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Do UK efforts to prevent establishment and understand impacts of ***Vespa velutina*** offer insights for elsewhere in Europe?

Bieten die britische Bemühungen zur Verhinderung der Ansiedlung und zum Verständis der Auswirkungen von ***Vespa velutina*** Erkenntnisse für andere Teile Europas?

UK biosecurity policies

- Government policies addressing animal, plant, and bee health (i.e. relevant to economic sectors) have existed for many decades.
- In contrast, UK policies addressing invasive alien species (IAS) are relatively recent.
- How a species is classified as an IAS rather than an e.g. animal pest is not always clear but can have implications for which authority takes responsibility for its control and budgets available.

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Small hive beetle (***Aethina tumida***)
- a free-living predator / scavenger
- diet = ***Apis***, ***Bombus*** and ***Melliponini*** spp.
- classed a bee health pest

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Asian hornet (***Vespa velutina***)
- a free-living predator
- diet = diverse; preference for ***Apis*** spp.
- classed an IAS

GB annual expenditure on biosecurity

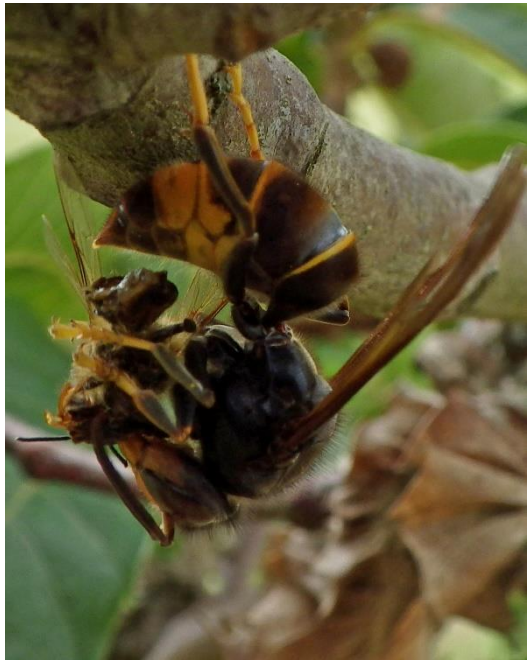
Biosecurity sector	Spend (£ million)	% Spend
Animal health	200.0	91.2
Plant health	13.2	6.0
Aquatic animal health	3.1	1.4
Bee health	2.2	1.0
Invasive Alien Species	0.9	0.4
Total	219.4	

House of Commons (2019) EAC– Invasive Species

GB - IAS strategies

- Globally, introductions of non-native (alien) species predicted to rise by ~35% between 2005 and 2050 (Seebens ***et al***., 2020). Approx. 10% of these likely to be invasive.
- In Great Britain, 2,016 non-native (alien) species have established; 187 of these are considered invasive. Long term trend judged as "deteriorating".
- Defra reviewed their policies on IAS in 2003, soon after the United Nation's Convention on Biological Diversity (CBD) implemented article 8(h) …
  "***recognizing that invasive species represent one of the primary threats to biodiversity***".
- Led to the formation of the GB Non-Native Species Secretariat.
  - Develop GB – IAS strategies (2008, 2015, 2023).
  - Assess risk and prioritise actions.
  - Identify agency responsible for an IAS.
  - Develop education and awareness strategies.
  - Establish adequate monitoring and surveillance.
- In 2019, House of Commons EAC critical of UK Government.

V. velutina RA & contingency plan



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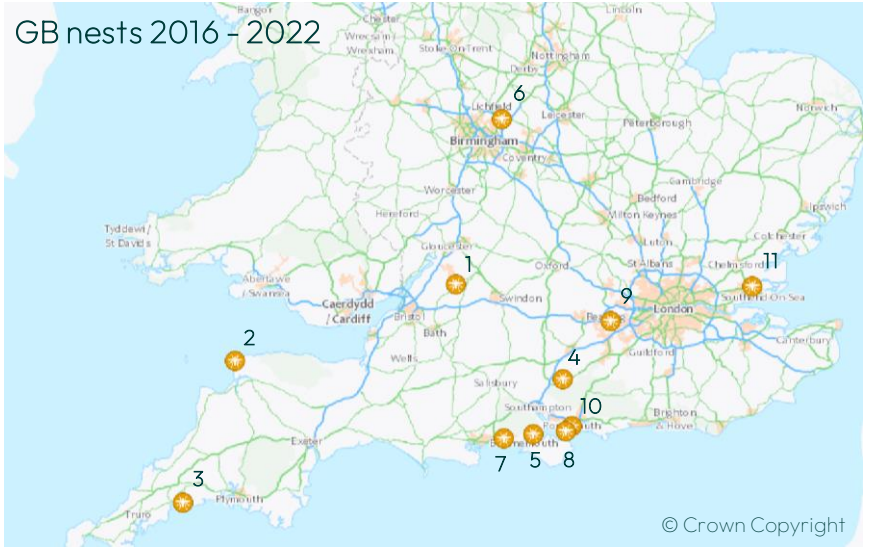
- Great Britain published its IAS risk assessment (RA) for ***Vespa velutina*** in 2011.
- It concluded that V. velutina was:
  - highly likely to enter GB via multiple routes.
  - highly likely to establish in GB.
  - once established, it would spread rapidly.
  - it would impact honey bees and beekeeping, as well as unmanaged pollinators and fruit production.
  - unlikely methods could be deployed to prevent introductions.
- Consequently, a contingency plan was developed in 2012 (well before Asian hornets arrived in GB) that emphasised early detection and rapid eradication.
- The contingency plan specified roles, responsibilities and a clear hierarchy for decision making.

Arrival of ***V. velutina*** in GB

- 1st reported in GB in September 2016 in Tetbury, Gloucestershire. The nest was found after 10 days of intensive searching by NBU and APHA staff.
- Much learned from the experience.
- Methods have been constantly refined and contingency plan revised in 2017 & 2023.
- Since 2016, typically takes 2-3 days to locate a nest, after foraging activity in a locality had been confirmed.
- In UK, only NBU & APHA staff are permitted to release caught Asian hornets to track and locate their nest.



1. 2016 Tetbury
2. 2017 Woolacombe
3. 2018 Fowey (2 nests)
4. 2018 New Alresford
5. 2018 Brockenhurst
6. 2019 Drayton Bassett
7. 2019 Christchurch (2 nests)
8. 2020 Gosport
9. 2021 Ascot
10. 2021 Portsmouth
11. 2022 Rayleigh

Plus 13 other single hornet sightings unrelated to a UK nest.

Development of tracking methods

- Most nests are located by use of bait stations, observing departing flightlines and timing return visits.
- Such efforts have also benefited from the development of a GIS 'Track & Trace' phone app.
- A 2017 Defra-funded pilot study resulted in the radio-tracking method to locate nests (Kennedy ***et al.*** 2018).

  See training manual: http://hdl.handle.net/10871/133513.

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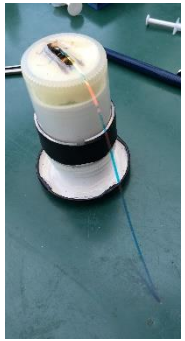

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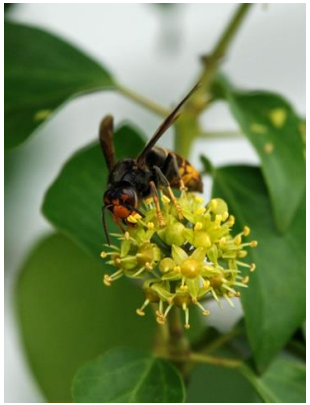
Review of potential impact

- Kennedy & Osborne (2019) conducted a literature review and questionnaire of stakeholders assessing the impact of ***V. velutina*** in countries where it is invasive and established.
- Requier ***et al***. (2019) built on Univ. Exeter's BeeHave individual-based honey bee model to understand how ***V. velutina*** influence honey bee foraging behaviour and affect colony survival.
- Rojas-Nossa ***et al***. (2023) demonstrated how the presence of ***V. velutina*** on ivy could disrupt pollinator assemblages and influence ivy seed set.
- O'Shea-Wheller ***et al***. (2023) discovered that ***V. velutina*** are attracted to bumblebee colonies, hawk at their entrances and attempt to predate individuals.
- Pedersen ***et al***. (in prep.) – a study of ***V. velutina*** diet based on samples from >100 nests from Spain, France, Channel Is. & UK.



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Early detection is key

- Critical to the UK rapid response strategy is the early detection of ***V. velutina*** at a location. This relies heavily on the public and beekeepers being aware of this invasive hornet, noticing its presence and reporting it to appropriate authorities.

- Phone app: 'Asian Hornet Watch'.
  Email: alertnonnative@ceh.ac.uk
  N.B. a photograph to enable submitted reports to be verified.
- Annually, > 6000 sightings are submitted but < 0.1% are confirmed as ***V. velutina***. The most common insect confused with it is ***V. crabro***, followed by ***Voluzella zonaria*** and ***Urocerus gigas***.
- Credible sightings are forwarded by experts at the UK Centre for Ecology & Hydrology to the National Bee Unit (NBU) to investigate.
- Once located, destruction of the nest is conducted by APHA's specialist Wildlife Team. The nest is collected and analysed to determine the presence of sexuals and relatedness to other nests.

Role of associations & AHTs

- Beekeeping associations in the UK have been concerned about
  V. velutina since its arrival.
- Association quickly setup Asian Hornet Teams (AHTs) made up of beekeeper who spent more time learning about this invasive predator.
- The 148 AHTs perform critical additional support:
  - Raising awareness of V. velutina and its impact amongst the public
  - Assisting the public and beekeepers with ID of this insect
  - Providing local support / knowledge for NBU inspectors.
- The British Beekeeping Association also run awareness campaigns:
  - An annual Asian Hornet Week awareness & media campaign.
  - Awareness advertising on backs of buses.

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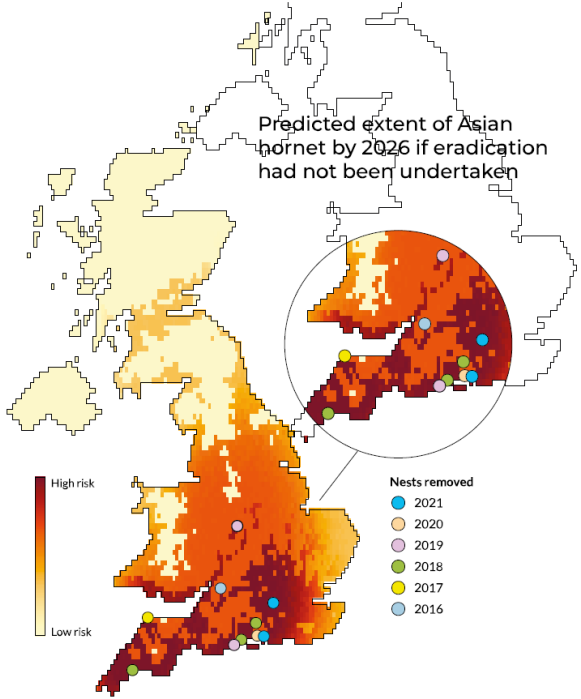
Predicted spread if no control



Defra (2023) GB Invasive Non-Native Species Strategy 2023-2030
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- Keeling ***et al***. (2017) used a model to estimate the spread of ***V. velutina*** had the first nest in 2016 not been discovered before gynes (new queens) dispersed.
- They predicted 129 nests concentrated within ~100 km radius of Tetbury within 5 years. Within 10 years, > 50,000 nests with densities in some regions > 5 nests per km^2.
- UK Centre for Ecology and Hydrology ran a different model to predict the spread of ***V. velutina*** by 2026 if the eradications of nests between 2016 – 2021 had not been performed.
- Given the low no. of nests located to end 2022 and the lack of evidence for an established population, the UK Government have considered their strategy a success.

Situation in 2023

- 64 Asian hornet nests have been located this year in 49 locations. (5x total no. nests in all previous years)
- 1st sighting (5 April): a queen imported in a cauliflower from France, only discovered when the vegetable was prepared as animal feed in a Northumberland zoo.
- Earliest nest to date was found on 22 June 2023 in Dover, Kent.
- Nests were discovered as far north as Yarm, North Yorkshire, and as far west as Plymouth, Devon.
- The majority (~40) nests were found in Kent, esp. around Dover & Felixstowe and along transit routes.
- Results from genetic assessments of the nests are eagerly anticipated.

Lessons learned

- Important to have plans in place before Asian hornets arrive in a region.
- Clear allocation of responsibilities, roles, lines of communication and budgets for all response activities in advance.
- Continual efforts to raise awareness and improve recognition of Asian hornets amongst the public, stakeholders (esp. beekeepers), travellers, importers, distributors, and environmental NGOs.

- Public vigilance augmented by developing automated AI-based Asian hornet detectors.
- Well-understood, simple to use and effective reporting mechanisms.
- Trained & funded personnel experienced in locating Asian hornet nests quickly.
    - *Qu: How long until NBU inspectors will be overwhelmed?*
- As Asian hornets spread across Europe, propagule pressure via trade & tourist links is likely to increase. Crucial to articulate new plans in advance of move to containment.

Acknowledgements

- Prof. Juliet Osborne (University of Exeter)
  - co-author of "A review of the success of the UK strategy to tackle the invasive ***Vespa velutina***, the Asian hornet"; http://hdl.handle.net/10871/133510.
- Dr. Belinda Phillipson (Bee Health Policy Lead, Defra)
- Nigel Semmence (Contingency Planning and Science Officer, APHA-NBU)