

**COLLETES FRANCESAE, A NEW SPECIES OF COLLETID BEE
(HYMENOPTERA: COLLETIDAE) ASSOCIATED WITH *SIDEROXYLON TENAX*
(SAPOTACEAE) IN FLORIDA SCRUB HABITAT**

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ABSTRACT

Colletes francesae, new species, is described and differentiated from other *Colletes* species. All specimens were collected from Florida scrub habitat on the Lake Wales Ridge in Peninsular Florida, an area known for arthropod endemism. *Colletes francesae* is oligolectic, at least locally, on a shrub of the genus *Sideroxylon*. Specimens of *C. francesae* are currently known from 5 protected sites; its conservation status is uncertain.

Key Words: oligolectic, bee conservation, Lake Wales Ridge endemism, Florida scrub habitat, *Colletes*, *Sideroxylon*

RESUMEN

Una nueva especie, *Colletes francesae*, es descrita y diferenciada de otras especies del género *Colletes*. Todos los especímenes fueron colectados en ambientes de matorral en la cadena de dunas del Lago Wales (Lake Wales Ridge) en la península de Florida, un área conocida por presentar un alto grado de endemismo en especies de artrópodos. *Colletes francesae* es oligolectica, por lo menos localmente, en un arbusto del género *Sideroxylon*. Se han encontrado especímenes de *C. francesae* en cinco aéreas protegidas; el grado de conservación de esta especie es incierto.

The genus *Colletes* includes about 100 species in North America north of Mexico (Stephen 1954), of which about 34 occur in eastern North America (Mitchell 1960). We here describe an additional species of *Colletes* found in Florida scrub habitat on the Lake Wales Ridge. We also provide information on the natural history of this species, including its association with the shrub *Sideroxylon tenax* L (Sapotaceae). Our purpose is to increase awareness of an interesting species that is possibly rare and restricted in distribution, and to add to the understanding of southeastern *Colletes*.

Most specimens obtained for this study were collected during a survey of the distribution and conservation status of over 80 species of arthropods that occur on the Lake Wales Ridge and are restricted to Florida scrub habitat. Florida scrub habitat has a notable concentration of narrowly endemic and habitat-restricted arthropods, with the largest concentration of such species occurring on the Lake Wales Ridge (Deyrup 1990).

pubescence on the mesoscutum, such as *C. productus* Robertson, *C. simulans* Cresson, and *C. banksi* Swenk. Separated from other species north of Mexico by the following combination of characteristics: malar space less than quarter the width of base of mandible; central subapical area of clypeus slightly depressed; subapical lateral areas of clypeus with 2 or 3 irregular convergent striae composed of a few elongate punctures separated by narrow, impunctate shining interstriae; metapleuron completely lacking overhanging carinate protuberance; posterior area of mesoscutum with only a few, widely scattered punctures; a band of short, pale, plumose hairs along the posterior edge of the mesoscutum; basal area of first gastral tergum strongly shining, with minute, sparse punctures, median area with a dilute band of pale pubescence, posterior third with fine, sparse setigerous punctures and a subapical dense band of white, appressed pubescence. Specimens of this species dead-end at couplet 56 in Stephen's key to females (1954) and at couplet 19 in Mitchell's key (1960).

In our experience, the association with *Sideroxylon tenax* (Fig. 1) is a useful field indicator, as we have not found other *Colletes* species associated with this host.

DESCRIPTION OF NEW SPECIES

Colletes francesae Deyrup & Deyrup, **sp. nov.**

Diagnosis of Female

Similar in general size and appearance to several other species that have relatively dilute whitish

Description of Female and Male

Female: head and body 12.0 mm long; length of forewing from distal end of costal sclerite to apex

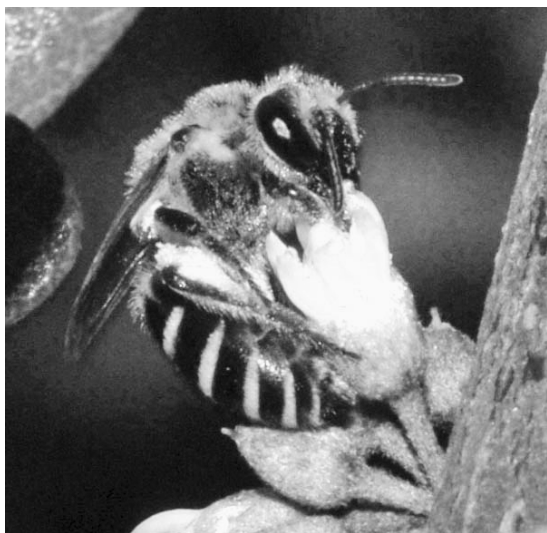


Fig. 1. Female *Colletes francesae* visiting flowers of *Sideroxylon tenax*.

6.5 mm. Head: malar space less than quarter the width of base of mandible; clypeus with median apical rim and adjacent subapical area without distinct punctures, apical third of clypeus shallowly but distinctly impressed, sides of clypeus with 3 convergent striae composed of a few large elongate punctures separated by narrow impunctate shining interstriae; facial fovea deep and wide above, extending to level halfway up lateral ocelli, upper margins of foveae sharply margined, not evenly intergrading with occiput, apically wider than antennal width at second flagellar segment. Mesosoma: pronotal humeral angle spinose; metapleuron lacking overhanging carinate protuberance; mesopleuron with deep, round punctures, separated by smooth interspaces slightly less than the width of a puncture, interspaces with sparse, minute setigerous punctures; mesoscutum shining, with deep, round punctures crowded around margins, separated by about their own width in a band laterad of parapsidal lines, becoming progressively more separated towards center, disc with a few distinct, widely separated punctures, area near posterior margin shining, almost impunctate, contrasting conspicuously with dense punctures of posterior margin and with dense band of short, pale hairs along posterior margin; scutellum with large, distinctly separated punctures about twice the size of those on scutum; basal area of propodeum separated by sharp carinae into 6 smooth, subquadrate divisions, sides of posterior face of propodeum bounded by a distinct, weakly elevated carina, hind basitarsi about 3 times as long as wide. Metasoma: basal third of first tergum with a median impunctate stripe, laterally with fine, sparse

punctures bearing long, pale setae, at midlength with a sparse, transverse band of pale pubescence, posterior half of first with fine, distinct, sparse setigerous punctures, subapical area with a dense white band of appressed pubescence; terga 2-5 densely, finely punctate, not shining. Vestiture: long hairs on head and body whitish; subapical bands of appressed hairs on tergites 1-5 and basal band of appressed hairs on tergite 2 whitish; tergites 2-5 with dense, semi-recumbent black setae obscuring surfaces of tergites. Male: similar to female, but hairs on head and body slightly yellowish, those on clypeal, frontal and paraocular areas long and dense, concealing sculpture of head. Structure of sternite 7 (Fig. 2) diagnostic: each half deeply emarginate, almost crescent-shaped; entire structure brown, lacking membranous areas except for transparent digitate appendage on inner apical corners on each side.

Specimens of this species dead-end at couplet 41 in Stephen's key to males (1954), at couplet 30 in Mitchell's key (1960).

Type material

Holotype female (AMNH): Florida: Highlands Co., Archbold Biological Station, 21-VI-2010, M.

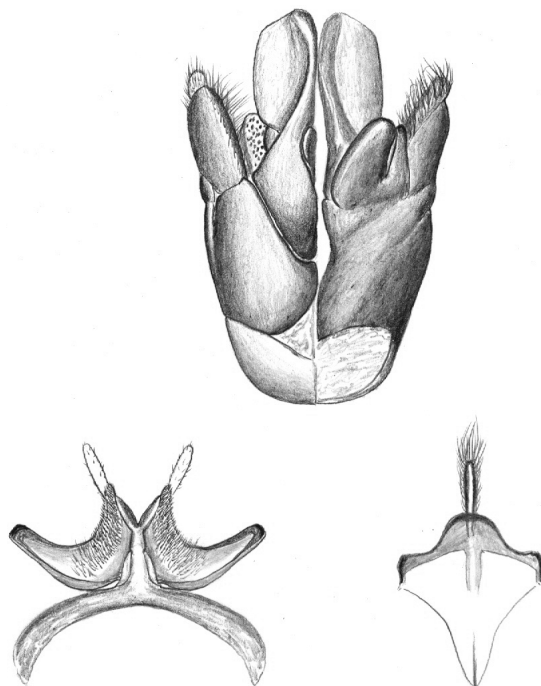


Fig. 2. Male genital structures of *Colletes francesae*, presented so as to allow comparison with figures in Mitchell 1960. Above, genital capsule, dorsal (left) and ventral (right) aspects. Below, left, sternum 7. Below, right, sternum 8.

Deyrup & L. Deyrup, on flower of *Sideroxylon tenax* on Calamintha tract.

Paratypes: all paratypes from Florida. Abbreviations for paratype information: institutions receiving type material: American Museum of Natural History, New York, New York: (AMNH); Florida State Collection of Arthropods, Gainesville, Florida: (FSCA), Archbold Biological Station: (ABS). County abbreviations: HI: Highlands County; PO: Polk County. Collector's initials: MD: Mark Deyrup; LD: Leif Deyrup; KD: Ken Dearborn; ND: Nancy Deyrup; JD: Josh Dunlap; AM: Alexander May. Site abbreviation: Archbold Biological Station: ABS.

One female: HI Co., ABS, 23-V-2002, MD, on flower *S. tenax* (ABS); 2 males: HI Co., ABS, 24-V-2002, MD, on flower *S. tenax* (ABS); 1 female: HI Co., ABS, 15-VI-2004, MD, on flower *S. tenax* (ABS); 1 male: HI Co., ABS, 17-VI-2004, MD & LD, on flower *S. tenax* (ABS); 1 male: HI Co., ABS, 9-VI-2004, MD, on flower *S. tenax* (ABS); 1 female: HI Co., ABS, 21-VI-2010, MD & LD, on flower *S. tenax* (ABS); 5 females: HI Co., ABS, 23-VI-2010, MD, on flower *S. tenax* (3 ABS, 1 AMNH, 1 FSCA); 1 male: HI Co., Gould Rd. Preserve, 15-V-2009, AM & MD, caught in flight trap w/pan in Florida scrub (ABS); 1 female: HI Co., Placid Lakes Development, 19-VI-2010, MD & LD, on flower *S. tenax* (FSCA); 8 females and 16 males: HI Co., Placid Lakes Development, 29-V-2011, MD, on blooming *S. tenax*, (12 ABS, 6 AMNH, 6 FSCA); 2 males and 2 females: PO Co., Broussard/Catfish Creek State Park, 18-VI-2010, MD, on flower *S. tenax* (2 ABS, 2 AMNH, 1 FSCA); 1 male: PO Co., Walk-in-Water State Forest, 14-VI-2010, JD, MD, ND & KD, caught in flight trap in yellow sand scrub (AMNH); 1 male: PO Co., Lake Wales Ridge State Forest, Area LC1, 2-VI-2010, JD, MD, ND & KD, caught in flight trap in Florida scrub habitat (FSCA); 1 female: PO Co., Lake Wales Ridge State Forest, Area LC1, 10-VI-2010, JD, MD, ND & KD, caught in flight trap in Florida scrub habitat (ABS); 1 male: PO Co., Lake Wales Ridge State Forest, Area LC1, 10-VI-2010, MD, on flower *S. tenax* (AMNH).

Etymology

This species is named in honor of Frances Archbold Hufty, enduring friend of the Archbold Biological Station, including all its interesting plants and all its unusual animals, from humble bees to human beings. After the death of her scientist brother, Richard Archbold, the founder of the Archbold Biological Station, Frances remained as Chairman of the Board of Trustees of the Archbold Biological Station for 34 years, actively participating until her death in 2010. Under her careful and farseeing watch the Station continued and expanded its mission of local scientific discovery (including the discovery of new species), protection of

the endangered Florida scrub habitat (where *Colletes francesae* lives), and natural history education. In furthering this mission, Frances Archbold Hufty accepted her brother's vision and built upon it to make it her own. We shall miss her.

NATURAL HISTORY

Association of *Colletes francesae* with *Sideroxylon tenax*

We believe *C. francesae* may be an oligolectic species associated with *Sideroxylon* (Fig. 1) because it was found on no other hosts during an extensive survey of bees and their hosts at the Archbold Biological Station (ABS) (Deyrup et al. 2002) and in subsequent work on flower-visitor webs at the same site. During this work we have accumulated 391 flower visitor records for various species of *Colletes* at the ABS. The genus *Colletes* is known to include both oligolectic and polylectic species (Michener 2000). The highest proportion of oligolectic bees is found in xeric regions, possibly because synchronized flowering of large numbers of species favors resource partitioning (Michener 1979). The upland habitat of the Lake Wales Ridge where *C. francesae* occurs might be considered a xeric area because the Lake Wales Ridge is a massive sand dune complex with a pronounced dry season in winter and spring. Although *Colletes francesae* appears to be monolectic on *S. tenax* at the ABS, we follow Michener's practice of describing a species as oligolectic if there is a reasonable possibility that it would visit related plants if these were available (Michener 1979, 2000). There are 9 other species of *Sideroxylon* elsewhere in Florida (Wunderlin & Hansen 2003); 1 of these, *S. lanuginosum* Michaux, may occur in sandy uplands, although its range does not extend as far south as the known range of *C. francesae*. *Sideroxylon* is a primarily tropical genus found in both the Eastern and Western Hemispheres (Nelson 1996).

The following features of *S. tenax* (unpublished observations by MD) might permit a species of bee to evolve a specialized relationship, based on the relatively large size, persistence, and distinctive features of the resource provided by *S. tenax*. Individual plants occur as long-lived shrubs that are resilient to burning and persist for at least 20 yr. The species is not ubiquitous in Florida scrub habitat, but where it occurs, usually on the driest and most open sites, it is usually found as groups of individuals within easy bee-flight distance of each other. While the flowers are small (about 3.5 mm in diameter), they are numerous, clustered in axillary cymes (Fig. 1) that allow a bee to move easily among the small number of blossoms that are open in a cluster on a particular day. The flowers have, to the human nose, a strong, heavy fragrance that should allow bees to easily locate blooming plants. The nectar and pollen resource persists from about mid-May through late Jun;

not all individuals bloom at the same time, and there is occasional off-season blooming by individual plants. Each plant blooms for about 3-4 wk, probably allowing bees time to learn the location of individual plants. Blooming plants are visited by large numbers of individuals of insects that feed on nectar but not pollen, including butterflies of the families Lycaenidae and Hesperidae, and wasps of the families Sphecidae, Scolidae, Tiphiidae and Pompilidae; this suggests a generous supply of nectar. Pollen is easily available from 5 anthers that protrude around the circumference of each flower.

While *C. francesae* might be dependent on *S. tenax*, this host is probably not dependent on *C. francesae* for pollination. We have a long list of other insects that visit flowers of *S. tenax*, including many species that are abundant (such as augochlorine halictid bees) and can be seen moving from plant to plant. This fits with a general pattern noted by Michener (1979, 2000): a species of plant visited by an oligolectic bee is not usually dependent on this specialized visitor. At the ABS insects that are the principal pollinators of a plant usually have many additional flower hosts, while plants that are the principal flower host of an insect have many additional flower visitors. The lack of narrow reciprocal specializations in insect-flower relationships may be associated with ecological instability in an ecosystem that is in a transitional climatic zone and maintained by fire (Deyrup et al. 2002).

Origins and Relationships of *Colletes francesae*

In its general morphology *C. francesae* shows no sign of belonging to a strongly divergent lineage in *Colletes*. It generally resembles several mid-sized Florida *Colletes*, such as *C. distinctus* Cresson, *C. banksi* Swenk and *C. productus* Cresson. There is no phylogenetic study of North American *Colletes* into which this species may be inserted, but it might possibly belong to the *hyalinus* species group proposed by Stephen (1954) along with *C. distinctus*. Species of arthropods restricted to Florida scrub habitat originate in some cases from autochthonous lineages from the Southeastern Coastal Plain, in other cases they are derived from southwestern lineages that migrated east during the late Pliocene through middle Pleistocene (Deyrup 1990; Webb 1990). The current distribution of North American *Sideroxylon* provides no clear indication of the origin of *C. francesae*: while most species are southeastern, 1 species occurs from Florida through southern Arizona (Nelson 1996). In preparing this paper it was possible to compare specimens of *C. francesae* with specimens or descriptions of all known species of *Colletes* north of Mexico. Specimens and descriptions of some neotropical species of *Colletes* were not available, but it is extremely un-

likely that this habitat-specific oligolectic is an extraordinarily disjunct population of a neotropical species; biogeographically, this would be unprecedented among Florida bees. It is still more unlikely that *C. francesae* is an introduced species that happened to be deposited in central Florida in an area of suitable habitat and host plant.

Survey Techniques for *C. francesae*

Colletes francesae is most readily observed by locating blooming individuals of *S. tenax*, where the female bees begin to appear around 8:30 or 9:00 AM and continue active until about 3:00 PM. Specimens are difficult to capture because *S. tenax* produces a dense growth of stiff twigs thickly beset with long, sharp, net-snagging thorns. Males dart with great speed about the periphery of the shrubs, dipping in and out of its thorny structure. They can be collected, with difficulty, by rapidly swinging a net back and forth above the plants. To make matters more difficult, a blooming *S. tenax* buzzes with a distracting array of other insects. Female *C. francesae* may be tracked as they move about the interior of a bush by listening for the sound they make in flight, a note that is lower than that of a megachilid, higher than that of a honey bee, and much louder than that of any of the augochlorine halictids. A Malaise trap in the vicinity of a blooming *S. tenax* is another way to procure specimens.

Conservation Status

The conservation status of *C. francesae* remains unclear. It is currently known to occur on only 5 protected sites. All of these are on the Lake Wales Ridge, where about 85% of the original upland habitat has been destroyed by agriculture or development (Turner et al. 2006). The most positive conservation indicator for *C. francesae* is its known geographical range, which extends for about 100 straight-line km, from about 20 km south of the town of Lake Placid to a site east of the town of Dundee. The protected sites are well distributed along the Ridge. There are at least 7 additional protected sites on the Lake Wales Ridge where *C. francesae* is likely to occur, based on the presence of the appropriate habitat and host plant. The range of *S. tenax* includes upland areas through much of the Florida Peninsula (Wunderlin and Hansen 2003), and it is possible that *C. francesae* is neither rare nor threatened. Considering, however, that Florida scrub habitats on the isolated Lake Wales Ridge harbor a good number of plants and arthropods that occur nowhere else (Deyrup 1990), it seems prudent to provisionally consider *C. francesae* a species of conservation concern until proven otherwise. With respect to management, *C. francesae* can probably persist under the management regimes

already established to protect a variety of scrub plants and vertebrates. If, however, its entire habitat in a preserve were managed by burning or mowing in a single year, there might be no host plants blooming for 1 to 3 years, and the bee population would probably be extirpated.

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REFERENCES CITED

- DEYRUP, M. 1990. Arthropod footprints in the sands of time. *Florida Entomol.* 73: 529-538.
- DEYRUP, M., EDIRISINGHE, J., AND NORDEN, B. 2002. The diversity and floral hosts of bees at the Archbold Biological Station, Florida (Hymenoptera: Apoidea). *Insecta Mundi* 16: 87-120.
- MICHENER, C. D. 1979. Biogeography of the bees. *Ann. Missouri Bot. Garden* 66: 277-347.
- MICHENER, C. D. 2000. The bees of the World. The Johns Hopkins University Press, Baltimore, Maryland, xiv + 913 pp.
- MITCHELL, T. D. 1960. The bees of the eastern United States. I. Tech. Bull. North Carolina Agric. Exper. Sta. 141: 1-538.
- NELSON, G. 1996. The shrubs and woody vines of Florida. Pineapple Press, Sarasota, Florida. 391 pp.
- STEPHEN, W. P. 1954. A revision of the bee genus *Colletes* in America north of Mexico. *University of Kansas Sci. Bull.* 36: 149-527.
- TURNER, W. R., WILCOVE, D. D., AND SWAIN, H. M. 2006. State of the scrub: Conservation progress, management responsibilities, and land acquisition priorities for imperiled species of Florida's Lake Wales Ridge. Archbold Biological Station, Lake Placid, Florida. 160 pp.
- WEBB, S. D. 1990. Historical biogeography, pp. 70-100 *In* R. L. Myers and J. J. Ewel, [eds.], *Ecosystems of Florida*. University of Central Florida Press, Orlando. 765 pp.
- WUNDERLIN, R. P., AND HANSEN, B. F. 2003. Guide to the vascular plants of Florida. Second edition. University Press of Florida, Gainesville, Florida. 787 pp.