Legume-Feeding Lepidoptera of the Florida Keys: Potential Competitors of an Endangered Lycaenid Butterfly

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Source: Florida Entomologist, 103(3) : 360-368

Published By: Florida Entomological Society

URL: https://doi.org/10.1653/024.103.0308

Legume-feeding Lepidoptera of the Florida Keys: potential competitors of an endangered lycaenid butterfly

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Abstract

Two Fabaceae in the Florida Keys, *Pithecellobium keyense* Coker and *Guilandina bonduc* Griseb., have been of interest because they are the larval host plants for the endangered Miami blue butterfly (*Cyclargus thomasi bethunebakeri* [Comstock & Huntington]; Lepidoptera: Lycaenidae). As a part of ongoing research and conservation for this butterfly, wild host plant material has been periodically collected in order to supplement a captive colony of *C. t. bethunebakeri* located in Gainesville, Florida, USA. In examining this plant material, 26 lepidopterans were detected, including several host records, a new continental record, and 2 likely undescribed species, 1 *Aristotelia* (Gelechiidae) and 1 *Crocidosema* (Tortricidae). Our results expand the geographic, life-history, and taxonomic understanding of lepidopteran herbivores that use *P. keyense* and *G. bonduc* in South Florida.

Key Words: *Pithecellobium keyense*; *Guilandina bonduc*; Fabaceae; herbivory

Resumen

En los Cayos de Florida, habitan dos especies de plantas hospederas críticas para el ciclo de vida de la mariposa Miami blue (*Cyclargus thomasi bethunebakeri* [Comstock y Huntington]; Lepidoptera: Lycaenidae), la cual está en peligro de extinción. Ambas plantas son de la familia Fabaceae: *Pithecellobium keyense* Coker y *Guilandina bonduc* Griseb. Como parte de una investigación de la conservación de esta mariposa, periódicamente se recolectaron muestras de estas especies de plantas para suplementar una población cautiva de *C. t. bethunebakeri* en Gainesville, Florida, EE. UU. Tras examinar el material vegetal colectado, encontramos veintiséis especies de Lepidópteros. Varios de éstos corresponden a nuevos registros de plantas hospederas y uno de ellos corresponde a un registro nuevo para el continente. Además, encontramos dos especies probablemente no descritas, una del género *Aristotelia* (Gelechiidae) y el otro del género *Crocidosema* (Tortricidae). Nuestros resultados expanden el conocimiento de la geografía, historia de vida y taxonomía de Lepidópteros herbívoros que utilizan *P. keyense* y *G. bonduc* en el sur de la Florida.

Palabras Claves: *Pithecellobium keyense*; *Guilandina bonduc*; Fabaceae; herbívoro

The flora of the Florida Keys (Monroe County, Florida, USA) includes 81 species of Fabaceae (Wunderlin et al. 2019), which support a variety of insect herbivores. Two of these species are grey nickerbean (*Guilandina bonduc* Griseb.; Fabaceae) and Florida Keys blackbead (*Pithecellobium keyense* Coker; Fabaceae), woody legumes that are the larval host plants for a number of Lepidoptera, including an endangered butterfly, the Miami blue (*Cyclargus thomasi bethunebakeri* (Comstock and Huntington); Lepidoptera: Lycaenidae) (USFWS 2012). *Pithecellobium keyense* is a large woody shrub that grows in a variety of coastal habitats, including beach dunes, hardwood hammocks, and pine rocklands throughout the Florida Keys and northward along on the coast to Martin and Lee counties (Wunderlin & Hansen 2011). In the Florida Keys, *G. bonduc* is far less abundant than *P. keyense*, and frequently grows in coastal beach dune ecosystems in South and Central Florida as a fast-growing, pioneering shrub, where it often forms dense thickets of vegetation (Wunderlin & Hansen 2011).

As part of a broader collaborative conservation effort for *C. t. bethunebakeri*, the Florida Museum of Natural History's McGuire Center for Lepidoptera and Biodiversity at the University of Florida in Gainesville (Alachua County, Florida, USA) maintains a large captive-breeding population to support various recovery and research objectives, including organism translocation within the historic range. In order to adequately support captive stock on a yr-round basis, an extensive plant nursery is maintained and periodically augmented with terminal plant material gathered from permitted sites in the Florida Keys.

Surveying the legume-feeding Lepidoptera in the Florida Keys is important because southern Florida is a sentinel region for adventive tropical species. Establishment of these species could impact cultivat-

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ed legumes and threatened native plant species. Other legume species that are not suitable hosts for *C. t. bethunebakeri* may sustain populations of other Lepidoptera that feed on a wider range of Fabaceae. Established populations of such polyphagous species could compete with *C. t. bethunebakeri* larvae for food resources.

These surveys were supplemented additionally by collections from a state pest survey. In Apr 2018, a team from the Florida Department of Agriculture and Consumer Services, Division of Plant Industry surveyed legumes on Big Pine Key (Monroe County, Florida, USA). The previous mo, collectors David Fine and James Troubridge caught a specimen of *Maruca vitrata* (Fabricius) (Lepidoptera: Crambidae) at an ultraviolet light trap in the National Key Deer Wildlife Refuge (Monroe County, Florida, USA) (Hayden 2018). *Maruca* larvae feed in legume pods and are significant pests of Fabaceae (Leonard 1931; Ferguson 1983; Gilligan & Passoa 2014). Although no *Maruca* larvae were found in subsequent surveys on Big Pine Key, larvae and adult moths of several other Lepidoptera collected from these surveys are included in this study. Here, we include results from vegetation collected opportunistically during fieldwork for *C. t. bethunebakeri*, as well as the Division of Plant Industry surveys.

Materials and Methods

Terminal host material, which included new vegetative growth, flower buds, and inflorescences of both *P. keyense* and *G. bonduc* were collected from 6 islands in the lower Florida Keys. Although *C. t. bethunebakeri* may use both hosts, *P. keyense* generally is more widespread and abundant in many locations, including on islands that currently support extant populations of the butterfly. All collection sites (Fig. 16) were selected opportunistically while conducting other activities and based on the availability of high-quality terminal growth on host plants. Resulting plant material was packaged and sent via express carrier to the conservation laboratory facilities at the McGuire Center for Lepidoptera and Biodiversity in Gainesville, Florida, USA, where it was comprehensively inspected for live insects prior to incorporation into the existing captive population and associated research facilities. When immature Lepidoptera were detected on this plant material, these organisms were reared to maturity and subsequently identified.

Unidentified Lepidoptera larvae encountered on *P. keyense* within the Key West National Wildlife Refuge (Monroe County, Florida, USA) were collected opportunistically during routine monitoring of known extant populations of *C. t. bethunebakeri* on the Marquesas Keys and Boca Grande Key. The larvae were reared to maturity for identification. The first shipment of larvae on host material was combined from 2 sites and dates, so the exact origin is uncertain; the data for subsequent shipments were exact. All larvae were clearly labeled based on locality and collection date, and subsequently reared to maturity under controlled laboratory conditions. Where necessary, existing host material was augmented with living cuttings from our nursery. Eclosed adult moths were collected for taxonomic identification.

The Division of Plant Industry team surveyed legumes at several sites on Big Pine Key and other keys within a 10 mile radius of the *Maruca* collection site on 9 to 13 Apr 2018. Two 15-watt ultraviolet light traps were operated: 1 for 2 nights near the detection site, and another trap for 1 night each at Bahia Honda State Park (10 Apr), Big Pine Key (11 Apr), and Cudjoe Key (12 Apr). Larvae were collected in vials and bags and placed in ice coolers. Specimens were screened in the field to avoid inadvertent transportation of any *M. vitrata* specimens. Despite the care taken, larvae collected in the Division of Plant Industry survey suffered greater mortality in transit and subsequent rearing.

After the survey, an ultraviolet light trap was operated at the detection site (24.70941°N, 81.38254°W), and a Malaise trap was maintained at another site where nickerbean is abundant (Palmetto Avenue, 24.67261°N, 81.36339°W). The ultraviolet light trap was operated overnight on a monthly basis, and the Malaise trap was sampled every 2 wk. Trap contents were shipped for identification and deposition in the Florida State Collection of Arthropods, housed in the McGuire Center for Lepidoptera and Biodiversity at the Florida Museum of Natural History, Gainesville, Florida, USA. Collection data are summarized in Table 1.

Determinations were made by consulting relevant keys and by comparison with specimens in the Florida State Collection of Arthropods. In instances where specimens could not be identified to species using those resources, original descriptions of congeners were examined and taxonomists were consulted in order to determine whether the specimens represented undescribed species.

Results

REARED ON *PITHECELLOBIUM KEYENSE*

Aristotelia sp. (Fig. 1) (Gelechiidae)

This may be a species in the *Aristotelia rubidella* Clemens (Lepidoptera: Gelechiidae) group, although it keys out nowhere in Forbes (1932). We have not been able to identify it as any described species. The males have a large hair tuft on the hind wing, characteristic of those species that Walsingham (1897) placed in *Eucatoptus*, a synonym of *Aristotelia* (Hübner). In the male genitalia, 2 needle-like processes on the tegumen anterior of the uncus can be seen by brushing scales from the abdomen. The Division of Plant Industry survey caught many more specimens at light on Big Pine and Cudjoe Keys where blackbead is abundant (Table 1). The larvae are distinctively red and striped, and they scrape the epidermis of the leaves. No older specimens of this species could be found in the Florida State Collection of Arthropods, but oddly, another related species, with hind wing tuft and tegumen processes but different valvae and other details, is represented by a few specimens from Big Pine Key and Key Largo in the 1970s and 1980s.

Ithome simulatrix Hodges (Fig. 2) (Cosmopterigidae)

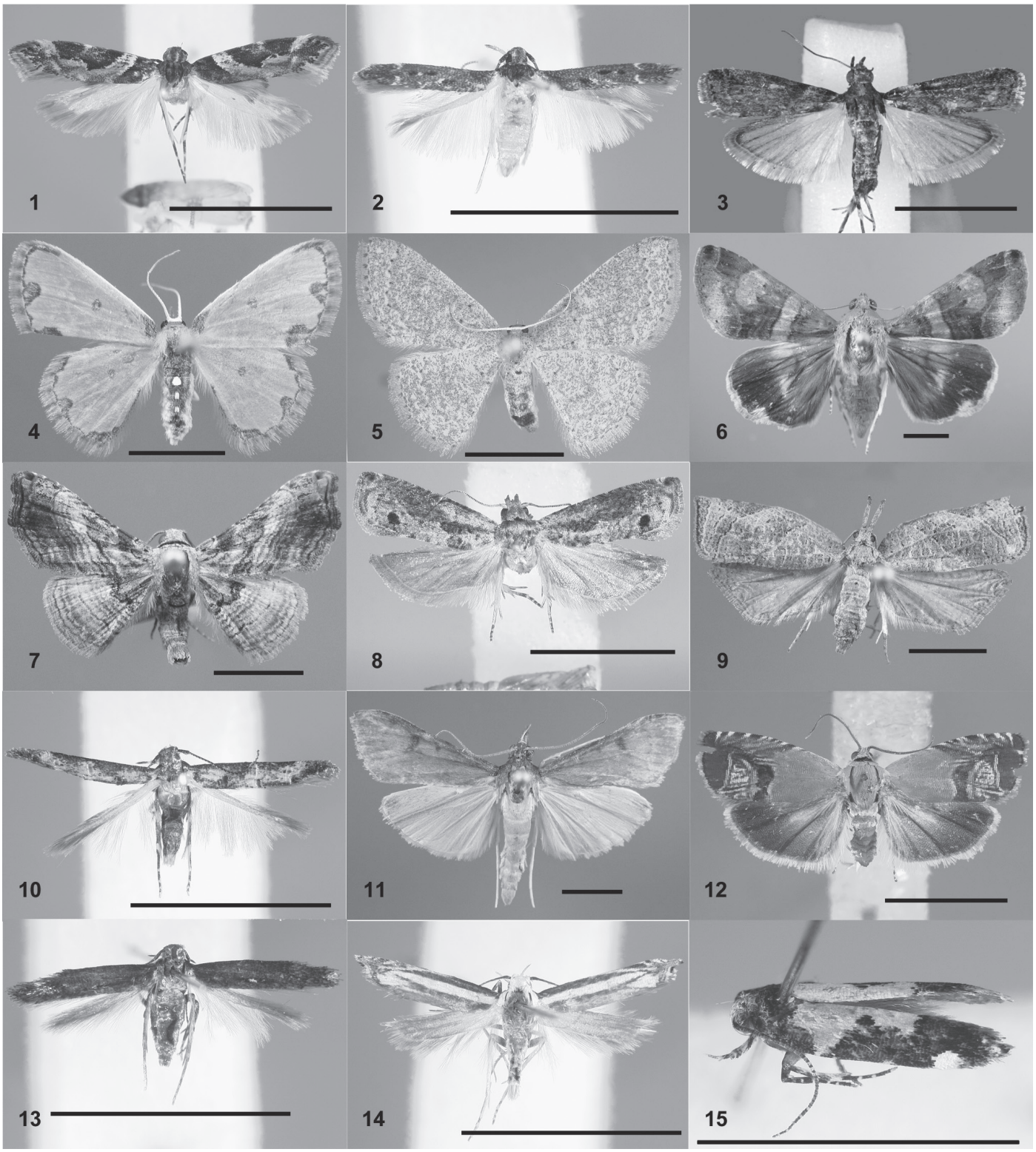
This is the first feeding record for this rarely collected species. Hodges (1978) described it from 1 specimen caught in "Everglade, Florida." Other species of *Ithome* Chambers also feed on leguminous shrubs, such as *Ithome aquila* Hodges and *Ithome concolorella* (Chambers) (both Lepidoptera: Cosmopterigidae) (Table 1). The Division of Plant Industry survey caught numerous specimens of the latter 2 species at light, but none appear to be *I. simulatrix*.

Sarasota plumigerella Hulst (Fig. 3) (Pyralidae)

This species has been recorded on a few other unrelated hosts, including *Laguncularia racemosa* (L.) C.F. Gaertn (Combretaceae) and *Coccoloba uvifera* (L.) L. (Polygonaceae). The host record is new. It was caught also at light (Table 1).

Synchlora xysteraria (Hulst) (Fig. 4) (Geometridae)

The maculation of the specimen matches that species at the McGuire Center for Lepidoptera and Biodiversity. This species ranges through much of Florida but is rare northward. It is very similar to *Synchlora gerularia* Hübner (Lepidoptera: Geometridae), known in the US only from "the southern tip of Texas" (Ferguson 1985). The latter has forewing discal spots about half the size of those on *S. xysteraria*



Figs. 1–15. Habitus of moths. (1) *Aristotelia* sp. (Big Pine Key, 2016); (2) *Ithome simulatrix* (Boca Grande Key, 2017); (3) *Sarasota plumigerella* (Big Pine Key, 2016); (4) *Synchlora xysteraria* (Big Pine Key, 2016); (5) *Pleuroprucha insulsaria* (Boca Grande Key, 2018); (6) *Melipotis januaris* (Boca Grande Key, 2017); (7) *Tyrissa tilinea* (Big Pine Key, 2016); (8) *Crocidosema* sp. (Big Pine Key, 2018); (9) *Platynota rostrana* (Spanish Harbor Key, 2017); (10) *Stilbosis lonchocarpella* (Big Pine Key, 2018); (11) *Uresiphita reversalis* (Big Pine Key, 2018); (12) *Cydia fahlbergiana* (Sanibel Island, 1983); (13) *Ithome concolorella* (Big Pine Key, 2018); (14) *Polyhymno luteostrigella* (Big Pine Key, 2018); (15) *Stegasta bosqueella* (Cudjoe Key, 2018). Scale bars = 5 mm.

and also lacks the small purplish patch on the forewing costa at the wing base that is present in the former. This species (misidentified as *S. gerularia*; see Ferguson 1985) has been recorded on mango and lychee (Kimball 1965). Ferguson (1985) obtained eggs from a female but had little success in rearing the ensuing larvae on *Taraxacum officinale* F.H. Wigg (Asteraceae), which is not a natural host.

Table 1. Summary of collection data.

Species	Family	Key	Latitude	Longitude	Date	Host	Method
Apotoforma rotundipennis	Tortricidae	Big Pine	24.67261°N	81.36339°W	2–16.x.2019	–	Malaise trap
Aristotelia sp.	Gelechiidae	Big Pine or Long	–	–	28.xi or 5.xii.2016	*P. keyense*	Reared
Aristotelia sp.	Gelechiidae	Big Pine	24.67889°N	81.35778°W	22.vi.2017	*P. keyense*	Reared
Aristotelia sp.	Gelechiidae	Boca Grande	24.53278°N	82.00897°W	19.xi.2017	*P. keyense*	Reared
Aristotelia sp.	Gelechiidae	Boca Grande	24.53278°N	82.00897°W	i or ii.2018	*P. keyense*	Reared
Aristotelia sp.	Gelechiidae	Big Pine	24.7096°N	81.3826°W	12–13.iv.2018	–	UV light
Aristotelia sp.	Gelechiidae	Cudjoe	24.66385°N	81.47875°W	12–13.iv.2018	–	UV light
Aristotelia sp.	Gelechiidae	Big Pine	24.6759°N	81.3515°W	11–12.iv.2018	–	UV light
Aristotelia sp.	Gelechiidae	Big Pine	24.7096°N	81.3826°W	11–12.iv.2018	–	UV light
Blastobasidae sp.	Blastobasidae	Cudjoe	24.66373°N	81.47905°W	12.iv.2018	*P. keyense*	Hand-caught
Caristanius minimus Neunzig	Pyralidae	Big Pine	24.67261°N	81.36339°W	23.vii–7.xiii.2019	–	Malaise trap
Crocidosema sp.	Tortricidae	Spanish Harbor	24.65482°N	81.30067°W	22.ii.2017	*G. bonduc*	Reared
Crocidosema sp.	Tortricidae	Big Pine	24.67283°N	81.36355°W	11.iv.2018	*G. bonduc*	Reared
Cydia fahlbergiana	Tortricidae	Big Pine	24.6759°N	81.3515°W	11–12.iv.2018	–	UV light
Cydia largo	Tortricidae	Big Pine	24.6759°N	81.3515°W	11–12.iv.2018	–	UV light
Cydia largo	Tortricidae	Big Pine	24.67261°N	81.36339°W	22.i–5.ii.2019	–	Malaise trap
Elousa albicans	Erebidae	Big Pine	24.6759°N	81.3515°W	11–12.iv.2018	–	UV light
Elousa albicans	Erebidae	Big Pine	24.7096°N	81.3826°W	12–13.iv.2018	–	UV light
Elousa albicans	Erebidae	Big Pine	24.67261°N	81.36339°W	13–30.xi.2018, 22.i–5.ii, 19.ii–5.iii, 2–1.v, 11.vi–10.vii, 23.vii–16.x.2019	–	Malaise trap
Isogona scindens	Erebidae	Big Pine	24.67261°N	81.36339°W	13.xi–26.xii.2018, 5.ii–5.iii, 2.iv–1.v, 16–28.v, 7–21.viii, 5.ix–2.x, 16–30.x.2019	–	Malaise trap
Ithome aquila	Cosmopterigidae	Big Pine	24.7096°N	81.3826°W	11–12.iv.2018	–	UV light
Ithome aquila	Cosmopterigidae	Big Pine	24.7096°N	81.3826°W	12–13.iv.2018	–	UV light
Ithome concolorella	Cosmopterigidae	Big Pine	24.7096°N	81.3826°W	12–13.iv.2018	–	UV light
Ithome concolorella	Cosmopterigidae	Cudjoe	24.66385°N	81.47875°W	12–13.iv.2018	–	UV light
Ithome concolorella	Cosmopterigidae	Big Pine	24.7096°N	81.3826°W	11–12.iv.2018	–	UV light
Ithome concolorella	Cosmopterigidae	Big Pine	24.67261°N	81.36339°W	22-I–5-ii, 5–19-ii-2019	–	Malaise trap
Ithome simulatrix	Cosmopterigidae	Big Pine or Long	–	–	28.xi or 5.xii.2016	*P. keyense*	Reared
Ithome simulatrix	Cosmopterigidae	Boca Grande	24.53278°N	82.00897°W	19.xi.2017	*P. keyense*	Reared
Melipotis acontioides	Erebidae	Cudjoe	24.66385°N	81.47875°W	12–13.iv.2018	–	UV light
Melipotis famelica	Erebidae	Big Pine	24.7096°N	81.3826°W	12–13.iv.2018	–	UV light
Melipotis famelica	Erebidae	Big Pine	24.67261°N	81.36339°W	2–15.iv, 1.v–11.vi, 21.viii–2.x.2019	–	Malaise trap
Melipotis januaris	Erebidae	Boca Grande	24.53194°N	82.00889°W	28.vi.2017	*P. keyense*	Reared
Melipotis januaris	Erebidae	Marquesas	24.54833°N	82.16°W	13.vi.2018	*P. keyense*	Reared
Oecophoridae sp.	Oecophoridae	Big Pine	24.70856°N	81.38318°W	12.iv.2018	*P. keyense*	Hand-caught
Platynota rostrana	Tortricidae	Spanish Harbor	24.65482°N	81.30067°W	22.ii.2017	*G. bonduc*	Reared
Pleuroprucha insulsaria	Geometridae	Big Pine or Long	–	–	28.xi or 5.xii.2016	*P. keyense*	Reared
Pleuroprucha insulsaria	Geometridae	Boca Grande	24.53278°N	82.00897°W	7.ii.2018	*P. keyense*	Reared
Polyhymno luteostrigella	Gelechiidae	Big Pine	24.7096°N	81.3826°W	11–12.iv.2018	–	UV light
Polyhymno luteostrigella	Gelechiidae	Big Pine	24.6759°N	81.3515°W	11–12.iv.2018	–	UV light
Polyhymno luteostrigella	Gelechiidae	Big Pine	24.7096°N	81.3826°W	12–13.iv.2018	–	UV light
Polyhymno luteostrigella	Gelechiidae	Big Pine	24.67261°N	81.36339°W	28.v–11.vi, 5–19.ix.2019	–	Malaise trap
Sarasota plumigerella	Pyralidae	Big Pine or Long	–	–	28.xi or 5.xii.2016	*P. keyense*	Reared
Sarasota plumigerella	Pyralidae	Big Pine	24.6759°N	81.3515°W	11–12.iv.2018	–	UV light
Sarasota plumigerella	Pyralidae	Cudjoe	24.66385°N	81.47875°W	12–13.iv.2018	–	UV light
Stegasta bosqueella	Gelechiidae	Big Pine	24.7096°N	81.3826°W	12–13.iv.2018	–	UV light
Stegasta bosqueella	Gelechiidae	Cudjoe	24.66385°N	81.47875°W	12–13.iv.2018	–	UV light
Stilbosis lonchocarpella	Cosmopterigidae	Big Pine	24.67615°N	81.35129°W	11.iv.2018	*Piscidia piscipula*	Reared
Stilbosis lonchocarpella	Cosmopterigidae	Big Pine	24.7096°N	81.3826°W	11–12.iv.2018	–	UV light
Stilbosis lonchocarpella	Cosmopterigidae	Big Pine	24.7096°N	81.3826°W	12–13.iv.2018	–	UV light
Stilbosis lonchocarpella	Cosmopterigidae	Cudjoe	24.66385°N	81.47875°W	12–13.iv.2018	–	UV light
Stilbosis lonchocarpella	Cosmopterigidae	Big Pine	24.6759°N	81.3515°W	11–12.iv.2018	–	UV light
Synchlora xysteraria	Geometridae	Big Pine or Long	–	–	28.xi or 5.xii.2016	*P. keyense*	Reared
Tortricidae sp.	Tortricidae	Cudjoe	24.66373°N	81.47905°W	12.iv.2018	*P. keyense*	Hand-caught

Table 1. (Continued) Summary of collection data.

Species	Family	Key	Latitude	Longitude	Date	Host	Method
Tyrissa multilinea	Erebidae	Big Pine or Long	–	–	28.xi or 5.xii.2016	*P. keyense*	Reared
Uresiphita reversalis	Crambidae	Middle Torch	24.68666°N	81.40815°W	10.iv.2018	*Sophora tomentosa*	Reared
Uresiphita reversalis	Crambidae	Big Pine	24.66236°N	81.36868°W	12.iv.2018	*Sophora tomentosa*	Reared
Uresiphita reversalis	Crambidae	Big Pine	24.6759°N	81.3515°W	11–12.iv.2018	–	UV light
Uresiphita reversalis	Crambidae	Big Pine	24.7096°N	81.3826°W	11–12.iv.2018	–	UV light

Pleuroprucha insulsaria (Guenée) (Fig. 5) (Geometridae)

The uniformly medium dark gray wing coloring of the 2 reared specimens falls within the range of colors in this species from across its range. We cannot find any genitalic differences between Florida specimens and more northern specimens. It is polyphagous, including several records on Fabaceae: *Chamaecrista fasciculata* (Michx.) Greene, *Senegalia riparia* (Kunth) Britton & Rose, and *Prosopis* sp. (Tietz 1972; Robinson et al. 2002). It has been reared on *Albizia julibrissin* Durazz. in Gainesville (Division of Plant Industry Entomology sample 2012-6977, L. Buss).

Melipotis januaris (Guenée) (Figs. 6, 17) (Erebidae)

Significant defoliation of *P. keyense* by *Melipotis januaris* (Guenée) (Lepidoptera: Erebidae) has been observed several times in the Marquesas Keys and Boca Grande Keys. In Jun 2018, it was estimated that thousands of *M. januaris* larvae were present in a small but dense patch of *P. keyense* consisting of approximately 10 plants. Defoliation of these plants was considerable, and *M. januaris* larvae were so abundant that the sound of their frass falling against the vegetation was audible to an observer. Interestingly, these outbreaks appear to be highly localized, with a high abundance of larvae present in a small area with adjacent areas apparently being unaffected. The host record on *P. keyense* is new. Little is otherwise known about the habits of this species. A "general outbreak" of *M. januaris* on *Inga laurina* (Sw.) Willd. (Fabacae) occurred in Puerto Rico in 1917 (Van Zwaluwenburg 1918). Janzen and Hallwachs (2009) record it infrequently on *Pithecellobium oblongum* Benth. (Fabaceae) and *Zygia longifolia* (Willd.) Britton & Rose (Fabaceae). Wagner et al. (2011) remark on the ability of melipotines to undergo population explosions and defoliate trees, and this behavior in *M. januaris* is consistent with that of other members of the tribe. Two other *Melipotis* species were taken at light (Table 1).

Tyrissa multilinea Barnes and McDunnough (Figs. 7, 18) (Erebidae)

Pithecellobium keyense is a new host record. One moth was reared from a larva, and a second larva from another harvest did not survive. *Tyrissa multilinea* Barnes & McDunnough (Lepidoptera: Erebidae) has been recorded on "Acacia" in Texas (Wagner et al. 2011).

REARED ON *GUILANDINA BONDUC*

Crocidosema sp. (Fig. 8) (Tortricidae)

The first specimen of this undetermined species was a male reared on nickerbean foliage brought to Gainesville. Based on the male, J. Baixeras (Universitat de València personal communication) remarked that it seems to represent an undescribed species. The Division of Plant Industry team subsequently found larvae rolling leaves at a vacant lot on Palmetto Avenue on Big Pine Key. One female emerged from that lot (Fig. 8); the other larvae perished during the return to Gainesville. It should be easy to rear locally. *Crocidosema* Zeller species (Lepidoptera: Tortricidae) feed on various plant families, and *Crocidosema aporema* (Walsingham) (Lepidoptera: Tortricidae) is a major pest of legumes. The male genitalia, although similar to those of *C. aporema*, more closely resemble *Epinotia arctostaphylana* (Kearfott) (Lepidoptera: Tortricidae), a Western species (Heinrich 1923), but the new species has androconia typical of *Crocidosema*. The male has hair pencils on the dorsal base of the forewing that probably fit underneath tufts on the abdominal pleura. We could not find any conspecific specimens in the Florida State Collection of Arthropods or McGuire Center for Lepidoptera and Biodiversity collections, including material recently collected in the Bahamas by J.Y. Miller and D. Matthews. The male and female

Fig. 16. Map of collection sites.

Fig. 17. *Melipotis januaris* larvae on *Pithecellobium keyense*.

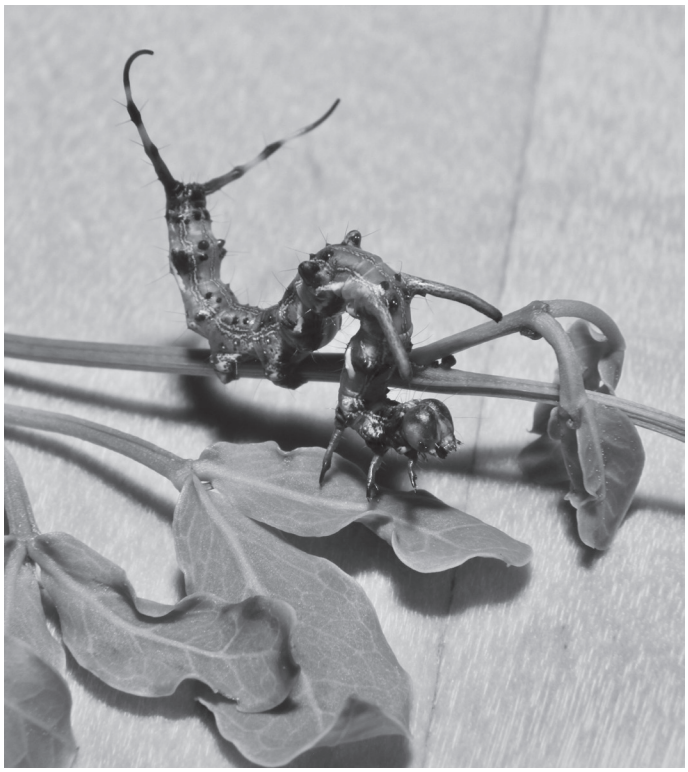


Fig. 18. *Tyrissa multilinea* larva on *Pithecellobium keyense*. Photo courtesy of Jorge Cabrera.

do not exactly match any described species that is illustrated in its original description, but the maculation resembles *Crocidosema cayeya* Razowski and Becker (Lepidoptera: Tortricidae) and other Antillean species. Several species of *Crocidosema* have been described in recent yr, some only on the basis of less variable female specimens. We hesitate to provide a formal description until more specimens of it and congeners can be obtained from the Caribbean region. No specimens were caught in the Malaise trap at the site despite biweekly trap servicing.

Platynota rostrana (Walker) (Fig. 9) (Tortricidae)

This species is so polyphagous (Powell & Brown 2012) that a new host record is trivial.

RESULTS OF THE DIVISION OF PLANT INDUSTRY SURVEY

A few other species were raised on other legumes or were collected at light by the Division of Plant Industry survey. Two ultraviolet light bucket traps were placed the nights of 10 to 12 Apr. One was at the Key Deer Refuge trailhead near where *M. vitrata* was collected (24.7096°W, 81.3826°N) and were run both nights. The other was at Bahia Honda State Park on 10 Apr, at Hibiscus Drive on Big Pine Key (24.6759°N, 81.3515°W) on 11 Apr, and on Cudjoe Key along Route 1 (24.6639°N, 81.4788°W) on 12 Apr. Light-trapping was limited because the focus was surveying for larvae.

Larvae Collected on Legumes

Many of the pods of blackbead and also the shrub *Vachellia farnesiana* (L.) Wight & Arn. (Fabaceae) on the Keys had small holes with frass, but the culprit was elusive. In 1 pod of *P. keyense* collected on Cudjoe Key, a dead desiccated larva of a tortricid was found in a seed. The agent may have been *Cydia fahlbergiana* (Thunberg) (Lepidoptera: Tortricidae), which was caught at light (Table 1). Each pod of *V. farnesiana* (also collected on Cudjoe Key) had 1 hole with 1 adjacent seed bored and frass from the larva inside the pods. The damage may have been caused by *Cydia largo* Heppner (Lepidoptera: Tortricidae) (Table 1), although no larvae were found.

An unidentified larva of Blastobasidae was collected on the same host and site as E18-1860, but it was not reared successfully. Likewise, an unidentified oecophorid larva was skeletonizing and webbing leaves of *P. keyense* on Big Pine Key, but the rearing was not successful.

Stilbosis lonchocarpella Busck (Fig. 10) (Cosmopterigidae)

This was reared on *Piscidia piscipula* (L.) Sarg. (Fabaceae), tying leaves and producing much frass. Many more were collected at light on the 4 sites and dates. This species was reared previously on the same host in Collier County by L.C. Dow (Mar 1987, in McGuire Center for Lepidoptera and Biodiversity) and on "*Piscidia* sp." in Miami (May 1983, P. Perun, in Florida State Collection of Arthropods). Robinson et al. (2002) also record it on *Lonchocarpus sericeus* (Poir.) DC (Fabaceae).

Uresiphita reversalis (Guenée) (Fig. 11) (Crambidae)

This was reared on *Sophora tomentosa* L. (Fabaceae) on Middle Torch and Big Pine Keys, and specimens were collected with ultraviolet light on Big Pine Key. The larvae feed on leaves of many legumes, including *S. tomentosa* (Robinson et al. 2002). It has been reared on *S. tomentosa* in Pinellas and Monroe counties (Florida State Collection of Arthropods). James Troubridge reports that *U. reversalis* was abundant in his traps the previous mo (personal communication).

Collected only with Ultraviolet Light or Malaise Trap

Cydia fahlbergiana (Fig. 12) (Tortricidae)

This species has been reared on *Pithecellobium unguis-cati* (L.) Benth. (Fabaceae) and *Cojoba arborea* (L.) Britton & Rose (Fabaceae) on Sugarloaf Key and Mayagüez, Puerto Rico, USA, respectively (Brown et al. 1983). It is the only tortricid seed-borer on *Pithecellobium* that we know, and it may be the same as the mystery tortricid found in a *P. keyense* pod. How much of the damage to pods can be attributed to this species remains speculative without actual rearings. The illustrated specimen was collected elsewhere (Sanibel Island, Nov 1983, L.C. Dow, in McGuire Center for Lepidoptera and Biodiversity).

Cydia largo (not figured) (Tortricidae)

The larvae feed on several species of Fabaceae: *V. farnesiana*, *Pithecellobium dulce* (Roxb.) Benth. (Fabaceae), and *Lysiloma latisiliquum* (L) Benth. (Fabaceae). Heppner (1981) does not indicate the location of feeding, but the Florida State Collection of Arthropods has specimens of it reared on *V. farnesiana* both feeding in the pods (Pinellas County, Clearwater, 29 Jan 2013, W. Salway, E13-647) and webbing leaves and shoots (Lee County, Fort Myers, 20 May 2015, S. Brown, E15-3444).

Apotoforma rotundipennis Walsingham (not figured) (Tortricidae)

Two specimens were caught in a Malaise trap. The larvae of this species feed on leaves of *V. farnesiana*, "*Acacia arabica*" (probably *V. nilotica* [L.] P.J.H. Hurter & Mabb) (Fabaceae), *Acacia macracantha* (Humb. & Bonpl. ex Willd.) Seigler & Ebinger (Fabaceae), and *Prosopis juliflora* (Sw.) DC. (Fabaceae) (Busck 1934; Razowski 1993; Heppner 2007).

Ithome concolorella (Chambers) (Fig. 13) (Cosmopterigidae)

This species is very similar to *I. simulatrix*, but males of *I. concolorella* can be distinguished without dissection by the semicircular eighth abdominal tergum (Hodges 1978: fig. 42i), whereas this tergum in *I. simulatrix* and *I. aquila* is elongate. *Ithome concolorella* is widespread and can be a pest on flowers of *V. farnesiana* and mesquite (Hodges 1978).

Ithome aquila Hodges (not figured) (Cosmopterigidae)

The larvae feed on inflorescences of *P. unguis-cati* (Hodges 1978).

Aristotelia sp.

We found larvae on *P. keyense* in the Key Deer Refuge that matched the appearance of others collected from *P. keyense*, but we were unsuccessful in rearing them.

Polyhymno luteostrigella Chambers (Fig. 14) (Gelechiidae)

Polyhymno luteostrigella is frequently listed as feeding on *Chamaecrista fasciculata* (Michx.) Greene (Fabaceae), but it has been recorded on *V. farnesiana* (Robinson et al. 2002), as has its western relative *Polyhymno acaciella* Busck (Lepidoptera: Gelechiidae) (Busck 1900b). The latter plant is abundant in the Key Deer Refuge, so in all likelihood it was the host of *P. luteostrigella*.

Stegasta bosqueella (Chambers) (Fig. 15) (Gelechiidae)

Although primarily known as a pest of peanut, this species feeds on various other Fabaceae (Robinson et al. 2002).

Caristanius minimus Neunzig (not figured) (Pyralidae)

This phycitine pyralid was described from Big Pine Key and is endemic to the island as far as known. The larvae feed on *Cassia keyensis* (currently *Chamaecrista lineata* var. *keyensis* (Pennell) H.S. Irwin & Barneby (Fabaceae) (Neunzig 1977).

Sarasota plumigerella Hulst (Fig. 3) (Pyralidae)

This species has been recorded on a few other unrelated hosts, including *Laguncularia racemosa* (L.) C.F. Gaertn (Combretaceae) and *Coccoloba uvifera* (L.) L. (Polygonaceae). The host record is new. It was caught also at light (Table 1). Two females were collected on Big Pine and Cudjoe Keys.

Melipotis acontioides (Guenée) (Erebidae)

The larvae are pests of *Delonix regia* (Hook.) Raf. (Fabaceae) (Wagner et al. 2011), and it also feeds on *Parkinsonia aculeata* L. (Fabaceae) and *Poeppigia procera* C.Presl (Fabaceae) (Robinson et al. 2002).

Melipotis famelica (Guenée) (Erebidae)

This has been recorded on several fabaceous hosts, including *V. farnesiana* (Janzen & Hallwachs 2009), *Lysiloma latisiliquum* (L.) Benth. (Fabaceae) (Robinson et al. 2010), and *Leucaena leucocephala* (Lam.) de Wit (Fabaceae) (Wolcott 1948).

Elousa albicans Walker (not figured) (Erebidae)

The host of this species is not known (Nicholas Homziak personal communication), but Fabaceae is predicted because it is related to other legume-feeding omopterine erebids, such as *Tyrissa* and *Heteranassa* (Smith). Big Pine Key has the only known population of *E. albicans* in Florida. The collection effort significantly added to the holdings of the Florida State Collection of Arthropods. Subsequent to the first one, specimens were caught in many of the biweekly Malaise trap samples at the Palmetto Avenue site in Oct 2019. The host plants of *E. albicans* and the next species should be sought.

Isogona scindens (Walker) (not figured) (Erebidae)

This is another erebid that occurs only on Big Pine Key in its Florida distribution and that frequently occurred in Malaise traps. Although not reared in this survey, it has been raised on *V. farnesiana* in Costa Rica (Janzen & Hallwachs 2009). Although Janzen's record (82-SRNP-265.1) for *I. scindens* is unique, it is supported by rearings of other species of *Isogona* Guenée on Fabaceae.

Heppner (2007) lists a few other species that were not detected. *Leptotes cassius theonus* (Lucas) (Lepidoptera: Lycaenidae) has been recorded on *P. keyense*. Lepidoptera that use various *Caesalpinia* species (Fabaceae) include *Aphrissa orbis orbis* (Poey) (Lepidoptera: Pieridae), *Mesophleps adustipennis* (Walsingham) listed as *Brachyacma palpigera* (Walsingham) (Lepidoptera: Gelechiidae), *Cyclargus ammon* (Lucas) (Lepidoptera: Lycaenidae), *Fundella argentina* Dyar (Lepidoptera: Pyralidae), *Fundella pellucens* Zeller (Lepidoptera: Pyralidae), *Marmara guilandinella* Busck (Lepidoptera: Gracillariidae), *Pococera floridella* (Hulst) (Lepidoptera: Pyralidae), and *Selenisa sueroides* (Guenée) (Lepidoptera: Erebidae). Not all of these are recorded through the Division of Plant Industry samples. *Holcocera guilandinae* (Busck) (Lepidoptera: Blastobasidae) was described as "bor[ing] in the stem and pupat[ing] outside in a slight web" on *G. bonducella* (= *G. bonduc*) (Busck 1900a). However, Busck mentions 2 other blastobasids bred from the same material. *Holcocera* species are generally detritivo-

rous. *Phoebis agarithe maxima* (Neumoegen) (Lepidoptera: Pieridae) is commonly encountered on *P. keyense* in the study area though specimens were not collected.

An unusual undescribed cosmopterigid feeds on leaf galls of *P. keyense* in the Florida Keys. Although it has been referred to a new genus (Weekley 2000), specimens key to *Afeda* Hodges (Hodges, 1978: 99–100), which includes 1 sympatric species, *A. biloba* Hodges. The larvae mine galls made by the wasp *Tanaostigmodes pithecellobiae* LaSalle (Hymenoptera: Tanaostigmatidae) (Weekley 2000). We have not reared any in the present surveys, but the moths are represented by a few specimens in the Florida State Collection of Arthropods and McGuire Center for Lepidoptera and Biodiversity.

The team from the Division of Plant Industry did not find any local evidence of certain other legume pod-borers that co-occur with *Maruca vitrata*. *Etiella zinckenella* (Treitschke) (Lepidoptera: Pyralidae), *F. pellucens*, and *Mesophleps adustipennis* (Walsingham) (Lepidoptera: Gelechiidae) historically infest the same crops in Puerto Rico as *Maruca* (Leonard 1931), and they all are present in Florida (Heppner 2007). *Fundella argentina* Dyar also was not detected, although it is established on the Florida mainland.

Discussion

Our results expand the geographic, life-history, and taxonomic understanding of lepidopteran herbivores that utilize the *P. keyense* and *G. bonduc* in South Florida. This survey is only a snapshot in time of a fauna that displays a substantial degree of seasonal and stochastic change. A systematically organized, periodic survey possibly could find more species. The sampling was limited in 2 ways: collection of the host plants was opportunistic, and it was temporally brief. A systematic, periodic sampling design during the course of a yr could yield greater diversity and data that are more amenable to analysis. It is interesting that past surveys have resulted in so few records, since both *P. keyense* and *G. bonduc* are abundant in the Florida Keys (Gann & Stocking 2019).

Due to the extremely restricted geographical range and low extant population abundance of *C. t. bethunebakeri*, any significant competition for host resources by other herbivorous insects potentially could limit population growth, or even impact population persistence. This is particularly true when key host resources are limited. Adult butterflies and their resulting larvae preferentially oviposit and feed on terminal growth that includes new host leaves, flower buds, and inflorescences. As terminal host growth is regulated inherently by season and a variety of environmental factors including rainfall, the optimal resource times often are highly constrained and sporadic (Henry et al. 2015). Current climate change models predict a decrease in precipitation in the Florida Keys by the end of the century, with potentially drier winters (IPCC 2014). These shifts in precipitation may lead to increased competition for even more limited new growth during extended droughts. Beyond routine herbivory that has the likelihood to generate only minimal host damage, periodic population outbreaks by some taxa could generate significant host damage. We have routinely observed moderate to substantial defoliation of terminal growth resulting from larval feeding by *Melipotis januaris* and *Phoebus agarithe*.

Phoebus agarithe is considered one of the most widespread and abundant butterflies in the Florida Keys and in coastal habitats throughout the southern Florida mainland. It uses 3 fabaceous plants, *Pithecellobium keyense*, *P. unguis-cati*, and *Lysiloma latisiliquum* (L.) Benth. (Fabaceae) as larval hosts (Minno & Emmel 1993). Due to its overall abundance and corresponding large larval size, noticeable host damage is frequent and can be quite extensive. Moreover, *P. agarithe* larval feeding may inadvertently result in mortality of immature stages of *C. t. bethunebakeri* as a byproduct of direct consumption on terminal host resources. Beyond these impacts, it is unknown if other indirect effects such as potential increased parasitoid or predator loads could also be produced as a result of the diversity and quantity of other lepidopteran herbivores in this system.

Melipotis januaris would be a serious competitor for foliage in the same way that *M. acontioides* and other melipotines can defoliate trees. The *Crocidosema* species and the *Aristotelia* species are both reliably collected on nickerbean and blackbead, respectively. The fact that at least 1 and possibly both species are undescribed points to the need for taxonomic research on Florida microlepidoptera. The population levels of parasitoids and predators would be the other major limiting factor for the abundance of *C. t. bethunebakeri*. Since we did not sample predators, this remains speculative. High populations of generalist predators would be sustained by a dependable source of alternate host insects. Predator and tritrophic interactions surrounding *C. t. bethunebakeri* are largely unknown and warrant further investigation.

Acknowledgments

We thank Leroy Whilby, Brad Danner, Jason Stanley, Elijah Talamas, and Paul Corogin for planning and assistance with the Division of Plant Industry survey. We also thank the staff of the Florida Keys National Wildlife Refuges and Bahia Honda State Park for assisting with access to sampling locations. Surveys were conducted with National Key Deer Refuge permits FY17-8 and FY18-7, Florida State Parks permits #09221610B and #03251925, and through the US Fish and Wildlife Cooperative Recovery Initiative. We thank the Florida Department of Agriculture and Consumer Services, Division of Plant Industry for support of this work. We also thank Paul Skelley, Caroline Storer, Nicholas Homziak, David Plotkin, and Marcela Diaz Zamora, as well as 4 anonymous reviewers whose comments helped us to improve this manuscript.

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