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The introduction and establishment of *Campsomeris dorsata* (Hymenoptera: Scoliidae) in Florida

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Scoliidae comprises about 560 species worldwide (Osten 2005), with 20 occurring in North America north of Mexico belonging to 5 genera: *Campsomeris*, *Criscolia*, *Scolia*, *Trielis*, and *Triscolia* (Krombein 1951, 1958, 1967; Betrem 1972). Wasps in this family are characteristically large, often brightly patterned, varying in color combinations of red, yellow, white, and black (Fig. 1). Scoliids are solitary parasitoids of soil-inhabiting scarab beetle larvae (Scarabaeidae) (DeBach 1964). Females burrow into the ground in search of these grubs where they sting, paralyze, and lay a single egg on their prey (Triplehorn & Johnson 2005). Scarabaeidae larvae cause damage to the roots of several plants including turf grass, various beans, tree seedlings, and sugar cane (Kuranaga 1994; Potter & Held 2002; Blossey & Hunt-Joshi 2003). Because these wasps attack scarab beetle larvae, they are considered important biological control agents (Williams 1919; Nagamine 1980; Misra 1996; Inoue & Endo 2006; Grissel 2007).

In Florida, 3 genera (*Campsomeris*, *Scolia*, and *Trielis*) represented by 8 species (*C. fulvohirta* Cresson, *C. plumipes fossulana* Fab., *C. quadrimaculata* Fab., *C. trifasciata* Saussure, *S. bicincta* Fab., *S. dubia* Say, *S. nobilitata* Fab., and *T. octomaculata* Say) are native to Florida (Grissell 2007). Arnett (2000) identified 2 other scoliid species (*Campsomeris annulata* Fab. and *Campsomeris marginella modesta* Smith) that had been introduced in the 1920s in the northeastern United States to control the Japanese beetle (*Popillia japonica* Newman) (Krombein 1948), but have not become established (Fleming 1968). *Campsomeris dorsata* Fab. has been used as a biological control agent in Puerto Rico, Mauritius, and United States mainland (Van Dine 1913; Jepson & Moutia 1939; Clausen 1956) to help combat sugar cane (*Saccharum* spp. [Poaceae]) pests including grubs of coleopterans in the subfamily Melolonthinae (Van Dine 1913), genus *Phyllophaga* (Van Dine 1913), and subgenus *Phytalus* (Jepson & Moutia 1939). *Campsomeris dorsata* is native to South America, Central America, and the West Indies (Bradley 1928), but has not been reported to be established in Florida. In 2016, Florida harvested about 161,874 ha of sugar cane equating to about 16,120,000 tons in yields, making it the leading sugar producing state in the United States. Florida produces about 25% of the sugar in the United States (Glaz et al. 2005), grossing about $450 million in 2008 (Baucum et al. 2009), and about $493 million in 2011 (USDA & NASS 2012). As stated previously, there are a number of insect pests adversely affecting sugar cane, and in 1934 and 1936, *C. dorsata* was imported from Puerto Rico to south Florida to help control these populations (Clausen 1956). Additionally, one other *C. dorsata* colonization event occurred in an area of Louisiana, but never became established (Clausen 1956).

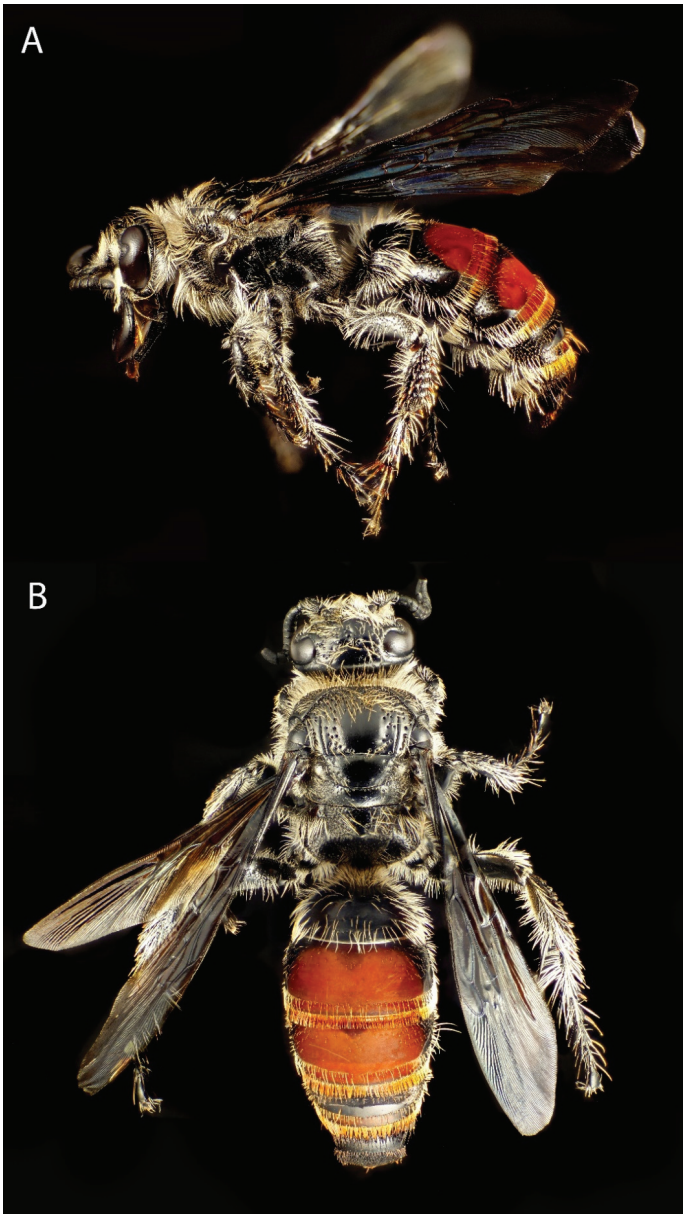

Fig. 1. Lateral (A) and dorsal view (B) of *Campsomeris dorsata*. Wasp is approximately 25 mm in length.

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Very few papers on *C. dorsata* have been published (Van Dine 1913; Bradley 1928; Jepson & Moutia 1939; Clausen 1956); although they provide important information on the biology of this species and its established ranges, they are outdated. The status of *C. dorsata* populations and establishment in Florida (and elsewhere) has been poorly documented. For this reason, it is unknown if *C. dorsata* had become established in Florida during its introduction in the 1930s or if it had become established more recently through other introduction events. Here, we present data that shows *C. dorsata* is most likely widely established throughout south Florida, and may have expanded well outside of sugar cane fields.

During Apr 2016 to Apr 2017 we conducted monthly bee and wasp trapping surveys throughout Florida, ranging from Franklin County to Collier County (east to west) and from Osceola County to Miami-Dade County (north to south) (Fig. 2). All *C. dorsata* specimens were collected from areas that contained deep sandy soils with the use of pan traps (Droege 2009) and vane traps (Stephen & Rao 2005). A total of 91 female *C. dorsata* specimens (no males collected) were collected throughout the survey period (65 in Miami-Dade County, 17 in Broward County, 4 in Osceola County, 3 in Lee County, and 2 in Collier County). *Campsomeris dorsata* were most abundant in Miami-Dade County and least abundant in Collier County. There is virtually no sugar cane production in Miami-Dade County, but landscape and sports turf is a dominant land cover in this highly urbanized county (Hodges & Stevens 2010). Therefore, turf grasses in urban areas may be an important habitat for white grubs and *C. dorsata* (Buss & Dale 2017). Because *C. dorsata* is endemic to South America, Central America, and the West Indies, climactic conditions might be more suitable in south Florida opposed to northern counties of the state. Additionally, we observed higher populations of *C. dorsata* during the fall and winter months, that might be related with greater abundance of their overwintering larval hosts. However, we did not measure prey availability and this needs to be investigated further. Most of the sugar cane agricultural systems are located in the south central part of the state located in the Everglades Agricultural Area around Lake Okeechobee. The Everglades Agricultural Area also is one of the major turf production areas of Florida. Future work should focus on surveying these areas to determine if populations of *C. dorsata* have been established within the Everglades Agricultural Area. Future work also should focus on surveying areas north of Osceola County to determine their most northern range, because it will be of value to the scientific community, as well as sugar cane and turf industries. Future research also should determine whether this non-native species is having any competitive impact on the native scoliids, tiphiids (Tiphiidae), and other soil-inhabiting arthropods.

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Summary

Campsomeris dorsata is a hymenopteran scoliid that is endemic to South America, Central America, and parts of the West Indies. It has been used as a biological control agent in the past in Puerto Rico, Mauritius, and Florida to aid in reducing coleopteran pests in sugar cane agricultural systems. The status of *C. dorsata*'s establishment in Florida has been unknown since intentional introductions to sugar cane fields occurring during the 1930s. We surveyed primarily coastal sites throughout the state of Florida and captured 91 females ranging from Osceola County to Miami-Dade County (north vs south) and from Broward County to Collier County (east vs west). The results from this study show that *C. dorsata* is well established in these areas of Florida, and might still be an important biological control agent of white grubs in sugar cane as well as turf production and maintenance.

Key Words: wasp; sugar cane; turf; dunes; biological control; survey

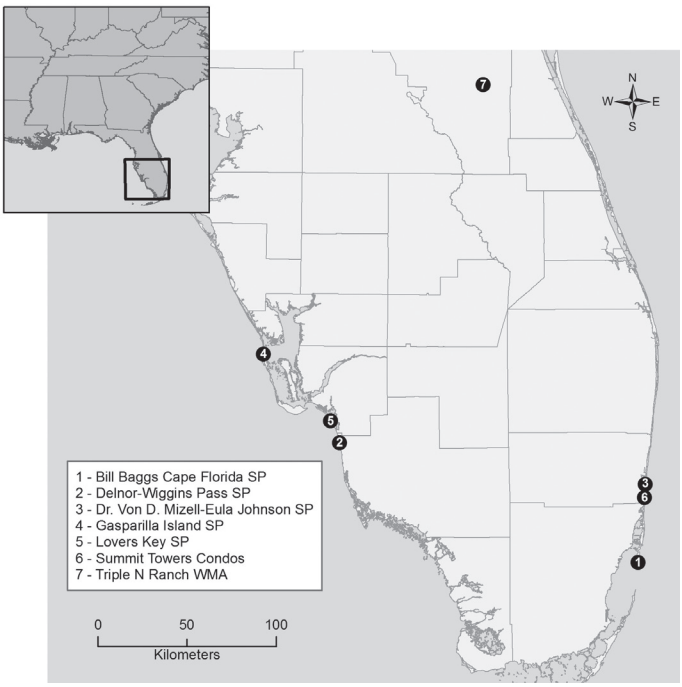

Fig. 2. Sites throughout Florida where *Campsomeris dorsata* were collected. Study sites ranged from Broward County to Collier County (east to west) and from Osceola County to Miami-Dade County (north to south).

Sumario

Campsomeris dorsata es un scoliid himenóptero endémico de América del Sur, América Central y partes de las Indias Occidentales. Se ha utilizado en el pasado como un agente de control biológico en Puerto Rico, Mauricio y la Florida para ayudar a reducir las plagas de coleópteros en los sistemas agrícolas de caña de azúcar. Se desconoce el estado del establecimiento de *C. dorsata* en la Florida desde que se realizaron introducciones intencionales a los campos de caña de azúcar durante la década del 1930. Examinamos principalmente sitios costeros en todo el estado de Florida y capturamos 91 hembras, desde el condado de Osceola hasta el condado de Miami-Dade (norte versus sur) y desde el condado de Broward hasta el condado de Collier (este y oeste). Los resultados de este estudio muestran que *C. dorsata* está bien establecida en estas áreas de Florida, y aún podría ser un importante agente de control biológico de gusano blancos (Scarabaeidae) en la caña de azúcar, así como en la producción y mantenimiento del césped.

Palabras Clave: avispa; caña de azúcar; césped; dunas; control biológico; sond

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