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NOTES ON *DIANTHIDIUM SIMILE* (CRESSON) (HYMENOPTERA: MEGACHILIDAE) IN MICHIGAN

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ABSTRACT

Dianthidium simile (Cresson) is a small ground-nesting megachilid bee restricted to sandy areas in Michigan, often bordering lakeshores. Females dig their nests in sand, at the base of dried clumps of grass. Nests are small clusters of cells, formed from conifer resin and sand grains, with each 1-1.5 cm in length by 8.5 mm in diameter. Collection records and field observations indicate a flight period from late June to early September. This is the first report on the behavior of this species.

Here I report on the behavior and nesting habits of *Dianthidium simile* (Cresson), a colorful, fairly small but robust member of the Megachilidae (Hymenoptera) that nests fossorially, most often in sandy lacustrine regions. It is a member of the tribe Anthidiini, a diverse group of megachilids that use a variety of materials to line their nests, ranging from plant resins to trichomes (Michener 2000). Members of the genus *Dianthidium* are known to use resins and small stones and debris to construct the brood cells in the ground, in trap nests, and on above-ground substrates. *D. simile* ranges from the Great Lakes region to Maine, and south to Georgia (Krombein, et al. 1979). Fischer (1951) reported rearing two specimens from a partly rotted log, but nothing else has been published about its biology. Although Romankova (2004) included it in the list of the anthidiines of Ontario, no new biological information was presented for it.

The Megachilidae are known for their diverse array of nesting sites, nesting materials, and behavior, even within a genus. Members of the genus *Dianthidium* display a range of nesting preferences: multi-celled nests on small shrubs; vertical faces of gravel pits; and edges of dunes amongst grass rhizomes. All of the published behavioral observations have one commonality: cells made of resin with a matrix of sand grains and plant debris. Several western North American species of *Dianthidium* have been studied, and the plasticity of nesting behavior within this genus of small megachilids is evident from those studies. *Dianthidium ulkei* (Cresson) was briefly studied by Hicks (1933) near Boulder, Colorado. He reported that the bees constructed short tunnels in natural cavities in soil. Nests of one or two cells were constructed with pebbles and plant debris in a resin matrix. Frolich and Parker (1985) studied the nesting and mating behavior of *D. ulkei* in a greenhouse, and were able to induce females to nest in wood cavities. The nests were lined with a resin, pebble, and soil matrix. Krombein (1967) described the nests of a number of southwestern species from trap nests, as well as a nest of the Floridian species *D. floridiense* Schwarz. An Arizona nest of *Dianthidium pudicum pudicum* (Cresson) was studied briefly by Clement (1974), and in that instance the nest was found in the fork of small branches of a small tree (*Larrea tridentate* (DC.) Coville, creosote bush). The aerial, external nest was triangular in shape (held in the "V" between 2 branches), and contained 10 cells. The nest was comprised of resin,

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small pebbles, and plant debris. Fischer's (1951) report on *Dianthidium concinnum* (Cresson) also revealed that the 10-celled nest was constructed externally on a branch of a small elm in Kansas. The nests were comprised of the same materials as above. Fischer (1951) made some additional observations on *D. sayi*, Cockerell (now *D. curvatum sayi* Cockerell [Krombein et al. 1979]) which nested in the soil in a vertical bank in Kansas. The cells were also constructed of soil and plant resin. Michener and Michener (1999) studied an aggregation of the same species for several years in a vertical sandy bank adjacent to the Oldman River in Alberta, Canada.

OBSERVATIONS

In Michigan, *D. simile* has been collected predominantly from lacustrine sandy areas bordering the Great Lakes, but there are a few records towards the center of the state (Fig. 1). Adults have been collected from 30 June to 12 September, with most records from late July to early August. Specimen labels indicate that they visit the following flowers: *Coreopsis lanceolata* L., *Rudbeckia hirta* L., and *Polanisia graveolens* Raf.

I collected adults, excavated several nests, and made the following observations at two sites in Michigan: in the Lower Peninsula at Ludington State Park (LSP), Mason Co., in a stretch of vegetated back dunes well away from Lake Michigan from 1745 -1845 hr on 7 August 1990, and in the Upper Peninsula (22°C) at 1400 hr, on 29 July 1994 in Mackinac Co. in back dunes along Lake Michigan at Big Knob State Forest Campground (BSF) area. Both sites were similar in that areas of bare sand were intermingled with grasses and other herbaceous plants, and were at the edges of old dunes that bordered ecotones leading to conifer-dominated woods. These sites were all more or less horizontal, with a slight slope leading away from the nesting area.

LSP: I collected 8 females at the site, and at least 10 *D. simile* were seen nesting at the base of dead clumps of grass, in an area 30 × 15 cm. Cells were intermingled with dead rhizomes, often just below the surface. Bees were flying in with provisions every 2-3 minutes. I dug up a few clumps of cells, but not the entire aggregation. Cells were 1.0 – 1.5 cm long × 0.8 – 0.9 cm in diameter. Thirteen cells were in one cluster, all facing up, nearly perpendicular to the substrate (Fig. 2). Another nest (Fig. 3) had 7 cells arranged around a grass stem, also pointing upwards. These nests were placed in sealed containers but were never subjected to cool temperatures. During January-February 1991, 4 females and 3 males emerged.

BSF: Nests were located in a back dunes-beach area closest to the edge of woods in stable grassy/shrubby area. I estimated that there were 20-24 nest entrances in one square meter. I also observed several females coming and going from the nest site. All nest entrances were located at the base of old clumps of dried grass, all facing south, and partially obscured by dead grass leaves. In one 30 × 30 cm area, I counted 7 nest entrances. All cells were made of coniferous resin embedded with sand grains. I collected 6 females there.

Most clumps of cells were at the very basal rhizome portion of the grasses, just below the surface, varying from 1-5 cm deep. Some nests that appeared to be older were 3 cm deep. All were very close to the main stems of grass. None of the cells were grouped like those from LSP. The nests that I found had no more than 3 or 4 cells grouped together. All cells were made of coniferous resin embedded with sand grains and small bits of plant debris.

Six clumps of cells were placed in small snap-top containers, and sometime over the winter, 4 males and 3 females emerged from the cells. No parasitoids emerged from the collected cells. The pungent aroma of honey and pine resin was quite noticeable after the nests were placed into small containers.

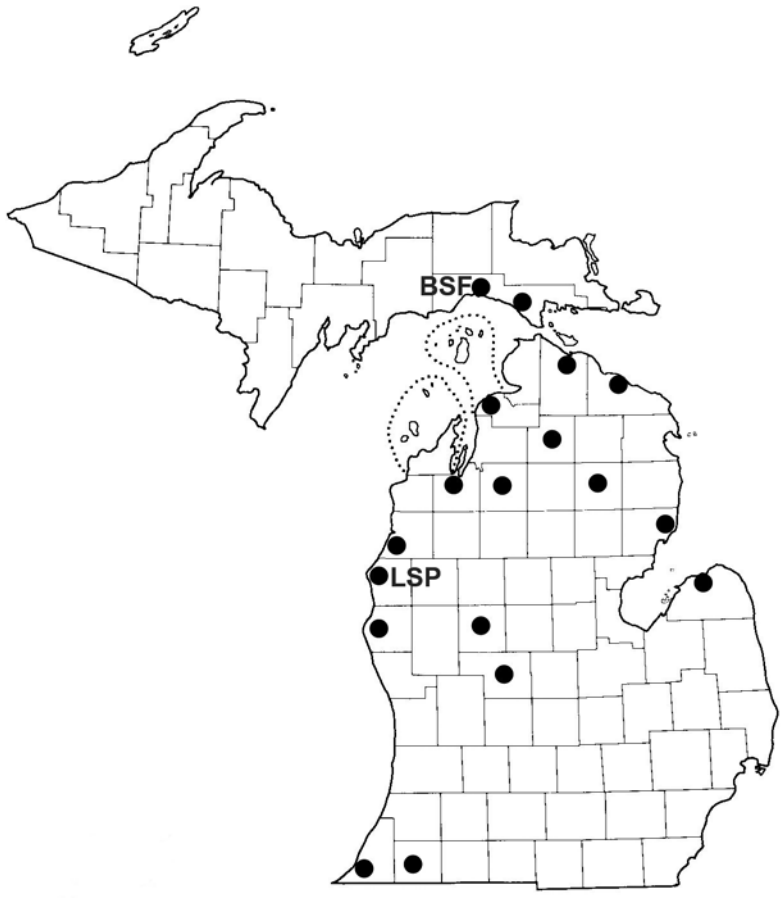

Figure 1. Map of Michigan, with dots representing collection localities of *Dianthidium simile* from specimens in the Univ. of Michigan Museum of Zoology and Michigan State Univ. Cook Arthropod Research Collection. The two study sites are designated as follows: BSF = Big Knob State Forest Campground, and LSP = Ludington State Park.

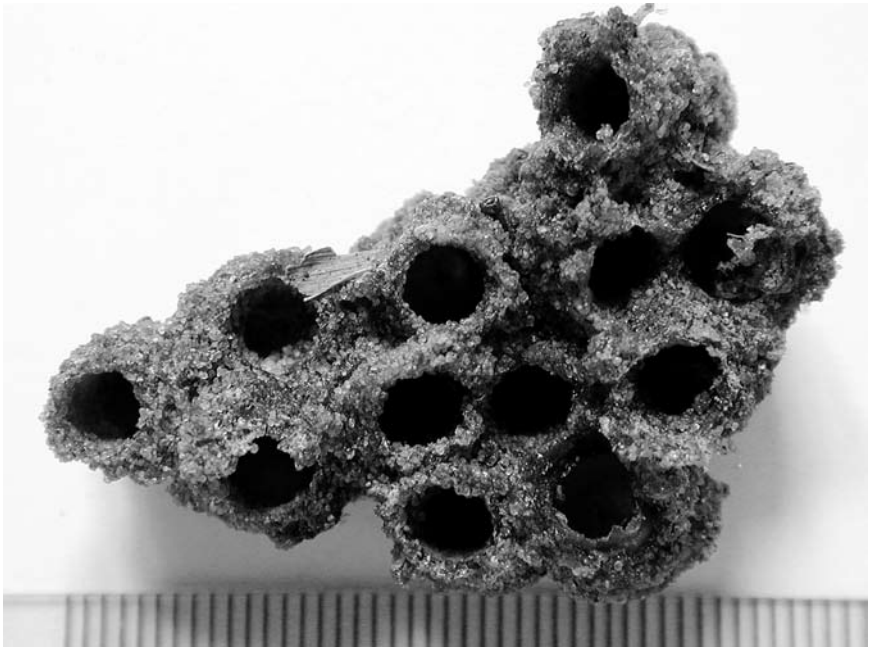

Figure 2. Excavated nest of *Dianthidium simile*, Mason Co., MI. The scale is in mm.

Figure 3. Excavated nest of *Dianthidium simile*, Mason Co., MI. The scale is in mm.

DISCUSSION

Dianthidium simile is an interesting inhabitant of the dune ecosystem, and it would be desirable to know how much variation exists in nest site selection across its range. Romankova (2004) listed many Ontario sites that also appear to be located near water and a similar flight period (July-August). In Michigan, most of the localities are around the margins of the state, with a few in the interior (Fig. 1). Based on observations, I would predict all of the sites to be in sandy substrates.

Nests from BSF differed from those found at LSP. For example, the LSP nests had most of the cells oriented in the same direction and the clumps of cells were more connected forming a mass of cells in a single plane, whereas the BSF cells were more random in orientation and fewer than 5 cells in a cluster was typical (Fig. 4). Of course, there was a mixture of old (previous years) and new cells in the BSF matrix of cells amidst the grass rhizomes, whereas the LSP cells all appeared recently constructed.

Although there were some differences in the maximum number of cells and orientation between nests in Mason and Mackinac Counties, that may only be a reflection on the ability of a bee to dig amongst grass rhizomes and construct adjacent cells. Otherwise, the two sites are consistent in terms of substrate, cell size, materials used in lining the cells, and location of the nests. Based upon the two sites, it appears that a given nesting area supports many individuals nesting in close proximity, as reported for the closely related *D. curvatum sayi* (Michener and Michener 1999).

I am skeptical of Fischer's (1951) report of rearing two *D. simile* from a partially-rotted log. Without further attribution as to the site and specimen verification, it's a bit anomalous compared to what I have seen for *D. simile* in Michigan, however, if the rotted log came from a sandy area, the record would certainly be more credible.

Figure 4. Excavated cells from nests of *Dianthidium simile*, Mackinac Co., MI. The scale is in mm.

ACKNOWLEDGMENTS

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All specimens and nest materials collected by me are deposited in the collection of the Insect Division at the University of Michigan Museum of Zoology.

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