPPA^{1,2}, ALESSANDRO CINI^{1,2}, IRENE PEPICIELLO¹, IACOPO PETROCELLI¹
and RITA CERVO¹



- males are more attracted to **bigger females** with more **abundant fat storage**, good indicators of female reproductive caste in wasps, **regardless of nestmateship**.



In press, available online

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. F.¹, Anfora G.^{3,4}, Dani F.R.¹,

Bortolotti L.⁵, Wen P.⁶, Cervo R.¹

1) VENOM VOLATILES

Stimuli:

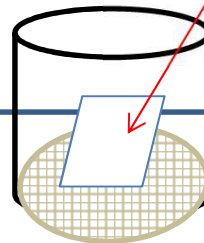
blank control
solvent control DCM
venom reservoir
content of workers
venom reservoir
content of gynes



venom stimuli
suspended into 10 ul of
dichloromethane and
absorbed on a 1x1 cm
filter paper

As volatiles
rapidly
evaporate, trials
lasted three
minutes^[15]
Male behavior
recorded every
30 seconds

Stimulus



sternal gland
secretion
collected with a
tip and absorbed
on a 0.3x0.3 cm
filter paper

Focal males



2) STERNAL GLAND SECRETION

Stimuli:

blank control
solvent control
DCM
synthetic
pheromone
sternal gland
secretion of 1
worker
sternal gland
secretion of 1 gyne

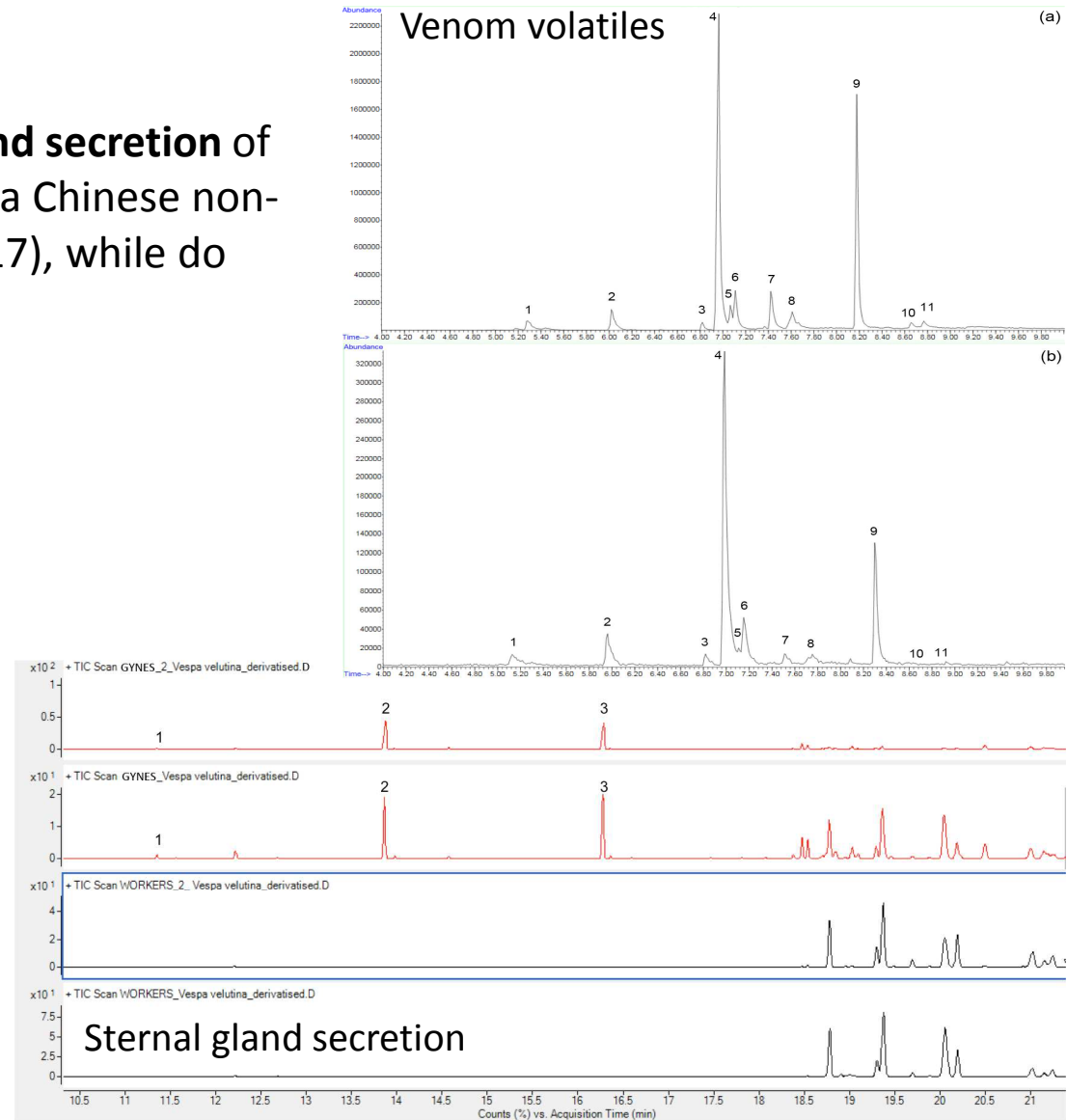
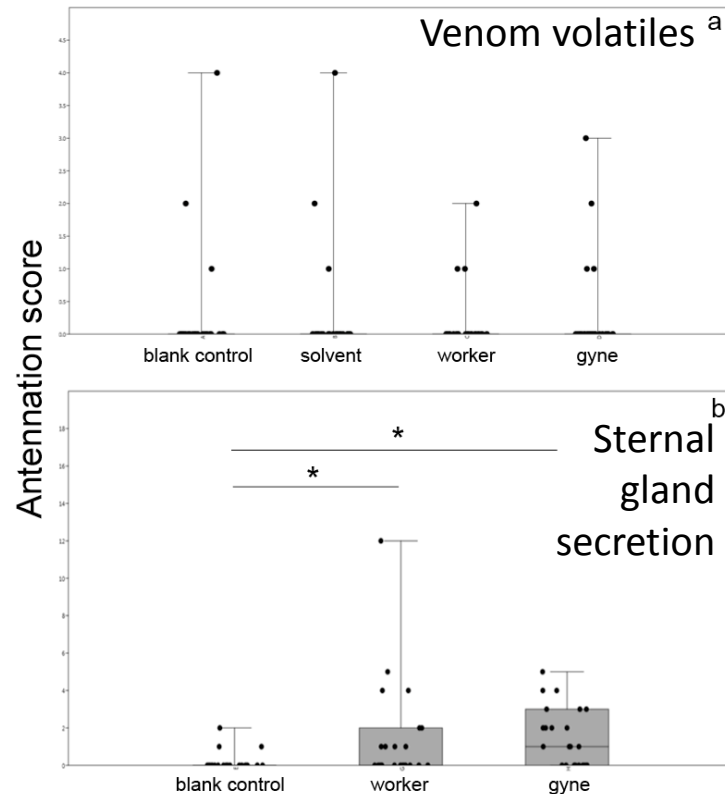
Under review

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. F.¹, Anfora G.^{3,4}, Dani F.R.¹,

Bortolotti L.⁵, Wen P.⁶, Cervo R.¹

- Males **attracted by the sternal gland secretion** of females, as previously observed in a Chinese non-invasive subspecies (Wen et al. 2017), while do not respond to venom volatiles



Under review

Investigating immunocompetence and resistance to parasites in Red Palm Weevil developmental stages and sexes

Cappa F.^{1,*}, Torrini G.², Mazza G.², Inghilesi A.F.¹, Benvenuti C.², Viliani L.¹, Cervo R.¹, Roversi P.F.²

1) Department of Biology, University of Florence, Via Madonna del Piano, 6, I-50019 Sesto Fiorentino, Florence, Italy

2) CREA Research Centre for Plant Protection and Certification, via di Lanciola 12/A, I-50125, Cascine del Riccio, Florence, Italy

Infection of larvae, pupae and adults (males and females) with *E. coli* -> **evaluation of bacterial clearance**



Infestation of larvae and adults (males and females) with 2 species of parasitoid nematodes -> **evaluation of mortality and parasitoid progeny**

- 1) Larvae more resistant than adults to pathogen and parasitoids
- 2) Female more resistant than males to parasitoids

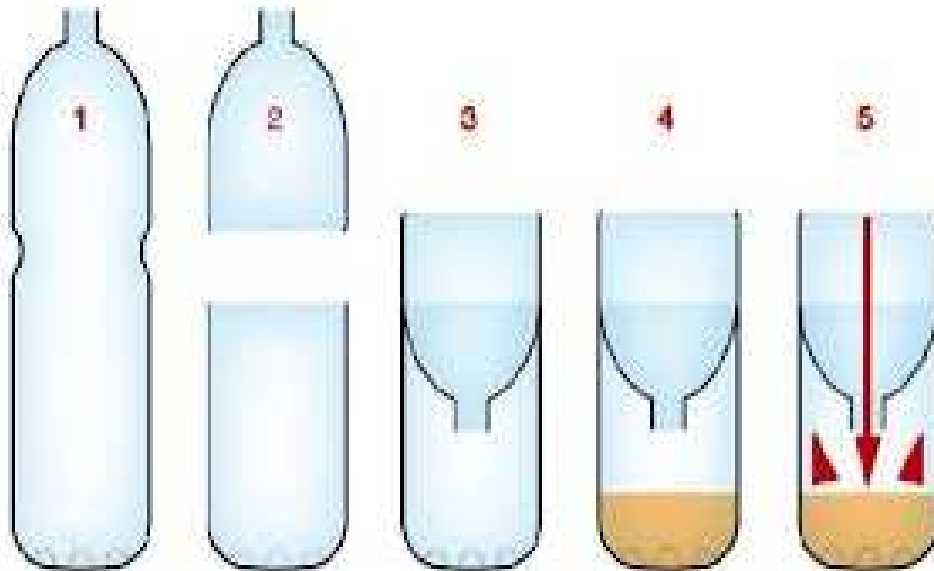
In preparation

Monitoraggio e Trappolaggio

- Uso di bottiglie munite di TapTrap®

<http://www.taptrap.com/IT/default.aspx>

- Trappole fai-da-te



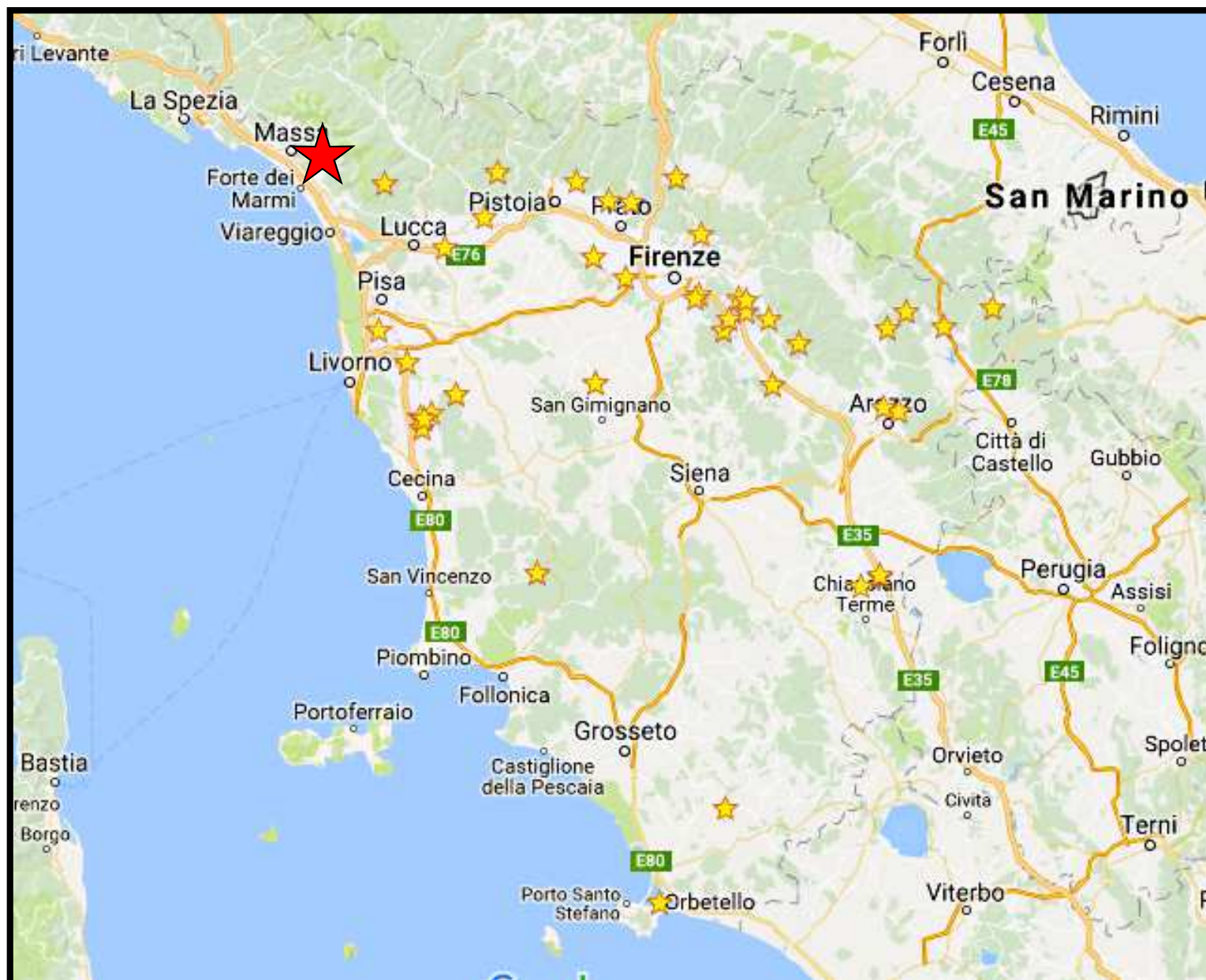
<http://www.stopvelutina.it/richiedi-una-trappola/>

Trappole riempite con contenuto di una **lattina di birra chiara (33cl, 4.7% di alcool)**

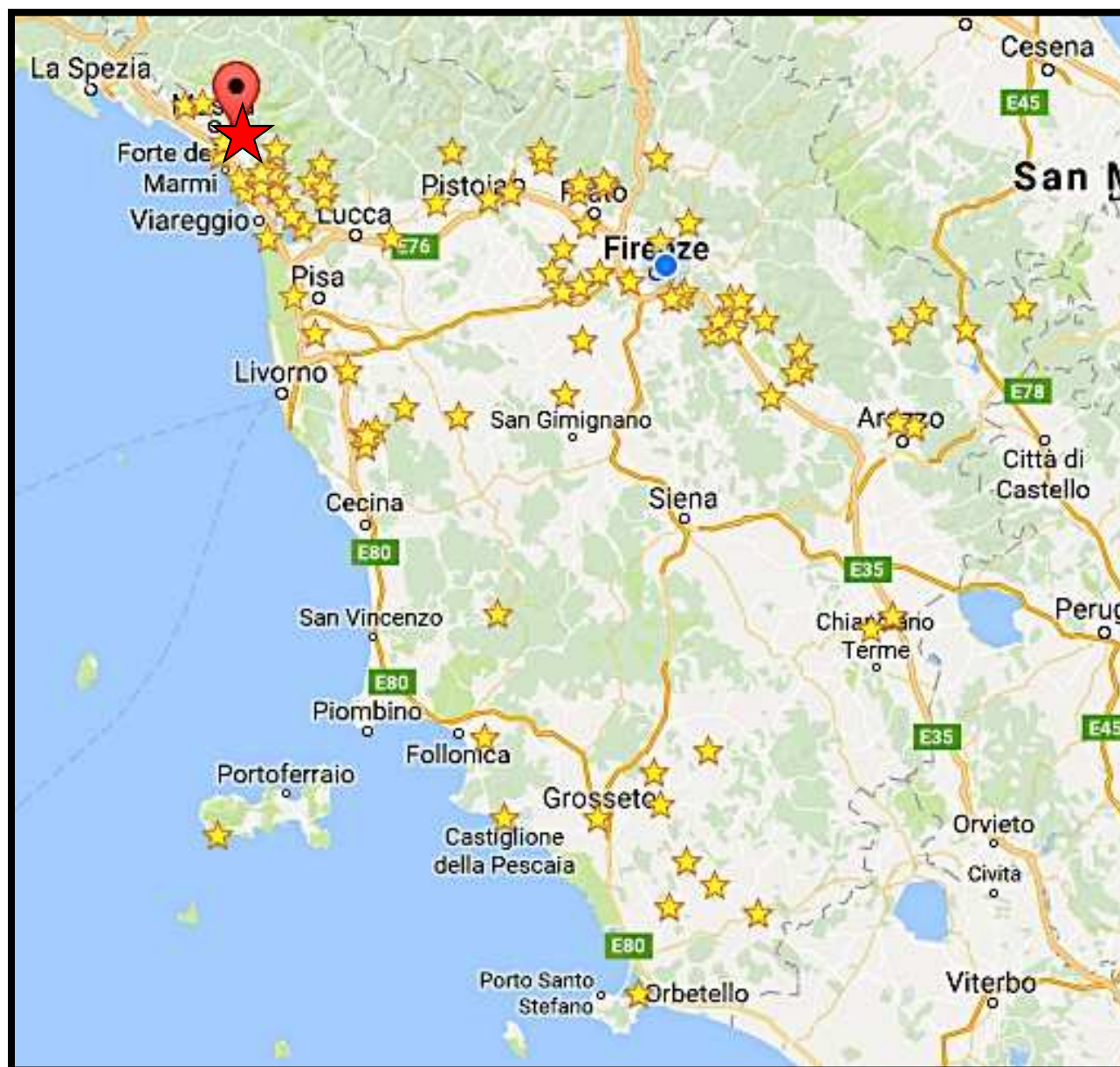
Controlli cadenza **quindicinale:**

- Sostituzione birra
- Valutazione presenza-assenza *Vespa velutina*
- Conteggio numero calabroni (*V. velutina* + *V. crabro*) presenti

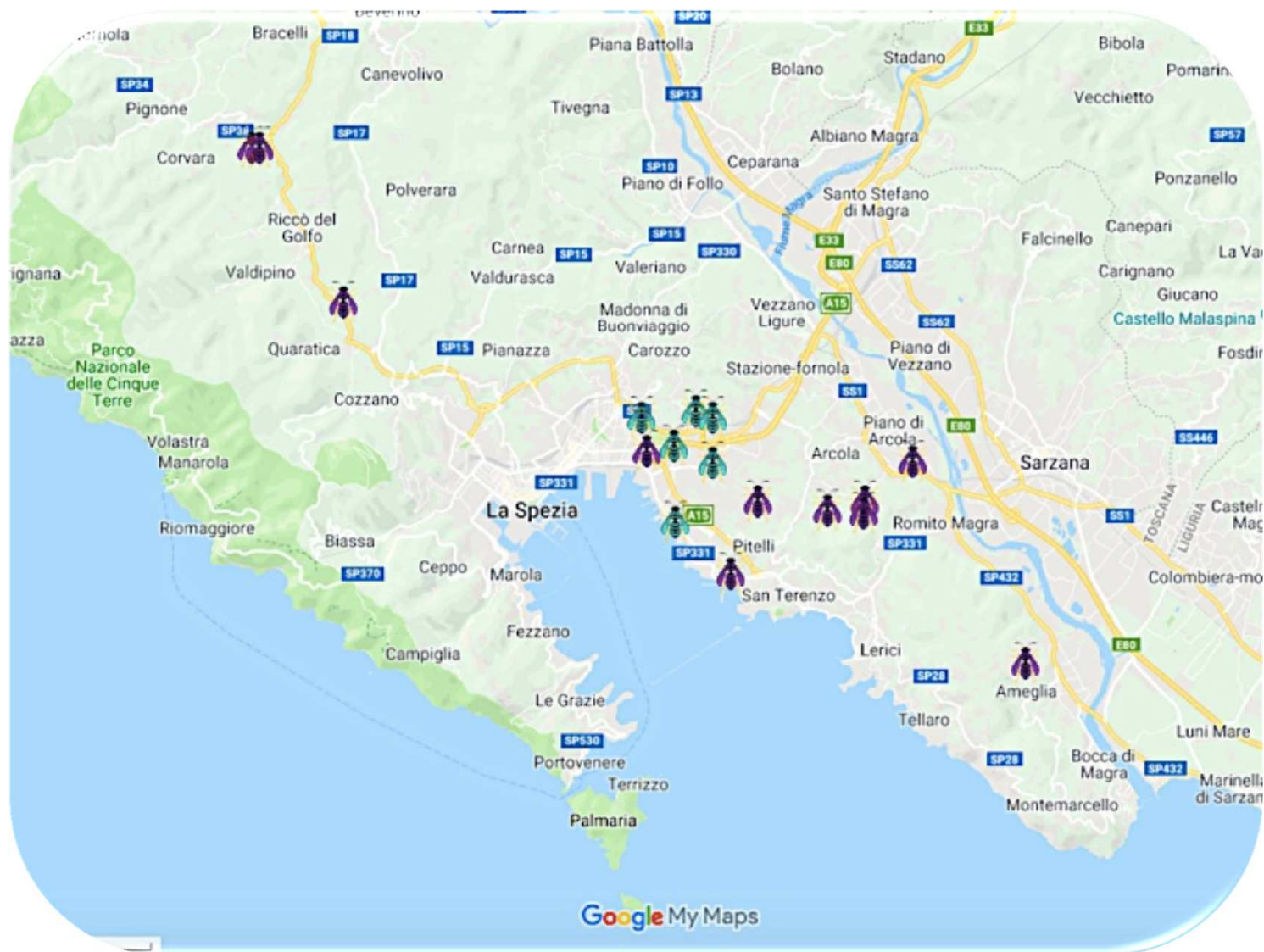
Rete monitoraggio ALIEM Toscana 2017



Rete monitoraggio ALIEM Toscana 2017



Monitoraggio 2018



Database insetti alieni della Regione Toscana

- Sviluppato in occasione del progetto **ALT – Atlante specie alloctone in Toscana** (relazione finale Tricarico et al. 2012)
- Distribuzione a livello regionale di alcune specie selezionate (e.g. *Rhynchophorus ferrugineus*, *Gonipterus scutellatus*, *Stenopelmus rufinasus*)
- Pubblicazione scientifica (Inghilesi et al. 2013) e

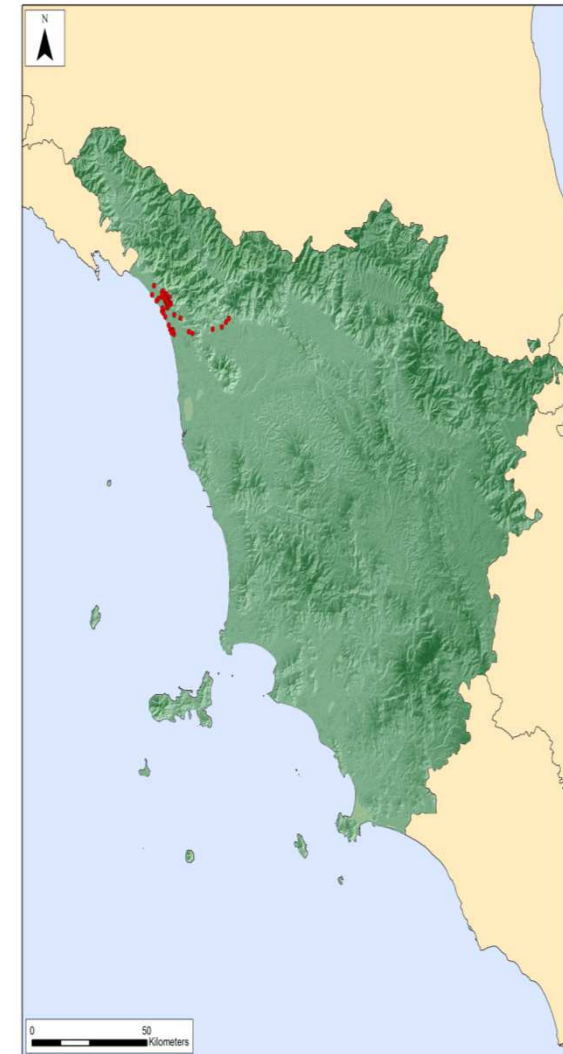
Journal of Insect Science: Vol. 13 | Article 73

Inghilesi et al.



Alien insects in Italy: Comparing patterns from the regional to European level

Alberto F. Inghilesi^{1a*}, Giuseppe Mazza^{1b}, Rita Cervo^{1c}, Francesca Gherardi¹, Paolo Spissimo^{2d}, Elena Tricarico^{1e}, Marzio Zapparoli^{3f}



Distribuzione di *Rhynchophorus ferrugineus* aggiornata a marzo 2012, così come riportato nella relazione finale di ALT (adesso la specie è distribuita praticamente lungo tutta la costa tirrenica)

GRAZIE

