

VESPA VELUTINA, IN EUROPE: IMPACT ON HONEY BEES, MONITORING, SENSITIVITY AND LIMITS OF DETECTION AND CONTROL METHODS

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The Yellow-legged hornet, *Vespa velutina nigrithorax*, originates from eastern temperate to subtropical zones of Asia (Villemant et al., 2011); it was unintentionally introduced in France before 2004 (Haxaire et al 2006) via the importation of Chinese pottery for horticulture (Arca et al 2015).

Bees being one of its main preys, this hawking hornet is an additional threat to European beekeeping that already suffered multiple decline factors. It is of great concern among public authorities and beekeepers because of its rapid multiplication and high impact on bee colonies. More than direct predation on honey bees (Perrard et al 2009), its main impact is due to its hawking behavior that disrupts bee foraging activity (Monceau et al 2013; Arca et al 2014) and leads the most fragile colonies to die from depletion in the following winter.

As a result of this nuisance, the Asian hornet was classified in France as Health Hazard of Second Category and Invasive Alien Species (IAS) and IAS of concern to the European Union (Commission Implementing Regulation (EU) 2016/1141, 13 July 2016). Surveillance, prevention and control measures have been subsequently defined.

In France, the spread of *V. velutina* has been followed for twelve years using a monitoring protocol based on citizen warning and local networks: today, the hornet invasion extends in almost all French territory and reached the neighboring countries (Spain, Portugal, Italy, Germany, Belgium and Great Britain) (<http://frelonasiatique.mnhn.fr/home>), progressing at a rate of about 60 km per year (Rome et al. 2013; Robinet et al. 2016). Also introduced in South Korea in the early 2000s, it arrived in Japan in 2015 (Kishi and Goka 2017).

We described here the monitoring data validation protocol used to reliably confirm the locations where *V. velutina* is able to establish. We also show how these presence data registered in the INPN database (INPN 2003) are used to make predictions on hornet expansion (Villemant et al 2011; Barbet-Massin et al 2013) and evaluate the effectiveness of control methods.

We finally go around the detection and control methods currently used to struggle this species and discussed their sensitivity and limits.

Keywords: Invasive Alien Species; monitoring; detection; prevention; control