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Three new species of *Cautethia* Grote (Lepidoptera: Sphingidae) from the Lucayan Archipelago and keys to West Indies species

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Abstract. Five species of *Cautethia* Grote (Lepidoptera: Sphingidae) occur in the Lucayan (Bahamas) Archipelago, three of which are new to science. *Cautethia simoni* Miller, Matthews, and Gott, **new species**, is described and illustrated from Mayaguana Island, Bahamas, and Providenciales and Grand Turk of the Turks and Caicos Islands. *Cautethia gossi* Miller, Matthews, and Gott, **new species**, is described and illustrated from Great Inagua, Bahamas. *Cautethia geraceorum* Miller, Matthews, and Gott, **new species**, is described from San Salvador Island. Diagnoses are provided and new island records are reported for the two previously described Bahamas species, *Cautethia grotei* Edwards and *Cautethia exuma* McCabe. A taxonomic key based primarily on genitalia is provided for males and known females of the ten described species occurring in the West Indies. COI barcodes were obtained from representative Bahamas specimens and analyzed along with existing barcodes.

Key words. Caribbean Basin, barcodes, *Chiococca*, cryptic species, Dilophonotini, *Erithalis*, hawk moth, Macroglossinae, Rubiaceae

ZooBank registration. urn:lsid:zoobank.org:pub:D0590B45-FCBC-4411-B50B-A80940C5EA28

Introduction

The genus *Cautethia* Grote (subfamily Macroglossinae, tribe Dilophonotini) includes 13 species and are among the smallest hawkmoths (Sphingidae) in the world. Three species (*Cautethia spuria* (Boisduval), *C. yucatana* Clarke, and *C. simitia* Schaus) occur on the mainland of Central America, with *C. spuria* also breeding in Southern Texas and strays recorded from Arizona and Oklahoma (Tuttle 2007). Ten species occur in the West Indies, one of which, *Cautethia grotei* Edwards, is also present in Florida. Recent works (Haxaire and Schmit 2001; Haxaire 2002, 2016; Haxaire and Melichar 2012, 2016; Melichar et al. 2016) have provided major contributions to our knowledge of the West Indies fauna. While the fauna of the Greater Antilles has been relatively well-studied for this genus, the Lesser Antilles, and the Lucayan Archipelago, consisting of the islands of the Commonwealth of the Bahamas and the Turks and Caicos Islands have received less attention by collectors and systematists. Prior to our studies, *Cautethia* known from the Bahamas included *Cautethia exuma* McCabe and *Cautethia grotei*. The latter species includes five subspecies, two of which were recently described by Melichar et al. (2016): *Cautethia grotei jamaicensis* Melichar, Řezáč, and Ilčíková from Jamaica and *Cautethia grotei bahamensis* Melichar, Řezáč, and Ilčíková. The type series from the latter included specimens from the western islands of the Little and Great Bahamas Banks as well as Crooked Island to the east.

Ongoing surveys of Lepidoptera of the Bahamas by Miller et al. have increased the number of recognized morphospecies from about 300 to 1000 since 2010 with 13 major islands sampled. Several new species in other taxa have been published (e.g., Brown et al. 2018; Gilligan et al. 2018; Austin et al. 2019; Matthews et al. 2019) with more in progress. In curating *Cautethia* from these surveys, it was necessary to prepare genitalia dissections of representatives from each island to distinguish between the two previously known species and to understand individual variation in wing patterns. In doing so, distinct morphological forms of genitalia were discovered on the more remote eastern islands of San Salvador, Mayaguana, and Great Inagua, as well as the Turks and Caicos, which correspond to some slight, yet consistent differences in wing patterns. These three distinct forms are herein described as new species.

The recent publications on *Cautethia* mentioned above, together with the online resources provided by Kitching (2019), have provided indispensable information and illustrations for identifications of these moths. With the addition of three new species and the potential flux of island populations, we also provide a taxonomic key to the genus for the entire Caribbean Basin. Female genitalia have received little treatment within the genus which may be due in part to their scarcity in collections and paucity at lights. Along with males, female genitalia are illustrated for the Lucayan species as well as two other Caribbean species not previously illustrated in the literature.

Materials and Methods

Abbreviations. Species accounts below include full label data for all Bahamas and Turks and Caicos specimens examined. Partial data is given in figure captions for these specimens. In addition, comparative material representing the entire genus and subspecies of *C. grotei* and *C. noctuiformis* (Walker) was examined as available from the following institutions:

CMNH Carnegie Museum of Natural History, Pittsburgh, PA
MGCL McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, Gainesville, FL
UCDC R. M. Bohart Museum of Entomology, University of California, Davis, CA
USNM National Museum of Natural History, Washington, DC.

In material examined sections, collection codens are indicated in brackets where not already apparent from alphanumeric unique identifier barcode labels. For brevity, the following collector names have been replaced with initials:

DLM Deborah L. Matthews
GJG Gary J. Goss
JYM Jacqueline Y. Miller
MJS Mark J. Simon
RMR Richard M. Rozycki
RWP Roger W. Portell
TAL Terry A. Lott

Other abbreviations: TL – Type locality.

Field methods. Adult specimens were collected at sheets illuminated by 250-watt standard or 160-watt self-ballasted mercury vapor lights, LepiLED lamps, or 15-watt blacklight tubes. Thirteen major islands (Abaco, Cat, Crooked, Eleuthera, Exuma, Grand Bahama, Inagua, Long, Mayaguana, New Providence, North Andros, San Salvador, and South Andros) were sampled, with individual trips covering one or two islands lasting up to 12 days. Lights were set up at a different remote location each night in addition to lodging areas. A variety of habitats were sampled such as Caribbean pinelands, various types of coppice, mangrove, beach, coastal rocklands, and disturbed sites.

Morphological study. Genitalia were prepared by soaking abdomens in cold 10% KOH overnight and dissecting in water with a trace of dish soap added to reduce surface tension. Specimens were lightly stained with Chlorazol Black E and stored in glycerin. Temporary slide mounts were made using depression slides and KY® jelly for imaging different aspects of male and female genitalia. Genitalia were photographed with a Leica DM6B microscope system with a Leica DMC6200 camera. Genitalia were subsequently placed in glycerin vials for storage. Adults were photographed with a Canon 70D camera and Canon 100mm IS macro lens against a white background and illuminated with a Canon MT-26EX-RT Macro Twin Lite and OttLite® bulbs. Adult habitus images were stacked as needed with Zerene Stacker, version 1.04 using the DMap algorithm and images were assembled on the plates with Adobe Photoshop CS5.1. Wing venation nomenclature (Fig. 1) follows Hodges (1971). Wing pattern elements are adapted from Tuttle (2007). Color names in descriptions are adapted from Ridgway (1912). Genitalic nomenclature is adapted from Klots (1956) and Kristensen (2003).

Barcode analyses (Fig. 79). Legs were removed from specimens for COI barcoding with extractions completed following protocols from the Qiagen DNeasy Blood and Tissue Kit. Extracted DNA was amplified using COI primers LepF 5′-ATTCAACCAATCATAAAGATATTGG-3′ and LepR 5′-TAAACTTCTGGATGTCCAAAAAATCA-3′ (Hajibabaei et al. 2006) and PCR products were quantified using gel electrophoresis. High quality PCR products were sent to Eurofins Genomics for sequencing. Sequences were submitted to GenBank and assigned accession numbers ON511146–ON511155 (See Table 1). Additional sequences were extracted from the Barcode of Life Database (BOLD) and Melichar et al. (2016) for inclusion in our molecular analyses. Twenty-five sequences were

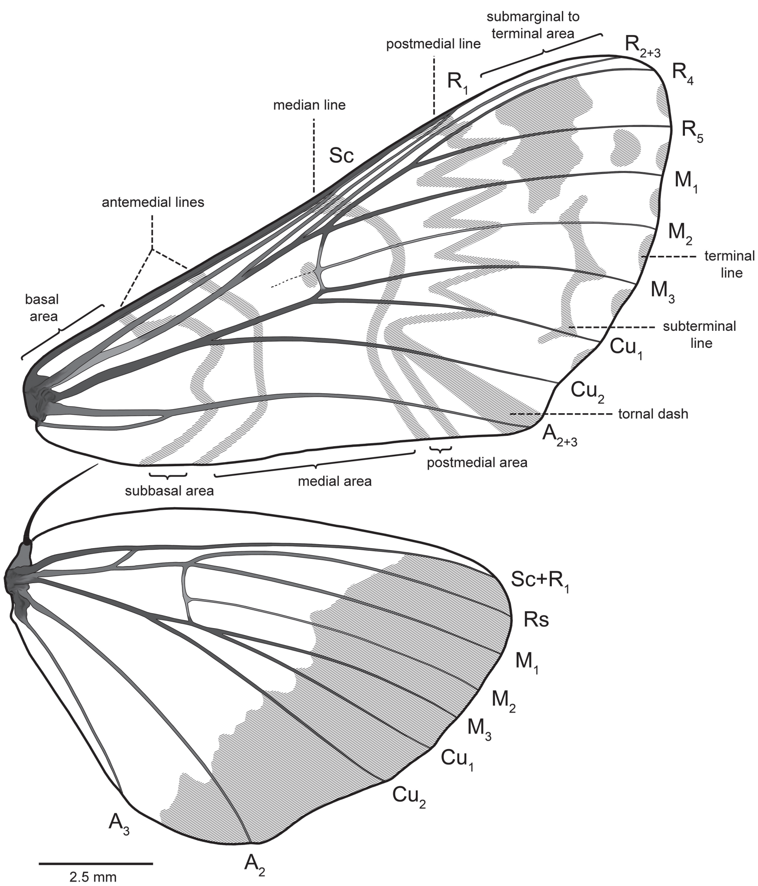


Figure 1. Generalized venation and wing patterns of *Cautethia* (based on *C. grotei*).

Table 1. GenBank accession numbers of *Cautethia* COI barcodes newly sequenced for this study.

Species	Specimen ID	Accession no.
Cautethia calezae	LEP-65162	ON511152
Cautethia exuma	LEP-22437	ON511155
Cautethia exuma	LEP-65159	ON511150
Cautethia geraceorum	LEP-65155	ON511146
Cautethia gossi	LEP-65156	ON511147
Cautethia gossi	LEP-65158	ON511149
Cautethia grotei apira	LEP-65160	ON511151
Cautethia grotei bahamensis	LEP-22426	ON511154
Cautethia grotei bahamensis	LEP-65163	ON511153
Cautethia simoni	LEP-65157	ON511148

aligned using the Clustal Omega plugin in Geneious Prime with sequences trimmed to 573 base pairs (bp) while one sequence, SOWE169-07_*C_grotei_grotei*, contained 524 bp. The holotype sequence of *C. grotei bahamensis* reported by Melichar et al. (2016) was removed from the analysis after determining the wrong sequence was likely published for CEITECF.117 *C. grotei bahamensis* due to this sequence's similarity to *Xylophanes crenulata* Vaglia and Haxaire (99.4%, base pairs 230–658, BC-HAX 1153) and other *Xylophanes* spp. when completing a BLAST search. Two identical sequences were removed, reducing the molecular dataset to 22 sequences. Molecular analyses were completed using MEGA version X (Kumar et al. 2018; Stecher et al. 2020). The gamma rate parameter was estimated as 0.2, and a pairwise distance matrix was calculated using the Kimura 2-parameter model with 0.2 gamma rate distribution to determine if barcoding gaps existed among sampled taxa (Kimura 1980). A difference ≥2% with pairwise distances was used to delimit species with molecular data since multiple specimens were not able to be sampled to determine if a tenfold difference between interspecific and intraspecific pairwise distances is present (Hebert et al. 2003, 2004; Hajibabaei et al. 2006). The overall average pairwise distance was calculated to be 0.05 with the Jukes-Cantor distance model, which supports the use of a neighbor-joining method to analyze the data (Jukes and Cantor 1969; Saitou and Nei 1987; Nei and Kumar 2000). *Himantoides undata* (Walker) was used as the outgroup taxon based on results from Kawahara et al. (2009) indicating a close relationship between the genera *Cautethia* and *Himantoides* Butler. Trees were inferred using the neighbor-joining method with 1000 bootstrap replicates completed (Felsenstein 1980). Branches with less than 50% support were removed and polytomies were created.

Results – Morphology

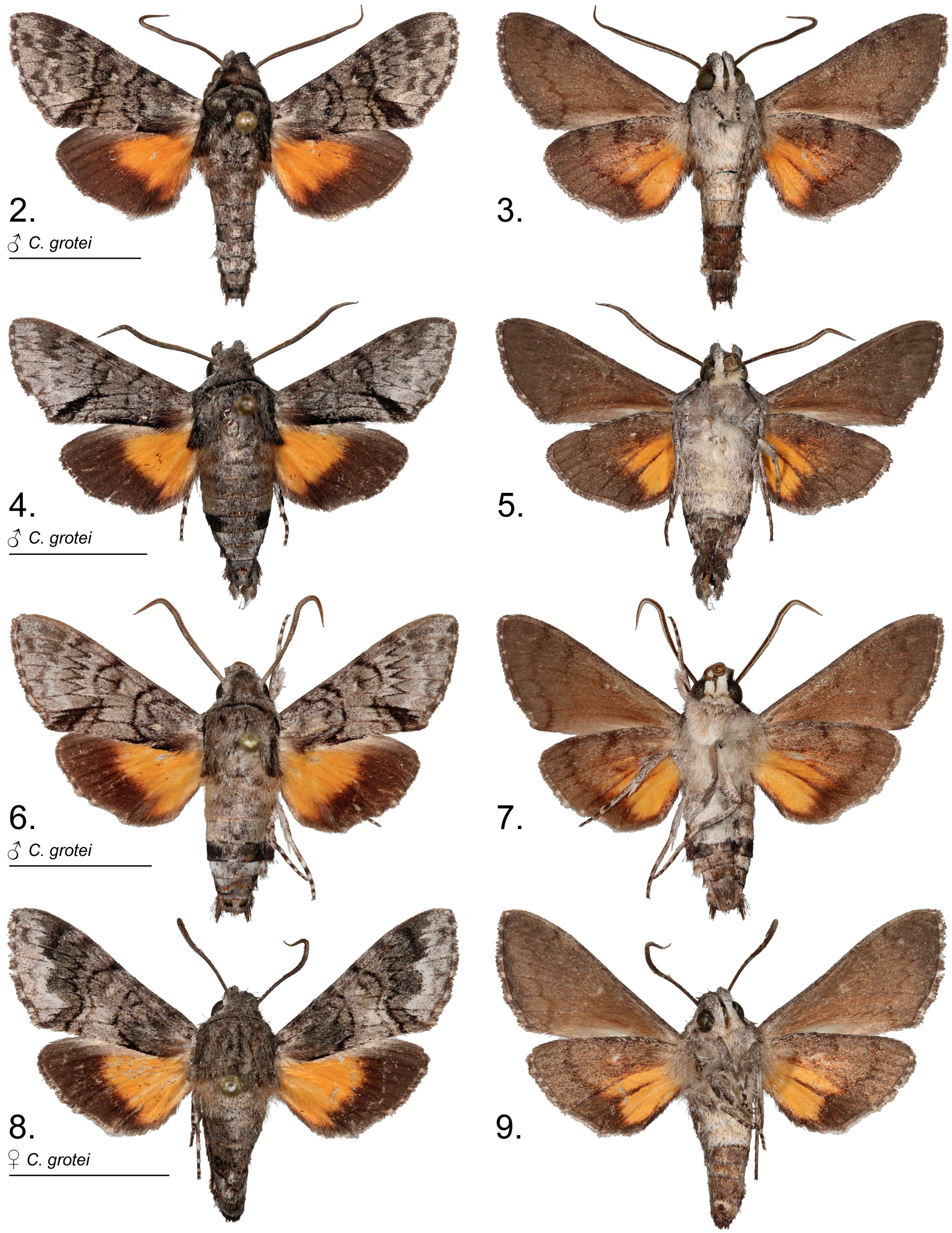
Five species of *Cautethia* are now known to occur in The Lucayan Archipelago, one of which is also found in south Florida, Cuba, Jamaica, and the Cayman Islands. Of the five species, one, previously misidentified as *C. noctuiformis* [CMNH], occurs on both the Turks and Caicos, and Mayaguana Island of the Bahamas. Life histories are known for one species based on Florida specimens and another (*C. exuma*) based on the accounts given by McCabe (1984) at the time of description.

Species Accounts

Cautethia exuma McCabe, 1984

Fig. 14–17, 26, 31, 42, 43, 60, 69, 72

Diagnosis. Males and females not distinctly dimorphic as in other species of the genus. Distinguished from *C. grotei* and the three new species by characters of the thorax, forewings, antennae, and genitalia. Thorax even



Figures 2–9. Variation in Lucayan *Cautethia grotei* adults. **2)** Dorsal view ♂, MGCL 246910, North Abaco, 6.vi.2016. **3)** Ventral view, same specimen. **4)** Dorsal view ♂, MGCL 231507, North Andros, 27.x.2011. **5)** Ventral view, same specimen. **6)** Dorsal view ♂, MGCL 1076036, Crooked Island, 18.ix.1988. **7)** Ventral view, same specimen. **8)** Dorsal view ♀, MGCL 235183, Great Exuma Island, 25.v.2014. **9)** Ventral view, same specimen. Scale bar under names 1 cm.

mottled gray without traces of transverse fuscous band along anterior margin or fuscous marks on tegulae as in *C. grotei* and the new species. Forewing markings obscured compared to *C. grotei* and the others as follows. Basal area pale gray with white scale patches at base, antemedial lines indistinct, indicated by two fuscous spots present along costa, a third spot at costa within basal area. Subbasal area and medial area similar mottled smoke gray, veins not distinctly traced with darker scales, medial line obscure. Discal spot a small poorly defined patch of white scales bordered distally by diffuse patch of fuscous scales. Postmedial line zigzagged but more diffuse than in the other species. Postmedial area smoke gray. Submarginal area smoky gray bordered by narrow white band. Terminal area drab admixed with white scales. Tornal dash poorly defined, mottled smoky gray basally outlined by diffuse fuscous postmedial line. Antenna dorsum drab to gray scaled, without cream stripe along venter. Male genitalia similar to *C. grotei* but with gnathos short, stout, and only slightly curved, ventral aspect of apex convex, not distinctly bifid as in *C. grotei*. Valvae with sacculus short, tapered, simple, terminus somewhat sclerotized but not forming a distinct process as in *C. simoni* and *C. gossi*. Phallus distinguished from *C. grotei* and *C. geraceorum* in having the terminal margin sclerotized on the dorsal left side forming a minute pointed extension, by relative lengths of the vesica, and from *C. simoni* and *C. gossi* by the absence of lateral diverticuli. Female genitalia distinguished from other Bahamas species by having the posterior margin of the lamina postvaginalis medially notched. McCabe (1984) differentiated *C. exuma* from *C. grotei* by the relative size of the appendix bursae, however after examining more material this character was found variable and may be either subequal to the corpus bursae or much larger as in *C. grotei*.

Specimens examined. BAHAMAS: **Eleuthera Island:** Governor's Harbour, s.l., 28.ix.2000, L. D. Miller & MJS, Allyn Museum Acc. 2000-11 (1 ♂) MGCL 231519; **Long Island:** blue hole E of Anderson, 23.533233°, −75.237334°, 31.v.2014, JYM, GJG, MJS, DLM, MGCL Acc. 2014-14 (1 ♂, prep. DM 2139), MGCL 239531 (LEP-22437); **North Andros:** 1 mi. E of Andros Town Int. airport nr. AUTEC Naval Base, 24.696535°, −77.772421°, 14.vi.2012, MJS, GJG, RMR, Michael Simon (1 ♂) MGCL 231516; Captain Bill's Blue Hole, 24.742046°, −77.862031°, 29.x.2011, JYM, MJS, GJG, DLM, MGCL Acc. 2011-32 (1 ♂) MGCL 231517 (1 ♀) 231515; Stafford Creek, Love at First Sight (motel), 18m, 24.901449°, −77.936089°, 28.x.2011, JYM, MJS, GJG, DLM, MGCL Acc. 2011-32 (1 ♂) MGCL 231518; **South Andros Island:** Black Point, Steven's Rd., 23.997568°, −77.560616°, 27.iii.2014, JYM, MJS, RMR, DLM, MGCL Acc. 2014-9 (1 ♂) MGCL 233420, (1 ♂, prep. DM 2233) MGCL 233423, (5 ♀, prep. DM 2141) MGCL 233417, 233418 (LEP-65159), 233419, 233422, 233424; farm road north of The Bluff, 24.130088°, −77.590680°, 30.iii.2014, JYM, MJS, RMR, DLM, MGCL Acc. 2014-9 (♂) MGCL 233515.

Life history. McCabe (1984) included a description and illustration of the larva with the original description of this species based on one larva which pupated but did not properly eclose. This larva was on black torch, *Erithalis fruticosa* (Linnaeus) (Rubiaceae). This foodplant occurs throughout the archipelago (Correll and Correll 1982).

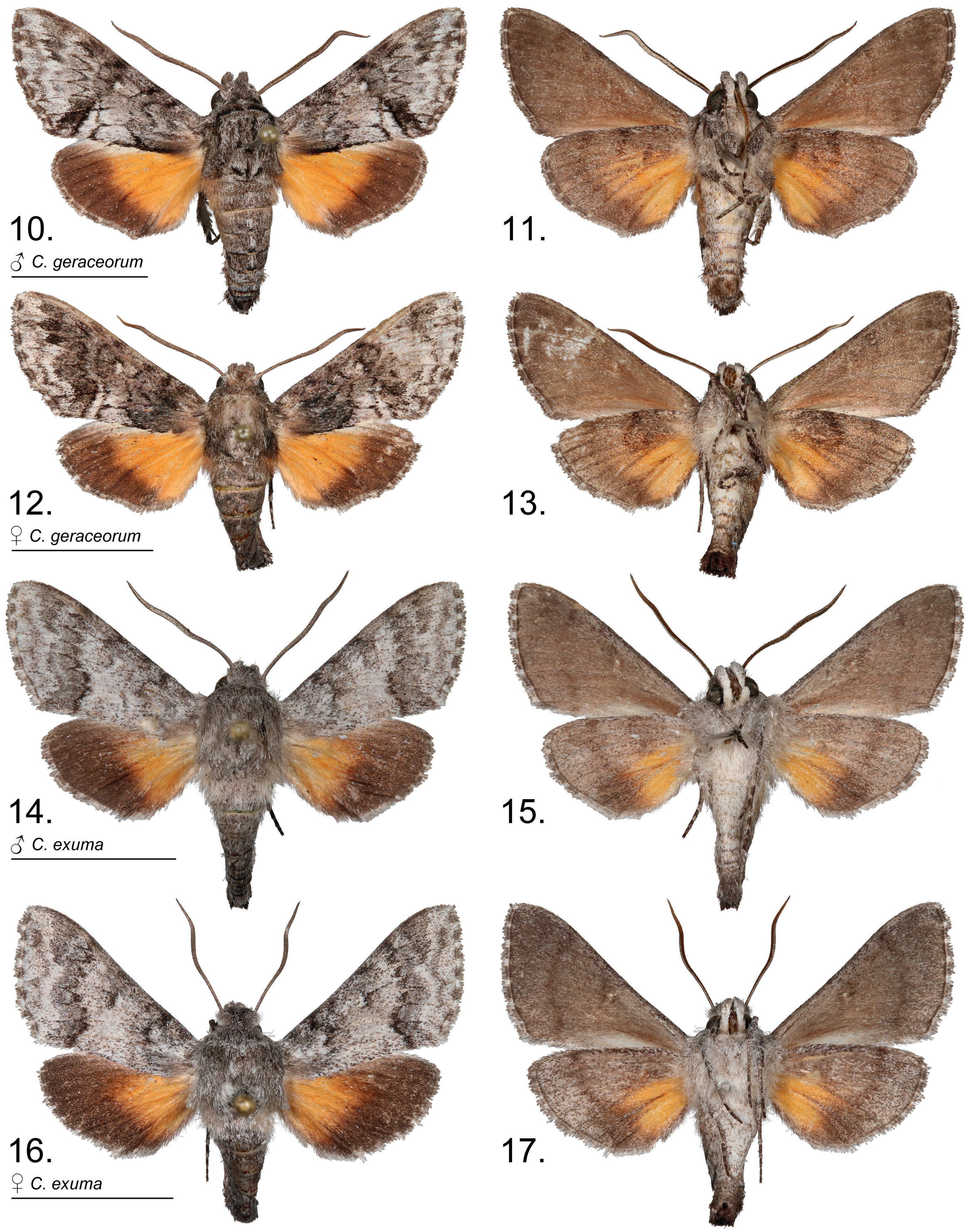
Distribution. *Cautethia exuma* was previously only known from Great Exuma Island. Its distribution now also includes Eleuthera, Long, North Andros, and South Andros Islands.

Cautethia grotei Edwards, 1882

Fig. 2–9, 27, 32, 44, 45, 58, 68, 71

This species is by far the most common and widely distributed *Cautethia* in the West Indies, with five described subspecies. It was originally described from Florida and has been known from the Bahamas since first reported by Hampson (1904). Melichar et al. (2016) recently designated and described the subspecies *Cautethia grotei bahamensis* Melichar, Řezáč, Ilčíková, based on the type series from Islands of the Little and Great Bahamas Bank, and Crooked Island. *Cautethia grotei* has not yet been collected on any islands east of Crooked Island. Specimens from San Salvador Island, though externally similar to *C. grotei*, differ in genitalic morphology and represent a separate species. In addition to the *C. grotei* subspecies occurring in the Bahamas and the nominate subspecies from Florida and Cuba, the others include *Cautethia grotei apira* Jordan, 1940 from Grand Cayman, *C. grotei hilaris* Jordan, 1940 from Cayman Brac, and *C. grotei jamaicensis* Melichar, Řezáč and Ilčíková, 2016 from Jamaica.

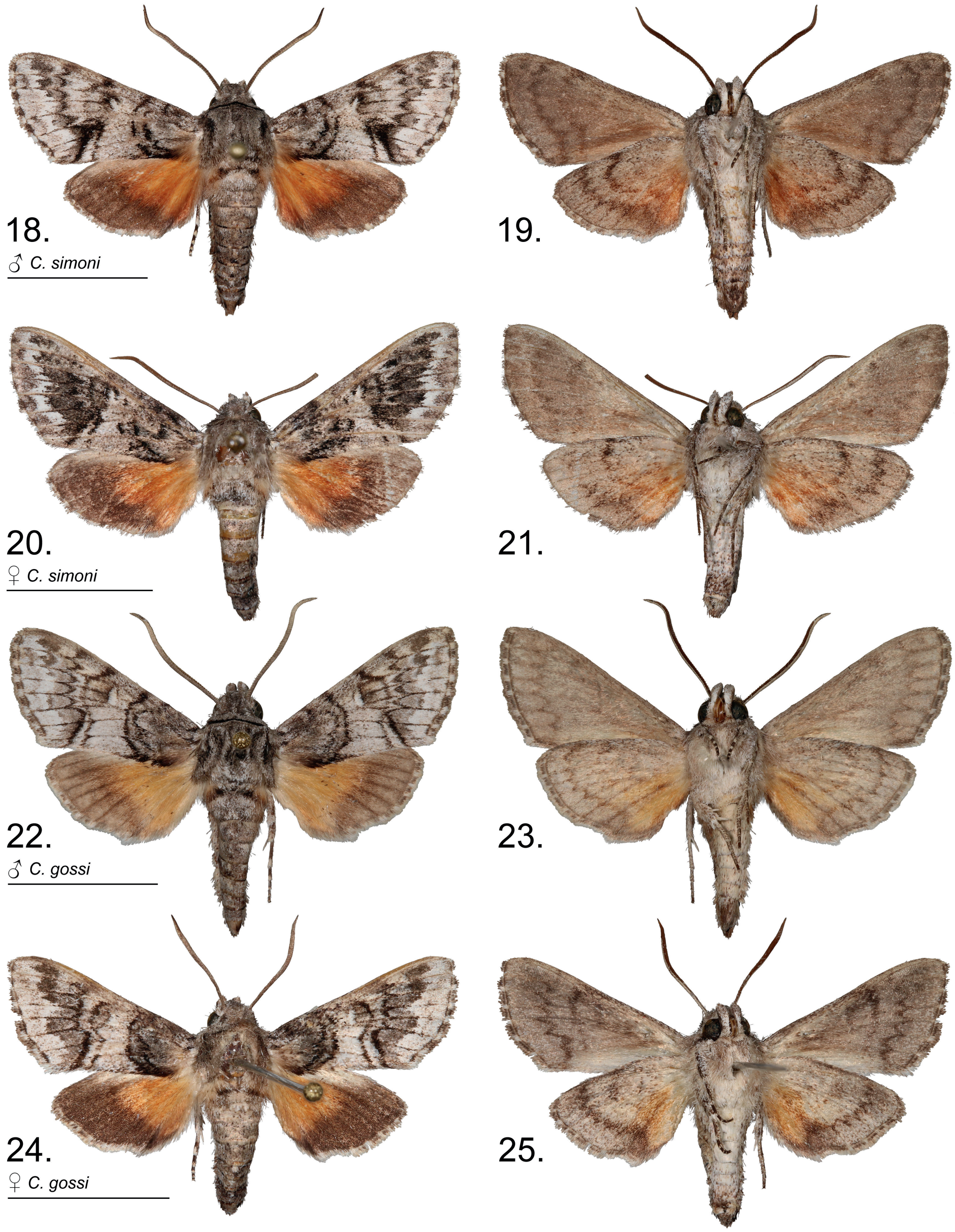
Diagnosis. Wing patterns of the subspecies are similar to the nominate subspecies from Florida and Cuba. Males are recognized by the presence of a strong tornal dash (Fig. 2, 4, 6) on the forewing (characteristic of the genus)



Figures 10–17. Lucayan *Cautethia* adults. **10)** Dorsal view of *C. geraceorum*, **new species**, ♂ holotype, MGCL 244145, San Salvador Island, 22.vii.2015. **11)** Ventral view, same specimen. **12)** Dorsal view of *C. geraceorum*, **new species**, ♀ paratype, MGCL 244181, San Salvador Island. **13)** Ventral view, same specimen. **14)** Dorsal view of *C. exuma* ♂, MGCL 233420, South Andros Island, 27.iii.2014. **15)** Ventral view, same specimen. **16)** Dorsal view of *C. exuma* ♀, South Andros Island, 233419. **17)** Ventral view, same specimen. Scale bar under names 1 cm.

and the paired antemedial lines are distinct, with the basal of the two appearing scalloped and indented at cell Cu_2–A_{2+3} together with the hindwing having the basal half pale orange-yellow, and distal half chocolate brown. Males with postmedial area gray as opposed to white adjacent to tornal dash as in the three new species described below. In females, the submarginal and terminal areas meet with a contrasting jagged edge with the terminal area white admixed with gray and the submarginal area fuscous and gray. The tornal dash is present yet less obvious than in males as it is contiguous with the dark basal half of the submarginal area. *Cautethia grotei* is distinguished from *C. exuma* by the presence of a transverse fuscous line across the anterior margin of the thorax and by the usually darker forewings with more distinct antemedial and postmedial lines, and from the three new species described below by the generally darker ground color of the forewings, characters of the antemedial lines, postmedial area, and genitalia. Male genitalia are characterized by the absence of a saccular process in combination with a medially notched gnathos apex. Females are distinct from other *Cautethia* species in having a square medial sclerite on the lamina postvaginalis.

Specimens examined. BAHAMAS: **Abaco:** Central Abaco, E side of S.C. Bolle Hwy., 3 mi. S of Treasure Cay Rd., 26.656294°, −77.306661°, 5.vi.2016, JYM, MJS, GJG, DLM, MGCL Acc. 2016-09 (1 ♂) MGCL 246978; Central Abaco, Marsh Harbour, 4.ix.1970, J. Bowe (1 ♂) MGCL 1076008; same location, 19.viii.1972, J. Bowe (1 ♀) MGCL 1076043; same location, 9-18.viii.1988, J. Bowe (3 ♂) MGCL 1076006, 1076009, 1076010 (1 ♀, prep. DM 2212) MGCL 1076042; Elbow Cay, Hopetown, 10.x.2006, D. G. Marqua, MGCL Acc. 2008-21 (2 ♂) MGCL 1076011, 1076003; North Abaco, 1 mi. S of Blackwood Village, 26.785115°, −77.421319°, 6.vi.2016, DLM, JYM, MJS, GJG, MGCL Acc. 2016-09 (1 ♂) MGCL 246910 (LEP-65163); Great Abaco, 17.vii.1963, J. Bowe (2 ♂) MGCL 1076004, 1076005, 1076007; South Abaco, Schooner Bay Institute, 26.161333°, −77.187667°, 29.x.2014, JYM, MJS, RMR, DLM, MGCL Acc. 2014-31 (5 ♂) MGCL 244735, 244736, 244767, 244954, 245952; same data except, 31.x.2014 (1 ♂) MGCL 246111; same location, 31.v.2016, DLM, JYM, MJS, GJG, MGCL Acc. 2016-09 (1 ♂) MGCL 247131; Schooner Bay, coppice trail, 26.167000°, −77.181167°, 30.x.2014, JYM, MJS, RMR, DLM, MGCL Acc. 2014-31 (1 ♂) MGCL 244961; vicinity of Sawmill Sink, 26.218346°, −77.210170°, 31.x.2014 JYM, MJS, RMR, DLM, N. & M. Albury, MGCL Acc. 2014-31 (2 ♂) MGCL 245833, 246142; same location, 2.vi.2016, JYM, MJS, GJG, DLM, MGCL Acc. 2016-9 (1 ♂) MGCL 247263; **Cat Island:** Fernandez Bay Village, 24°19.183', -75°28.271', 4–8.vi.2009, JYM, MJS, GJG, RMR, MGCL Acc. 2009-22 (2 ♂) MGCL 231501, 231502; same data except 3–9.vi.2009 (3 ♂) MGCL 231498–231500; N of Old Bight Settlement/E of Moss Town, 24.244333°, −77.379667°, 21.vi.2014, JYM, MJS, DLM, GJG, MGCL Acc. 2014-15 (1 ♂) MGCL 246346; SE of Old Bight Settlement, 1.46 mi. from Queen's Hwy on road to Port Howe, 24.222603°, −75.364922°, 22.vi.2014, JYM, GJG, MJS, DLM, MGCL Acc. 2014-15 (1 ♂) MGCL 240645; SE of Old Bight Settlement, 2 mi. from Queen's Hwy on road to Port Howe, 24.220000°, −75.355500°, 25.vi.2014, JYM, MJS, DLM, GJG, MGCL Acc. 2014-14 (2 ♂) MGCL 236761, 236956; vic. Ocean Dream Resort, E of Smith Town, 24.232273°, −75.454536°, 23.vi.2014, JYM, MJS, DLM, GJG, MGCL Acc. 2014-15 (1 ♂) MGCL 240691; vic. Dumfries, 2 mi. SE of Arthur's Town Airport, 24.603249°, −75.643619°, 24.vi.2014, JYM, GJG, MJS, DLM, MGCL Acc. 2014-15 (1 ♂) MGCL 240408; **Crooked Island:** 0.5 mi. E of Ferry at Church Grove Settlement, 22.758933°, −74.242501°, 6.vi.2014, MJS & Michael Simon, MGCL Acc. 2014-13 (1 ♂, prep. DM 2208) MGCL 239522 (LEP-22462); 1 mi. E Colonel Hill, 18.ix.1988, L. D. Miller & MJS, Allyn Museum Acc. 1988-18 (9 ♂, prep. DM 2207) MGCL 1076014, 1076015, 1076021, 1076022, 1076031, 1076033, 1076036, 1076037, 1076040 (1 ♀, prep. DM 2213) MGCL 1076041; same data except 19.ix.1988 (3 ♂) MGCL 1076034, 1076035, 1076038; same data except, 20.ix.1988 (11 ♂) MGCL 1076013, 1076016–1076020, 1076023–1076025, 1076032, 1076039; 1.5 mi. E of Landrail Pt., 22.813263°, −74.321186°, 10.vi.2013, MJS & GJG, MGCL Acc. 2013-21 (1 ♂) MGCL 231512; N side of Horseshoe Beach nr. Gun Bluff, 22.83532°, −74.323017°, 6.vi.2013, MJS & GJG, MGCL Acc. 2013-21 (1 ♂) MGCL 231513; Pittstown Point, 22.831211°, −74.348717°, 3.vi.2014, MJS & Michael Simon, MGCL Acc. 2014-13 (1 ♂) MGCL 238033; vic. Pittstown, 23.ix.1986 MJS & L. D. Miller, Allyn Museum Acc. 1986-19 (2 ♂) MGCL 1076012, 1076030; same data except 24.ix.1986 (1 ♂) MGCL 1076028; same data except 25.ix.1986 (3 ♂) MGCL 1076026, 1076027, 1076029; **Eleuthera Island:** 1.4 mi. N of Rock Sound Airport, 23.912834°, −76.166422°, 28.vi.2014, JYM, MJS, DLM, GJG, MGCL Acc. 2014-15 (1 ♂) MGCL 242304; 4.3 mi. S of Palmetto Point, 25.109584°, −76.151370°, 29.vi.2014, MJS, JYM, GJG, DLM, MGCL Acc. 2014-15 (1 ♂) MGCL 242309; Leon Levy Native Plant Preserve, 25.187667°, −76.212833°, 27.vi.2014, DLM, JYM, MJS, GJG, P. DeLuca, F. Cartwright, E. Freid, MGCL Acc. 2014-15 (1 ♂) MGCL 242272, (1 ♀) MGCL 242815; N of Queen's Hwy, 2.4 mi. SE Governor's Harbour, 25.174333°, −76.210500°, 26.vi.2014, JYM, MJS, DLM, GJG,



Figures 18–25. Lucayan *Cautethia* adults. **18)** Dorsal view of *C. simoni*, **new species**, ♂ holotype, MGCL 236856, Mayaguana Island, 28.vii.2014. **19)** Ventral view, same specimen. **20)** Dorsal view of *C. simoni*, **new species**, ♀ paratype, MGCL 247894, Mayaguana Island, 31.vii–1.viii.2014. **21)** Ventral view, same specimen. **22)** Dorsal view of *C. gossi*, **new species**, ♂ holotype, MGCL 242737, Great Inagua Island, 26.vii.2014. **23)** Ventral view, same specimen. **24)** Dorsal view of *C. gossi*, **new species**, ♀ paratype, Great Inagua, 24.vii.2014. **25)** Ventral view, same specimen. Scale bar under names 1 cm.

MGCL Acc. 2014-15 (2 ♂) MGCL 241098, 241958; North Palmetto Point, Unique Village Resort, 25.168249°, −76.166613°, 30.vi.2014, JYM, DLM, MGCL Acc. 2014-15 (1 ♂) MGCL 242352; **Grand Bahama Island:** vic. Owl's Hole, 26.587496°, −78.469854°, 27.x.2014, JYM, MJS, RMR, DLM, MGCL Acc. 2014-31 (1 ♂) MGCL 242937; **Great Exuma Island:** 0.8 mi. SW of Farmer's Hill; Palm Rd. & Sea View Dr., 23.579202°, −75.929259°, 23.v.2014, JYM, MJS, DLM, GJG, MGCL Acc. 2014-14 (4 ♂) MGCL 234622–234625; SE of Moss Town & airport, 23.551167°, −75.863333°, 27.v.2014, JYM, MJS, GJG, DLM, coppice/salt marsh transition, MGCL Acc. 2014-14 (1 ♂) MGCL 236378; SW of Hoopers Bay, 23.518167°, −75.823667°, 26.v.2014, JYM, MJS, DLM, GJG, MGCL Acc. 2014-14 (2 ♂) MGCL 234381, 234382; vic. Rolleville, 23.661833°, −75.987333°, 25.v.2014, JYM, MJS, DLM, GJG, MGCL Acc. 2014-14 (2 ♂, prep. DM 2128) MGCL 236703, 236704, (1 ♀) MGCL 235183; **Long Island:** 1.25 mi. S of Salt Pond, Line Bay development, 23.327167°, −75.113667°, 28.v.2014, JYM, MJS, DLM, GJG, MGCL Acc. 2014-14 (2 ♂) MGCL 236425, 236454; blue hole E of Anderson, 23.533233°, −75.237334°, 31.v.2014, JYM, GJG, MJS, DLM, MGCL Acc. 2014-14 (1 ♂) MGCL 237900; Deadman's Cay, vic. Airport, 23.175500°, −75.096333°, 29.v.2014, JYM, GJG, MJS, DLM, MGCL Acc. 2014-14 (2 ♂) MGCL 236922, 239538, (1 ♀) MGCL 239539; NE of Whitehouse, 23.407167°, −75.160500°, 1.vi.2014, JYM, GJG, MJS, DLM, MGCL Acc. 2014-14 (2 ♂) MGCL 236621, 237881; Stella Maris, 26.ix.1988, L.D. Miller & MJS, Allyn Museum Acc. 1988-18 (1 ♂) MGCL 1076002; vic. Salt Pond, 23.353833°, −75.119500°, 30.v.2014, JYM, MJS, GJG, DLM, MGCL Acc. 2014-14 (2 ♂) MGCL 237450, 237889, (1 ♀, prep. DM 2130) MGCL 237483; **New Providence Island:** Adventure Learning Center Zoo off Marshall Rd., 25.004472°, −77.353807°, 10.iv.2014, JYM, DLM, M. Mundle & entomology class, MGCL Acc. 2014-10 (1 ♂, prep. DM 2214) MGCL 233107; **North Andros Island:** 2.4 mi. S of Staniard Creek, 24.797594°, −77.888264°, 27.x.2011, JYM, MJS, GJG, DLM, MGCL Acc. 2011-32 (3 ♂) MGCL 231507, 231508, 231510; same location, 11-12.vi.2012 MJS, GJG, RMR & Michael Simon, MGCL Acc. 2012-28 (2 ♂) MGCL 231503, 231505; Andros Town, 7–13.iii.1966, O. L. Cartwright (1 ♂, prep. DM 2181) [USNM]; Captain Bill's Blue Hole, 24.742046°, −77.862031°, 29.x.2011, JYM, MJS, GJG, DLM, MGCL Acc. 2011-32 (1 ♂) MGCL 231509; same location, 13.vi.2012, MJS, GJG, RMR & Michael Simon, MGCL Acc. 2012-28 (1 ♂) MGCL 231511 (1 ♀) MGCL 231514; Small Hope Bay, 0–3m, 27.v.1994, Lee Miller & MJS, Allyn Museum Acc. 1994-10 (2 ♂) MGCL 1076000, 1076001; Stafford Creek, Love at First Sight property, 24°54.10', -77°66.13', 1.vi.2006, Simons, Millers, RMR (1 ♂) MGCL 231488; Stafford Creek, Love at First Sight, 24°54.1', -77°56.2, 18m, 7-11.vi.2008, MJS, RMR, JYM, GJG, MGCL Acc. 2008-25 (5 ♂) MGCL 231493–231497; same location, 10-12.viii.2008, MJS, MGCL Acc. 2009-9 (6 ♂, prep. DM 2215) MGCL 231487, 231489–231492, 231504; Stafford Creek, Love at First Sight, 24.901449°, −77.936089°, 18m, 28.x.2011, JYM, MJS, GJG, DLM, MGCL Acc. 2011-32 (1 ♂) MGCL 231506; **Ragged Islands:** Hog Cay, 22 14.13N,75 45.15W, 11.i.2018 MT+pitfall traps, L. S. Kimsey (1 ♀) [UCDC]; **South Andros Island:** Black Point, Steven's Rd., 23.997568°, −77.560616°, JYM, MJS, RMR, DLM, MGCL Acc. 2014-9 (4 ♂) MGCL 233426–233429, (1 ♀) MGCL 233421; farm road north of The Bluff, 24.130088°, −77.590680°, 30.iii.2014, JYM, MJS, RMR, DLM, MGCL Acc. 2014-9 (7 ♂) MGCL 233511–233514, 233535, 233567, 233568; SW of Driggs Hill Settlement, 24.204092°, −77.599468°, 28.iii.2014, JYM, MJS, RMR, DLM, MGCL Acc. 2014-9 (5 ♂) MGCL 233589–233593; W of The Bluff Settlement, 24.106939°, −77.557659°, 29.iii.2014, JYM, MJS, RMR, DLM, MGCL Acc. 2014-9 (7 ♂) MGCL 233138–233142, 233270, 233271.

Life history. Edwards (1887) described the pupa from a Florida specimen of *C. grotei grotei* and Dyar (1896) described the larva from Florida on *Chiococca alba* (= *C. racemosa*) (L.) Hitchc. (Rubiaceae). In addition to *Chiococca alba*, Tuttle (2007) also lists *Erithalis fruticosa* as a host. The Bahamas subspecies (*C. grotei bahamensis*), though not yet reared, likely feeds on the same plants, both occurring throughout the archipelago along with some endemic congeners (Correll and Correll 1982).

Distribution. The Bahamas subspecies is recorded from the islands of Abaco, Cat, Crooked, Eleuthera, Grand Bahama, Great Exuma, Long, New Providence, North and South Andros. It may also occur on Acklins which is directly adjacent to Crooked Island. However, the moth fauna of this island has not yet been surveyed. No specimens have been found from the more eastern islands.

Cautethia geraceorum Miller, Matthews, and Gott, new species

Fig. 10–13, 28, 33, 46, 47, 59, 70

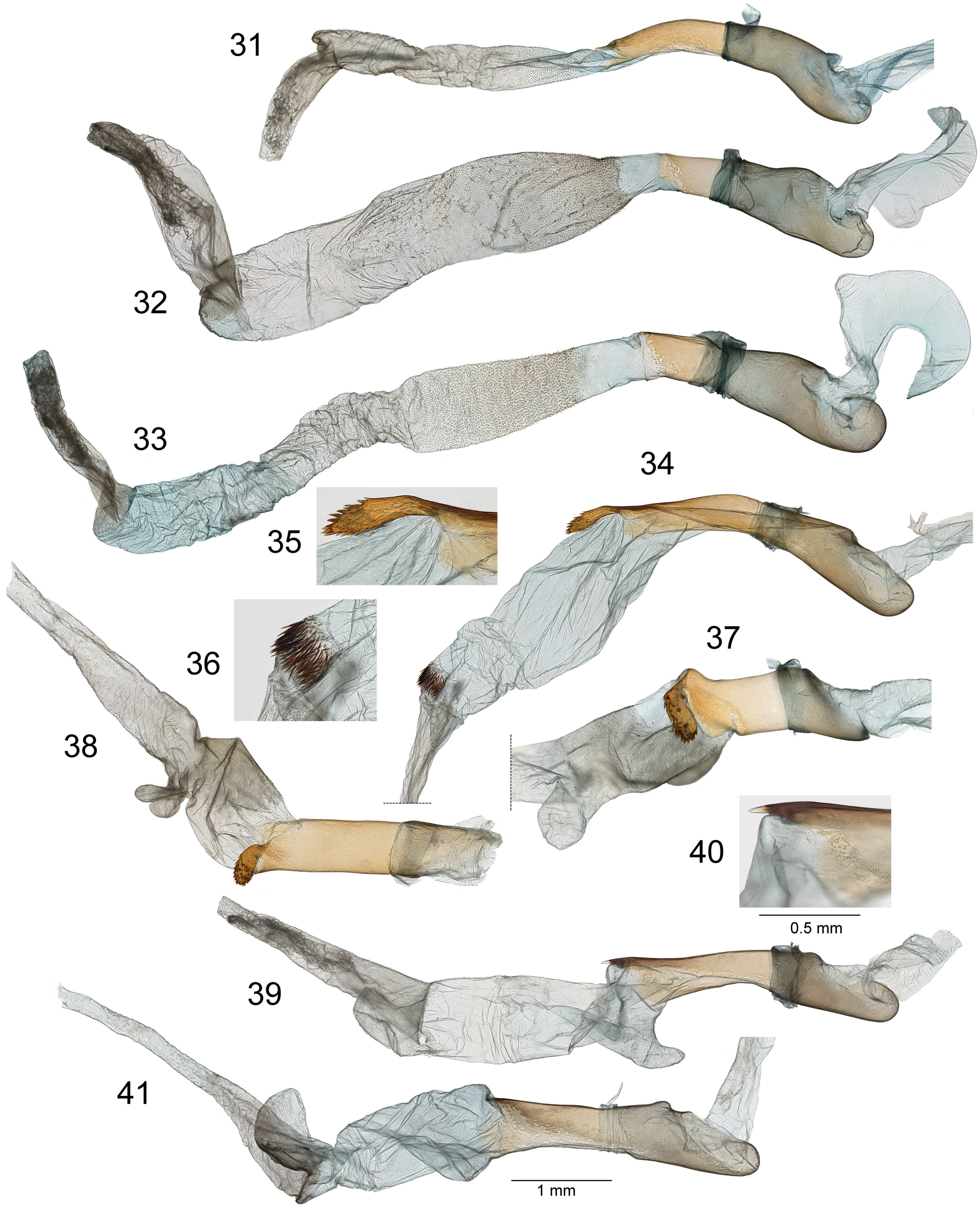
Figures 26–30. Male genitalia of Lucayan *Cautethia* with valvae spread and phallus removed. **26)** *C. exuma*, prep. DM 2233, MGCL 233423, South Andros Island, 27.iii.2014. **27)** *C. grotei bahamensis*, prep. DM 2208, MGCL 239522, Crooked Island, 6.vi.2014. **28)** *C. geraceorum*, **new species**, paratype, prep. DM 2209, MGCL 247849, San Salvador Island, 12.vi.2018. **29)** *C. gossi*, **new species**, paratype, prep. DM 2136, MGCL 321522, Great Inagua, 9-12.vi.2007. **30)** *C. simoni*, **new species**, paratype, prep. DM 2176, Grand Turk, 6.ii.2001 [USNM].

Diagnosis. Wing patterns of this species are like those of *C. grotei* except the forewing ground color tends to appear paler in males with more white scales mixed with gray and fuscous in the medial and submarginal areas. The forewing is generally darker in females than males as in *C. grotei* except the medial area is much paler in contrast to the adjacent subbasal and postmedial areas in cell Cu_2–A_{2+3} and the anal cell, and with the veins distinctly outlined in fuscous. The pale, terminal area also contains some distinct dark markings interrupting the pale area. The species can only be reliably distinguished from *C. grotei* by characters of the male or female genitalia. In males, the gnathos of *C. geraceorum* has an upturned apex extending from the basal lobes as in *C. grotei* but differs in having the terminus broadly spatulate (Fig. 46) and evenly sclerotized as opposed to medially notched with a clear, less sclerotized, midline extending along the stalk (Fig. 45). The lateral lobes of the gnathos also project more distally in *C. geraceorum* than in *C. grotei* and are covered with much longer spinules. The gnathos of *C. geraceorum*, is similar to that of *C. fideli* Haxaire and Melichar from Cuba but the latter has a more elongate gnathos overall with the terminus more distinctly Y-shaped, a slenderer stalk, and the basal lobes not produced to the extent seen in *C. geraceorum*. Females of *C. geraceorum* can be distinguished from *C. grotei* by the proportionally longer and narrower ductus bursae and a more extensive ventral sclerotized area on segment A7 as opposed to a smaller square-shaped sclerite on the lamina postvaginalis in *C. grotei*. The female of *C. fideli* is unknown.

Description (male). Based on the male holotype and 42 male paratypes. *Head*. Dorsum of front with gray to drab, white-tipped dentate scales. Palpi stout, with similar mottled gray scaling on second segment except for lateral fuscous patch. Second segment length just exceeding eye diameter. Third segment minute, uniform drab. Basal (first) segment with elongate white scales and a small fuscous patch laterally. Antennae white at base, dorsally drab with cream ventrolateral stripe. *Thorax*. Dorsum mottled drab to gray with fuscous subdorsal dash adjacent to midline and fuscous transverse band across anterior near head, contiguous with median fuscous band along tegulae; metascutum edged in fuscous. Venter white and buff with small fuscous patch near eye. Legs with coxa white, interspersed with cinnamon buff and drab scales; femur and tibia mottled fuscous, drab, and white; tarsi banded, fuscous alternating with white or white mixed with cinnamon buff. Ventral part of tarsomeres armed with short ferruginous spines. Foreleg epiphysis shiny brownish olive. Mid- and hindleg tibial spurs white. *Forewing*. Length 13.5–16.5 mm, $\bar{x}$ = 15.2 ± 0.59 (n = 43), holotype 15.5 mm. Ground color mottled gray. Antemedial, median, and postmedial lines thin, fuscous. Two very small fuscous scale patches near wing base. Antemedial lines jagged, wider, and forming pair of spots along costa. Subbasal area (between antemedial lines) mottled gray, darker than medial area. Medial area white, interspersed with gray scales, veins traced with fuscous; discal spot round, white with fuscous border on distal half; area distad of spot in cells M_1–M_2 and M_2–M_3 gray. Postmedial area white, interspersed with gray, drab near costa. Postmedial line zig-zagged from costa to tornal dash. Tornal dash distally fuscous, grading to drab, bordered basally by fuscous postmedial line and transected by fuscous line tracing vein Cu_2. Submarginal area with subapical drab to fuscous triangle, white submarginal band, and broken scalloped drab subterminal line with fuscous to drab spot in cell R_5–M_1. Subterminal line consisting of drab crescents along margin within extradiscal cells. Fringes light grayish olive or deep olive gray, white at vein terminals. Ventral forewing buffy brown to fawn color, cinnamon buff near base along cubitus, cream-buff along anal margin. Median and postmedial lines faintly traced with buffy brown scales (expression individually variable). *Hindwing*. Costa cream buff to white. Basal two-thirds yellow ocher (dull orange), medial and submarginal area russet to cinnamon brown. Fringes alternating patches of cream buff to white and russet to drab. Ventral hindwing buffy brown to fawn color along costa and distal third. Costa scattered with white scales. Medial and postmedial lines traced with buffy brown near costa. Basal half of cells Cu_2–A_2 and A_2–A_3 yellow-ocher, with vein A_2 partly traced with cinnamon brown. *Abdomen*. Dorsum mottled with dentate, white-tipped drab, fuscous, and white scales. Segments A2–A6 armed with transverse row of stout spine-like ferruginous to fuscous scales. Segments A2–A4 sometimes with small middorsal patch of fuscous scales preceded by white. A rectangular fuscous patch laterad on A4. Venter mixed white and cream buff with scattered buffy brown scales. Segments A6–A7 buffy brown.

Male genitalia (*n* = 2). Uncus longer than tegumen and distally exceeding gnathos, widest at distal third (lateral aspect), tapered to a small sclerotized ventrally projecting point (Fig. 47). Gnathos basal lobes strongly protruding, with dense covering of elongate spines. Gnathos apex fused, with short, stout, upturned stalk and darkly sclerotized spatulate tip (Fig. 46). Valvae elongate, weakly curved toward dorsum, and slightly wider at base, distal ends rounded (Fig. 28). Sacculus tapered to a simple blunt apex, without sclerotized process (Fig. 59). Juxta a simple lightly sclerotized collar-like sclerite supporting phallus. Saccus projecting posterad, apex rounded. Phallus (Fig. 33) stout, widest near basal third just distad of inception of ductus ejaculatorius, apex without sclerotized process. Vesica tubular, without diverticulum; membranous connection with phallus apex followed by spiculate slightly wider section, again membranous and constricted before a slender terminal section angled away from main axis.

Description (female). Based on two female paratypes. Similar to males except forewing ground color appearing a darker mottled gray. Medial area gray along antemedial line, grading to white along median line. Medial area



Figures 31–41. Phalli of West Indies *Cautethia*. **31)** *C. exuma*, prep. DM 2233, MGCL 233423 South Andros Island, 27.iii.2014. **32)** *C. grotei bahamensis*, prep. DM 2208, MGCL 239522, Crooked Island, 6.vi.2014. **33)** *C. geraceorum*, **new species**, paratype, prep. DM 2209, MGCL 247849, San Salvador Island, 12.vi.2018. **34)** *C. n. noctuiformis*, prep. DM 2186, Dominican Republic, La Vega Province, 10 km NE Jarabacoa, Hotel Montana, 28.v.1972, Don & M. Davis [USNM]. **35)** same specimen, enlargement of apical process. **36)** same specimen, enlargement of cornuti. **37)** *C. calezae*, prep. DM 2143, MGCL 1076079, Puerto Rico, Bosq. Est. Toro Negro, Rte. 143, UPRM Biol. Station, 18.1783°N 66.4878°W, 7.viii.2007, J. E. Hayden. **38)** *C. carsusi*, prep. DM 2142, MGCL 1076062, Dominican Republic, La Vega Province, 5 km S of Jarabacoa, 1700', 28.vi.1981, Charles M. Stevens. **39)** *C. gossi*, **new species**, paratype, prep. DM 2136, MGCL 321522, Great Inagua, 9-12.vi.2007. **40)** same specimen, enlargement of apical process. **41)** *C. simoni*, **new species**, paratype, prep. DM 2176, Grand Turk, 6.ii.2001 [USNM].

distad of discal spot dark gray. Postmedial area anterad of tornal dash dark gray, white adjacent to tornal dash. Tornal dash muted with white scales toward anal margin. Submarginal area with subapical triangle darker than in males, dark gray to fuscous. Area bordering postmedial line also darker than in males, dark gray bordered distally by white. Subterminal line well developed, fuscous to drab. Forewing length 16.0–16.5 mm, $\bar{x}$ = 16.25 ± 0.35 (n = 2).

Female genitalia (*n* = 1). Papillae anales moderately setose, longest setae reaching length of papillae anales. Apophyses posteriores length about 2× that of papillae anales. Apophyses anteriores originating from anterior margin of sternite VIII, length of free portion about 1.5× length of papillae anales, slightly swollen and then tapered at apex. Ostium poorly defined, a broad opening into triangular, moderately sclerotized antrum. Lamina postvaginalis evenly sclerotized across its entire width. Inception of ductus seminalis near juncture of antrum with ductus bursae. Corpus bursae round, distinct from ductus bursae, with laterally attached larger and more membranous appendix bursae. Ductus bursae length about 4× diameter of corpus bursae.

Types. HOLOTYPE. ♂ - with the following labels: 'Bahamas: San Salvador | Is.; Gerace Research Centre | vic. Water Tanks | 24.117589°, –74.465207° | 22.vii.2015 D. Matthews | T.A. Lott, R.W. Portell' [white printed]; 'SAN SALVADOR IS. | SURVEY, D. Matthews | et al. MGCL Acc. # | 2015-57' [white printed]; 'HOLOTYPE ♂ | *Cautethia* | *geraceorum* | J.Y. Miller | D.L. Matthews | R.J. Gott' [red printed]; 'MGCL 244145 | McGuire Center for Lepidoptera | & Biodiversity, FLMNH, UF' [green printed with barcode]. The holotype is deposited at MGCL. PARATYPES. 42 ♂, 2 ♀ - BAHAMAS: **San Salvador Island:** 0.25 mi. W of Gerace Research Centre, 24.119145°, –74.469995°, 25.vii.2015, DLM, TAL, RWP, MGCL Acc. 2015-47 (24 ♂) MGCL 244175–244177, 244182, 244183, 244432, 244435, 244440, 244444, 244454, 244455, 244457, 244461, 244468, 244472, 244473, 244476, 244826–244832, (1 ♀) MGCL 244181; same location, 12.vi.2018, DLM & JYM, MGCL Acc. 2018-19 (1 ♂, prep. DM 2209) MGCL 247849; beach NE of Gerace Research Centre, 24.120114°, –74.461898°, 24.vii.2015, DLM, TAL, RWP, MGCL Acc. 2015-57 (6 ♂, prep. DM 2140) MGCL 244082, 244083, 244399, 244402, 244403, 244405, (1 ♀, prep. DM 2210) MGCL 244084; Gerace Research Centre, Alfred Pike Trail, 24.117166°, –74.463864°, 23.vii.2015, DLM, TAL, RWP, MGCL Acc. 2015-57 (8 ♂) MGCL 244215, 244425, 244426, 244885–244889; same location, 10.vi.2018 DLM & JYM, MGCL Acc. 2018-19 (1 ♂) MGCL 247828 (LEP-65155); Gerace Research Centre, vic. Water Tanks, 24.117589°, –74.465207°, 22.vii.2015, DLM, TAL, RWP, MGCL Acc. 2015-57 (2 ♂) MGCL 244146, 244164.

Life history. Unknown. As in related taxa, larvae on San Salvador Island most likely feed on species of Rubiaceae.

Distribution. Known only from San Salvador Island.

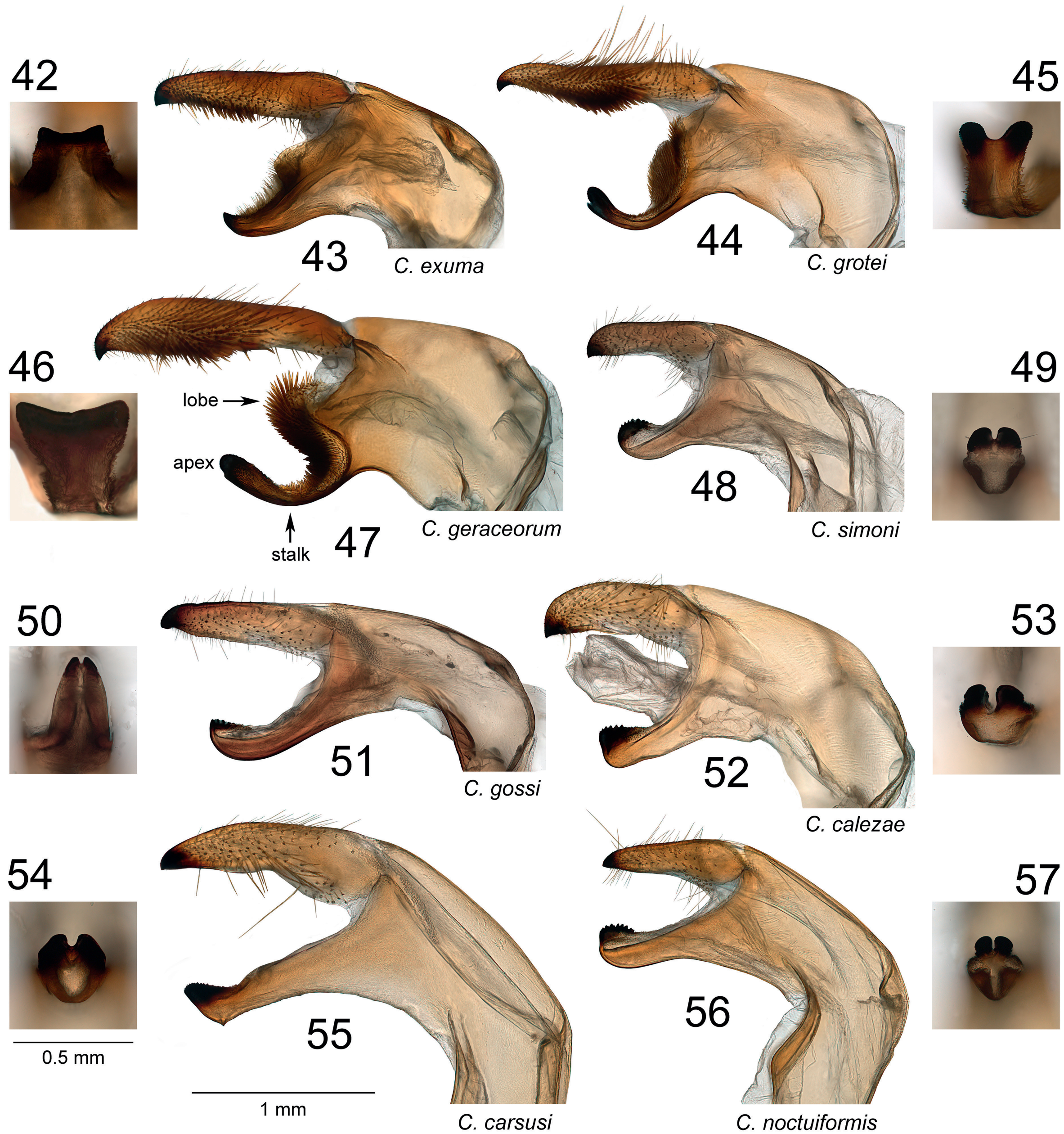
Etymology. This species is named in honor of Kathy Gerace and her late husband, Donald T. Gerace, for their work in Caribbean marine sciences, archaeology, geology, and biology, and for their dedicated efforts in the development and support of the Gerace Research Centre, the type locality for this moth.

Cautethia simoni Miller, Matthews, and Gott, new species

Fig. 18–21, 30, 41, 48, 49, 61, 62, 75

Diagnosis. Wing patterns similar to *C. geraceorum* and *C. grotei*, except males with narrower black line forming tornal dash. Ground color of forewing tending to be paler than in *C. grotei*. Hindwings of males and females more ferruginous or ochraceous (raw sienna) as opposed to orange or orange yellow. Distinguished from *C. gossi* by characters of the antemedial lines, postmedial, area and characters of male and female genitalia. Male genitalia distinguished from *C. exuma*, *C. grotei*, and *C. geraceorum* by the absence of basal lobes on the gnathos and the presence of a sclerotized terminal process on the sacculus. Distinguished from *C. gossi* by the shape of the terminal saccular process and gnathos apex. Female genitalia distinguished from other Bahamas congeners by the large rectangular antrum.

Description (male). Based on the holotype and seven male paratypes. *Head*. Dorsum of front drab with scale tips (teeth) edged in white. Palpi as in *C. geraceorum*, third (distal) segment variable, solid drab, or drab with white tips. Antennae with only a few white or white-tipped scales at base, dorsally buffy brown with cream ventrolateral stripe. *Thorax*. Dorsum drab to gray with distinct transverse fuscous line near anterior margin. Dorsal markings variable, with a thin fuscous middorsal line flanked by weak or broken subdorsal dashes. Tegulae drab to



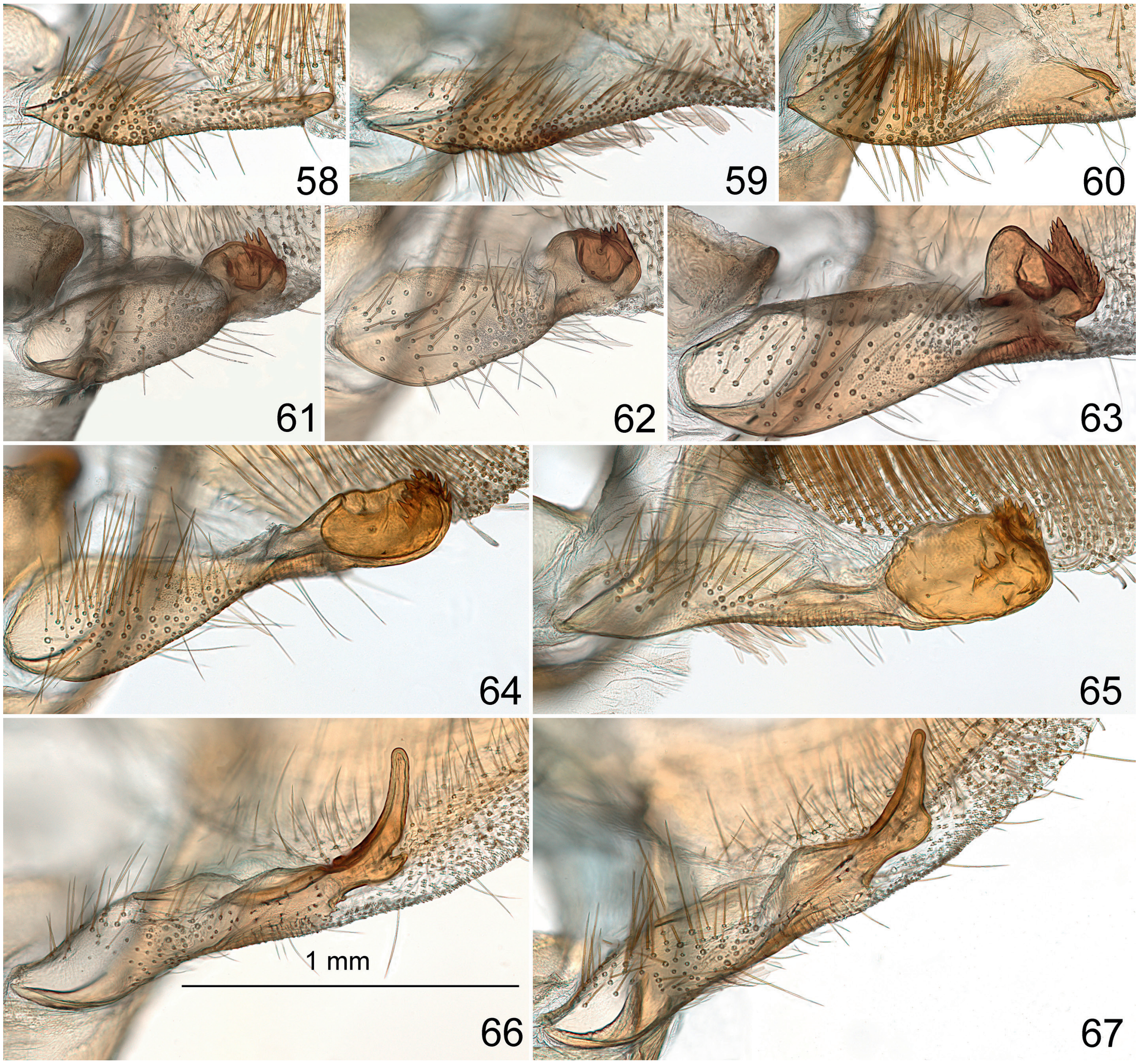
Figures 42–57. Lateral views of uncus, gnathos, and tegumen and ventral views of gnathos apex in West Indies *Cautethia* males. **42)** Ventral view, *C. exuma*, prep. DM 2233, MGCL 233423 South Andros Island, 27.iii.2014. **43)** Lateral view, same specimen. **44)** Lateral view, *C. grotei bahamensis*, prep. DM 2208, MGCL 239522, Crooked Island, 6.vi.2014. **45)** Ventral view, same specimen. **46)** Ventral view, *C. geraceorum*, **new species**, paratype, prep. DM 2209, MGCL 247849, San Salvador Island, 12.vi.2018. **47)** Lateral view, same specimen. **48)** Lateral view, *C. simoni*, prep. 2176, Grand Turk, 6.ii.2001 [USNM]; **49)** Ventral view, same specimen. **50)** Ventral view, *C. gossi*, **new species**, paratype, prep. 2136, MGCL 321522, Great Inagua, 9-12.vi.2007. **51)** Lateral view, same specimen. **52)** Lateral view, *C. calezae*, prep. DM 2143, MGCL 1076079, Puerto Rico, Bosq. Est. Toro Negro, Rte. 143, UPRM Biol. Station, 18.1783°N 66.4878°W, 7.viii.2007, J. E. Hayden. **53)** Ventral view, same specimen. **54)** Ventral view, *C. carsusi*, prep. DM 2142, MGCL 1076062, Dominican Republic, La Vega Province, 5 km S of Jarabacoa, 1700', 28.vi.1981, Charles M. Stevens. **55)** Lateral view, same specimen. **56)** Lateral view, *C. n. noctuiformis*, prep. DM 2186, Dominican Republic, La Vega Province, 10 km NE Jarabacoa, Hotel Montana, 28.v.1972, Don & M. Davis [USNM]. **57)** Ventral view, same specimen.

gray, strongly marked with fuscous patch near base that diverges into traces along tegulae margins. Metascutum posterior margin with lateral patch of fuscous scales. Venter mixed white and pale drab, fuscous patch near eye reduced or absent. Legs as in *C. geraceorum*, with fuscous and white to buff banded tarsomeres. *Forewing*. Length 13.0–15.0 mm, $\bar{x}$ = 14.06 ± 0.73 mm, holotype 14.5 mm. Ground color mottled drab or drab gray. Antemedial, medial, and postmedial lines fuscous. Basal area similar to *C. geraceorum* except with more suffused white scaling adjacent to basal antemedial line. Basal antemedial line with costal section distinctly offset and disjunct from discal cell section. Antemedial lines evenly spaced apart from discal cell to anal margin. Subbasal area mottled gray, similar or just slightly darker than medial area. Medial area white with scattered drab scales; area distad of discal spot only slightly darker. Discal spot pure white, irregular, or elliptic, with partial fuscous margin anterad. Postmedial area white except entirely fuscous in cell Cu_1–Cu_2 and merging with tornal dash. Postmedial line narrowly zig-zagged or formed from series of fuscous crescents from costa to Cu_1. Tornal dash with fuscous part formed from postmedial line, bolder and wider than adjacent median line, submarginal part solid gray without distinct fuscous distal margin. Submarginal area with fuscous to drab subapical triangle contiguous with irregularly scalloped drab band adjacent to postmedial line. Distal part of subterminal (terminal area) white with scattered drab scales. Subterminal line indistinct. Fringes like *C. geraceorum* but with scales of fuscous patches not extending as far as subtending layer of drab scales. Ventral forewing buffy brown to fawn color as in *C. geraceorum*, with variable trace of medial and postmedial lines. *Hindwing*. Costa cream buff to white; basal two-thirds ochraceous tawny to clay color in faded specimens; submarginal area russet to cinnamon brown. Fringes alternating patches of cream buff to white with patches of russet and drab. As in forewing, the darker (russet) scales not as long as in *C. geraceorum* and do not extend as far distally as the white and drab scales. Ventral hindwing buffy brown to fawn color as in *C. geraceorum* but with hindwing medial and postmedial lines more strongly marked and postmedial line roughly zigzagged. Basal half of cells Cu_2A_2 and A_2–A_3 ochraceous tawny to clay color. *Abdomen*. Dorsum mottled with white-tipped drab scales and scattered fuscous scales; a fuscous middorsal patch on A4–A6 or A4–A5 preceded by cinnamon buff and/or white scales. Posterior margin of A1–A6 with narrow band of fuscous scales laterally, cinnamon buff and drab middorsally. Segments A4–A6 with fuscous scales denser but not forming a distinct rectangular patch on A4. Venter white with scattered cinnamon buff and buffy brown scales; A7 buffy brown and fuscous.

Male genitalia (*n* = 4). Uncus just exceeding gnathos in lateral aspect, width similar across length, apex tapered to a small darkly sclerotized point (Fig. 48). Gnathos without protruding basal lobes, basal arms, without setae or spines. Gnathos apex fused, not upturned, with darkly sclerotized tip bearing minute teeth, ventral aspect with median notch and central pale area (Fig. 49). Valvae distinctly wider at base, weakly curved toward dorsum, distal ends rounded. Sacculus (Fig. 61, 62) short, stout, with a lightly sclerotized bulbous terminal process containing a small compact darkly sclerotized flange overlapping a multi-toothed process. Juxta lightly sclerotized along distal margin. Saccus short (compared to congeners), apex rounded. Phallus (Fig. 41) with dorsal part of apex more darkly sclerotized than base, margin sharp but not forming a distinctly separate projecting process. Vesica with broad shapeless membranous area followed distally by a spiculate lateral lobe and gradually narrowing tubular terminal part.

Description (female). Based on one female paratype. Forewing length 16 mm. Similar to male except forewing with certain areas darker. Basal area with costa and middle of cell Cu_2–A_{2+3} with small patch of fuscous scales. Median area distad of discal spot dark gray. Postmedial area from costa to tornal dash mottled with fuscous and drab as opposed to white in males. Submarginal area with part adjacent to postmedial line fuscous and incorporating subapical triangle and tornal dash; margined distally by white band followed by mottled drab terminal area/line.

Female genitalia (*n* = 1). Papillae anales moderately setose. longest setae about 0.75× length of papillae anales. Apophyses posteriores length about 3× that of papillae anales. Free part of apophyses anteriores length about 2× that of papillae anales. Ostium a broad pocket-like opening into large sclerotized rectangular antrum. Antrum length at least 2× width. Lamina postvaginalis sclerotized across posterior margin with sclerite extending medially to a point aimed toward antrum. Inception of ductus seminalis near juncture of antrum with ductus bursae. Corpus bursae obovate (irregularly shaped with spermatophores left in situ in specimen examined).



Figures 58–67. Examples of sacculus and saccular processes in West Indies *Cautethia* males. **58)** *C. grotei bahamensis*, prep. DM 2128, MGCL 239522, Crooked Island, 6.vi.2014. **59)** *C. geraceorum*, **new species**, paratype, prep. DM 2209, MGCL 247849, San Salvador Island, 12.vi.2018. **60)** *C. exuma*, prep. DM 2233, MGCL 233423, South Andros Island, 27.iii.2014. **61)** *C. simoni*, **new species**, paratype, prep. DM 2229, CMNH-IZ 720410, Providenciales, 28–30.i.1978 [CMNH]. **62)** *C. simoni*, **new species**, paratype, prep. DM 2176, Grand Turk, 6.ii.2001 [USNM]. **63)** *C. gossi*, **new species**, paratype, prep. DM 2136, MGCL 321522, Great Inagua, 9-12.vi.2007. **64)** *C. n. noctuiformis*, prep. DM 2186, Dominican Republic, La Vega Province, 10 km NE Jarabacoa, Hotel Montana, 28.v.1972, Don & M. Davis [USNM]. **65)** *C. carsusi*, prep. DM 2142, MGCL 1076062, Dominican Republic, La Vega Province, 5 km S of Jarabacoa, 1700', 28.vi.1981, Charles M. Stevens. **66)** *C. calezae*, prep. DM 2143, MGCL 1076079, Puerto Rico, Bosq. Est. Toro Negro, Rte. 143, UPRM Biol. Station, 18.1783°N 66.4878°W, 7.viii.2007, J. E. Hayden. **67)** *C. calezae*, prep. DM 2231, CMNH 64087, Puerto Rico, Isabela, Bosque Estatal de Guajataca, Montanas Aymamon, 18-25-06N, 66-57-55W, 210m, 14-15.vi.1996, J. Rawlins, W. Zanol, R. Davidson, C. Young, M. Klingler, S. Thompson [CMNH].

Membranous appendix bursae attached anterolaterad on right side of corpus bursae, and of similar size. Ductus bursae length less than that of corpus bursae.

Types. HOLOTYPE. ♂ - with the following labels: 'BAHAMAS: Mayaguana Is. │3.4 mi. NW of airport │22.410411°, −73.056102° │ 28.vii.2014 │ M.J. Simon & G. Goss' [white printed]; 'Bahamas Survey │MGCL Accession │No. 2014-21' [white printed]; 'HOLOYPE ♂ │*Cautethia simoni* │J.Y. Miller │D.L. Matthews │ R.J. Gott' [red printed]; 'MGCL 236856 │ McGuire Center for Lepidoptera │& Biodiversity, FLMNH, UF' [green printed with barcode]. The holotype is deposited at MGCL. PARATYPES. 7 ♂, 1 ♀ - BAHAMAS: **Mayaguana Island:** 3.5 mi. NW of airport, 22.413611°, −73.052500°, 30.vii.2014, MAJ & GJG, MGCL Acc. 2014-21 (1 ♂) MGCL 236915; Pirates Well, Baycaner Beach, 22.435833°, −73.102222°, 31.vii–1.viii.2014, MJS & GJG, MGCL Acc. 2014-21 (1 ♂, prep. DM 2138) MGCL 242491 (LEP-65157), (1 ♀, prep. DM 2242) MGCL 247894; TURKS & CAICOS ISLS.: **Grand Turk:** E ridge NE of Cockburn Town, 21°29'N, 71°07'45"W, 6.ii.2001, W.E. Steiner & J.M. Swearingen, at black light in mixed scrub near salt pond (2 ♂, prep. DM 2176) [USNM]; **Providenciales:** Erebus Hotel area ca 21°48'N, 72°15'W, Sta. 467, 28-30.i.1978, H. & M. Clench, at hotel lights, C. M. Acc. 29717, *Cautethia noctuiformis bredini* Cary, Det. T.L. McCabe (3 ♂, prep. DM 2229) CMNH-IZ 720409–720411.

Life history. Unknown.

Distribution. Mayaguana Island, Bahamas, and Providenciales and Grand Turk of the Turks and Caicos Islands.

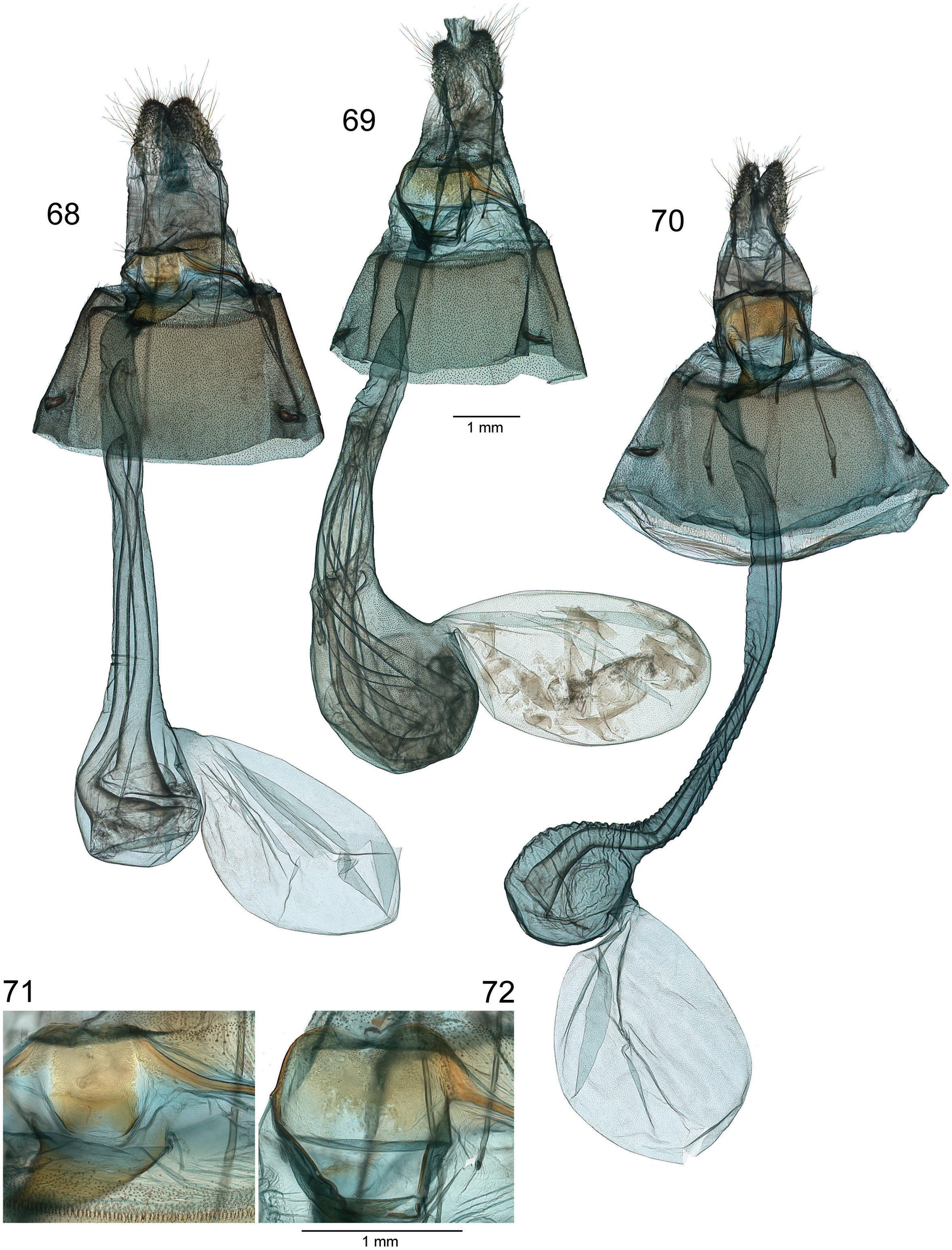
Etymology. This species is named in honor of one of the collectors of the holotype, Mark Jay Simon, who has played a key role in surveys of the Bahamas Lepidoptera fauna starting with initial island butterfly surveys in the 1980s and continuing to the present with comprehensive all-Lepidoptera inventories.

Cautethia gossi Miller, Matthews, and Gott, new species

Fig. 22–25, 29, 39, 40, 50, 51, 63, 76, 78

Diagnosis. Wing patterns of this species are similar to *C. simoni* except in the forewing antemedial lines where the basal line is indented within cell Cu_2–A_{2+3} as opposed to appearing parallel with the more distal antemedial line. In males, the costal half of the postmedial area tends to be narrower than in *C. simoni*. The species is best distinguished by genitalia characters. In males, the saccus is tapered to a point (Fig. 29) as opposed to rounded in congeners. The sacculus bears a uniquely shaped bilobed terminal sclerotized process (Fig. 63), and the gnathos lacks basal lobes and the apex is tapered to narrow notched tip. Female genitalia are unique from congeners in having the antrum divided into a wide posterior half and a narrower anterior half, as well as having a sclerotized cup-like receptacle on the lamina postvaginalis (Fig. 78).

Description (male). Based on the holotype and eight male paratypes. *Head*. Front, palpi, and antennae as in *C. simoni*. *Thorax*. Dorsum similar to *C. simoni* except tegulae with fuscous scaling heavier at base and not distinctly diverging into traces along margins. Venter white, mixed with drab and buff. Legs banded as in *C. geraceorum* and *C. simoni*. *Forewing*. Length 13.5–14.5 mm, $\bar{x}$ = 14.0 ± 0.5 mm (n = 9), holotype 14.5 mm. Basal and subbasal areas mottled dark gray, together tending to appear darker than in *C. simoni* and contrasting paler medial area. Antemedial lines fuscous with basal of the pair indented at middle of cell Cu_2–A_{2+3}. Medial area white with scattered drab scales, with less drab than in *C. simoni* and with area distad of discal cell tending to be broader and paler than in *C. simoni*, and with drab grading to white from discal spot. Drab to fuscous trace on veins M_1–Cu_1 distinct. Discal spot oblong, pure white, distally margined in fuscous. Postmedial area white with scattered drab scales, similar in shade to medial area; tending to be narrower near costa than in *C. simoni*, nearly contiguous from costa to anal margin with constriction at apex of tornal dash. Tornal dash with fuscous part formed from postmedial line bolder than adjacent medial line, tending to be of uniform width (not widened or blurred at tornal dash apex as in *C. simoni*). Submarginal area with subapical triangle and area bordering postmedial line drab, remaining subterminal area tending to be white, flecked with drab scales and paler than in *C. simoni*; without distinct elements of subterminal line separating terminal area. Venter of forewing variable as in *C. simoni*. *Hindwing*. As in *C. simoni* except basal two-thirds on dorsum clay color as opposed to ochraceous tawny in fresh specimens. *Abdomen*. Dorsum similar to *C. simoni*. Lateral patch of fuscous scales on A4 sometimes trailing to dorsum but not as developed as in *C. grotei*; a smaller patch laterad on A6. Venter white or cream buff with scattered buffy brown scales.



Figures 68–72. Female genitalia of *Cautethia*. **68)** *C. grotei*, prep. DM 2212, MGCL 1076042, Central Abaco, 9–18.viii.1988. **69)** *C. exuma*, prep. DM 2141, MGCL 233424, South Andros Island, 27.iii.2014. **70)** *C. geraceorum*, **new species**, prep. DM 2210, San Salvador Island, 24.vii.2015. **71)** *C. grotei bahamensis*, enlargement of lamina postvaginalis, prep. DM 2212. **72)** *C. exuma*, enlargement of lamina postvaginalis, prep. DM 2141.

Male genitalia (*n* = 2). Tegumen relatively narrow in lateral aspect. Uncus exceeding gnathos in lateral aspect, distally tapered to a blunt sclerotized point (Fig. 51), setae minute to short, sparse. Gnathos without basal lobes, apex fused, curved slightly dorsad, terminus darkly sclerotized, with a few minute teeth or scobinations. Distal aspect of gnathos tapered to a narrow apex with a minute median notch. Valvae strongly curved toward dorsum, slightly wider at base, distal ends rounded. Sacculus (Fig. 63) terminating in distinct bilobed sclerotized process consisting of a smooth protruding basal flange partly overlapping a strongly dentate terminal lobe. Juxta lightly sclerotized. Saccus apex acute. Phallus (Fig. 39) slightly constricted between anellus and apex, dorsal apex darkly sclerotized and forming spine-like process with a sharp clear tip (Fig. 40). Vesica with broad membranous area followed distally by a spiculate lateral lobe and tubular terminal part as in *C. simoni* but with a distinctive proximally projecting ventral lobe near base.

Description (female). Based on three female paratypes. Forewing length 12.0–14.0 mm, $\bar{x}$ = 13.2 ± 0.5 mm (*n* = 3). Overall, very similar to males except medial area distad of discal cell spot darker, similar in shade to basal area. Postmedial area also slightly darker from costa to apex of tornal dash. Submarginal area with dark gray apical triangle more or less contiguous with dark gray band along postmedial line and including tornal dash. Hindwing as in males. Abdomen with lateral fuscous markings less distinct than in males.

Female genitalia (*n* = 1). Papillae anales moderately setose with longest setae about half length of papillae anales. Apophyses posteriores length about 2.5× that of papillae anales. Free part of apophyses anteriores length about 1.5× that of papillae anales. Antrum constricted near middle, subdivided into a broad concave pocket posterad and a cylindrical collar anterad. Lamina postvaginalis with a small moderately sclerotized cup-like receptacle (Fig. 78). Inception of ductus seminalis near juncture of antrum with ductus bursae. Ductus bursae wider than anterior part of antrum, grading into pyriform corpus bursae, width similar to posterior part of antrum. Appendix bursae present, round, with short, stout stalk-like connection to anterior right end of corpus bursae, and of similar diameter.

Types. HOLOTYPE. ♂ - with the following labels: 'BAHAMAS: Great Inagua │0.95 mi. SE of lighthouse │20.926944°, −73.661111°│26.vii.2014│M.J. Simon & G. Goss' [white printed]; 'Bahamas Survey│MGCL Accession │No. 2014-21' [white printed]; 'HOLOTYPE ♂ │*Cautethia gossi* │J.Y. Miller │D.L. Matthews │R.J. Gott' [red printed]; 'MGCL 242737 │ McGuire Center for Lepidoptera │& Biodiversity, FLMNH, UF' [green printed with barcode]. The holotype is deposited at MGCL. PARATYPES. 8 ♂, 3 ♀ - BAHAMAS: **Great Inagua:** 0.95 mi. SE of lighthouse, 20.926944°, −73.661111°, 26.vii.2014, MJS, GJG, MGCL Acc. 2014-21 (2 ♂, prep. DM 2131) MGCL 246338 (LEP-65158), 246339; 1 mi. ESE of lighthouse, 22.934722°, −73.661944°, 23.vii.2014, MJS, GJG, MGCL Acc. 2014-21 (1 ♂) MGCL 240269; Man of War Bay nr. Calf Pond, 20°56'N, 73°40'W, 9–12.vi.2007, L.D. Miller, JYM, MJS, mesic trop. forest, MGCL Acc. 2007-9 (1 ♂, prep. DM 2136) MGCL 231522, (3 ♂) MGCL 231520, 231521, 231523; 1.3 mi. NNE of Morton dock, 21.066111°, −77.638056°, 27.vii.2014, MJS, GJG, MGCL Acc. 2014-21 (1 ♂) MGCL 242667, (1 ♀, prep. DM 2137) MGCL 242680; 3 mi. SW of Morton dock, 21.022222°, −73.685556°, 27.vii.2014, MJS, GJG, MGCL Acc. 2014-21 (1 ♀) MGCL 234858 (LEP-65156); 7.4 mi. N of airport, 21.082516°, −73.641644°, 24.vii.2014, MJS, GJG, MGCL Acc. 2014-21 (1 ♀) MGCL 242696.

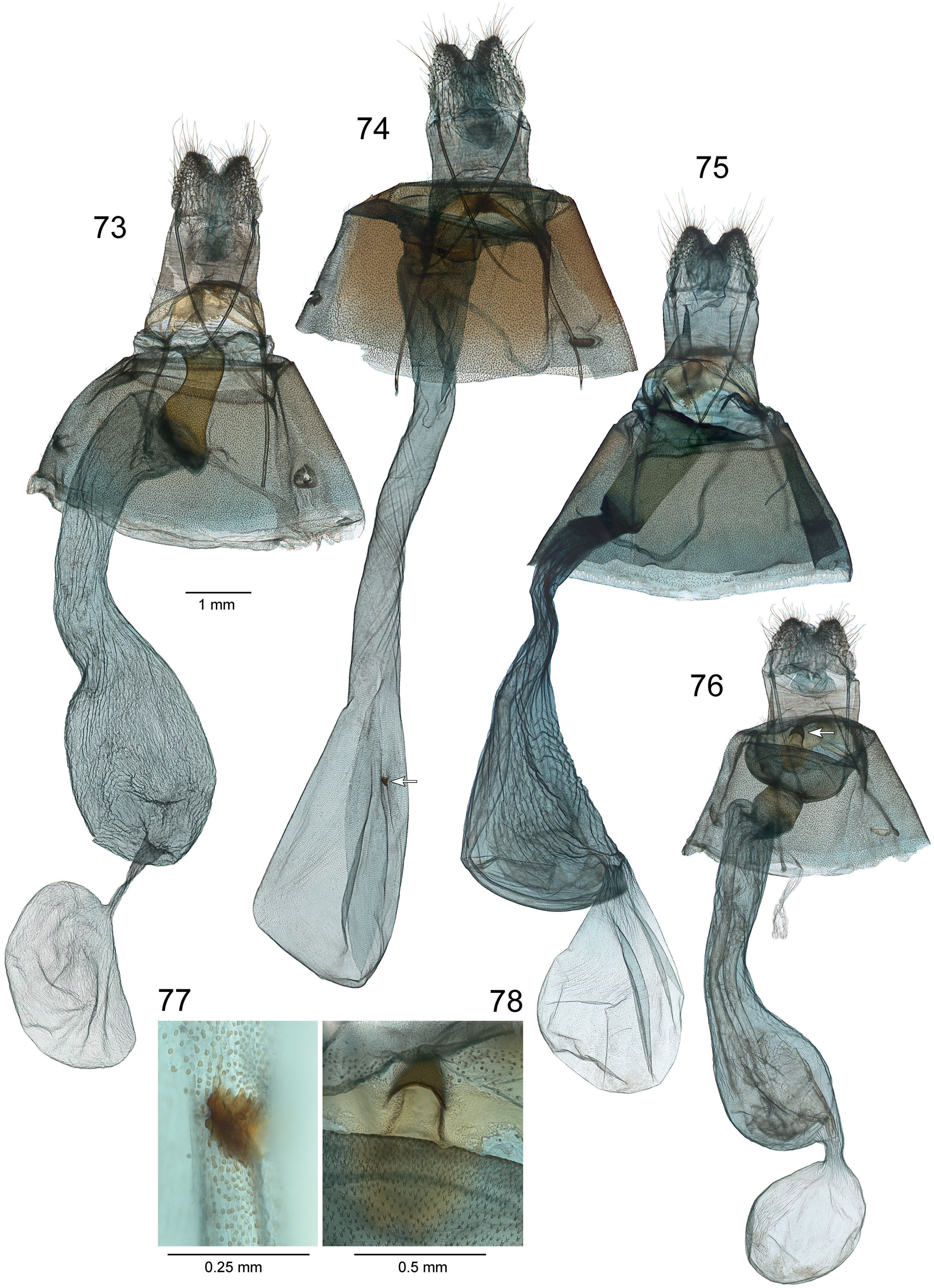
Life history. Unknown.

Distribution. Known only from Great Inagua.

Etymology. This species is named in honor of one of the collectors of the type series, Gary Jack Goss, who has been a dedicated member of the Miller Bahamas field team, assisting not only with collecting but also field photography of moths. Goss also has a past connection to the type locality, having studied pollination biology of orchids of the genus *Encyclia* Hook. on Great Inagua during the early 1970s.

Results – Barcode Analyses

The deeper level relationships among taxa are not clear based on molecular data collected for this study due to the limitations of using only COI barcodes (Rubinoff and Holland 2005; Talavera et al. 2022). We do note, however, that our putative outgroup *Himantoides undata* (Walker) along with *Cautethia carsusi* Haxaire and Schmit and *C. calezae* Haxaire and Melichar, were found to be further apart from the other *Cautethia* species examined (Fig. 79) and this separation may correspond with morphological characters such as female genitalia once these are more



Figures 73–78. Female genitalia of *Cautethia*. **73)** *C. noctuiformis*, prep. DM 2185, Virgin Islands, St. Croix, Kingshill, 6–15.vii.1967, E. L. Todd [USNM]. **74)** *C. calezae*, prep. DM 2234, CMNH 63974, Puerto Rico, Isabella, Boswue Estatal de Guajataca, Montanas Aymamon, 18-25-06N, 66-57-55W, forest, 210m, 14-15.vi.1996, J. Rawlins, W. Zanol, R. Davidson, C. Young, M. Klinler, S. Thomson [CMNH]. **75)** *C. simoni*, **new species**, prep. DM 2242, MGCL 247894, Mayaguana Island, 31.vii–1.viii.2014. **76)** *C. gossi*, **new species**, prep. DM 2137, MGCL 242680, Great Inagua Island, 27.vii.2014. **77)** *C. calezae*, enlargement of signum, prep. DM 2234. **78)** *C. gossi*, **new species**, enlargement of receptacle on the lamina postvaginalis, prep. DM 2137.

completely known for the genus. Within the genus, there is moderate barcode support for a clade composed of *C. simoni*, *C. gossi*, and *C. noctuiformis*. There is weak barcode support for a clade containing *C. spuria*, *C. yucatana*, *C. grotei*, and *C. exuma*. A sister relationship of *C. geraceorum* to *C. grotei* + *C. exuma* is also weakly supported. There is likewise weak support for the sister relationship of *C. grotei* and *C. exuma*.

The identities of existing COI sequences for *C. spuria* and *C. yucatana* are unclear and need further examination. These sequences are nearly identical and may only represent one of the two species. Males of these two species can be separated without dissection by examining the tip of the uncus. Morphological examination of previously sequenced specimens may help resolve the identity of these problematic sequences. Another complication is the possible synonymy of *C. simitia* with *C. yucatana*. Additional molecular work sampling primary types may be helpful in resolving the identities of reported sequences and questions of synonymy.

In addition to morphological characters delimited in the species accounts, there is strong evidence seen in our pairwise distance matrix (Fig. 80) and neighbor joining tree (Fig. 79) to support the description and naming of the three new Lucayan species based on COI barcodes. Barcodes indicate the three species are distinct from each other and from other *Cautethia* in the region. First looking at *C. gossi*, there is a 2.2% difference from *C. simoni*, a 3.1–3.3% difference from *C. n. noctuiformis*, and a 3.9–4.1% difference from *C. noctuiformis bredini* Cary. Considering *C. simoni*, along with the noted difference from *C. gossi*, there is a 2.9–3.1% difference from *C. n. noctuiformis* and 3.7–3.9% difference from *C. n. bredini*. For *C. geraceorum*, we found a 3.5–3.9% difference from *C. exuma* and a 2.0–2.7% difference from the clade containing *C. g. apira*, *C. g. bahamensis*, and *C. g. grotei*. In addition, *C. geraceorum* differed from *C. g. jamaicensis* by 3.7–4.1% (see additional comments below).

There is more work to be done with *C. grotei* throughout its range, as the relationships among subspecies are not confidently supported by the neighbor joining tree and pairwise distance matrix. While outside the initial scope of our study, an unexpected result is strong evidence that the subspecies *C. grotei jamaicensis* is distinct at the species level from the other *C. grotei* subspecies as well as *C. exuma* and should be addressed as a separate

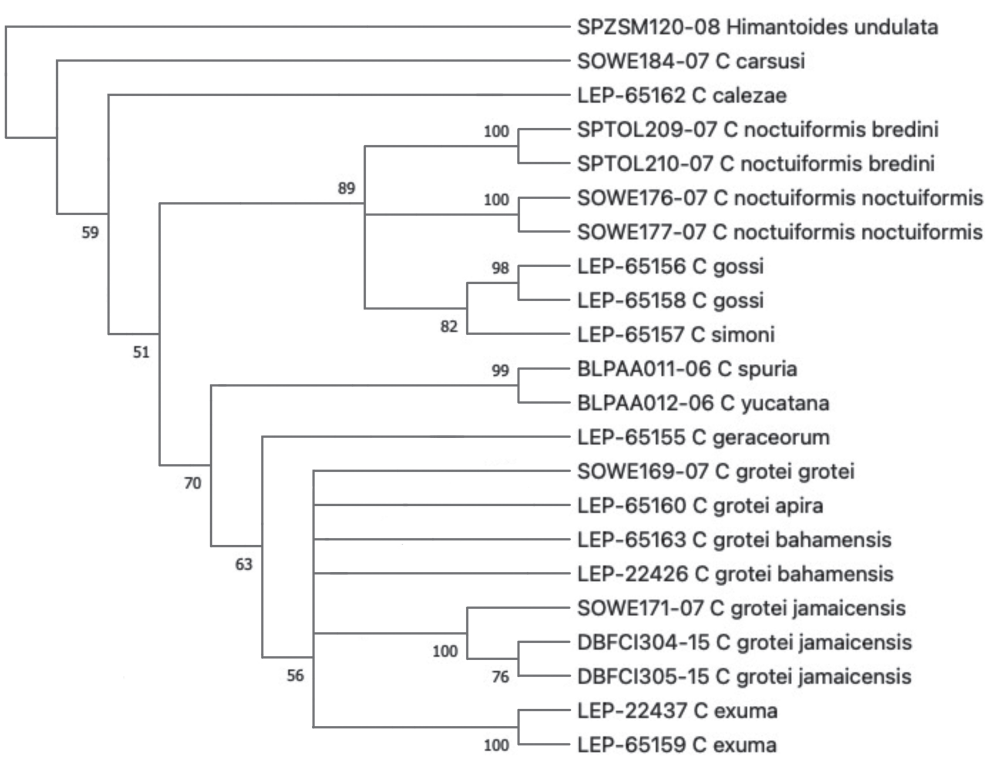


Figure 79. Optimal neighbor-joining tree indicating percentage of bootstrap replicate trees. All branches below 50% reduced to polytomies.

	SOWE184-07_C_carsusi	SPZSM120-08_Himantoides_undulata	BLPAA011-06_C_spuria	BLPAA012-06_C_yucatana	SOWE169-07_C_grotei_grotei	SOWE171-07_C_grotei_jamaicensis	SOWE172-07_C_grotei_jamaicensis	DBFCI304-15_C_grotei_jamaicensis	DBFCI305-15_C_grotei_jamaicensis	SPTOL209-07_C_noctuiformis_bredini	SPTOL210-07_C_noctuiformis_bredini	SOWE176-07_C_noctuiformis_noctuiformis	SOWE177-07_C_noctuiformis_noctuiformis	LEP-65162_C_calezae	LEP-65157_C_simoni	LEP-65156_C_gossi	LEP-65158_C_gossi	LEP-65155_C_geraceorum	LEP-22437_C_exuma	LEP-65159_C_exuma	LEP-65160_C_grotei_apira	LEP-22426_C_grotei_bahamensis	LEP-65163_C_grotei_bahamensis
SOWE184-07_C_carsusi																							
SPZSM120-08_Himantoides_undulata	0.084																						
BLPAA011-06_C_spuria	0.077	0.077																					
BLPAA012-06_C_yucatana	0.081	0.081	0.009																				
SOWE169-07_C_grotei_grotei	0.073	0.064	0.032	0.034																			
SOWE171-07_C_grotei_jamaicensis	0.086	0.084	0.053	0.045	0.026																		
SOWE172-07_C_grotei_jamaicensis	0.086	0.084	0.053	0.045	0.026	0.000																	
DBFCI304-15_C_grotei_jamaicensis	0.090	0.088	0.057	0.049	0.028	0.005	0.005																
DBFCI305-15_C_grotei_jamaicensis	0.090	0.088	0.057	0.053	0.030	0.007	0.007	0.005															
SPTOL209-07_C_noctuiformis_bredini	0.079	0.084	0.065	0.061	0.049	0.063	0.063	0.067	0.067														
SPTOL210-07_C_noctuiformis_bredini	0.079	0.081	0.063	0.058	0.047	0.061	0.061	0.065	0.065	0.002													
SOWE176-07_C_noctuiformis_noctuiformis	0.081	0.077	0.052	0.048	0.036	0.063	0.063	0.067	0.072	0.037	0.035												
SOWE177-07_C_noctuiformis_noctuiformis	0.079	0.075	0.050	0.050	0.036	0.065	0.065	0.069	0.069	0.035	0.033	0.002											
LEP-65162_C_calezae	0.090	0.097	0.071	0.073	0.069	0.086	0.086	0.086	0.086	0.086	0.084	0.077	0.075										
LEP-65157_C_simoni	0.086	0.081	0.057	0.057	0.042	0.069	0.069	0.074	0.074	0.039	0.037	0.031	0.029	0.077									
LEP-65156_C_gossi	0.081	0.079	0.052	0.052	0.045	0.063	0.063	0.067	0.067	0.041	0.039	0.033	0.031	0.073	0.022								
LEP-65158_C_gossi	0.079	0.079	0.052	0.052	0.045	0.063	0.063	0.067	0.067	0.039	0.037	0.031	0.029	0.073	0.022	0.002							
LEP-65155_C_geraceorum	0.071	0.073	0.037	0.037	0.020	0.037	0.037	0.041	0.041	0.057	0.054	0.053	0.050	0.073	0.053	0.049	0.048						
LEP-22437_C_exuma	0.079	0.086	0.049	0.049	0.022	0.047	0.047	0.047	0.047	0.058	0.056	0.056	0.054	0.077	0.055	0.055	0.054	0.035					
LEP-65159_C_exuma	0.084	0.090	0.049	0.049	0.024	0.047	0.047	0.047	0.047	0.061	0.058	0.058	0.056	0.082	0.057	0.057	0.057	0.039	0.004				
LEP-65160_C_grotei_apira	0.077	0.067	0.033	0.037	0.006	0.031	0.031	0.035	0.035	0.061	0.059	0.041	0.039	0.071	0.051	0.051	0.051	0.027	0.033	0.037			
LEP-22426_C_grotei_bahamensis	0.073	0.064	0.035	0.035	0.002	0.026	0.026	0.029	0.029	0.051	0.049	0.047	0.045	0.071	0.049	0.049	0.048	0.022	0.027	0.031	0.013		
LEP-65163_C_grotei_bahamensis	0.069	0.069	0.041	0.041	0.008	0.033	0.033	0.037	0.037	0.059	0.057	0.046	0.044	0.080	0.053	0.053	0.052	0.025	0.027	0.031	0.014	0.011	

Figure 80. Calculated pairwise distances between sequences using the Kimura 2-parameter model.

study. Pairwise distances were 2.6–3.7% between *C. g. jamaicensis* and *C. g. apira* + *C. g. bahamensis* + *C. g. grotei*. Potential specimens of *C g. hilaris* were not confidently identified by wing patterns nor sequenced. In addition, further study of the *C. grotei bahamensis* holotype is necessary to determine its identity and confirm whether an incorrect barcode was published with its description (see comments in Materials and Methods).

The use of the 2% COI barcode gap to delimit species in the genus *Cautethia* is supported by previously described species having greater than 2% barcode gaps, and the new species described herein, initially noticed by morphological characters, are supported with barcode gaps greater than 2%. We view our attempt to analyze barcodes as an initial study to encourage further exploration of the genus *Cautethia* for additional undescribed species and to clarify relationships with additional data from multiple sources, including molecular, morphological, ecological, and biological, as described by de Queiroz (2005) with the unified species concept.

List of *Cautethia* Taxa and Type Localities

Cautethia carsusi Haxaire and Schmit, 2001; TL - Pedernales, Dominican Republic
Cautethia insolita Haxaire, 2016; TL - La Vega, Dominican Republic
Cautethia calezae Haxaire and Melichar, 2016; TL - Bosque Estatal de Susùa, Puerto Rico
Cautethia noctuiformis (Walker, 1856)
- *C. noctuiformis noctuiformis* (Walker, 1856); TL - St. Domingo, Dominican Republic
- *C. noctuiformis bredini* Cary, 1970; TL - English Harbor, Antiqua, British West Indies
- *C. noctuiformis choveti* Haxaire 2002, Saint Barthélemy, Lesser Antilles

Cautethia gossi Miller, Matthews, and Gott, **new species**; TL - Great Inagua, Bahamas
Cautethia simoni Miller, Matthews, and Gott, **new species**; TL - Mayaguana Island, Bahamas
Cautethia spuria (Boisduval, [1875]); TL - Mexico
Cautethia yucatana Clarke, 1919; TL - Izamal, Yucatan, Mexico
Cautethia simitia Schaus, 1932; TL - Simiti, Colombia
Cautethia geraceorum Miller, Matthews, and Gott, **new species**; TL - San Salvador Island, Bahamas

Cautethia grotei Edwards, 1882

C. grotei grotei Edwards, 1882; TL - Indian River, Florida

C. grotei apira Jordan, 1940; TL - Grand Cayman

C. grotei bahamensis, Melichar, Řezáč, Ilčíková, 2016; TL - Bahamas

C. grotei hilaris Jordan, 1940; TL - Cayman Brac

C. grotei jamaicensis Melichar, Řezáč, and Ilčíková, 2016; TL - Bluefields, Jamaica

Cautethia fideli Haxaire and Melichar, 2012; TL - Parc National Alejandro Humboldt, Mont Iberia, Guantanamo, Cuba

Cautethia exuma McCabe, 1984; TL - Simon's Point, Great Exuma, Bahamas

Keys to West Indies Species

Adult habitus images for species included in the keys but not illustrated in this paper are available in the original descriptions as follows (Haxaire 2016 – *C. insolita*; Haxaire and Melichar 2012 – *C. fideli*; Haxaire and Melichar 2016 – *C. calezae*; Haxaire and Schmit 2001 – *C. carsusi*) or online (Kitching 2019 – *C. noctuiformis*). Genitalia dissections are usually necessary for species confirmation. Characters for known species used in the keys below are illustrated by figures herein as well as figures referenced in literature citations. Females are completely unknown for two of the ten species occurring in the region, and for one species (*C. carsusi*) the female paratype was not dissected by Haxaire and Schmit (2001). Representative specimens were examined for all subspecies except *C. noctuiformis choveti*. Keys include only species level characters so that the nominate subspecies and all other subspecies key to species level as currently defined. Future refinements may be necessary should *C. grotei jamaicensis* be elevated to species level based on molecular data. Prior to using the key, *Cautethia* males and females may be separated by the presence of a single stout frenulum spine in males and a set of several finer bristles in females.

Key to West Indies *Cautethia* males

1. Hindwing with basal half ferruginous, orange, or yellowish **2**

— Hindwing entirely dark gray .... ***C. insolita* Haxaire**

2(1). Sacculus terminus with a distinct sclerotized process (Fig. 61–67); gnathos base barren and without protruding basal lobes **3**

— Sacculus terminus without a distinct process, blunt tipped (Fig. 58, 59), or with a minute sclerotized ridge (Fig. 60); gnathos base with spinules and protruding basal lobes **6**

3(2). Ventral aspect of gnathos apex medially notched, forming pair of sclerotized knobs separated by membranous or less darkly sclerotized meson .... ***C. grotei* Edwards**

— Ventral aspect of gnathos not medially notched, weakly concave, uniformly sclerotized across meson . . **4**

4(3). Anterior part of mesonotum with transverse black band contrasting gray scales of thorax and tegulae (Fig. 10); apex of gnathos narrower than stalk (Fig. 42) .... ***C. exuma* McCabe**

— Anterior part of mesonotum without transverse black band, thorax uniformly gray (Fig. 14.); apex of gnathos broader than stalk **5**

5(4). Apex of gnathos spatulate, stalk short and broad (Fig. 46); basal half of hindwing yellowish orange to orange (Fig. 10) .... ***C. geraceorum* Miller, Matthews, and Gott, new species**

— Apex of gnathos Y-shaped, stalk elongate and narrow (Haxaire and Melichar 2012, figure 3); basal half of hindwing ferruginous .... ***C. fideli* Haxaire and Melichar**

6(2). Phallus with sclerotized apical process bent at right angle (Fig. 37, 38) **7**

— Phallus with sclerotized apical process not bent at right angle (Fig. 34, 35, 39, 40) or absent **8**

7(6). Uncus exceeding gnathos in lateral aspect (Fig. 52); saccular process slender, elongate, tapered toward apex (Fig. 66, 67) .... ***C. calezae* Haxaire and Melichar**

— Uncus not exceeding gnathos in lateral aspect (Fig. 55); saccular process a broad sclerotized mass .... ***C. carsusi* Haxaire and Schmit**

8(6). Vesica with small patch of dark spinose cornuti (Fig. 34, 36), appendix lobes absent; gnathos near or exceeding uncus in lateral aspect (Fig. 56) .... ***C. noctuiformis* (Walker)**

— Vesica without cornuti; diverticuli present; gnathos not exceeding uncus in lateral aspect **9**

9(8). Apex of phallus with clear-tipped spine (Fig. 39, 40); forewing antemedial lines with basal line indented within cell Cu_2–A_{2+3} (Fig. 22); saccular process with distinct indentation separating basal lobe and toothed distal part (Fig. 63) . . . . ***C. gossi* Miller, Matthews, and Gott, new species**

— Apex of phallus without clear-tipped spine (Fig. 41); forewing antemedial lines with basal line not indented within cell Cu_2–A_{2+3}, appearing evenly concentric with distal antemedial line (Fig. 18); saccular process without distinct indentation separating basal lobe and toothed distal part (Fig. 61, 62) . . . . ***C. simoni* Miller, Matthews, and Gott, new species**

Key to known West Indies *Cautethia* females*

1. Medial area of forewing (Fig. 1) distinctly darker than surrounding areas (Haxaire and Schmitt 2001, figure 1c) . . . . ***C. carsusi* Haxaire and Schmit**

— Medial area of forewing not distinctly darker than surrounding areas **2**

2(1). Appendix bursae present (Fig. 68–73, 75, 76), signum absent **3**

— Appendix bursae absent (Fig. 74), a small signum present (Fig. 74, 77) . . . . ***C. calezae* Haxaire and Melichar**

3(2). Lamina postvaginalis medially excavate (Fig. 72) . . . . ***C. exuma* McCabe**

— Lamina postvaginalis not medially excavate, straight (Fig. 71), convex, or absent **4**

4(3). Antrum distinctly constricted at middle, anterior part about half width of posterior part (Fig. 76); lamina postvaginalis bearing a sclerotized cup-like receptacle (Fig. 76, 78) . . . . ***C. gossi* Miller, Matthews, and Gott, new species**

— Antrum not distinctly constricted at middle; lamina postvaginalis without sclerotized receptacle **5**

5(4). Appendix bursae with elongate stalk-like connection to anterior part of corpus bursae; anterior end of antrum wider than posterior . . . . ***C. noctuiformis* (Walker)**

— Appendix bursae with short broad connection to lateral part of corpus bursae; anterior end of antrum narrower than posterior **6**

6(5). Antrum quadrate (Fig. 75) . . . . ***C. simoni* Miller, Matthews, and Gott, new species**

— Antrum triangular (Fig. 68, 70) **7**

7(6). Lamina postvaginalis with central square sclerotized area (Fig. 71); ductus bursae gradually tapering into corpus bursae, length about 3× maximum width of corpus bursae (Fig. 68) . . . . . ***C. grotei* Edwards**

— Lamina postvaginalis sclerotized across entire width (Fig. 70); ductus bursae distinct from corpus bursae, length about 4× maximum width of corpus bursae (Fig. 70) . . . . ***C. geraceorum* Miller, Matthews, and Gott, new species**

* Females are unknown for *C. insolita* and *C. fideli*. It is likely that female *C. insolita*, like males, may be distinguished by having an entirely dark gray hindwing.

Discussion and Conclusions

Morphological variation and subspecies complications. Wing patterns of *Cautethia* are somewhat useful in distinguishing between certain species yet not completely reliable due to wear and individual variation. As seen in *C. grotei* males (Fig. 2–7), even within the same subspecies and populations there are individual differences in the degree of expression of forewing antemedial, median, and postmedial lines and in the perceived dark vs. pale ground color based on the amount of white overscaling and/or wear to specimens. In hindwings, the basal area of Central American species is more yellowish whereas in the Caribbean species it is more orange. However, in older specimens, orange had often faded to yellow. Early subspecies descriptions, such as by Jordan (1940) for *C. grotei apira* from Grand Cayman Island and *C. grotei hilaris* from Cayman Brac (Jordan 1940) are based primarily on wing patterns, in this case with the ground color of *C. grotei hilaris* being a paler gray than *C. grotei apira*. While these patterns may appear constant based on a few individuals, larger samples collected over a longer period may show overlap. Within *C. grotei* examined for this study, variation between individuals and populations was also seen in male genitalia, particularly in the apex of the gnathos (Fig. 45) where the apex is always medially notched, but the two sclerotized tips may diverge at slightly different angles, be rounded or blunt, and have the paler area between the tips varying in extent. Examples of all five described subspecies were examined and while a larger sample of dissected individuals might clarify subspecies level trends in the gnathos, individual variation seen within *C. grotei bahamensis* did not encourage further investigation of this character within the scope of this study, though the character is somewhat useful in distinguishing between other species (Fig. 42, 46, 49, 50, 53, 54, 57).

Subspecies have likewise been described for *Cautethia noctuiformis*, with *C. noctuiformis bredini* described by Cary (1970) from Barbuda and Antigua and *C. noctuiformis choveti* more recently described by Haxaire (2002) from St. Barthélemy and St. Martin. The nominate subspecies described from the Dominican Republic is recognized by a dark line tracing hindwing vein A_2 across the orange basal band (Kitching and Cadiou 2000, Haxaire 2002). This line was absent in all *C. noctuiformis* examined from Puerto Rico and the Lesser Antilles. Prior to the description of *C. noctuiformis choveti*, all non-Hispaniolan *C. noctuiformis* could be ascribed to *C. noctuiformis bredini*. However, with *C. noctuiformis choveti* occurring between western non-Hispaniolan populations and the *C. noctuiformis bredini* type locality, the recognition of subspecies based on geography becomes difficult. Haxaire (2002) distinguished *C. noctuiformis choveti* from *C. noctuiformis bredini* based on characters of the harpe (saccular process), gnathos, and terminal process of the phallus. These characters were unfortunately not illustrated by Haxaire, but from the description, it is noted that the apical process of the phallus in *C. noctuiformis choveti* is toothed, less so than in *C. n. noctuiformis* but more so than in *C. noctuiformis bredini*. While we were initially concerned about being certain that *C. gossi,* **new species**, is distinct from *C. noctuiformis choveti*, not having seen the genitalia, *C. gossi* is unique in having a smooth, clear-tipped process on the phallus apex (Fig. 40). We also examined the genitalia slide of the *C. noctuiformis bredini* holotype [USNM] and note the absence of multiple teeth on the phallus apical process and the presence of cornuti, the latter unique at the species level to *C. noctuiformis*. Our barcode evidence supports the placement of *C. gossi* **new species** and *C. simoni* **new species** within the "noctuiformis" clade as well distinguishing both from available barcodes of two *C. noctuiformis* subspecies.

Related taxa. Within the tribe Dilophonotini, a recent phylogeny (Kawahara et al. 2009) placed *Cautethia* within the New World clade Diphonotina, noting its placement is not strongly resolved. Though not included in the above analysis, the putative outgroup to *Cautethia* is the monotypic genus *Himantoides* Butler. This genus, represented by *H. undata* from Jamaica, was placed next to *Cautethia* in the higher-level classification by Kitching and Cadiou (2000) and shows up to 94.72% similarity in COI with *Cautethia grotei* in BOLD (Ratnasingham and Hebert 2007). Aside from some wing pattern similarities, there are some interesting comparisons of *H. undata* with *Cautethia* genitalia morphology that may be of use in future refinement of the tribal phylogeny and biogeography. First, in females we found the appendix bursae to be present in seven of the eight *Cautethia* species dissected. This structure was only absent in *C. calezae* which unlike the others, also possesses a small signum of the corpus bursae (Fig. 74, 77). Online images provided by Kitching (2019) show that *H. undata* females have a similar shaped bursa copulatrix, no appendix bursae, and a similar small signum. Males of *H. undata*, like *C. noctuiformis*, *C. calezae*, *C. carsusi*, and *C. insolita*, have a similar prominent variably toothed apical process on the phallus. Finally, *H. undata* males, like C. *noctuiformis*, *C. carsusi*, *C. insolita*, *C. simoni*, **new species**, *C. gossi*, **new species**, and *C. calezae*, have a well-developed saccular process, though somewhat smaller than the others and most similar in shape to that of *C. noctuiformis*. Within *Cautethia*, one of the most remarkable characters, which is only found in species without a well-developed saccular process, is the presence of spiny basal lobes on the gnathos. These occur in *C. grotei*, *C. geraceorum*, **new species**, *C. fideli*, *C. exuma*, and the Central American species *C. yucatana*, *C. spuria*, and *C. simitia*. The Central American species are further distinct in having only these spiny basal lobes and not a centrally fused apical extension of the gnathos. Further work is needed in documenting the distributions of the Central American species, including the possible synonymy of *C. simitia* with *C. yucatana*.

Our discovery of not one, but three new cryptic *Cautethia* species within the Lucayan Archipelago was an initial surprise but not unusual given the complexity of habitats in the West Indies and the historic and present-day potential for environmentally induced changes in the distributions of island populations (e.g., founder effects and reduced gene pools). For *Cautethia*, Cuba and the Lesser Antilles need further exploration. We hope the provided keys and illustrations will be useful tools for identifications and future study of this group.

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Literature Cited

Austin KA, Dombroskie JJ, Matthews DL, Miller JY. 2019. A review of the Archipini of the Bahamas with the description of a new species of *Argyrotaenia* Stephens (Tortricidae). Journal of the Lepidopterists' Society 73(1): 5–17.

Boisduval J-A. [1875]. Histoire Naturelle des Insectes, Species général des Lépidoptères Hétérocères 1: 319.

Brown JW, Matthews DL, Miller JY. 2018. Two new species of *Megalota* from the Bahamas (Lepidoptera: Tortricidae: Olethreutinae). Zootaxa 4455(3): 597–600.

Cary CR. 1970. A new sphinx moth from the West Indies (Sphingidae). Journal of the Lepidopterists' Society 24(4): 267–270.

Clarke BP. 1919. Some undescribed Sphingidae. Proceedings of the New England Zoological Club 6: 99-114.

Correll DS, Correll HB. 1982. Flora of the Bahama Archipelago (Including the Turks and Caicos Islands). Gantner Verlag; Vaduz, Liechtenstein. 1692 p.

Dyar HG. 1896. The larva of *Cautethia grotei* Hy. Edw. Psyche 7: 385–386.

Edwards H. 1882. New species of Heterocera. Papilio 2(1): 9–15.

Edwards H. 1887. Early stages of some North American Lepidoptera. Entomologica Americana 3: 161–171.

Felsenstein J. 1980. Confidence limits on phylogenies: An approach using the bootstrap. Evolution 39(4): 783–791.

Gilligan TM, Matthews DL, Miller JY. 2018. Two new species of Eucosmini from the Bahamas (Lepidoptera: Tortricidae). Zootaxa 4378(2): 265–268.

Hajibabaei M, Janzen DH, Burns JM, Hallwachs W, Hebert PDN. 2006. DNA barcodes distinguish species of tropical Lepidoptera. PNAS 103(4): 968–971.

Hampson GF. 1904. The Lepidoptera-Phalaenae of the Bahamas. The Annals and Magazine of Natural History Series 7(14): 165–188.

Haxaire J. 2002. Un nouveau Sphingidae des iles St Barthelemy et de St Martin (Petites Antilles): *Cautethia noctuiformis choveti* (Lepidoptera Sphingidae). Lambillionea 102: 263–266.

Haxaire J. 2016. Les Lépidoptères Sphingidae de République Dominicaine. Liste actualiséeet description de deux nouvelles espèces (Lepidoptera Sphingidae). The European Entomologist 8: 61–78.

Haxaire J, Melichar T. 2012. Une nouvelle espèce du genre *Cautethia* Grote, 1865 de l'île de Cuba: *Cautethia fideli* sp. n. (Lepidoptera, Sphingidae). The European Entomologist 4: 55–62.

Haxaire J, Melichar T. 2016. A new species of the genus *Cautethia* Grote, 1865 (Lepidoptera: Sphingidae) from Puerto Rico. The European Entomologist 8(3): 93–103.

Haxaire J, Schmit P. 2001. Un nouveau Sphingidae de République Dominicaine: *Cautethia carsusi* (Lepidoptera Sphingidae). Lambillionea 101: 605–608.

Hebert PDN, Cywinska A, Ball SL, deWaard JR. 2003. Biological identifications through DNA barcodes. Proceedings of the Royal Society of London. 270(1512): 313–321.

Hebert PD, Stoeckle MY, Zemlak TS, Francis CM. 2004. Identification of birds through DNA barcodes. PLOS Biol. 2: e312.

Hodges RW. 1971. Sphingoidea. The Moths of America, North of Mexico Including Greenland, vol. 21. E.W. Classey Limited and R.B.D. Publications Inc.; London. 158 p.

Jordan K. 1940. Results of the Oxford University biological expedition to the Cayman Islands, 1938. Sphingidae (Lep.). Entomologist's Monthly Magazine 76: 275–277.

Jukes TH, Cantor CR. 1969. Evolution of protein molecules. p. 21–132. In: Munro HN (ed.). Mammalian protein metabolism. Academic Press; New York. 590 p.

Kawahara AY, Mignault AA, Regier JC, Kitching IJ, Mitter C. 2009. Phylogeny and biogeography of hawkmoths (Lepidoptera: Sphingidae): evidence from five nuclear genes. PLOS ONE 4(5): e5719.

Kimura M. 1980. A simple method for estimating evolutionary rate of base substitutions through comparative studies of nucleotide sequences. Journal of Molecular Evolution 16: 111–120.

Kitching IJ. 2019. Sphingidae Taxonomic Inventory. Available at http://sphingidae.myspecies.info/ (Last accessed 22 October 2019.)

Kitching IJ, Cadiou J-M. 2000. Hawkmoths of the world, an annotated and illustrated revisionary checklist (Lepidoptera: Sphingidae). Cornell University Press; Ithaca, NY. 226 p.

Klots AB. 1956. Lepidoptera. p. 97–111. In: Tuxen SL (ed.). Taxonomist's glossary of genitalia in insects. Munksgaard, Copenhagen. 284 p.

Kristensen NP. 2003. Reproductive organs. p. 427–447. In: Kristensen NP (ed.). Lepidoptera, moths and butterflies Volume 2: Morphology, physiology and development, Handbook of Zoology. Volume IV Arthropoda: Insecta, Part 36. Walter de Gruyter; New York. 564 p.

Kumar S, Stecher G, Li M, Knyaz C, Tamura K. 2018. MEGA X: Molecular evolutionary genetic analysis across computing platforms. Molecular Biology and Evolution 35: 1547–1549.

Matthews DL, Miller JY, Simon M, Goss G. 2019. Additions to the plume moth fauna of the Bahamas. Insecta Mundi 0708: 1-35.

Melichar T, Řezáč M, Ilčíková A. 2016. Descriptions of two new subspecies of the genus *Cautethia* Grote, 1865 (Lepidoptera: Sphingidae) from the Bahamas and Jamaica. The European Entomologist 8(4): 165–177.

McCabe, TL. 1984. A new *Cautethia* from the Bahamas (Lepidoptera: Sphingidae). Proceedings of the Entomological Society of Washington 86: 614–618.

Nei M, Kumar S. 2000. Molecular evolution and phylogenetics. Oxford University Press; New York, NY. 348 p.

de Queiroz K. 2005. A unified concept of species and its consequences for the future of taxonomy. Proceedings of the California Academy of Sciences 56(Supplement I): 196–215.

Ratnasingham S, Hebert PDN. 2007. BOLD: The Barcode of Life Data System (www.barcodinglife.org). Molecular Ecology Notes 7: 355–364.

Ridgway R. 1912. Color standards and color nomenclature. Published by the author; Washington, DC. 43 p. + 53 color plates.

Rubinoff D, Holland BS. 2005. Between two extremes: mitochondrial DNA is neither the panacea nor the nemesis of phylogenetic and taxonomic inference. Systematic Biology 54(6): 952–961.

Saitou N, Nei M. 1987. The neighbor-joining method for reconstructing phylogenetic trees. Molecular Biology and Evolution 4: 406–425.

Schaus W. 1932. New species of Sphingidae and Saturniidae in the U.S. National Museum. Journal of the Washington Academy of Sciences 22: 137–148.

Stecher G, Tamura K, Kumar S. 2020. Molecular Evolutionary Genetics Analysis (MEGA) for macOS. Molecular Biology and Evolution 37: 1237–1239.

Talavera G, Lukhtanov V, Pierce NE, Vila R. 2022. DNA barcodes combined with multilocus data of representative taxa can generate reliable higher-level phylogenies. Systematic Biology 71(2): 382–395.

Tuttle JP. 2007. The hawk moths of North America, a natural history study of the Sphingidae of the United States and Canada. The Wedge Entomological Research Foundation; Washington, DC. 253 p.

Walker F. 1856. List of the specimens of lepidopterous insects in the collection of the British Museum. Part VIII. – Sphingidae. British Museum (Natural History); London. 271 p.

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