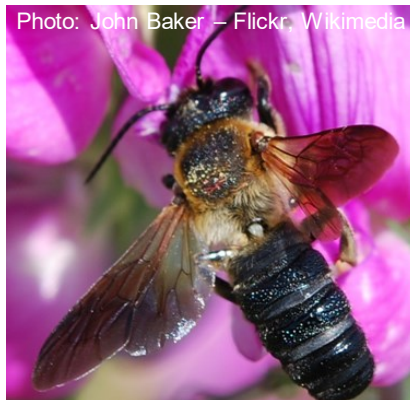


Photo: John Baker – Flickr, Wikimedia



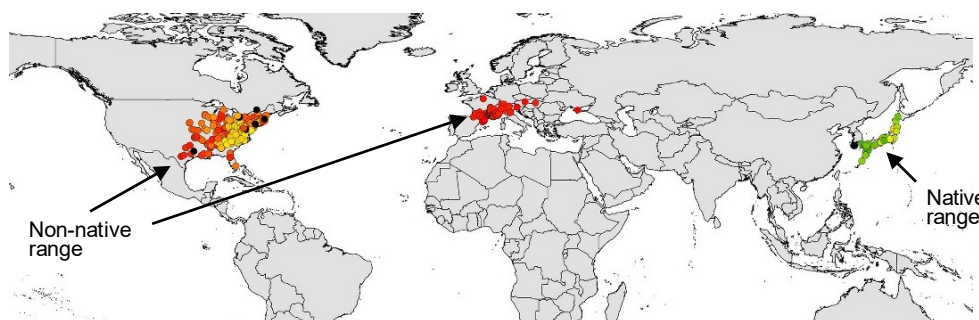
Giant Resin-bee (*Megachile sculpturalis*)

- A large (up to 25mm long), obvious bee, from eastern Asia.
- Has spread rapidly in Europe since it was detected in 2008. Also invasive in North America since introduction in the early 1990s.
- Nests in wood cavities, potentially introduced with wood and wood products.
- Conditions would be suitable for establishment and rapid spread in GB, climate change could exacerbate this.
- May outcompete native cavity nesting bee and wasp species, though none that are threatened.

History in GB

This species is not yet present in GB. This risk assessment was commissioned after the rapid spread of the species in continental Europe since it was detected in France in 2008. It is now found in at least 10 territories in Europe (Austria, Crimea, France, Germany, Hungary, Italy, Liechtenstein, Slovenia, Spain, Switzerland). Introduced to North America in 1990s and now found in most states.

Current Distribution



GB Distribution

Not yet present in GB

From: Polidori and Sánchez-Fernández (2020). <https://doi.org/10.1016/j.gecco.2020.e01365>.

Impacts

Environmental (minor, medium confidence)

- An aggressive competitor for nesting cavities in wood or plants.
- The most likely impact is therefore to outcompete native stem-nesting species, including some native *Osmia* and *Megachile* species, as well as the Wool-carder Bee (none of which are Endangered or Near Threatened in GB).
- Has potential for other impacts, including disrupting native pollinators and potentially acting as a carrier of pests or pathogens; although these are not considered significant.

Economic and Social (minimal, high confidence)

- There is no evidence of negative economic or social impacts elsewhere in this species range.

Introduction pathway

Imports of wood (e.g. pallets, seasoned timber), cavities of which it uses to nest.

Deliberate (illegal) introduction is possible.

Natural dispersal from Europe is unlikely, but could occur if populations establish in northern Europe.

Spread pathway

Natural: capable of rapid natural spread, c. 100km per annum in France.

Summary

	Response	Confidence
Entry	LIKELY	HIGH
Establishment	LIKELY	HIGH
Spread	RAPID	MEDIUM
Impact	MINOR	MEDIUM
Overall risk	LOW	MEDIUM

GB Non-native Species Rapid Risk Assessment (NRRAP)

Rapid Risk Assessment of: *Megachile sculpturalis* (Giant Resin-bee)

Author: Stuart Roberts, Visiting Research Fellow at University of Reading

Version: Draft 1 (May 2019), Peer Review (June 2019), NNRAP 1st review (February 2020), Draft 2 (September 2020), NNRAP 2nd review (September 2020), Draft 3 (October 2020), NNRAP 3rd review (December 2020), Draft 4 (December 2020)

Signed off by NNRAP: December 2020

Approved by Programme Board: September 2021

Placed on NNSS website: February 2022

Introduction:

The rapid risk assessment is used to assess invasive non-native species more rapidly than the larger GB Non-native Risk Assessment. The principles remain the same, relying on scientific knowledge of the species, expert judgement and peer review. For some species the rapid assessment alone will be sufficient, others may go on to be assessed under the larger scheme if requested by the Non-native Species Programme Board.

1 - What is the principal reason for performing the Risk Assessment? (Include any other reasons as comments)

Response: To rapidly assess the risk associated with this species in Great Britain. Although currently unrecorded, this exotic Eastern Palearctic species has spread rapidly across central and southern Europe since its first detection (in France) in 2008 (Vereecken & Barbier, 2009). It is also a well-documented invasive in North America (Mangum & Brooks, 1997; Parys et al., 2015).

2 - What is the Risk Assessment Area?

Response: *Great Britain*

3 - What is the name of the organism (scientific and accepted common; include common synonyms and notes on taxonomic complexity if relevant)?

Response: *Megachile (Callomegachile) sculpturalis* Smith, 1853 known as the Giant Resin-bee (a name given to all species of the sub-genus *Callomegachile*)

4 - Is the organism known to be invasive anywhere in the world?

Response: Yes.

The species is invasive in North America (US, from Texas northwards to Canada) where it is now widely distributed (Mangum & Brooks, 1997; Parys et al., 2015), and in Europe it has been found in 10 territories since its first discovery in 2008 (summarised in Aguado et al., 2018; Lanner et al., 2020). There are records from Austria (2017), Crimea (2019), France (2008), Germany (2015), Hungary (2015), Italy (2009), Liechtenstein (2019), Slovenia (2018), Spain (2018), Switzerland (2012).

5 - What is the current distribution status of the organism with respect to the Risk Assessment Area?

Response: Currently there are no records from Great Britain

6 - Are there conditions present in the Risk Assessment Area that would enable the organism to survive and reproduce? Comment on any special conditions required by the species?

Response: Yes.

The species nests in existing cavities in wood (Vereecken & Barbier, 2009) and would find ample opportunities for establishment in GB. The species is broadly polylectic, in that it will use a wide variety of floral resources with which to provision brood cells (Quaranta et al, 2014; Parys et al, 2015). This trait has enabled the species to exploit a range of different available floral resources throughout both its native and invasive ranges.

7 - Does the known geographical distribution of the organism include ecoclimatic zones comparable with those of the Risk Assessment Area or sufficiently similar for the organism to survive and thrive?

Response: Yes.

The climatic envelope found in GB is consistent with that in parts of its natural range in eastern Asia, North America and continental Europe. In Europe, the species rapidly established itself in the Mediterranean climatic region, with the centre of invasion in the Marseille area of southern France (Vereecken & Barbier, 2009). The spread from southern France was rapid to both east (into Italy; Quaranta et al, 2014) and west (into Spain; Aguado et al, 2018). Since 2015, the expansion has been northwards across the Alps (Lanner et al, 2020), more widely in the continental climatic zones of France and into Germany (Le Féon et al, 2017) and Hungary (Kovács, 2015). In the USA, the species is found in most states east of the Mississippi, northwards to Maine and into Canada. It has recently expanded into Missouri, Arkansas and Texas (Parys et al, 2015)

It is likely that under climate change, the conditions it is thriving under in continental Europe would enable the species to flourish in GB, and particularly in the south. Current (2020) mean summer temperature maxima in south eastern UK and Bavaria are similar (<https://en.climate-data.org/>; <https://www.climatestotravel.com/climate/germany#bavaria>)

8 - Has the organism established viable (reproducing) populations anywhere outside of its native range (answer N/A if you have answered 'yes' to question 4)?

Response: N/A

9 - Can the organism spread rapidly by natural means or by human assistance?

Response: Yes.

It is likely that initial establishment in GB would be as a result of inadvertent introduction of nests in cavities in wood (and stems of plants). Le Féon et al. (2017) regard this as the most likely explanation for its arrival in Europe in 2008.

Le Féon et al (2017) using citizen science collected data in France, suggest an annual dispersal rate of c. 100km per year – on a par with the rate of dispersal of invasive *Bombus terrestris* in South America.

10 - Could the organism itself, or acting as a vector, cause economic, environmental or social

harm in the Risk Assessment Area?

Response: Possibly.

The most likely harm that could be caused is environmental. It is likely to compete with native species particularly for nesting resources. Le Féon et al (2017) (summarising studies in the US conducted by Laport & Minckley (2012) and Roulston & Malfi (2012)) state that *Megachile sculpturalis* is known to develop aggressive behaviour toward other species and compete for their nesting sites. Le Féon et al further report several events of nest occupation or eviction of *Osmia* sp. and *Xylocopa* sp. individuals by *M. sculpturalis*. In GB there are relatively few species of bees that will nest in existing aerial cavities (Falk & Lewington, 2015; Else & Edwards, 2018), but these do include *Osmia bicornis* and *O. cornuta*, several *Megachile* species and *Anthidium manicatum*. Nest competition could also affect cavity nesting species of wasp (eg *Symmorrhphus* spp., *Gymnomerus laevipes*, *Ancistrocerus* spp. and their associated brood parasites (eg. Chrysididae)(Falk, 1991)

Russo (2016) also adds that invasive species in general may assist in pollination of invasive weeds, be involved in co-invasion with pathogens and parasites, cause damage to buildings, affect the pollination of native plant species, and change the structure of native pollination networks. Concern over the ability of non-native and managed bees to act as vectors of pathogens to native taxa is also voiced by Graystock, et al, (2016) and Singh et al. (2010).

Entry Summary

Estimate the overall likelihood of entry into the Risk Assessment Area for this organism (comment on key issues that lead to this conclusion).

Response: *likely*
Confidence: *high*

Comments (include list of entry pathways in your comments):

Most non-native bee species are accidentally introduced (Russo 2016) and as *Megachile sculpturalis* nests in cavities in wood (and stems of plants) it is likely the species was introduced into the EU with wood or other nesting substrates (Le Feon et al. 2018). In the period 2020 to 2025, the most likely pathway for invasion into the UK would be via a sea-port with connections to either south-east Asia (the native range of the species) or southern Europe of the Eastern US and Canada.

Initial entry into GB is unlikely without further human agency in the medium term, as the species is currently no nearer than south central France, and the distance across the Channel to GB would pose a significant (but probably not insuperable) barrier to natural invasion. For the species to arrive in GB more rapidly, deliberate or inadvertent human agency would be required. This would be most likely through importation of established nests in wood (e.g. pallets, seasoned timber).

If the species becomes established in the near continent (possible or likely in the medium to long term), it is quite possible that invasion without human agency would be possible.

As *Megachile sculpturalis* is a large, impressive and obvious insect, and its nests are relatively easy to find and identify, it is possible that a deliberate and illegal introduction might be attempted. There have been deliberate introductions into Northern Ireland of non-native bee species and colour morphs in recent years. The most likely scenario would be for material to become available via online sales, and importation done via the post

Establishment Summary

Estimate the overall likelihood of establishment (comment on key issues that lead to this conclusion).

Response: *likely*
Confidence: *high*

Comments:

From the evidence of its home range, and particularly the invasive range, there seem to be few, climatic barriers to its spread. To summarise, the species is widespread across Europe including the Mediterranean, Alpine, Continental, Steppic and Pannonian bio-climatic regions. As yet, there are no reports of the species in the Atlantic zone but given a few years it is likely to appear there. *M. sculpturalis* is known in the North America from Maine to Texas, and eastward to Arkansas and this encompasses the Humid Continental (warm summer), Humid continental (cool summer) and humid sub-tropical climate zones

In the native range it is known from both the humid continental zone (in the north) and humid subtropical in the south (eg in Japan)

Habitat restrictions appear to be few as well, as the species is present in semi-natural habitats in France, Italy and Spain (Quaranta et al, 2013, le Féon et al., 2017). However, it is particularly associated with anthropogenic habitats and is widely present in towns, cities and villages eg in France, Switzerland and Austria (Le Féon et al., 2017; Lanner et al. 2020). As a polylectic species, it is capable of exploiting a wide range of floral resources (Quaranta et al, 2013), and this includes introduced and ornamental trees and shrubs. The species nests in a

variety of aerial cavities

The evidence from the US and from continental Europe suggests that once the species is present, establishment of a viable breeding population can happen quickly.

Spread Summary

Estimate overall potential for spread (comment on key issues that lead to this conclusion).

Overall response: *rapid*

Confidence: *medium*

Sub scores:

Natural spread only:

Response: *rapid*

Confidence *medium*

Human facilitated spread only:

Response: *intermediate*

Confidence: *medium*

Comments:

If the species were to arrive in GB it could spread rapidly (as has happened in the US and in southern Europe). Le Féon et al (2017) suggest an annual dispersal rate of c. 100km per year, a distance that would allow natural invasion of GB from France north of the Seine Estuary

Basic pathways: Natural invasion from an expanding population on the near continent followed by further natural dispersal and spread once established. Inadvertent or deliberate importation followed by natural dispersal and spread once established

Impact Summary

Estimate overall severity of impact (comment on key issues that lead to this conclusion)

Overall response: *minor*

Confidence: *medium*

Sub-scores

Environmental impacts:

Response: *minor*

Confidence: *medium*

Economic impacts:

Response: *minimal*

Confidence: *high*

Social impacts:

Response: *minimal*

Confidence: *high*

Comments:

The environmental impact is likely to be higher than either social or economic impacts. Russo (2016) suggests that there would be potential negative impacts associated with non-native bees (including *M. sculpturalis*) include competition with native bees for nesting sites or floral resources, pollination of invasive weeds, co-invasion with pathogens and parasites, damage to buildings, affecting the pollination of native plant species, and changing the structure of native pollination networks. Le Féon et al. (2017) reported nest occupation or eviction of native bees from their nests by *Megachile sculpturalis*.

The late emergence time of *Megachile sculpturalis* (July and August – eg Poggi et al., 2020), the large robust habitus, and aggressive nature of the bee would mean that in areas where there is competition for nesting resources, *M. sculpturalis* would be able to take over established nests of native bees and evict the brood (MacIvor, 2019). In GB this could impact on only the small guild of stem-nesting species, which include stem-nesting *Osmia*, other stem-nesting *Megachile* (eg *M. ligniseca* and *M. willughbiella*) and the Wool-carder Bee *Anthidium manicatum*. None of the taxa that *M. sculpturalis* would compete with is regarded as Endangered or Near Threatened.

As *M. sculpturalis* is broadly polylectic for its pollen requirements, it would be able to exploit a wide-range of plant species. This might put it in competition for forage with Honeybees and some bumblebee species, although it is unlikely to impact the Endangered and Near Threatened species, most of which are typical of open habitats (e.g. Anon, 2020). As a solitary species which does not have a densely aggregated nesting strategy, the number of individuals in any one area would be a lot fewer than for social species. This would also reduce competitive pressure on social species such as bumblebees and Honeybees

There is no evidence of negative social or economic impacts anywhere where the bee is invasive and the impact in GB is likely to be minimal.

Climate Change

What is the likelihood that the risk posed by this species will increase as a result of climate change?

Response: *high*
Confidence: *high*

Comments:

In continental Europe, the species is currently associated with the warmer parts of Europe, and spread has been particularly rapid in areas with a Mediterranean or sub-Mediterranean climate (e.g. in southern France, Italy, Spain and Slovenia). A warming continent would also encourage further northward and westward spread and bring the species nearer to the English Channel, increasing the risks of natural colonisation from the near continent.

A significant change in climate in GB would make further spread from an established population, more likely, and more rapid.

Conclusion

Estimate the overall risk (comment on the key issues that lead to this conclusion).

Response: *low*
Confidence: *medium*

Comments:

It is estimated that the likelihood of the arrival of *Megachile sculpturalis* in the UK is 50% within the next 10 years.

It is easily transported as nests in wooden structures and packing, and there are well established existing pathways for invasion via shipping (and the associated ports), and possibly even by road/rail via the Channel Tunnel. Natural spread from existing continental populations is also possible, but would likely require further northward and westward spread across Western Europe (especially France) first.

If a population was to become established in GB, it is likely that spread could be rapid, given that the dispersal range is long, nesting sites are readily available (particularly in urban and peri-urban areas) and that the species is a broad generalist in terms of its pollen requirements.

The most likely areas of impact of the species are via direct competition for nesting and floral resources with native insects, and disrupting existing pollination networks

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Provide here a list of the references cited in the course of completing assessment

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