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Two new species of *Hylaeus (Nesoprosopis)* (Hymenoptera: Colletidae) from O‘ahu, Hawai‘i

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Abstract

New insect species, even in relatively conspicuous taxa, continue to be discovered on O‘ahu despite its status as the most intensively collected island in Hawai‘i. This paper describes two new island endemic bees, *Hylaeus makaha* **new species** and *Hylaeus ulaula* **new species**. Both are known from a single site, a patch of remnant diverse mesic forest in Makaha Valley.

Key words: Hawaii, bees, pollinator conservation, endangered species

Introduction

The native bee fauna of Hawai‘i consists of a single radiation of *Hylaeus (Nesoprosopis)*. The previous revision, in 2003, described 10 new species, bringing the total to 60 (Daly & Magnacca, 2003). While the total diversity is relatively low compared to a continental area of similar size and ecological variation, this is nevertheless more *Hylaeus* species than occur in all of North America, and approximately 10% of the world total (Michener, 2007). Expanding on the previous work, this paper describes two newly-discovered O‘ahu endemic *Hylaeus*, both from the same site in Makaha Valley. These findings are particularly significant with the recent listing of seven Hawaiian *Hylaeus* as candidate endangered species (U.S. Fish and Wildlife Service, 2011). Six of those seven species are currently or were historically known from O‘ahu. Given that they were found in a small patch of diverse mesic forest, a rare habitat, and had not been collected in previous searches of other sites, both of the new species may be endangered as well. In addition, both were collected visiting flowers of an endangered plant, *Chamaesyce herbstii* (Euphorbiaceae), and may be important pollinators in this ecosystem.

The island of O‘ahu occupies an unusual position in the biogeography of the Hawaiian *Hylaeus*. Although it is relatively isolated, less than half of the species are island endemics. Several multi-island species found there (*H. anthracinus*, *H. connectens*, and *H. laetus*) are not genetically distinct from populations found on Maui Nui, even though Hawai‘i island populations (across a channel of similar width) are almost all distinct (Magnacca & Brown, 2010; Magnacca & Danforth, 2006). Nearly all of the O‘ahu island endemic species are extremely rare: one, *H. anomalus*, was moderately abundant in the eastern Ko‘olau range during the early period of collecting (1892–1930) but has not been seen since then; a second, *H. mimicus*, has the same distribution and is currently moderately common, but was taken only once during the earlier period. The remainder—*H. kuakea*, *H. mana*, *H. nalo*, and the two described here, as well as the O‘ahu population of *H. specularis* if it is a cryptic species—are only known from one or two collections and fewer than five specimens (Daly & Magnacca, 2003). This degree of localization (presumably an artefact of habitat destruction), combined with the fact that five of these rare endemics have been discovered in the last decade in spite of intensive collecting on the island since the 1890’s, suggests that 1) additional new species remain to be found on O‘ahu, and 2) others probably became extinct before they were discovered. The relatives of *H. nalo*, which is so distinctive that it cannot be placed into a species group and is itself only known from a single 1914 specimen, probably fall into the latter category.

Bees in general, and *Hylaeus* in particular, are usually described primarily from the males, and females are often difficult to reliably associate. However, in light of the low number of total specimens, the current push for increased invertebrate conservation awareness in Hawai‘i (Mitchell, et al., 2005; U.S. Fish and Wildlife Service,

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2011), and the unusual distinctiveness of these two species, I have decided to describe them from the current specimens, which are all females. Both are almost unique among non-parasitic Hawaiian *Hylaeus* in having extensive reddish coloration. The males should be readily recognizable based on this alone. They are also notable in being clearly closely related to quite distinctive species from the island of Hawai'i. That no related species are known from Maui Nui may indicate that more remain to be discovered there.

Type and paratype specimens are deposited at the Bernice Pauahi Bishop Museum (BPBM) and the University of Hawai'i at Mānoa Insect Museum (UHIM) in Honolulu. DNA sequences for the COI gene have been deposited at the Barcode of Life Database (http://www.boldsystems.org) and GenBank, with accession numbers noted below. Description conventions follow Daly & Magnacca (2003). Setae length is expressed in units of hundredths of a millimeter (usually equivalent to eyepiece micrometer tic marks at 10× magnification on a dissecting microscope, but calibration with a stage micrometer is necessary for accuracy). The first number in the range is the height of the shorter, dense layer of setae, and the second is that of the sparser emergent setae.

***Hylaeus makaha* n. sp.**
Fig. 1

Diagnosis. The color pattern, with a black mesosoma and largely orange-red metasoma with prominent black bands, is unique. The metasoma color serves to distinguish it from *H. mimicus* and *H. kokeensis*, which have the female face similarly marked. It is also the only species aside from *H. kona* and *H. kokeensis* to have the median plate yellow.

Description. ♀. **Head.** Front of head only weakly convex in lateral view. Mandible with two teeth. Malar space short, length 0.4 times the diameter of the median ocellus. Upper paraocular area and frons with small round pits less than one pit width apart, somewhat closer near the midline but not congested or distorted. Apex of clypeus weakly emarginate. Dorsal end of facial fovea just reaching to level of lateral ocellus. Vertex hair 6–10, pale brown, plumose. **Mesosoma.** Fore tarsus with most hairs erect, apically curved. Scutum with inconspicuous punctation consisting of very small, shallow pits 2–3 pit widths apart, ground dull; hair extremely short (about 2, rarely to 6), pale brown, simple. Scutellum with slightly larger pits, slightly lustrous. Metanotum dull. Mesepisternum with shallow pits 1–2 pit widths apart, ground smoothly coriaceous, lustrous; with long, yellow, plumose hair. Hypoepimeron weakly punctate, slightly swollen. Basal area of propodeum, including brow, smoothly coriaceous and lustrous, sometimes with a few short rugae at base. **Metasoma.** Disk of T2 impunctate, smoothly coriaceous, lustrous, with fine, pale, appressed hairs spaced about one hair length apart or more. T6 hair long, dark brown, erect. **Color.** Head and mesosoma black; metasoma predominantly reddish-orange with black bands. Face with three separate yellow marks: paraocular area with a broad stripe filling in area between clypeus and eye, extended along eye above antennal socket; clypeus with a more or less triangular apical mark of variable size, at largest occupying about the middle half laterally and extended back about halfway, sometimes reduced to a small orange smudge (probably occasionally absent). Pronotum with marks on lobes and interrupted transverse collar stripe; tegula with a yellow spot; median plate at base of wing yellow. Legs black except front tibia with anterior pale area, all femora narrowly yellow apically, and all tibiae yellow on basal half. Wings hyaline. Metasoma predominantly reddish orange, each segment with a broad dark brown dorsal band and a small dark lateral spot; T1 also with a large irregular dark spot on each side. T6 entirely black.

♂. Unknown. Probably with face marks resembling *H. kona* and body coloration resembling the female.

Holotype. O'ahu: ♀ (BPBM 17298), Makaha Valley, 2200 ft., 21.502°N 158.168°W, at *Bidens torta*, 10.viii.2010, K. Magnacca.

Paratypes. 3♀, same data as holotype, at *Chamaesyce herbstii* (1 at BPBM, 2 at UHIM).

Other Specimens. 1♀, 20.ix.2009, otherwise same data as paratype (used for DNA extraction, specimen temporarily stored at University of Hawai'i–Hilo research collection), GenBank accession no. JN679599.

Etymology. From the type locality, Makaha Valley. It is to be treated as a noun in apposition.

Discussion. The female keys to couplet 32 in Daly & Magnacca (2003), where it does not fit with either *H. kona* or *H. mimicus* due to having both the median plate yellow and usually at least a trace of a clypeal mark (the 2009 specimen lacks a clypeal mark and would run to *H. kona*). The distinctive banded metasoma is, oddly, otherwise only found in the sympatric *H. ulaula*, which is not closely related; both belong to the *dumetorum* species group but are not sibling species, and no other known members of the group have reddish coloration.

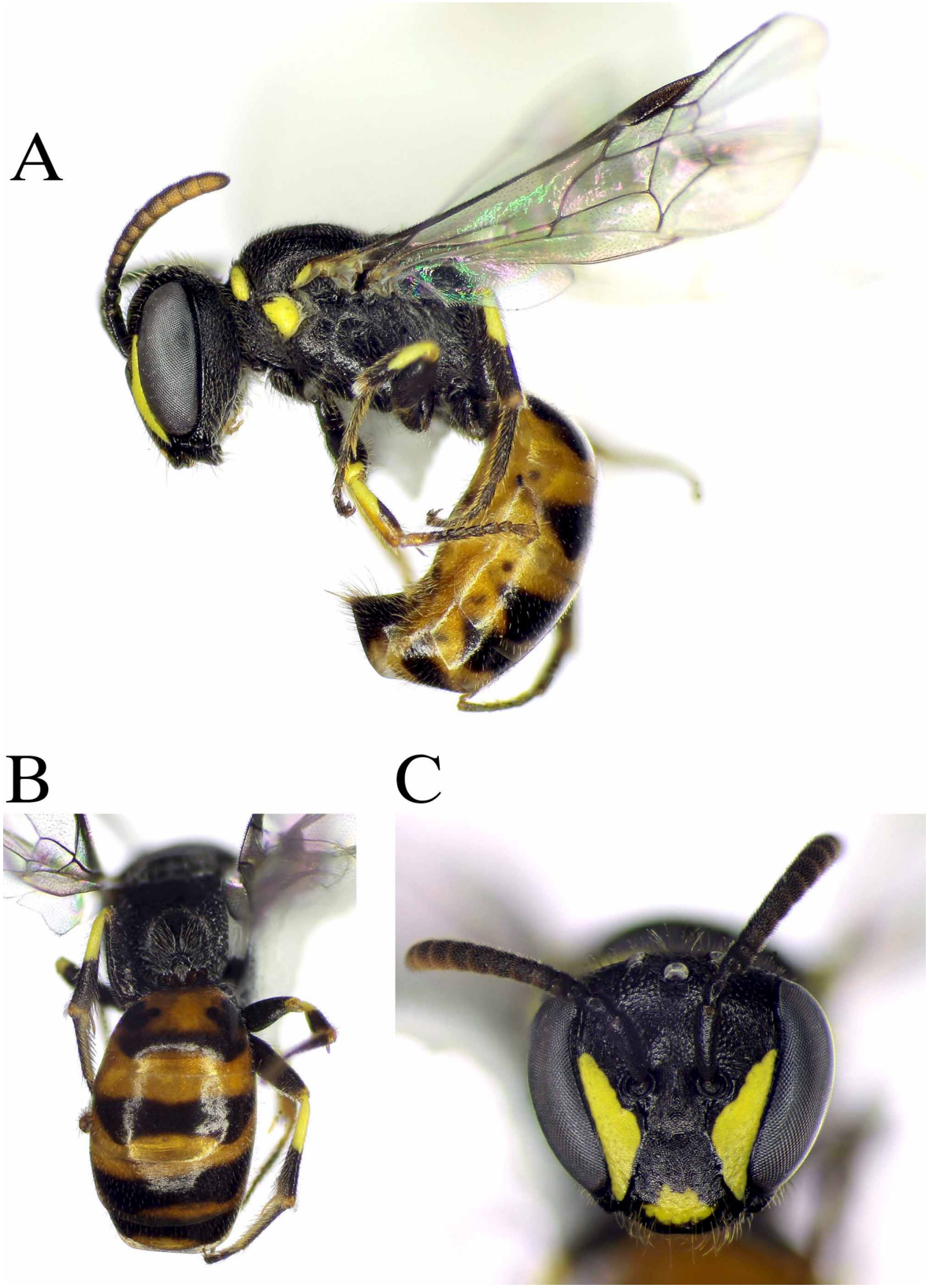

FIGURE 1. *Hylaeus makaha*, holotype ♀. A) Lateral habitus. B) Metasoma, dorsal view. C) Head, frontal view.

***Hylaeus ulaula* n. sp.**
Fig. 2

Diagnosis. This species is structurally almost identical to *H. crabronoides*, but the coloration is strikingly different. Due to the large facial markings, it would key to *H. mimicus* in Daly & Magnacca (2003). It is readily separated from that species and *H. makaha* by both the extensive red coloration of the head and mesosoma; and the structure of the head, which is strongly convex in lateral view with a prominent upper frons and clypeus as in *H. crabronoides*.

Description. ♀. **Head.** Front of head strongly convex in lateral view, apical portion of clypeus curving caudad and frons strongly convex between median ocellus and antennal sockets. Clypeus bulging well beyond the margin of the eye in lateral view. Mandible with two teeth. Malar space short, length 0.4 times the diameter of the median ocellus. Upper paraocular area and frons with small round pits less than one pit width apart, smaller and denser medially, contiguous above the supraclypeal area. Apex of clypeus weakly emarginate. Dorsal end of facial fovea not reaching to level of lateral ocellus. Vertex hair very short 2–4, simple. **Mesosoma.** Fore tarsus with most hairs erect, apically curved. Scutum with inconspicuous punctation consisting of very small, shallow pits 2–3 pit widths apart, ground dull; hair extremely short (about 2, rarely to 6), simple. Scutellum with slightly larger pits, slightly lustrous. Metanotum dull. Mesepisternum with shallow pits 1–2 pit widths apart, ground smoothly coriaceous, lustrous; with long, yellow, plumose hair. Hypoepimeron weakly punctate, slightly swollen. Basal area of propodeum, including brow, smoothly coriaceous and lustrous. **Metasoma.** Disk of T2 impunctate, smoothly coriaceous, lustrous, with fine, pale, appressed hairs spaced about one hair length apart or more. T6 hair long, dark brown, erect. **Color.** Face with three separate yellow marks: paraocular area with a broad stripe filling in area between clypeus and eye, extending broadly along eye above antennal socket; clypeus with an irregular apical mark, probably highly variable. Clypeus, supraclypeal area, mandibles, entire gena behind eye, and scape orange; frons from antennal sockets and above supraclypeal area to vertex black. Pronotum black, with yellow marks on lobes and interrupted transverse collar stripe; tegula transparent orange-brown, apparently with an indistinct yellow spot. Mesonotum largely orange-red, lateral and posterior margins black. Scutellum predominantly dark brown, irregularly rufous on the disc; axillae, metanotum, and propodeal triangle dark brown. Mesepisternum dark brown anterior of episternal groove, orange-red posterior; metapleuron and lateral face of propodeum also orange-red. Front coxae black, mid and hind coxae and all trochanters orange. All tibiofemoral joints narrowly marked with yellow. Front legs otherwise orange, tinged with brown; mid and hind tibiae and femora brown dorsally, grading to orange ventrally, tarsi brown. Wings slightly smoky. Metasoma prominently banded, T2–5 yellow-orange anterior and posterior with a broad dark brown medial band; T1 mostly brown dorsally with a large irregular pale spot on each side, T6 almost entirely brown.

♂. Unknown. Probably with face marks resembling *H. crabronoides* and body coloration resembling the female.

Holotype. O‘ahu: ♀ (BPBM 17299), Makaha Valley, 2200 ft., 21.502°N 158.168°W, at *Chamaesyce herbstii*, 10.viii.2010, K. Magnacca, GenBank accession no. JN679600.

Etymology. From the Hawaiian *‘ula‘ula*, very red, referring to the coloration. It is a non-latinized genderless adjective.

Discussion. A pale female specimen from Maui, identified as *H. specularis* in Daly & Magnacca (2003: 192), was presumed to have been heavily bleached by storage in alcohol or other materials, but may instead be a relative of *H. ulaula*.

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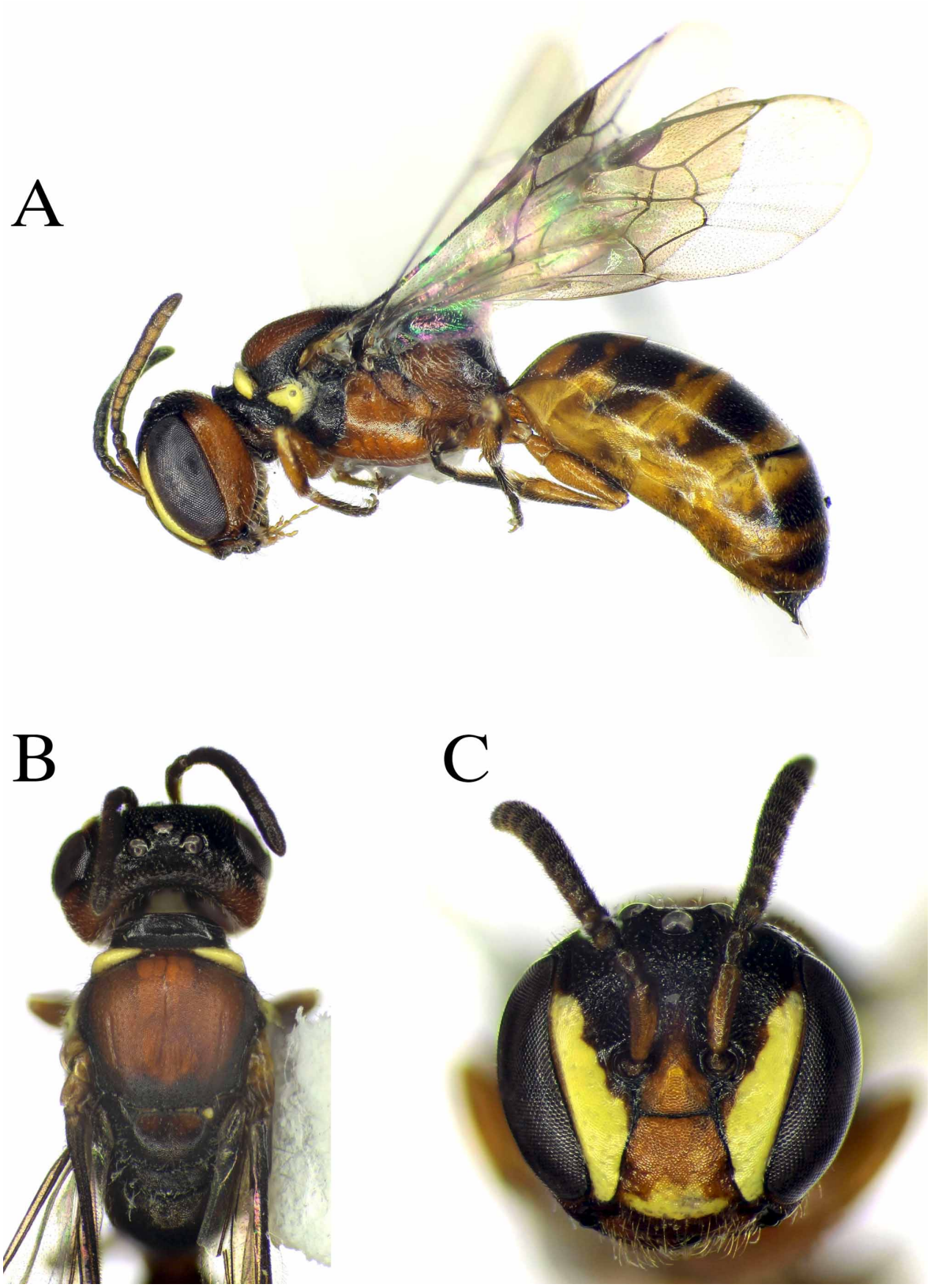

FIGURE 2. *Hylaeus ulaula*, holotype ♀. A) Lateral habitus. B) Head and mesosoma, dorsal view. C) Head, frontal view.

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