IS *VESPA VELUTINA* A TREATH TO WILD BEE COMMUNITIES AND POLLINATION ECOSYSTEM SERVICE?

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Introduction:

Worldwide, scientists are reporting a decrease of wild bees as consequence of human land use. Wild bees provide pollination ecosystem service and their decrease could threaten the pollination efficiency. Further impact on wild bee communities could be caused by interactions with invasive alien species, however this issue have been poorly studied. Under the EU funded LIFE STOPVESPA project, a study was performed since 2016 on the status and trends of wild bee communities in Liguria region (Italy) in order to evaluate the presence of any *V. velutina* impacts on wild bees.

Who is *Vespa velutina*?

Vespa velutina, or yellow-legged hornet, preys on honeybees (*Apis mellifera*) and other insect species to feed its brood. This alien hornet behaves as invasive species in Europe and may causes loss to beekeeping industry and to biodiversity in natural fields. *V. velutina* is organized in annual colonies and the predation intensity grows at the same rate of the colony.

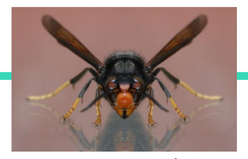

Fig.1 Vespa velutina

Objectives of the study:

- **Comparing the status of wild bee communities** in *V. velutina* **invaded** area **vs.** communities **without the presence of the hornet**;
- assessing **which wild bee species could be more affected** by *V. velutina;*
- reporting **whether biodiversity loss due to *V. velutina* have occurred** in the study areas.

Results:

Wild bee status:

- In this study, 1677 wild bee specimens were collected and divided between 182 morpho-species; 25 new species for Liguria region are reported, of these ***Andrena (Agandrena) asperrima*** was never previously found in Italy.

New species for Liguria (Italy):

Andrenidae
Andrena (Agandrena) asperrima PÉREZ 1895
Andrena (Charitandrena) hattorfiana (Fabricius, 1775)
Andrena (Chlorandrena) nigroolivacea Dours, 1873
Andrena (Chlorandrena) taraxaci Giraud, 1861
Andrena (Chrysandrena) fulvago (Christ, 1791)
Andrena (Euandrena) vulpecula Kriechbaumer, 1873
Andrena (Hoplandrena) rosae Panzer, 1801
Andrena (Plastandrena) bimaculata (Panzer, 1789)
Andrena (Proxiandrena) proxima (Kirby, 1802)
Panurgus (Panurgus) dentipes Latreille, 1811
Apidae
Ceratina dentiventris Gerstaecker, 1869
Eucera nigrescens Pérez, 1879
Colletidae
Colletes hederae Schmidt & Westrich, 1993
Hylaeus (Lambdopsis) annularis (Kirby, 1802)
Halictidae
Halictus (Monilapis) simplex [Halictus] Blüthgen, 1923
Halictus (Seladonia) seladonius (Fabricius, 1794)
Lasioglossum (Evylaeus) malachurum (Kirby, 1802)
Lasioglossum (Evylaeus) punctatissimum (Schenck, 1853)
Lasioglossum (Evylaeus) puncticolle (Morawitz, 1872)
Lasioglossum (Lasioglossum) discum (Smith, 1853)
Lasioglossum (Lasioglossum) lativentre (Schenck, 1853)
Lasioglossum (Lasioglossum) xanthopus (Kirby, 1802)
Megachilidae
Chelostoma (Foveosmia) distinctum (Stoeckhert, 1929)
Megachile (Callomegachile) sculpturalis Smith
Stelis (Stelis) breviuscula (Nylander, 1848)

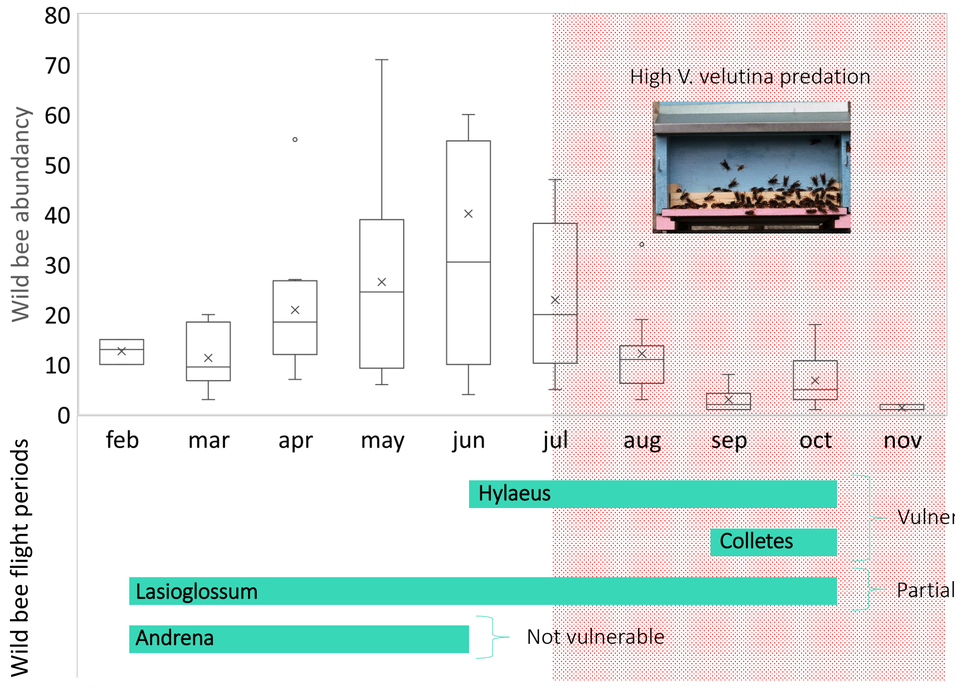

Fig.2 Wild bees abundancy and threatened species in relation to V. velutina colony dimension

Which wild bees species could be more affected by *V. velutina*?

- Wild bee abundancy and Shannon index have a peak in June when *V. velutina* predation is low (Fig. 2 and Fig. 3). Wild bee abundancy has a further increase in October however Shannon index remains low. **Wild bee species with late summer flight period** appear as the most threatened by *V. velutina* (Fig. 2). We suppose that the impact will be displaced on few species because of the low Shannon index during late summer.

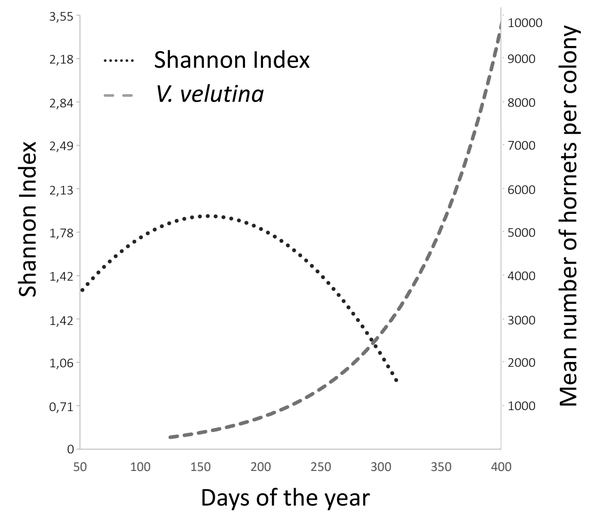

Fig.3 Shannon index curve and V. velutina population growth throughout the season

Have biodiversity loss occurred due to *V. velutina*?

- Rarefaction curves show that the species richness is similar in the study areas with the exception of area C (Fig. 4). We did not found richness differences between *V. velutina* invaded/not invaded areas;
- GLM models did not show any effect on wild bee abundancy due to *V. velutina* predation. The studied communities show high variability considering the short time survey. Longer time series data could identify any *V. velutina* impact on pollinators.

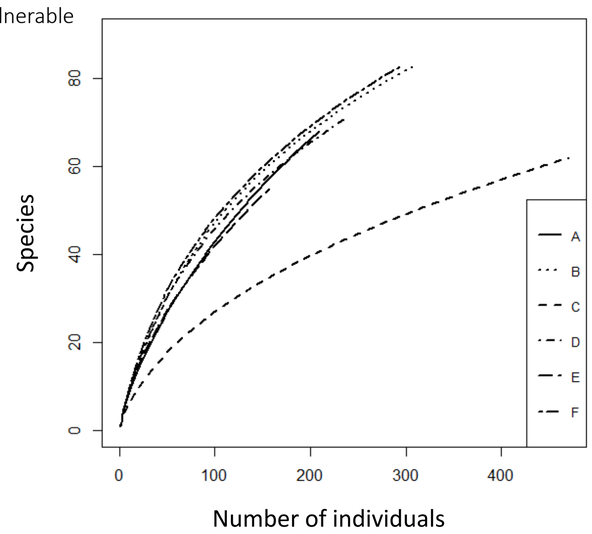

Fig.4 Rarefaction curves of the six study areas

Methods:

***Vespa velutina* colony activity:**

A total of 57 nests of *V. velutina* were collected during years 2015 - 2016 in Liguria (Italy). The number of hornets per colony (N) was estimated using the formula:

$$N = 10,19\,R^2 - 158,17\,R + 873,35$$

R: diameter of the largest comb (Rome *et al.* 2015).

The following assumption has been formulated: a greater N corresponds to higher predation intensity.

Data analysis:

- Rarefaction curves were created for each study area in order to compare species richness;
- curves of the trends throughout time were created using *V. velutina* colony data and wild bee community Shannon index;
- GLM models with wild bee abundancy as response variable and *V. velutina* presence, environmental factors and season were implemented.

Bee sampling: Wild bees were collected every 20 days between March and November using a pan-trap protocol in 6 areas (A-F) (Fig. 5). 23 monitoring sessions were performed in 2016 and 2017. The areas have different yellow-legged hornet nest densities. The wild bees have been identified at species or morpho-species level.

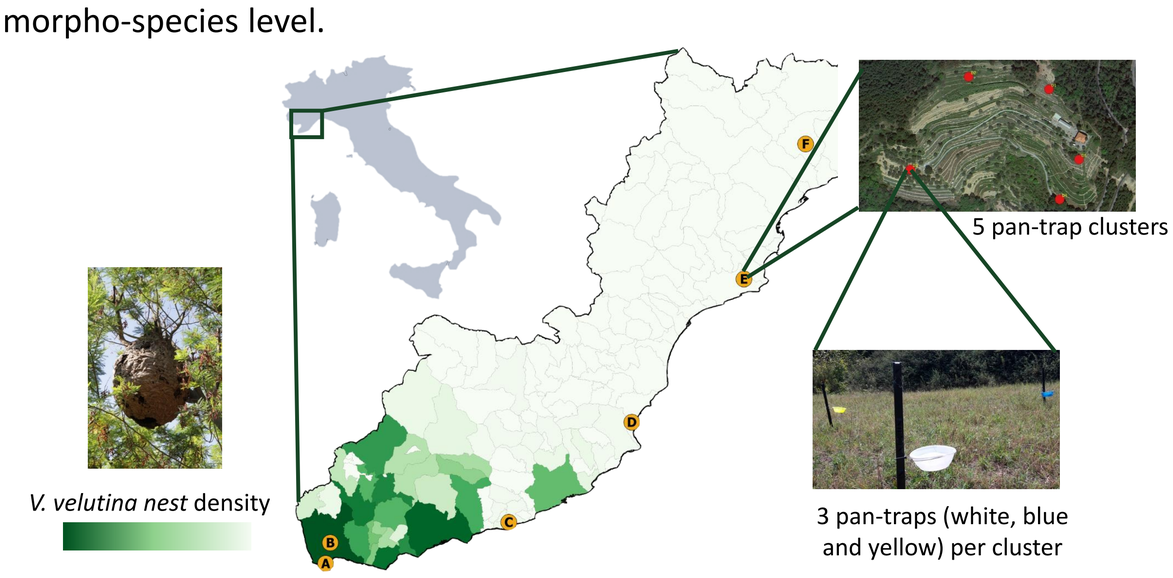

Fig.5 Sampling method

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