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## SHORT COMMUNICATION

### Occupation of Active *Xylocopa virginica* Nests by the Recently Invasive *Megachile sculpturalis* in Upstate New York

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#### Introduction

The Asian native Giant Resin Bee, *Megachile sculpturalis* Smith, was inadvertently introduced to the southeastern United States in the early 1990's (Mangum and Brooks, 1997; Mangum and Sumner, 2003; Hinojosa-Diaz, 2008). Since its introduction, it has rapidly spread throughout much of the eastern US from its North Carolina center of introduction (Magnum and Brooks, 1997), reaching north as far as New York and southern Ontario by 2000 and 2002, respectively (Ascher, 2001; Paiero and Buck, 2003), and as far west as Michigan and eastern Kansas by 2008 (Hinojosa-Diaz, 2008; O'Brien and Craves, 2008).

Despite the rapid spread, the ecological impact and affect on native bee fauna by *M. sculpturalis* has not been widely studied. It has been assumed that the invasion of the Giant Resin Bee is relatively benign except that it may preferentially pollinate plant species introduced to North America (*Koelreuteria paniculata* Laxm., *Ligustrum lucidum* Aiton, *Pueraria lobata* DC., *Sophora japonica* L.) from its native range. The presence of these plant species may have aided the establishment of *M. sculpturalis* in the U.S. (Mangum and Sumner, 2003).

Possible negative effects of *M. sculpturalis* on native North American bees are unstudied (Hinojosa-Diaz, 2005). *Megachile sculpturalis* nests have been reported in empty tree cavities, crevices, downed logs, and other debris sometimes used by native bees, as well as vacant burrows of the Eastern Carpenter Bee (*Xylocopa virginica* L.; Mangum and Brooks, 1997; Batra, 1998). It remains unknown, however, whether *M. sculpturalis* utilizes active *X. virginica* nests, evicting the resident female. Here we report a usurpation and occupation of active *X. virginica* burrows by *M. sculpturalis* in upstate New York.

#### Methods and Results

At the beginning of July 2010, we observed the ca. 1 cm diameter openings of *X. virginica* nests in an exposed wooden beam of a carport in Rochester, NY. The three nest openings were approximately 2 m above the ground, spaced approximately 0.5 m apart, and occurred approximately 5–10 m from individual *Pinus strobus* L., *Acer negundo* L., and *Acer platanoides* L. trees. On 23 July, we observed three *X. virginica* on the ground below the carport (though, not directly below the openings of the nests). All three *X. virginica* had worn wing edges, suggesting they had been actively foraging (second-year) females, and none attempted to escape from where they were originally found despite light prodding. Close inspection of all three individuals revealed they were irregularly covered in a sticky resin. Although the resin encumbering these *X. virginica* could have come from resin pockets within the wooden beams, this seems unlikely as the beams of the structure were oven-dried and several years old. Additionally, these individuals were probably from different nests that were ca. 0.5 m apart, making it unlikely that all three of these individuals encountered a resin pocket in separate nests. One of the three resin-covered individuals was collected and preserved (Fig. 1A).

Near dusk on 29 July, we placed fine wire mesh enclosures over all three nest openings. The entrance of one burrow had been sealed closed by a plug of dried mud and wood shavings. In the process of fastening mesh over the nest openings, a female *M. sculpturalis* carrying debris and/or resin in her mandibles entered a nest entrance that had not yet been covered. This individual was captured as it left the nest ca. 5 min. later (Fig. 1B). Several minutes later, a female *X. virginica* encumbered by resin on her underside (venter of

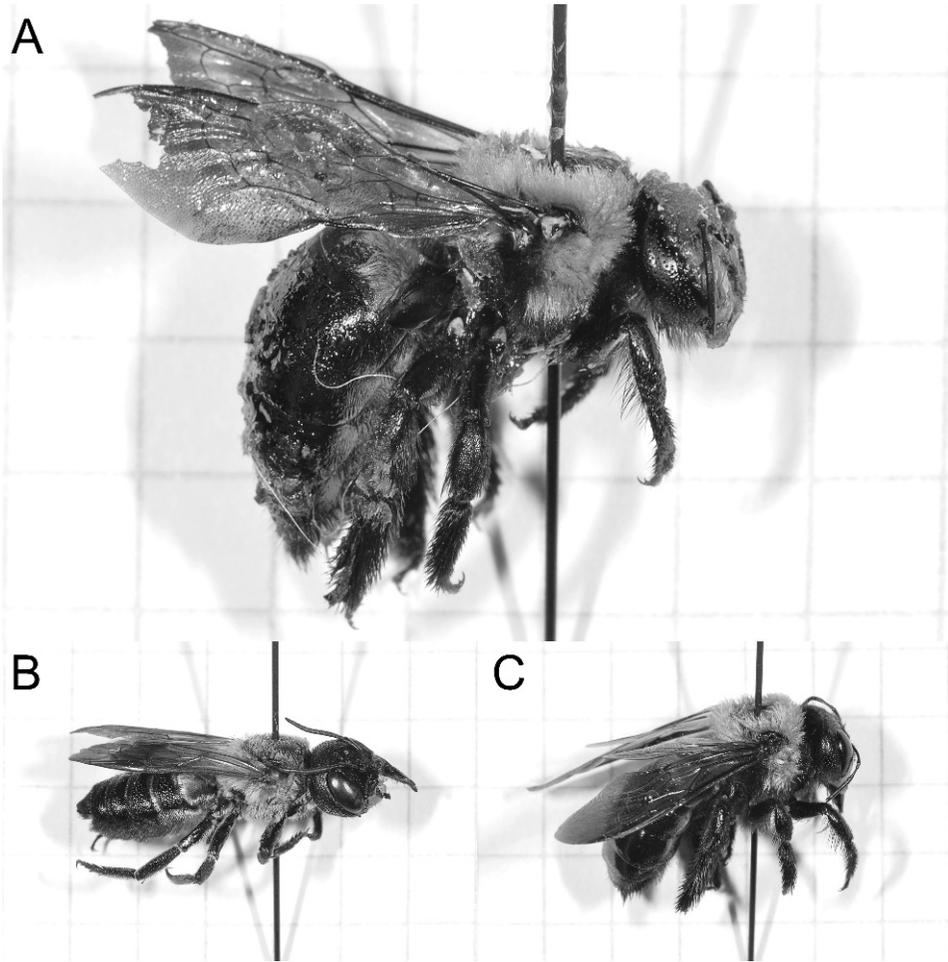


Fig. 1. Photographs of (A) *X. virginica* female with frayed wing margins and resin on its head, metasoma, and wings, (B) *M. sculpturalis* female collected upon emergence from provisioning/cell construction in *X. virginica* nest, (C) *X. virginica* female with complete wing margins and resin (not visible) attached to venter of mesosoma, coxae, and femorae of mid- and hind legs. Photos were taken with a Nikon D90 fitted with a MicroNIKKOR 105 mm MacroLens on a tripod. All photos were taken from the same distance with specimens resting against graph paper. Sides of the squares on the graph paper in each panel equal 5 mm. The intertegular spans (Cane, 1987) were (A) 6.38 mm, (B) 4.99 mm, and (C) 6.01 mm. Specimens were measured using digital calipers (Control Company, Model 3415).

mesosoma, coxae, and femorae of mid- and hind legs) emerged from the same nest. This individual was also collected (Fig. 1C).

On 5 August, we observed a *X. virginica* pushing wood shavings out of one of the nests into the mesh covering the opening. Among the shavings ejected from the nest was a large pupae of the parasitoid *Xenox tigrinus* DeGeer that had not eclosed. Several days later, a female *X. virginica* emerged from this nest and was collected from the mesh enclosure. The two other nests showed no subsequent signs of activity until 1 September when a male *X. virginica* was caught in the mesh covering the same nest from which the *M. sculpturalis* had previously been captured.

The following summer (2011) the mesh enclosures were removed, but little activity was observed around the nests. In one nest, the mud plug had been opened and a hole was found in the mesh indicating a bee had emerged and escaped. It remains uncertain if this nest contained *X. virginica* or *M. sculpturalis*, as

members of *Megachile* sometimes cap nest openings with mud (Mangum and Brooks, 1997). Over the remainder of the summer none of the nests were re-colonized by either *X. virginica* or *M. sculpturalis*. One year later (May 2012), however, all three burrows were reoccupied by *X. virginica*. Separate female *X. virginica* were observed leaving and reentering the nests on foraging bouts throughout late May 2012.

#### Discussion

*Megachile sculpturalis* has spread rapidly throughout eastern North America since the mid-1990's (Kondo *et al.*, 2000; Ascher, 2001; Mangum and Sumner, 2003; Hinojosa-Diaz, 2008). However, this rapid range expansion has been considered ecologically benign because little empirical information on positive or negative impacts is available (Mangum and Sumner, 2003). Possible negative effects of *M. sculpturalis* such as being a vector for novel diseases or parasites, harming native plants during foraging, providing a novel pollination service to introduced plant species, and potential competitive interactions for floral resources and nest sites between *M. sculpturalis* and North American natives (Mangum and Sumner, 2003) remain speculative.

To our knowledge, this is the first reported case of *M. sculpturalis* occupying active *Xylocopa* nests, suggesting that *M. sculpturalis* could be a potential threat to native populations of *X. virginica*. Eviction from nests and subsequent death of *X. virginica* could detrimentally affect population sizes, but it remains unclear how *X. virginica* offspring fare after *M. sculpturalis* occupy a nest. Although we observed a female we interpret to have newly eclosed emerge from a co-opted nest, the underside (venter of mesosoma, coxae, and femorae of mid- and hind legs) of this individual was encumbered by resin deposited in the nest by *M. sculpturalis* and it was unclear if she would be able to fly and forage normally. If events such as these occur frequently, the reproductive success of *X. virginica* may become depressed. On the other hand, recolonization by *X. virginica* of the same burrows two years after these nests had been co-opted from actively nesting *X. virginica* by *M. sculpturalis* may indicate that negative demographic effects of *M. sculpturalis* on *X. virginica* populations are minimal in areas where *M. sculpturalis* numbers are relatively low. Such sequential re-use of the same nest by different bee species is rarely recorded and should spur further investigation of the widespread presence and rapid expansion of *M. sculpturalis* populations throughout eastern North America.

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