

***Megachile sculpturalis* (Smith, 1853) (Hymenoptera: Megachilidae), the giant resin bee new to South Tyrol with a newly described plant species interaction**

Abstract

EN

In this article we present a bee species newly documented for South Tyrol. The occurrence of *Megachile sculpturalis* in South Tyrol was recorded once in 2016 and four times in summer 2019. The species is an accidentally introduced bee from South-East Asia that already colonized great parts of the US and is currently spreading across Central and Southern Europe. One record includes the observation of the alien wild bee visiting a sunflower, a hitherto unknown plant interaction for this species

DE

In diesem Beitrag stellen wir eine für Südtirol neu dokumentierte Bienenart vor. *Megachile sculpturalis* wurde fünf Mal in Südtirol nachgewiesen, das erste Mal im Jahr 2016 und weitere vier Male im Sommer 2019. Es handelt sich bei *Megachile sculpturalis* um eine eingeschleppte Art, welche aus Südostasien stammt, bereits einen Großteil der Vereinigten Staaten besiedelt und rezent sich auch in Mittel- und Südeuropa ausbreitet. Bei den Südtiroler Beobachtungen konnte auch eine bisher unbekannte Interaktion mit der Sonnenblume dokumentiert werden.

IT

Una nuova specie di ape per l'Alto Adige, *Megachile sculpturalis*, viene presentata e discussa. Questa specie è stata rilevata per cinque volte nel territorio a partire dal 2016 (con un singolo riscontro) con quattro recenti osservazioni nell'estate 2019. Si tratta di una specie originaria nel sud-est asiatico e importata in modo accidentale già negli Stati Uniti e che ora sta colonizzando il centro e sud Europa. Tra i ritrovamenti in Alto Adige riportiamo anche la prima interazione documentata con il girasole.

Keywords: *Megachile sculpturalis*, Giant Resin Bee, new species record, introduced species, new pollination interaction

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Introduction

The first introduced bee species in Europe was found in 2008 (VERECKEN & BARBIER 2009) in southern France, it was the so-called Giant Resin Bee (*Megachile sculpturalis* SMITH, 1853). The species is originally from East Asia (WU 2005), but has already spread throughout the USA from 1994 onward (MANGUM & BROOKS 1997). The introduction was probably caused by the transport of timber containing eggs and larvae (QUARTANA et al. 2014). Even from pictures, the wild bee is easy recognizable as it's a large bee (female 22- 27 mm and male 14- 22 mm in length) with dark infuscated wings and bright orange hairs on the thorax (Fig. 1; PAIERO & BUCK 2003).

Megachile sculpturalis is a cavity nesting species occupying preexisting holes in dead wood. As its body size suggests, rather big cavities with entry diameters of at least 8 mm are necessary for a successful larval development. The substrate ranges from Giant Cane (*Arundo donax*) to timber of different tree or shrub species. All these plant materials are often used for artificial nests. In regard of feeding preferences, *M. sculpturalis* is a polylectic species found to forage on a wide variety of plant species (QUARTANA et al. 2014; PARYS et al. 2015; LE FÉON et al. 2017; AGUADO et al. 2018; ANDRIEU-PONEL et al. 2018). Especially *Styphnolobium japonicum*, a common ornamental tree originating from the home range of *M. sculpturalis*, seems to be the preferred feeding resource (ANDRIEU-PONEL 2018).

One year after the first record in Aullach (France), the alien wild bee was also observed in Italy at the Lago Maggiore (QUARTANA 2014). Since then, *M. sculpturalis* has dispersed to other parts of France (LE FÉON et al. 2018) and continued its journey to Switzerland (AMIET 2012, Lanner 2019, pers. obs.), Germany (WESTRICH 2015), Austria (by Westrich, pers. Obs. in LE FÉON et al. 2017, Lanner 2019, pers. obs.), Hungary (KOVÁCS 2015), Slovenia (GOGALA & ZADRAVEC 2018) and Southern Spain (AGUADO et al. 2018). As the time span of these findings was relatively short, dispersal seems to have happened very quickly. Possibly, the dispersal took place mainly in a passive way through wood transportation across Europe. Alternatively, new introductions from outside Europe may have fueled its dispersal. Recently, *Megachile disjunctiformis*, a similar species originating also from East Asia, was discovered in Bologna (Italy) and surroundings (BORTOLOTTI et al. 2018), suggesting that multiple introductions of *M. sculpturalis* are very likely.



Fig. 1: Head detail of *Megachile sculpturalis*: Female (left side) and male (right side; second record in South Tyrol, Bruneck / Brunico, July 2019; picture by M. A. Stagg).

Methods

After the first casual record further occurrences were searched by the authors using nature platforms on the internet (namely iNaturalist.org) and by getting directly contacted by observers. Questions regarding the time of observation, the number of individuals and potential breeding events as well as visited plant species were posed to the observers completing the occurrence data set for South Tyrol.

A list of plant species (Tab. 1) visited by *Megachile sculpturalis* in Europe was also redacted, following the suggestion of GAZDIC & GROOM (2019) to use nature platforms as a source of biotic interaction records. This list is meant to extend already published plant species interactions by *M. sculpturalis* (QUARTANA et al. 2014; PARYS et al. 2015; LE FÉON et al. 2017; AGUADO et al. 2018; ANDRIEU-PONEL et al. 2018). Additional five observations (four with flower visitation) were found in another citizen science portal called naturgucker.de and can be viewed directly there. Andreas Hilpold and the “Arbeitskreis Flora von Südtirol” used these images to identify the plant species on which the introduced species was recorded.

Results

The first record in South Tyrol was made in summer 2016 in Meran / Merano, when one female was found drowned in a swimming pool (July/August; GPS: 46.675151N 11.160055 E, 325 m a.s.l.). No further individuals were observed during the flight season in 2016. This specimen (ID: MSIT7) is stored at the collection of the Institute for Integrative Nature Conservation Research at the University of Natural Life Science, Vienna as it will be part of an international research project focusing on the population genetics of European *Megachile sculpturalis*.

M.A. Staggl reported the second record from Bruneck / Brunico (GPS: 46.797237 N, 11.935611 E) in July 2019, where he was able to observe several individuals of both sexes (10 to 15 single individuals were estimated). Here the observations were made over a prolonged period of time (~30 days) and the individuals were observed feeding exclusively on *Wisteria sinensis* (Fig. 2). At this time of the year only a few inflorescences were found on *W. sinensis*. The females, in particular, tended to open closed buds to get pollen. In addition, the females first lifted up the typical Fabaceae middle upper petal, the banner, with the head and then bit at the base. They then used the second and third pair of legs to strip the pollen from the flower onto the bristled underside of the abdomen. The females were strongly urged by the males during the collecting activity and often very rough copulations occurred. The males, on the other hand, did not show the same behavior but rather fed on nectar. The brood place could not be located.



Fig. 2: *Megachile sculpturalis*. Picture of the individuals recorded in Bruneck / Brunico, South Tyrol, feeding on *Wisteria sinensis*. Left side: a female with pollen on the abdomen; right side: a male individual. (Second record for South Tyrol, Bruneck / Brunico, July 2019; pictures by M. A. Staggl).

A third record was done in Meran / Merano in summer 2019 (GPS: 46.661575 N, 11.172227 E, 325 m a.s.l.) by Urban Gamper. Several individuals (>5) were observed over a prolonged period of time (from the end of July through the whole of August) at an artificial nest searching for the bamboo stems with the largest diameter and collecting pollen from *Lavandula* sp.. The report on iNaturalist shows a female (link to the original observation: www.inaturalist.org/observations/31116103).

A fourth record was collected by the co-author J. Lanner in Bruneck / Brunico (GPS: 46.785114 N, 11.940066 E), where seven and sometimes even ten individuals were observed mating in an artificial nest. The alien wild bees were here first recognized on the 30.7.19. Females were observed collecting pollen on *Helianthus annuus* and *Lavandula* sp. (Fig. 3). The pollination interaction with sunflower is, to our knowledge, the first record for *Megachile sculpturalis*.

The fifth record came from Bolzano / Bozen on the 20.09.19 and consisted in one dead female (probably as a consequence of concomitant temperature drops) found in a courtyard by Andreas Hilpold (Eurac headquarters, GPS 46.494305N, 11.346456E; 300 m a.s.l.).

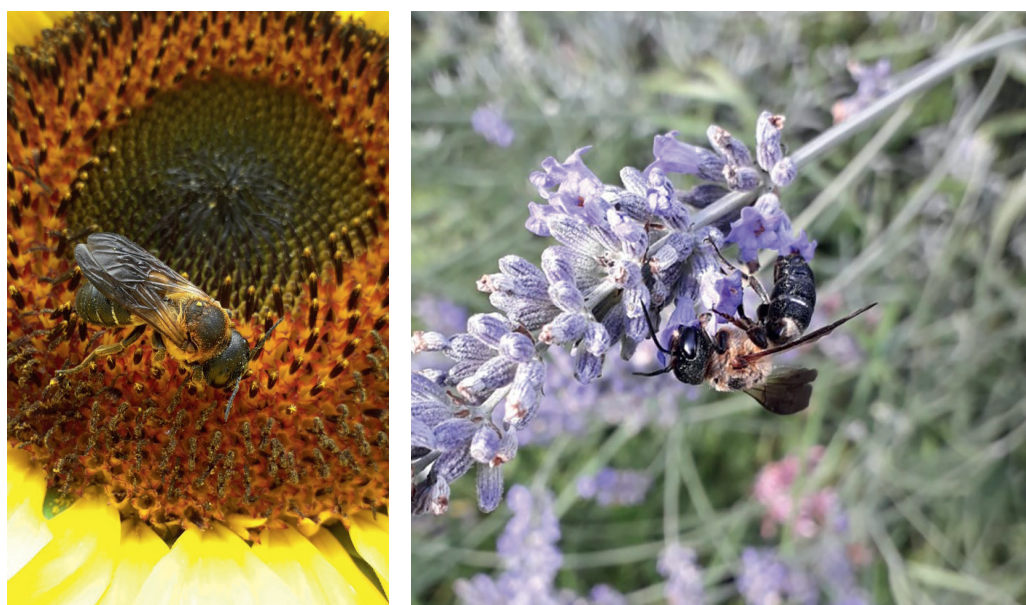


Fig. 3: *Megachile sculpturalis*. Pictures of females foraging on *Helianthus annuus* (left side) and *Lavandula* (right side).



Fig. 4: *Megachile sculpturalis* was observed breeding at an artificial nest (Fourth record for South Tyrol, Bruneck / Brunico, 30.07.2019; pictures by A. Elzenbaum).

Following the suggestion by GAZDIC & GROOM (2019) and the example of LE FÉON et al. (2017) we collected all the images of *Megachile sculpturalis* on flowers in Europe provided by the portal iNaturalist. Totally, 77 records are available with 43% showing flower visitations on the photograph. The results are listed below (Tab. 1) and depict a preference for *Lavandula* species and *Wisteria sinensis*.

Tab. 1: List of plant species visited by *Megachile sculpturalis* in Europe. Sources: iNaturalist.org and naturgucker.de. The number in brackets refer to the new visitations reported in the present article.

Plant family	Plant genus/species	Nr. of records
Lamiaceae	<i>Lavandula</i> sp.	12 (+2)
	<i>Mentha</i> sp.	1
	<i>Thymus</i> sp.	1
Fabaceae	<i>Wisteria sinensis</i>	8 (+1)
	<i>Styphnolobium japonicum</i>	1
Scrophulariaceae	<i>Buddleja davidii</i>	3
	<i>Buddleja</i> sp.	1
Lythraceae	<i>Lythrum salicina</i>	3
	<i>Lythrum</i> sp.	1
Caprifoliaceae	<i>Scabiosa</i> sp.	1
	<i>Knautia</i> sp.	1
Rutaceae	<i>Citrus</i> sp.	1
Oleacea	<i>Ligustrum</i> sp.	1
Asteraceae	<i>Helianthus annuus</i>	(+1) new record
	<i>Cirsium</i> sp.	1
Sum	13 plant taxa	36 (+4)

Discussion

The occurrence of the giant resin bee *Megachile sculpturalis* (in South Tyrol is most probably due to an introduction from the south, where the species has been known for several years (QUARTANA et al. 2014). The Brenner pass is the most heavily frequented traffic route connecting Italy and Central Europe (PERMANENT SECRETARIAT OF THE ALPINE CONVENTION 2018). Further occurrences of *M. sculpturalis* north of the Brenner are recently confirmed for Tyrol and Vorarlberg by one of the authors (Lanner J., unpublished data). We think that this is how the main spread through Europe has and is still being taken place, namely along main transport axes.

The species was recorded twice each in the cities of Meran/Merano and Bruneck/Brunico, which may indicate a major presence and persistence in these cities and the preference for artificial nests. Since people tend to observe this conspicuous species at their artificial breeding places more easily, reports of *Megachile sculpturalis* found in human settlements accumulate. Whereas, observations of the exotic wild bee in more natural or seminatural habitats in South Tyrol and many parts of Europe are still lacking. On the other hand, it is also possible that artificial breeding places are favoring the distribution and local persistence of this bee (maybe especially in cities), since cavity breeder seem to be limited to suitable and available nesting sites (STEFFAN-DEWENTER & SCHIELE 2008) and *M. sculpturalis* needs cavities with rather big diameter. Most of these artificial nests are placed in private gardens where ornamental and often exotic flowers abound. Artificial nests providing shelter and breeding places have become even more popular in the last years, although in regard to conservation they are controversially discussed (MACIVOR & PARCKER 2015).

With the fourth record, the non-native wild bee was observed feeding on *Helianthus*

annuus, representing a new interaction for this polylectic species. However, with this observation alone we cannot estimate whether the bee alone feeds on nectar or also on pollen which would be a sure indication of a pollination interaction. With the analysis of pictures of flower visitation by *M. sculpturalis* in Europe stored at citizen science portals, we could not detect any new pollination networks as described in literature (QUARTANA et al. 2014; PARYS et al. 2015; LE FÉON et al. 2017; AGUADO et al. 2018; ANDRIEU-PONEL et al. 2018), nevertheless, the plant interactions presented in table 1 underline the intensive use of *Lavandula* sp. and *Wisteria sinensis*, a plant species originating from Asia and already reported as the preferred food source in France (LE FÉON et al. 2017). Concerns about possible consequences of the introduction of *Megachile sculpturalis* focus on possible competition with autochthonous wild bees nesting in large cavities, such as *Xylocopa* spp. and *Osmia* spp. (ROULSTON & MALFI 2012; LE FÉON 2017). Additionally, the preference of *Megachile sculpturalis* to forage on non-native, sometimes even invasive plant species, such as *Ligustrum* spp. and *Styphnolobium japonicum* (AGUADO et al. 2018; QUARTANA et al. 2014) may empower their further expansion by increasing the pollination efficiency.

Finally, a consistent survey of the impact of this species (and further introduced bees) in Europe is lacking. A proper monitoring to assess the effect of the presence of the introduced species especially on other wild bees in Europe is strongly suggested along with monitoring of its further spread, the transport routes used, as well as to record the local persistence and density.

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