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Editorial

Nature's Architects: Exploring the Biology, Behavior, and Pollination Impact of Mason Bees

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Introduction

The term "mason bee" is now frequently used to refer to species of bees belonging to the Megachilidae family's genus *Osmia.* Mason bees are named for their habit of using mud or other "masonry" products in constructing their nests, which are made in naturally occurring gaps such as between cracks in stones or other small dark cavities. When available, some species preferentially use hollow stems or holes in wood made by wood-boring insects [1]. The orchard mason bee, *O. lignaria*; the blueberry bee, *O. ribifloris*; the hornfaced bee, *O. cornifrons* and the red mason bee, *O. bicornis etc.* are among the species that belong to this genus. The Northern Hemisphere is home to more than 300 species. Most are found in temperate habitats and are active from spring through late summer in the Palearctic and Nearctic regions [2].

Several *Osmia* species are blackish, and at least one is rust-red, although metallic green or blue is typically the dominant colour. The majority have black ventral scopae, which are undetectable unless they are pollen-laden. In contrast to *Megachile* or *Anthidium* species, they have arolia between their claws [1]. In the past, the name "mason bee" has also been used to describe bees from several other genera under the Megachilidae family, such as *Chalicodoma*, most notably in the 1914 book "The Mason-Bees" by Jean-Henri Fabre and his translator Alexander Teixeira de Mattos [3].

Morphology

All bees and the majority of insects share a basic anatomy with *Osmia,* with the head, thorax, and abdomen serving as the main functional parts. *Osmia* have two huge compound eyes, antennae, a mouth, and three-minute ocelli on its heads. *Osmia* have six legs and four wings on their thorax. In contrast to males, females have a scopa on their abdomen for gathering pollen. *Osmia* and other genera in the family Megachilidae have their scopa under their abdomens, despite the fact that it is typically found on the legs of most bees [4].

Life cycle

Unlike honey bees (*Apis*) and bumblebees (*Bombus*), *Osmia* species are solitary; each female is fertile and builds her own nest, and these species have no worker bees. When the bees emerge from their cocoons, the males arrive first. Males often stay around nests waiting for females, and some have been observed aggressively extracting females from their cocoons. The females emerge and mate with one or more males. The males die quickly, and the females begin filling their nests within a few days. Female *Osmia* usually nest in small gaps or naturally formed tubular chambers [1]. This most commonly refers to hollow twigs, although it can also refer to abandoned nests of wood-boring beetles or carpenter bees, snail shells, beneath bark, or other small protected holes [5]. They don't dig their own nests. The cell might be made of clay, dirt, grit, or chewed plant tissue. *O. avosetta* is one of only a few species known to line their nest burrows with flower petals [6]. Before settling in, a female may inspect several potential nests. By a few days of mating, the female has chosen a nest location and began visiting flowers to collect pollen and nectar for her nests; numerous trips are required to complete a pollen/nectar supply mass [7]. After a provision mass is finished, the bee returns to the hole and lays an egg on top of it. Next, she makes a "dirt" divider that serves as the rear of the next cell. The procedure is repeated until she has filled the cavity (Figure 1). Female eggs are placed at the back of the nest, whereas male eggs are put towards the front. As a bee finish building a nest, she closes the entrance to the tube and may seek for another nesting site [8]. By weeks after hatching, the larva has most likely devoured all of its food and begins weaving a cocoon around itself, entering the pupal stage, and the adult develops either in the fall or winter, hibernating inside its insulating cocoon [2,9]. The majority of *Osmia* species are found in areas where the temperature falls below 0 °C (32 °F) for extended periods of time, and they are well-adapted to cold winters; chilling appears to be a necessity for development [2]. Several mason bee species are semi-voltine, which means they undergo a two-year maturity cycle, with a full year (or more) spent as a larva [1].

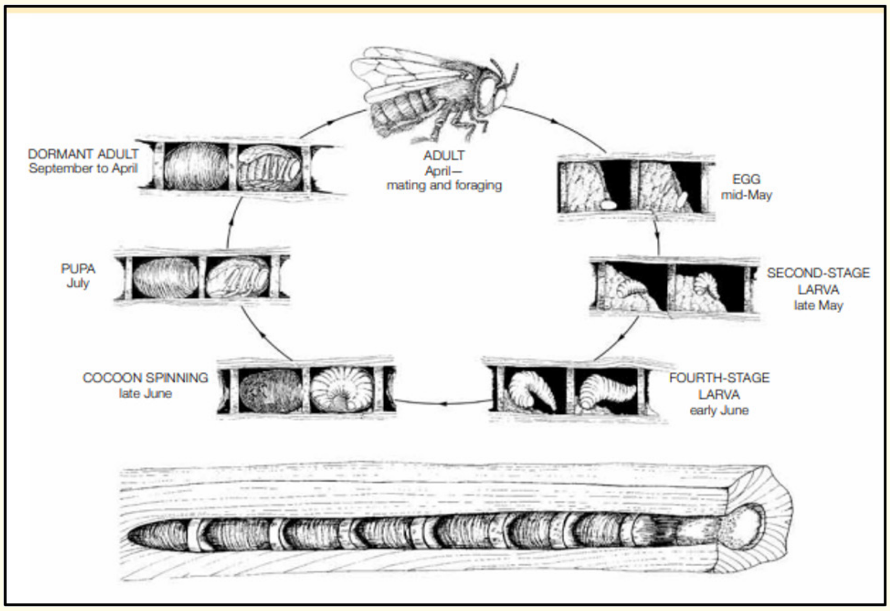

Figure 1: Lifecycle of the blue orchard bee in northern states [10].

Figure a

			
Orchard mason bee, *O. lignaria*	Blueberry bee, *O. ribifloris*	Hornfaced bee, *O. cornifrons*	Red mason bee, *O. bicornis*
			
Maine blueberry bee, *O. atriventris*	Two coloured mason bee, *O. bicolor*,	Blue mason bee, *O. caerulescens*	Blue calamintha bee, *O. calaminthae*

			
European orchard bee, *O. cornuta*	Mountain mason bee, *O. inermis*	Large mason bee, *O. xanthomelana*	Pinewood mason bee, *O. uncinata*
			
Spined mason bee, *O. spinulosa*	*O. latreillei*	*O. avosetta*	*O. californica*
Different species of mason bee			

Figure b

Pollination

The architecture and behaviour of *Osmia* allow them to pollinate quite efficiently. Unlike most other bee species, female *Osmia* and other bees in the Megachilidae utilize pollen-collecting hairs on their abdominal scopa to collect pollen. As *Osmia* transport pollen to flowers, dried pollen falls from the scopa onto the stigma of the flower, aiding pollination almost every time. *Osmia* pollinates early spring flowers in the Rosaceae family and will forage in adverse weather [11]. Several farmers are presently managing *Osmia* populations to ensure efficient pollination on their crops. Yet, utilising non-native *Osmia* species as controlled pollinators has accelerated disease transmission by introducing exotic bee species that compete with native bees. Native *Osmia* species are declining in certain locations as of 2020; methods to reduce the impact of non-native pollinators on wild species include prioritising the use of native bee species, boosting local bee populations, and enforcing parasite/disease screening [12]

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