

Nest Architecture of *Megachile yaeyamaensis* YASUMATSU et HIRASHIMA
(Hymenoptera, Megachilidae)

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Abstract Nesting site and nest architecture of *Megachile yaeyamaensis* YASUMATSU et HIRASHIMA is described from Iriomote Is., Japan for the first time.

Key words: Nesting site; nest architecture; Iriomote Is.; southwestern Japan.

As red-haired leaf-cutting bee of the group of *Megachile bicolor*, 5 species are known to occur from East Asia (YASUMATSU & HIRASHIMA, 1964). Out of 2 species, *M. yaeyamaensis* YASUMATSU et HIRASHIMA and *M. xanthothrix* YASUMATSU et HIRASHIMA are known to nest in sandy soil (YASUMATSU, 1931; YASUMATSU & HIRASHIMA, 1964). Presumably, other 3 species seem to be also sand-nesting bees. The nest of *M. yaeyamaensis* was found in Iriomote Is. (lat. 24° 20' N) on September 18, 2003, when the founding bee returned to her nest with a leaf piece. In this paper, details of the nesting site and nest architecture of *M. yaeyamaensis* are described. Nesting sites of Japanese leaf cutting bee species cited here were abbreviated as follows: G (ground), T (tubes) and D (decaying wood cavity).

1. Nesting site

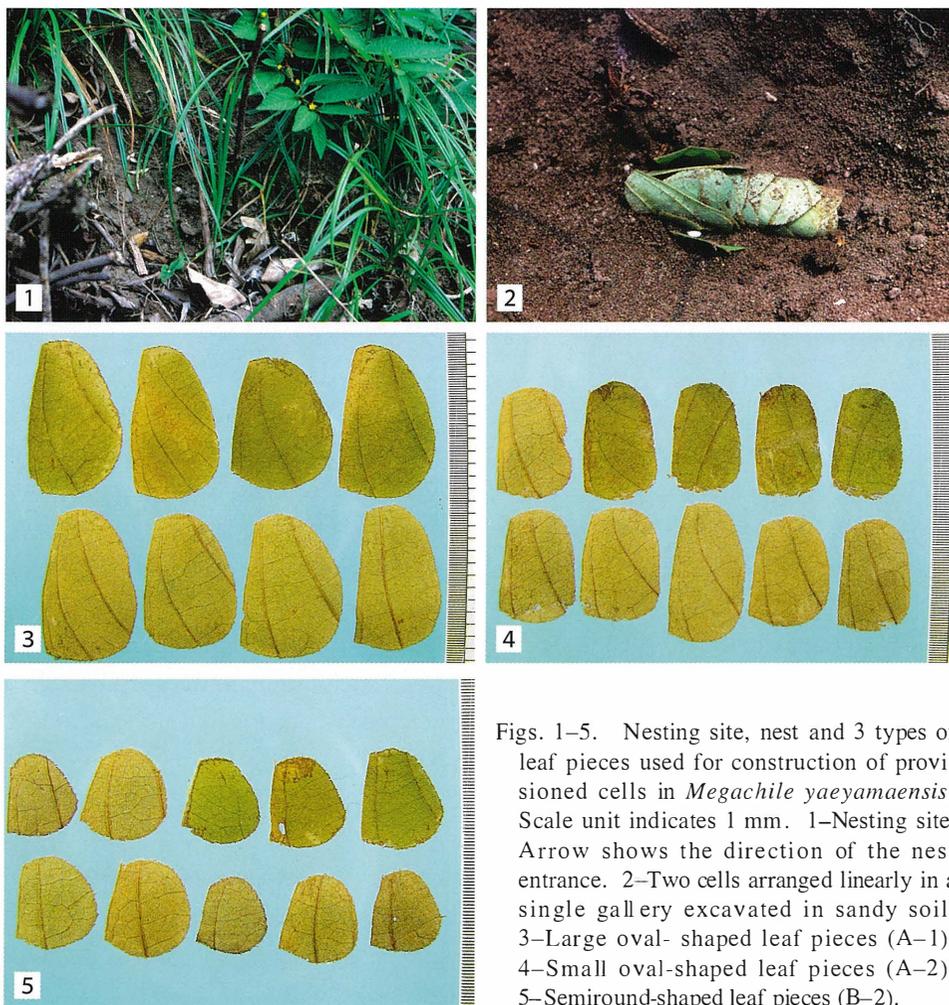
The nest was found in the sandy soil of a slope of hillock that was intermixing with dead tree branches and boughes. The nest entrance was faced towards the road side. The surface of the hillock, where the nest was located, was concave and covered sparsely with various weeds (Fig. 1). The entrance burrow was obscure, as it was merely closed with loose sandy soil.

YASUMATSU and HIRASHIMA (1964) found a very small nest aggregation of *M. yaeyamaensis*, which was situated in the sandy bank, slightly sloping and facing to the road at Kabira, Ishigaki Is., 20 km apart from Iriomote Is. To some extent, the present situation also corresponds with such habitat. *Megachile yaeyamaensis* seems to not make nest aggregation, like other sand-nesting leaf-cutting bees, e.g., *M. xanthothrix* (YASUMATSU, 1931), *M. kobensis* COCKERELL (MAETA & MINAGI, 1999), and *M. rixator sakishimana* YASUMATSU et HIRASHIMA (KITAMURA *et al.*, 2001).

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Figs. 1-5. Nesting site, nest and 3 types of leaf pieces used for construction of provisioned cells in *Megachile yaeyamaensis*. Scale unit indicates 1 mm. 1-Nesting site. Arrow shows the direction of the nest entrance. 2-Two cells arranged linearly in a single gallery excavated in sandy soil. 3-Large oval-shaped leaf pieces (A-1). 4-Small oval-shaped leaf pieces (A-2). 5-Semiround-shaped leaf pieces (B-2).

2. Nest architecture

The nest was excavated by us in the evening on the same day. A single burrow, which was located slightly upward (10 degrees) and was ca 12 cm in length, was found. It had 2 cells (5 cm in length). These 2 cells were made by fresh green leaf pieces (Fig. 2) of a single plant species, *Uraria crinita* (L.) Desv. ex. DC. The burrow was located beneath a piece of timber board. Tracing the burrow structure was difficult, as it was excavated in dry loose sandy soil. The diameter of the burrow, estimated indirectly from that of provisioned cells, was about 13 mm.

The Japanese leaf-cutting bees cut 3 different types of leaf pieces, *i.e.*, 1) large oval-shaped (A-1, Fig. 3), 2) small oval-shaped (A-2, Fig. 4), and 3) either semiround-shaped (B-2, Fig. 5) or completely round-shaped (B-1) from fresh or withered leaves. The former two (A-1 and A-2) are usually used for constructing cell cups, and the last two (B-2 and B-1) mainly for closing the cell cups. In these leaf pieces except for B-1, natural brim of leaf are partially remained. Some species of leaf cutting bees, *e.g.*, *M. rotundata* (FABRISIUS) (T), *M. kobensis* (G), *M.*

Table 1. Number and size of leaf pieces used for construction of provisioned cells in a nest of *Megachile yaeyamaensis*.¹⁾

Cell no.	Cup ²⁾		Cap		Remarks
	A-1	A-2	B-2	B-2	
1	19	4	9	0	Abandoned without completion
2	8	5	1	2	Being closed the mouth of cell
Size of leaf pieces (mm) ³⁾	23.8±1.2×	18.8±0.4×	11.5±0.8×	11.8±0.0×	
	15.4±1.3	12.5±0.6	9.8±0.6	10.6±0.2	
<i>N</i>	27	9	10	2	

1) Leaf pieces used for constructing cup and cap of cells were not shown by separating filler and firm leaves (MICHENER, 1953).

2) A-1: Large oval-shaped leaf piece; A-2: Small oval-shaped leaf piece; B-2: Semiround-shaped leaf piece.

3) Indicated by long and short axes, and given as mean ± SD.

subalbata YASUMATSU (T), *M. ainu* HIRASHIMA et MAETA (T), and *M. japonica* ALFKEN (G) (MAETA & MINAGI, 1999) cut only B-2 type and reform them so as to make round by masticating the margin with their mandibles. These modified B-2 (=B-1) are used at the inner part of cell caps. On the other hand, *M. rixator sakishimana* (G) and *M. tsurugenis* COCKERELL (T) cut only completely round-shaped leaf pieces (B-1). However, they also reform some of B-1 to reduce slightly the diameters. Reforming the shape of B-1 and B-2 seems to be performed to adjust them with the mouth of cell cups (KITAMURA *et al.*, 2000; MAETA *et al.*, 2001).

Table 1 shows the number and size of the above mentioned leaf pieces, which were used for cells in *M. yaeyamaensis*. Discrimination between filler leaves (used to fill the excess space around the cell) and firm leaves (used to form a cup by adhering each other with glue, supposedly secreted from mandibular gland) was rather difficult in *M. yaeyamaensis*. Neither immature on the pollen loaf nor cell cap was found in the first cell, presumably the cell was abandoned on the way of construction. Moreover, many B-2 were used as filler leaves, such case was unusual in leaf cutting bees. It happened probably because the bee could not maintain the appropriate diameter of the burrow. On the other hand, the second cell was normal and five A-2 were used as firm leaves to form the inner wall of the cup. A single B-2 was also used at the basal part of cup in both of the cells. The second cell was being closed with B-2 after oviposition. It is obvious that *M. yaeyamaensis* does not have a habit to use B-1, arising from reformed B-2. Moreover, the shape of B-2 in *M. xanthothrix* (Fig. 5) is remarkably roundless as compared with that of other species, which use B-1 modified from B-2. It may suggest that the technique to cut B-2 is poor in this species.

In *M. xanthothrix*, which belongs to the same group of *Megachile bicolor*, B-2 were almost exclusively used to close the mouth of cup (YASUMATSU, 1931; IWATA, 1941; MAETA & MINAGI, 1999). The monopolistic use of B-2 is also known in other Japanese species, such as *M. nipponica* (G, T), *M. humilis* SMITH (G), *M. igniscopata* COCKERELL (T), *M. lagopoda furukawai*

YASUMATSU (G), *M. pseudomonticola* HEDICKE (D), *M. remota sakagamii* HIRASHIMA et MAETA (G), and *M. sumizome* HIRASHIMA et MAETA (G, T) (MAETA & MINAGI, 1999).

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