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ESTABLISHMENT OF THE NEOTROPICAL ORCHID BEE *EUGLOSSA VIRIDISSIMA* (HYMENOPTERA: APIDAE) IN FLORIDA

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Neotropical orchid bees (Hymenoptera: Apidae: Euglossini) have been reported only twice from the United States of America; once near Brownsville, Texas (23.III.1908) and more recently (4.IV.1994) near Silverbell, Arizona (32°22'N, 111°26'W). In each case, a single male *Eulaema polychroma* Mocsáry 1899 had strayed north of the border from breeding populations in northern Mexico (Minckley & Reyes 1996).

During the summer of 2003, however, several male *Euglossa viridissima* Friese 1899 were trapped around Fort Lauderdale (26°08'N, 80°08'W), Florida, by USDA employees in the fruit fly monitoring program and sent to the Florida State Collection of Arthropods for identification (Wiley 2004). To date, more than 50 males and several females have been reported (Table 1). Neither the exact location of the introduction nor the current distribution in Florida is known. However, observations point to an accidental introduction around Butterfly World, Coconut Creek, Broward County—likely as a nest inside a wooden object (shipping pallet, bamboo furniture etc.)—followed by a southward spread to Dade County in 2004.

Euglossa viridissima is native to Mexico and most of Central America and recorded from near sea level up to 1,900 m.a.s.l. (Ramírez et al. 2002). The natural distribution mainly follows the range of the tropical dry forest on the Pacific Coast, from NW Costa Rica (ca. 10°N) to the northernmost population near 27°N in the State of Sonora, Mexico (Janzen et al. 1982; Búrquez, 1997), although the species has adapted to habitats ranging from lowland tropical rain forest over arid, scrubby secondary forest to oak-pine forest at 1,300-1,800 m.a.s.l. (pers. obs., Fierros-Lopez 1998). Adult males are active when ambient temperature exceeds 20°C, and the "typical" habitat will be 25-28°C with 70-80% relative humidity (pers. obs.).

Euglossa viridissima is a robust, medium-sized bee (3-4 mm wide, 11-13 mm long), bright metallic green, and with a long tongue (10 mm) neatly folded underneath the body. The male has a characteristic cushion of blond hairs on the second sternum (Roubik & Hanson 2004). *E. viridissima* nests in natural as well as man-made cavities (Friese 1922; Aquino Vázquez & Cuadriello Aguilar 1990). The females gather resin to seal off any cracks in the cavity, leaving only a small entrance hole, and to construct barrel-shaped cells for the mass-provisioned offspring. Each cell is about 11-12 mm tall, 5-8 mm across, and "glued" together with neighboring cells in a roughly hexagonal pattern in one plane (Friese 1922). A nest holds 4-20 cells, which can stand on the floor, or be glued to the walls, giving a "flying carpet" impression (Aquino Vázquez & Cuadriello Aguilar 1990). Sometimes two groups of cells can be found in the same cavity, probably founded independently. There is evidence of cell reuse, and seven females co-existed in a nest with only two open cells, indicating some level of sociality (Aquino Vázquez & Cuadriello Aguilar 1990). In Chiapas, Mexico, the species is multivoltine and generations can overlap. The life expectancy for an individual *E. viridissima* hardly exceeds a few months (60-90 days). During this time, the female can lay a minimum of 6-8 eggs (Friese 1922). The development from egg to adult in the nest studied by Aquino Vázquez & Cuadriello Aguilar (1990) was at least 53 days, but developmental time is expected to vary due to a negative correlation with temperature (Roubik & Hanson 2004).

Male orchid bees leave the natal nest upon eclosion and never return; they do not aid in construction, maintenance, provisioning, or defense of the nest. Instead they devote a considerable amount of time and energy collecting volatile compounds produced in fungus-infested wood, rotting vegetation, and specialized "perfume" flowers in Orchidaceae, Araceae, and a few other families (reviewed in Roubik & Hanson 2004). The fragrances are kept in hind tibiae that are uniquely modified for their storage, and are, most likely, used in species-specific recognition and/or as evidence of male fitness (Eltz et al. 1999). Male *Euglossa viridissima* are known to collect fragrances from at least eleven genera of orchids (Ramírez et al. 2002). They also can be attracted to pure compounds in field bioassays. Eugenol (clove oil) is especially attractive (Cameron & Fenster 1984), followed by cineole, methyl salicylate, *trans*-methyl cinnamate, and benzyl acetate. Males also collect terpinen-4-ol, veratrole, phenylethanol, *p*-cresyl acetate, and geraniol (pers. obs.).

A number of plant families provide resources for *Euglossa viridissima*. Flowers of *Dalechampia* spp. (Euphorbiaceae) that excrete a pliable resin (Armbruster 1988) are the only documented sources of resin for *E. viridissima*. However, Friese (1922) suggested cashew (*Anacardium occidentale*, Anacardiaceae) and conifers (Coni-

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TABLE 1. DOCUMENTED OBSERVATIONS OF *Euglossa viridissima* (HYMENOPTERA: APIDAE: EUGLOSSINI) IN FLORIDA, 2003-2004, COMPILED WITH HELP FROM DR. M. MEDINA HAY-ROE AND A. CHIN LEE (MCGUIRE CENTER FOR LEPIDOPTERA AND ENVIRONMENTAL RESEARCH), DR. J. M. GONZÁLEZ (UNIVERSITY OF GEORGIA), DR. D. W. ROUBIK (SMITHSONIAN TROPICAL RESEARCH INSTITUTE), AND E. BERNIER (EJB PHOTOGRAPHY). THE FORT LAUDERDALE LOCATION REFERS TO FERN FOREST NATURE PARK. THE JACKSON TRAPS ARE EMPLOYED TO LURE FRUIT FLIES WITH SYNTHETIC FOOD ATTRACTANTS SUCH AS ME (METHYL EUGENOL) OR ML (MULTI LURE: PUTRESCINE (DIAMINOBUTANE), AMMONIUM ACETATE, AND TRIMETHYLAMINE). THE SCENT BAITS CONSIST OF BLOTTER PAPER SATURATED WITH SYNTHETIC AROMAS: C (CINEOLE = EUCALYPTOL), E (EUGENOL = CLOVE OIL), OR MS (METHYL SALICYLATE = OIL OF WINTERGREEN). AN ASTERISK IDENTIFIES SPECIMENS OR PHOTOGRAPHS EXAMINED BY THE AUTHORS. MOST SPECIMENS WERE RELATIVELY YOUNG AS EVIDENCED BY INTACT WING MARGINS (WING WEAR IS AN AGE CORRELATE).

Date	Locality	Collector's notes	Specimens	Collector
17.VI.2003	Broward Co.: Coconut Creek	ML trap in mango (*Mangifera indica*)	1 male*	Paul Moeser USDA
13.VIII.2003	Broward Co.: Pompano Beach	Jackson trap in *Mimusops*	1 male*	Julie Palm USDA
8.X.2003	Broward Co.: Margate	Photographed while visiting pale lavender pentas *Pentas lanceolatas* (Rubiaceae) for nectar	1 (sex unknown)	Beth Bernier EJB Photography
IX.2003	Broward Co.: Wilton Manors	Flying around in foliage outside window on 2nd floor	1 female*	Melissa Hope Univ. of Florida
17.IX.2003	Broward Co.: Pompano Beach	ME trap in *Calophyllum*	2 males	David T. Benner USDA
18.XI.2003	Broward Co.: Plantation	Jackson trap	1 male	John Pieper USDA
XI.2003	Broward Co.: Coconut Creek	Photographed on blue porterweed, *Stachytarpheta jamaicensis* (Verbenaceae)	1 male*	Alan Chin Lee Butterfly World
31.III.2004	Broward Co.: Coconut Creek	ME trap	3 males*	Rick McKay USDA
14.IV.2004	Broward Co.: Sunrise	ML trap	1 male	Brian Cairns USDA
16.V.2004	Broward Co.: Ft. Lauderdale	Scent bait (C)	16 males	David Roubik STRI
28.V.2004	Dade Co.: Miami	Jackson trap (*Mangifera indica*)	2 males* (1 examined)	Javier C. del Hierro USDA
17.VIII.2004	Broward Co.: Margate	Photographed while visiting a purple flower	1 (sex unknown)	Beth Bernier EJB Photography
1.X.2004	Broward Co.: Fort Lauderdale	Scent baits (C, MS)	Ca. 20 males	David Roubik STRI
6.X.2004	Broward Co.: Davie	*Persea americana* (avocado)	1 male*	Miryam Briceno USDA
20.X.2004	Broward Co.: Ft. Lauderdale	Photographed while visiting blue porterweed, *Stachytarpheta jamaicensis* (Verbenaceae) for nectar	3 males and 2 females observed, photographs verified both sexes	Beth Bernier EJB Photography
4.XI.2004	Broward Co.: Margate	Photographed while visiting morning glory, *Ipomoea* sp. (Convolvulaceae) for nectar	1 male	Beth Bernier EJB Photography
9.XII.2004	Broward Co.: Margate	Scent baits (artificial vanilla, crushed cloves)	Min. 7 males	Beth Bernier EJB Photography
12.II.2005	Broward Co.: Margate	Scent baits (C, E)	2 males*	Charlotte Skov Univ. of Florida
13.II.2005	Broward Co.: Margate	Feeding on lavender *Lantana* (Verbenaceae)	1 female	Beth Bernier EJB Photography
14.II.2005	Broward Co.: Davie	Scent baits (C, E)	23 males*	Charlotte Skov Univ. of Florida

ferae) as potential resin sources in Costa Rica. In contrast, the bee is quite opportunistic in choice of food plants. Ramírez et al. (2002) list five families, including Apocynaceae and Bignoniaceae, as sources of nectar and/or pollen. The species also has been observed in flowers of Fabaceae (Fierros-

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Lopez 1998) and Passifloraceae (Aquino Vázquez & Cuadriello Aguilar 1990), and females collect pollen from Caesalpinaceae, Commelinaceae, and Nyctaginaceae (pers. obs.). In Mexico, males and females have readily adapted to forage for nectar from introduced plants such as the spice cardamom (*Elettaria cardamomum*, Zingiberaceae) from India (Aquino Vázquez & Cuadriello Aguilar 1990) and the ornamental allamanda (*Allamanda cathartica*, Apocynaceae) from northern Brazil and the Guayanas (pers. obs.). In Florida, *E. viridissima* visits blue and violet flowers of pickerel weed (*Pontederia cordata*, Pontederiaceae), pentas (*Pentas lanceolatas*, Rubiaceae), porterweed (*Stachytarpheta jamaicensis*, Verbenaceae), and morning glories (*Ipomoea* spp., Convolvulaceae) (Table 1).

In conclusion, Southern Florida represents an almost ideal habitat for *Euglossa viridissima*. The temperature and precipitation ranges south of Lake Okeechobee (McPherson & Halley 1996) match those of its native habitats; there are ample floral resources year-round for a long-tongued generalist bee to forage from; pine plantations that could provide resin for nests in urban and natural settings; and there are ornamental peace lilies (*Spathiphyllum* spp., Araceae) and tropical orchids in private gardens and nurseries from which males could collect fragrant compounds. The data presented in Table 1 point to a successful establishment of *E. viridissima* near Fort Lauderdale and we predict a further spread of the species.

Summary

A description of the orchid bee *Euglossa viridissima* and its nesting biology is given as well as notes on climate requirements and plant resources in its native habitats in Costa Rica and Mexico. An assessment is made for the establishment and spread in Florida.

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