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Range extension of the introduced bee species *Euglossa dilemma* (Hymenoptera: Apidae) in Monroe County, Florida, with notes of additional range extensions in southern Florida

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The spread of introduced species into a novel range should be determined by bioclimatic and ecological conditions that are similar to the native range. In 2003, an introduced orchid bee, originally identified as *Euglossa viridissima* Friese but now known to be *Euglossa dilemma* Bembé & Eltz (Hymenoptera: Apidae) (Eltz et al. 2011), was found in Broward County, Florida, attracted to baited traps during a fruit fly monitoring survey (Skov & Wiley 2005). By 2004, the species had spread south to adjacent Miami-Dade County (Skov & Wiley 2005; Liu & Pemberton 2009). Subsequent sampling with baited traps found the species occurring northward into Palm Beach County (Pemberton & Wheeler 2006). A modeling approach with bioclimatic data predicted that all of south Florida would be suitable habitat and that the species would likely spread to these areas in the near future with the highest habitat suitability predicted to be in southwestern peninsular Florida (Hinojosa-Díaz et al. 2009).

A 1 d survey of bees in the Flamingo area of Everglades National Park (Monroe County, Florida) was made 12 to 13 Aug 2016, with the 3 following techniques. Fifteen to 30 pan traps, which are 103.5 mL plastic cups painted fluorescent yellow, fluorescent blue, or unpainted white, were placed every 5 m on the ground and filled with soapy water. Colors alternated along the transect, and all traps were pooled within the transect for data analysis. Blue vane traps (SpringStar Inc.) with blue funnels, blue vanes, and yellow 1.8 L jars were hung from native vegetation at 2 m above ground and filled with soapy water. Both pan traps and blue vane

traps were left open for 24 h from 9 AM to 9 AM the next day. Sweep netting for 1 h was conducted at 2 locations on open flowers (*Bidens pilosa* L. [Asteraceae], *Phyla nodiflora* [L.] Greene [Verbenaceae], *Heliotropium curassavicum* L. [Boraginaceae]) where bees were active. Bees were identified to species based on keys at Discover Life (www.discoverlife.org) and comparison to vouchered collections at the Sam Houston State University Natural History Museum, Huntsville, Texas.

Eight bee species were collected, including 7 native species that had been recorded previously from the Flamingo area of Everglades National Park (Pascarella et al. 2000) and 1 introduced species, *E. dilemma*, which had not been present during the earlier survey (Tables 1 and 2). The introduced species *E. dilemma* was collected in both pan traps and blue vane traps but was not observed on the 3 flowering plant species (Table 2). The species was found throughout the collection area indicating that it is widespread in the coastal prairie and disturbed habitats common to this area, but areas of extensive mangrove forests have not yet been surveyed. In addition to this new record from coastal areas of Monroe County, recent records posted to Discover Life (accessed 23 Aug 2016) indicate further spread south in Miami-Dade County and spread into Collier and Lee counties on the west coast of Florida, with records from Biscayne National Park (19 Sep 2012), Naples (20 Oct 2012), and Sanibel Island (23 Sep 2015). As Skov & Wiley (2005) and Hinojosa-Díaz et al. (2009) predicted, the species has effectively colonized the potential range in Florida. As the species is an effective pollinator of both native

Table 1. Collections of bees from Flamingo area (Monroe County, Florida).

| Bee family | Species and author | Pan traps | Sweep nets | Blue vane traps | Total |
|--------------|--|-----------|------------|-----------------|-------|
| Apidae | <i>Euglossa dilemma</i> Bembé & Eltz | 23 | 0 | 39 | 62 |
| | <i>Melissodes communis</i> Cresson | 7 | 0 | 0 | 7 |
| Halictidae | <i>Augochlora pura</i> (Say) | 1 | 0 | 0 | 1 |
| | <i>Halictus poeyi</i> Lepeletier ^a | 4 | 8 | 0 | 12 |
| | <i>Lasioglossum halophitum</i> (Graenicher) | 8 | 2 | 0 | 10 |
| | <i>Lasioglossum puteuleanum</i> Gibbs ^b | 196 | 8 | 0 | 204 |
| Megachilidae | <i>Megachile pruina</i> Smith | 36 | 0 | 1 | 37 |
| | <i>Megachile pseudobrevis</i> Mitchell | 8 | 0 | 0 | 8 |
| Total | <i>N</i> = 8 species | 283 | 18 | 40 | 341 |

^a*Halictus poeyi* is indistinguishable morphologically from *Halictus ligatus* Say but differs genetically. Individuals sampled from south Florida were all *H. poeyi* (Carman & Packer 1996).

^bPreviously identified as *Dialictus tegularis* (Pascarella et al. 2000).

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Table 2. Collections of *Euglossa dilemma* bees from sites surrounding Flamingo, Everglades National Park (Monroe County, Florida).

| Trap type | Location | Sample size | No. of females | No. of males |
|------------------|--------------------------------------|-------------|----------------|--------------|
| Pan trap | Trailer parking coastal prairie edge | 15 | 3 | 0 |
| | Trailer parking area—weedy | 15 | 2 | 0 |
| | Tent camping coastal prairie edge | 15 | 1 | 0 |
| | Tent camping area—weedy | 15 | 1 | 0 |
| | Grassy area | 15 | 0 | 0 |
| | Water edge 1 | 15 | 2 | 0 |
| | Water edge 2 | 15 | 1 | 1 |
| | Weedy area 1 | 30 | 7 | 0 |
| | Christian Pass coastal prairie 1 | 30 | 1 | 0 |
| | Christian Pass coastal prairie 2 | 30 | 4 | 0 |
| Total (pan trap) | | 195 | 22 | 1 |
| Blue vane trap | Trailer parking coastal prairie edge | 1 | 25 | 4 |
| | Christian Pass coastal prairie | 1 | 8 | 2 |
| | Total (blue vane trap) | 2 | 33 | 6 |
| Sweep net | Trailer parking coastal prairie edge | 1 h | 0 | 0 |
| | Water edge 2 | 1 h | 0 | 0 |
| | Total (sweep net) | | 0 | 0 |
| All 3 trap types | Total (all 3 trap types) | | 55 | 7 |

and non-native plants (Pemberton & Wheeler 2006; Liu & Pemberton 2009), continued research will be needed to determine its ecological impact in various areas. In addition to fruit fly traps and other baited traps that have been shown to be highly effective in sampling this species (Skov & Wiley 2005; Pemberton & Wheeler 2006), this study shows that *E. dilemma* may be collected using soapy water pan traps and unbaited blue vane traps, which are highly effective in collecting large numbers of individuals and in attracting males.

Collections were made under a Scientific Research and Collecting Permit issued by Everglades National Park (study # EVER-00530, accession # EVER-02188). Funding for travel and sampling equipment was provided by the Sam Houston State University College of Science and Engineering Technology.

Summary

The introduced bee species *Euglossa dilemma* Bembé & Eltz (Hymenoptera: Apidae) continues to spread south and west of its 2003 introduction in Broward County, Florida. This study confirms its presence in Monroe County, and additional new internet records from 2012 to 2016 have found it present in Collier and Lee counties on the west coast of Florida. Soapy water pan traps and blue vane traps were found to be effective in sampling this species, which had previously only been collected with baited traps.

Key Words: invasive species; pollinator; pan trap; blue vane trap

Sumario

Una especie de abeja introducida *Euglossa dilemma* Bembé & Eltz (Hymenoptera: Apidae) continúa extendiéndose al sur y al oeste de su

primera introducción en el 2003 en el condado de Broward, Florida. Este estudio confirma su presencia en el condado de Monroe, y nuevos registros de internet del 2012 a 2016 lo han encontrado en los condados de Collier y Lee en la costa oeste de la Florida. Se descubrió que las trampas de bandejas con agua jabonosa y las trampas “vane” azules son efectivas en el muestreo de esta especie, que anteriormente sólo se había recolectado con trampas cebadas.

Palabras Clave: especies invasoras; polinizado; trampa de bandeja; trampa vane azul

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