

Redescription of Two Often-Confused Noctuid Pests, *Copitarsia decolora* and *Copitarsia incommoda* (Lepidoptera: Noctuidae: Cuculliinae)

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ABSTRACT Members of the genus *Copitarsia* Hampson (Noctuidae) are widespread pests of many agricultural commodities in Central and South America. Two species, *Copitarsia incommoda* (Walker) and *Copitarsia turbata* (Herrich-Schäffer), are of particular concern. This misidentification has affected life history studies, risk assessments, and biological control of these pest species. This article redescribes these species and distinguishes them from each other by using adult morphology. *C. turbata* is placed as a NEW SYNONYM of *Copitarsia decolora* (Guenée), *Copitarsia margaritella* (Dognin) is placed as a junior synonym of *C. decolora* (REVISED SYNONYM), and *Copitarsia hamptoni* (Brèthes) is designated as a NEW SYNONYM of *C. incommoda*.

KEY WORDS misidentification, morphology, agriculturally important species

SYSTEMATICS AND TAXONOMY ARE key to study, communication, and identification of agriculturally important species. The scientific name of a species is necessary for precise communication about its biology and its economic impact, both verbally and in the literature (Miller and Rossman 1995). Historical misidentifications of economically important species complicate scientific communication and literature, because the true identity of the species becomes unclear. Furthermore, risk assessments or identification materials based on literature also become questionable and of little use. This article deals with two species that have been mistaken for each other for >30 yr, *Copitarsia decolora* (Guenée, 1852) and *Copitarsia incommoda* (Walker, 1865).

Members of moth genus *Copitarsia* Hampson (1906) (Noctuidae: Cuculliinae) are native, polyphagous pests on at least 39 crop plants from 19 plant families in Mexico and Central and South America. These crops include many commodities that are also intensively grown in the United States, such as artichokes, cabbage, corn, and potatoes (Venette and Gould 2004). In South America, *Copitarsia* reduces the marketability of some vegetables by 24% and reduces grain yield by 80–90% (Venette and Gould 2004). *Copitarsia* larvae are often detected at U.S. ports of entry on cut flowers and vegetable commodities. *Copitarsia* has not been collected in the United States to date, but it is possible that it is present and undetected.

Copitarsia species are difficult to identify, and border regions have not been extensively sampled for the presence of these species. Although adult *Copitarsia* can be identified by the presence of large spines on the foretarsi, larval and egg identification characters are inconsistent or nonexistent. Thus, the possible establishment of *Copitarsia* populations within the United States is of great concern. Recent risk assessments (Venette and Gould 2004) suggest that if *Copitarsia* invades and establishes breeding populations, it will be found throughout the United States as a major agricultural pest.

Two species, *Copitarsia incommoda* (Walker, 1865) and *C. turbata* (Herrich-Schäffer, 1855), are the most economically important members of the genus. *C. incommoda* (Fig. 1A) is reported from Mexico to northern Chile (Artigas and Angulo 1973, Angulo and Weigert 1975, Parra et al. 1986). Documented hosts of *C. incommoda* include asparagus (Angulo and Weigert 1975, Sánchez and Apaza 2000), rapeseed (Artigas and Angulo 1973), and alfalfa (Arce de Hamity and Neder de Roman 1992). *C. turbata* (Fig. 1B) is reported from Mexico to northern Chile, eastward to northwest Argentina, and feeds on a variety of crops, including, cut flowers, lettuce, peas, beets, carrots, beans, and potatoes (Arce de Hamity and Neder de Roman 1992, Castillo and Angulo 1991). Comparison of male genitalia figured in Artigas and Angulo (1973), Angulo and Weigert (1975), and Parra et al. (1986) with the type specimens for *C. incommoda* and junior synonyms of *C. turbata* indicate that *C. turbata* was misidentified as *C. incommoda*. Recent revisions of *Copitarsia* perpetuate this error (Castillo and Angulo 1991, Angulo and

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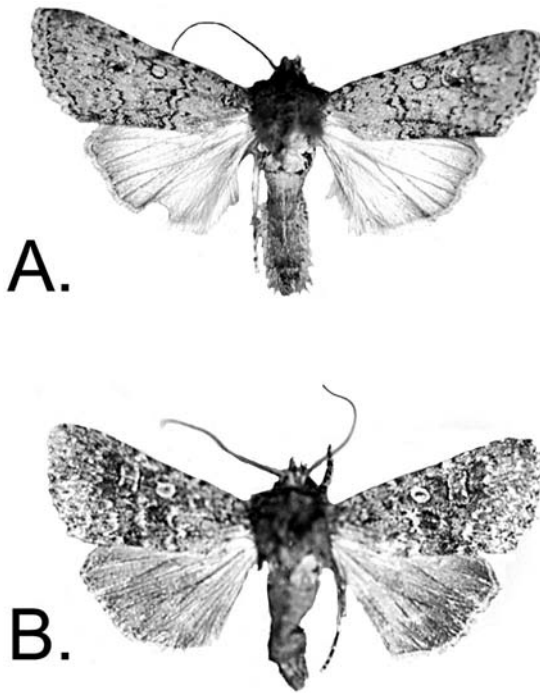


Fig. 1. Adult habitus. (A) *C. decolora*. (B) *C. incommoda*.

Olivares 2003). Unless genitalia are illustrated, information from the literature about geographic range, host preference, and other life history traits is suspect for these species. This article redescribes the geographic range based on dissected adult museum specimens of these two species.

The misidentification of *C. incommoda* and *C. turbata* is further complicated by taxonomic issues. Both species are often referred to by unavailable names. In the agricultural literature, *C. incommoda* is often called by *C. consueta* (Walker 1857), its unavailable senior synonym. *C. consueta* is a primary homonym of *Agrotis consueta* (Walker 1856), making the Walker 1857 name unavailable. Poole (1989) resolved this synonymy. *C. incommoda* is known to occur in Colombia, Ecuador, and Peru.

Polia turbata (= *Copitarsia turbata*) was described by Herrich-Schäffer (1855). *P. turbata* is a junior synonym of *Mamestra decolora* (Guenée 1852). The location of the type specimen of *C. turbata* is unknown, and the type locality given in the original description is incorrect (Turkey, Yugoslavia), because the species occurs solely in the New World (Poole 1989). Because of its agricultural importance, type material with accurate locality information is essential to facilitate further study of this species. This article designates *C. turbata* (Herrich-Schäffer) as a NEW SYNONYM of *C. decolora* (Guenée). Redescriptions of *C. decolora* and *C. incommoda* follow.

Materials and Methods

Standard genitalia dissections were performed following Winter (2000). Type specimens of *Agrotis consueta* Walker, 1857 (BMNH), *Agrotis hostilis* Walker, 1857 (BMNH), *Agrotis incommoda* Walker, 1865 (BMNH), *Agrotis peruviana* Walker, 1865 (BMNH), *Allorhodoecia hampsoni* Brèthes, 1923 (BMNH), *Graphiphora sobria* Walker, 1857 (BMNH), *Lycophotia margaritella* Dognin, 1916 (USNM), *Mamestra decolora* Guenée, 1852 (BMNH, MNHP), *Mamestra inducta* Walker, 1856 (BMNH), *Polia turbata* Herrich-Schäffer, 1855 (BMNH, original plate, no known type specimens exist), and *Spaelotis subsignata* Walker [1857], 1856 (BMNH) were examined to verify identifications. Digital photographs were made of selected specimens. Specimen deposition and genital preparation numbers are indicated under "Specimens Examined" (USNM numbers are genitalia slide numbers, RBS are Simmons dissection numbers, and the remainder are USNM barcodes; m, male; f, female).

Terminology for abdominal and genital morphology follows Klots (1970) and Forbes (1939). Collections consulted include BMNH, The Natural History Museum, London (D. Carter and D. Goodger); MNHP, Muséum National d'Histoire Naturelle, Laboratoire d'Entomologie, Paris (J. Minet); MZUC, Museo Zoología de Universidad de Concepción, Chile (A. O. Angulo) and USNM, the United States National Museum of Natural History, Smithsonian Institution, Washington, DC.

Copitarsia decolora (Guenée)

(Figs. 1A, 2A, 3, 4A and B, 5A–C, 6A and B)

Agrotis heydenreichii Freyer 1851: 139. Preoccupied by *Agrotis heydenreichii* Germar 1842: pl. 14. Poole 1989: 49.

Mamestra decolora Guenée, 1852: 190.

Copitarsia decolora Poole 1989: 272.

Polia turbata Herrich-Schäffer 1855: 60.

Copitarsia turbata Hampson 1906: 184; Poole 1989: 272. N. SYN.

Mamestra inducta Walker 1856: 272.

Copitarsia inducta Hampson 1906: 184; Poole 1989: 272.

Spaelotis subsignata Walker 1856: 371.

Copitarsia subsignata Hampson 1906: 184; Poole 1989: 272.

Agrotis hostilis Walker 1857: 737.

Copitarsia hostilis Hampson 1906: 184; Poole 1989: 272.

Graphiphora sobria Walker 1857: 744.

Copitarsia sobria Hampson 1906: 184; Poole 1989: 272.

Lycophotia margaritella Dognin 1916: 11.

Copitarsia margaritella Poole 1989: 272. REV. SYN.

Diagnosis. *C. decolora* lacks the brush-like androconia found in male *C. incommoda* (Fig. 2A). Male *C. decolora* have a blunt digitus and corona of spines on the valve (Fig. 4A and B). Female *C. decolora* are recognizable due to the spiculate, heavily sclerotized antevaginal plate (Fig. 6B).

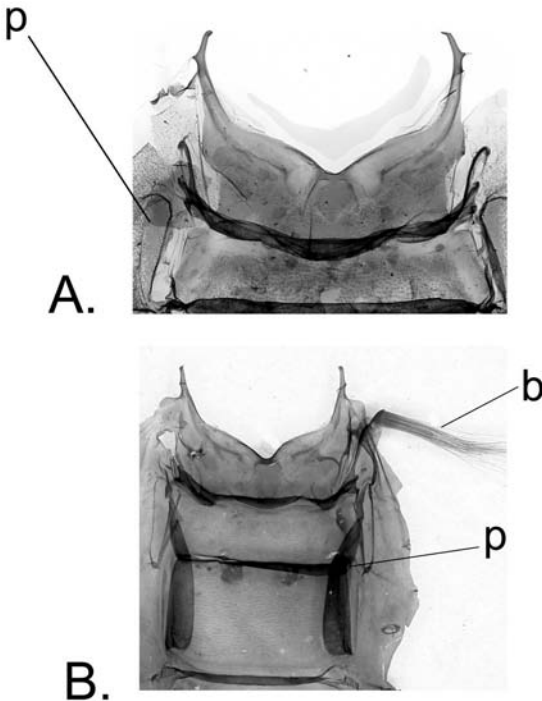


Fig. 2. Male sterna. (A) *C. decolora*. (B) *C. incommoda* (p, sclerotized patch; b, scent brush).

Description. Medium-sized, light brown or gray moths (Fig. 1A), with well-defined orbicular and reniform spots.

Male. Head. Brown; antenna light brown, biserrate and ciliated; palpus light brown, apex white.

Thorax. Patagium brownish gray; mesothorax pale brown; metathorax gray to white; fore, mid, and hind-leg mixed with white and brown scales, tibial spurs striped with brown; tarsi white.

Wings. Forewing. Length = 13–18 mm (average = 16.1 mm, SD = 1.3 mm, $n = 14$). Ground color light brown or gray; antemedial and postmedial lines, double row of brown zigzag lines, with white between them; basal area with well-defined brown lines; reniform spot brown outlined in white; orbicular spot ground color with white inner and black outer margin; outer margin with triangular black spots between wing veins; fringe grayish brown. Hindwing. Ground color white; wide marginal band brown; veins toward wing margin brown; fringe brown basally, remainder white.

Abdomen. First three abdominal segments light gray, remainder of abdomen gray; genital tuft gray; sclerotized patches present in pleural membrane near second abdominal segment; hair brushes, scent pouches and modified S2 absent (Fig. 2A); terminal tergite weakly sclerotized medially, more heavily sclerotized laterally, forming two circular areas (Fig. 3).

Genitalia (Figs. 4A and B, 5A–C). Tegumen rounded; uncus apically swollen, bearing long setae; saccus extended into narrow point; valve sinuate, tapering to pointed apex; corona present; ampulla attenuate, apex

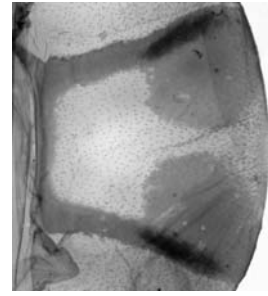


Fig. 3. Final tergite, male *C. decolora*. Tergite is identical for male *C. incommoda*.

extending beyond costal margin of valve; digitus spatulate; juxta a broad plate with pointed lateral margins, medio-ventral plate with rounded, sinuate margins, dorsal margin V-shaped with a pair of ventrally produced arms with dorsally curved apices; spinose pad present above aedeagus; apex of aedeagus with a small sclerotized plate (sp) consisting of one large and two pointed projections, a large serrate sclerotized plate (lp) opposite small plate; vesica elongate; cornuti various sized elongate spines in both clusters and solitary in a spiral line in basal one-quarter of vesica.

Female. As in male, except antennae filiform and ciliated; forewing length = 14–18 mm (average = 16.8 mm, SD = 1.2 mm, $n = 24$); hindwing darker than males.

Genitalia (Fig. 6A and B). Papillae anales, posterior apophyses unmodified; anterior apophyses reduced in length, thickened; S8 unmodified; antevagi-

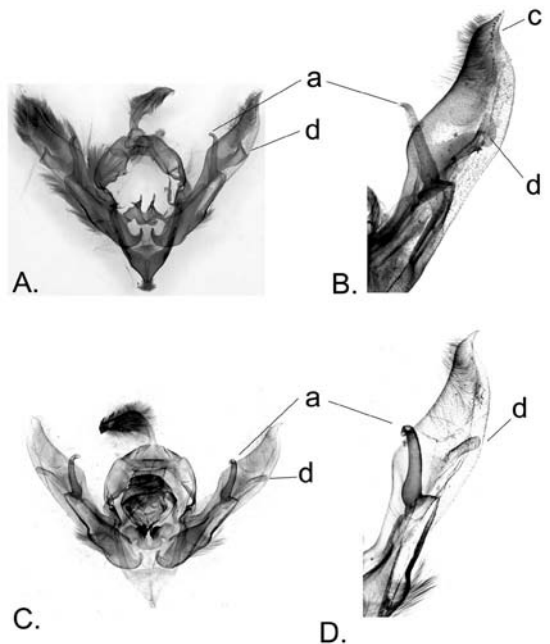


Fig. 4. Male genitalia. (A) *C. decolora*. (B) Valve of *C. decolora*. (C) *C. incommoda*. (D) Valve of *C. incommoda* (a, ampulla; c, corona; d, digitus).

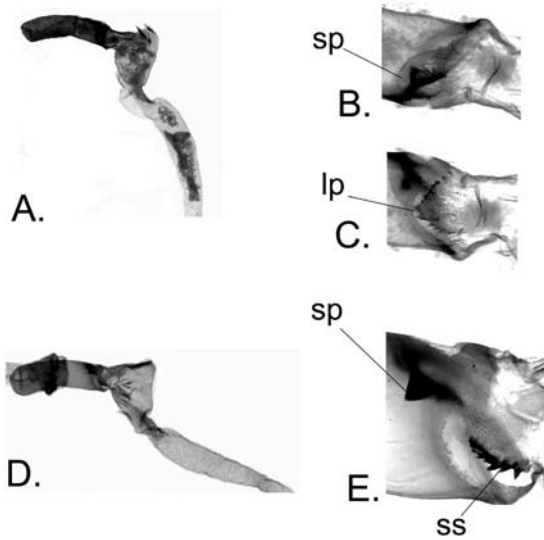


Fig. 5. Aedeagus. (A) *C. decolora*. (B) Enlarged view of aedeagus apex. (C) Enlarged view of aedeagus apex. (D) *C. incommoda*. (E) Enlarged view of aedeagus apex (sp, small plate; lp, large plate; ss, sclerotized spines).

nal plate U-shaped, spiculate texture, symmetrical; ductus bursae sclerotized, spinose; corpus bursae deeply ridged, spherical, three lines of signa; appendix bursae larger than corpus bursae, membranous, irregular in shape; ductus seminalis from posterior of appendix bursae.

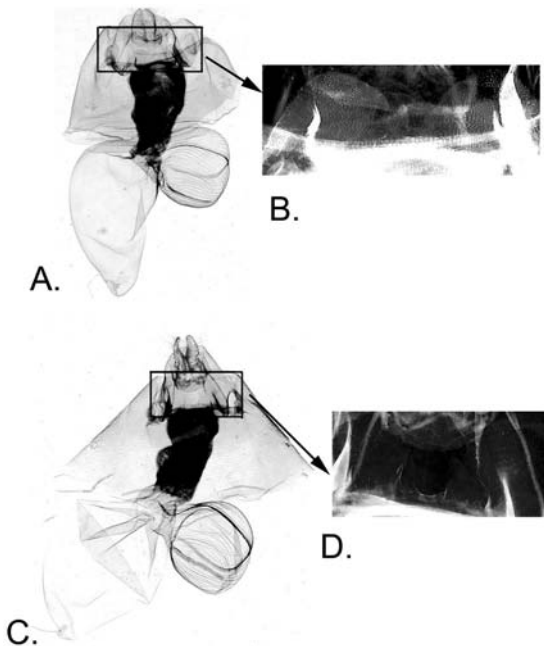


Fig. 6. Female genitalia. (A) *C. decolora*. (B) *C. decolora*, antevaginal plate (inverted black and white image). (C) *C. incommoda*. (D) *C. incommoda*, antevaginal plate (inverted black and white image).

Type Material. *Agrotis heydenreichii* Freyer. The type is apparently lost. Type locality: Dalmatia (in error for southern South America).

Mamestra decolora Guenée. The lectotype female (MNHP), designated by Viette (1951) is labeled: Colombia; *Mamestra decolora* Guenée cotype. Type locality: Colombia.

Polia turbata Herrich-Schäffer. The type is apparently lost. Type locality: Turkey, Yugoslavia.

Mamestra inducta Walker. The holotype female (BMNH) is labeled: Venezuela; *Mamestra inducta* Walker holotype. Type locality: Venezuela.

Spaelotis subsignata Walker. The holotype male (BMNH) is labeled: Bogotá 43-2; *Spaelotis subsignata* Walker holotype, Noctuidae genitalia slide no. 11159 male. Type locality: Bogotá, Colombia.

Agrotis hostilis Walker. The holotype female (BMNH) is labeled: Venezuela 47-9; *Agrotis hostilis* Walker holotype. Type locality: Venezuela.

Lycophotia margaritella Dognin. The lectotype male (USNM, here designated) is labeled: Volcan Irazu, Costa Rica, 10-VI-1948, Coll. Fassl.; Dognin collection; USNM genitalia slide 46492. Type locality: Volcan Irazu, Costa Rica. The lectotype is designated to ensure nomenclatural stability in this taxonomically confusing genus.

Graphiphora sobria Walker. The holotype female (BMNH) is labeled: Bogotá, Stevens; *Graphiphora sobria* Walker holotype. Type locality: Bogotá, Colombia.

Material Examined. ARGENTINA: Buenos Aires (RBS 413f, BMNH); Mendoza (46956f, USNM); Neuquen (142305m/142309f, BMNH). CHILE: Antumapu, Santiago (RBS 409f/RBS 401f, BMNH); Coguinbo (RBS 441f, BMNH); Concépcion (RBS 443, MZUC); Mulchen (RBS 442m, BMNH); Sa. Clemente, Talca (RBS 436f/RBS 437f, BMNH); St. Rivera (46965f, USNM). COLOMBIA: Bogotá (RBS 414m/RBS 415f, BMNH); Cauca (RBS 365m, BMNH); Pacho, 2200m (62958m/62962f/RBS 432m/RBS 433f, BMNH); Paso del Quindiu, 3500m (62967m/RBS 434m, RBS 435f, BMNH). COSTA RICA: San Pedro de Montes de Oca (46963m, USNM). ECUADOR: Baeza (63029f, BMNH); Chimborazo, Colta, Gatazo Chico (46951m/46964f, USNM); Rio Bamba, San Antonio (142298m/142301f, USNM); Tulcan (RBS 379f, MNHP). GUATEMALA: no locality (RBS 385f/RBS 394f, MNHP). MEXICO: Chiapas, San Cristobal de las Casas, N 15° 43.9' W 92° 36.8' (46962m, USNM); Cordoba (RBS 447f, BMNH); El Guarda, 9,800 feet (46949m/46950f, USNM); Jalapa (RBS 445f, BMNH); Litoruacuco (RBS 329f, MNHP); Mexico City (RBS 446f, BMNH); Montecillos (46957m, USNM); Puebla, Hwy. km 10 Tchuacán, Xaca N 18° 22' 3" W 97° 21' 7" (46954m, USNM); Sierra de Chalpupahua, Evs. De Colica (RBS 376f/RBS 377m, MNHP). PERU: Agualani, Carabaya, 9,000 feet (RBS 417f, BMNH); Cajamarca (46947m/46980f, USNM); Cusco (46981f/46982m, USNM); Ica (46953f, USNM); Lima, Arequipa, Tacna Rd., 1 km NW Intersection Ave Parra (46985m/46986f, USNM); Pisco (46960m, USNM).

VENEZUELA: El Valle (46948f, USNM); Merida (RBS 386f, BMNH); no locality (RBS 450, BMNH).

Distribution. Southern Mexico through northern Chile, eastward to Argentina (Buenos Aires).

Discussion. *C. decolora* varies slightly in coloration from lighter to medium brown. Females tend to be larger, and have darker hindwings than males. Mitochondrial DNA evidence indicates at least two morphologically cryptic species within *C. decolora*: one ranging from southern Mexico to Ecuador, the other occurring in Ecuador, Colombia and Peru (Simmons and Scheffer 2004).

Copitarsia incommoda (Walker)

(Figs. 1B, 2B, 3, 4C and D, 5D and E, 6C and D)

Agrotis consueta Walker 1857: 738. Preoccupied by *Agrotis consueta* Walker 1856.

Copitarsia consueta Hampson 1906: 183; Poole 1989: 272.

Agrotis incommoda Walker 1865: 692.

Copitarsia incommoda Hampson 1906: 183; Poole 1989: 272.

Agrotis peruviana Walker 1865: 693.

Copitarsia peruviana Hampson 1906: 183; Poole 1989: 272.

Allorhodoecia hampsoni Brèthes 1923: 5; Poole 1989: 67. N. SYN.

Diagnosis. *C. incommoda* is often confused with *C. decolora*. Males of *C. incommoda* can be identified externally by their brush-like androconia on the second abdominal segment (sometimes only after dissection), which are absent in *C. decolora*. Male *C. incommoda* has a rounded digitus, and valves lack a corona of spines that is present in *C. decolora* (Fig. 4C and D). Female *C. incommoda* can be identified by the smooth texture of the U-shaped antevaginal plate, compared with the spiculate antevaginal plate found in *C. decolora* (Fig. 6D).

Description. Medium-sized, pale brown moths (Fig. 1B), with well-defined orbicular and reniform spots, and light brown hindwings.

Male. Head. Brown; antenna pale brown, filiform and ciliated; palpus brown.

Thorax. Patagium brown; mesothorax lighter, tawny brown; metathorax cream to white; fore, mid, and hindleg mixed white and brown, tibial spurs striped with brown, tarsi white.

Wings. Forewing. Length = 14–18 mm (average = 16 mm, SD = 1.3 mm, $n = 15$). Ground color light brown; antemedial and postmedial lines, a double row of brown zigzag lines with white between them; basal area with well-defined brown lines; reniform spot ground color with white inner and black outer margin; orbicular spot ground color outlined in black; outer margin with triangular black spots between wing veins; fringe brown. Hindwing. Ground color brown mixed with white scales basally; fringe light brown basally, rest white.

Abdomen. Brown, genital tuft white; hair brushes, scent pouches and modified S2 present (Fig. 2B); terminal tergite as in *C. decolora* (Fig. 3).

Genitalia (Figs. 4C and D, 5D and E). As in *C. decolora*, except corona absent; digitus slender, apex round, not spatulate (Fig. 4C and D); apex of aedeagus with a small sclerotized plate (sp) consisting of one large, one small, and three minute pointed projections; a series of variously sized, heavily sclerotized spines opposite small plate (ss); cornuti in a similar pattern to that of *C. decolora*, but more robust.

Female. As in male, except forewing length = 14–19 mm (average = 17.2 mm, SD = 1.3 mm, $n = 18$); hindwing darker than males.

Genitalia (Fig. 6C and D). As in *C. decolora*, except lateral lobes of U-shaped antevaginal plate larger than *C. decolora* (Fig. 6D).

Type Material. *Agrotis consueta* Walker. The holotype male (BMNH) is labeled: Bogotá, Stevens, 56–42; *Agrotis consueta* Walker holotype; Noctuidae genitalia slide no. 11158 male. Type locality: Bogotá, Colombia.

Agrotis incommoda Walker. The holotype male (BMNH) is labeled: New Grenada 58-60; *Agrotis incommoda* Walker holotype. Type locality: New Grenada, Colombia.

Agrotis peruviana Walker. The holotype male (BMNH) is labeled: Peru; *Agrotis peruviana* Walker holotype. Type locality: Peru.

Allorhodoecia hampsoni Brèthes. The lectotype male (BMNH, here designated) is labeled: Buenos Aires, 15-III-1922; H. Krabbe 1923–1229; *Allorhodoecia hampsoni* Brèthes syntype. Type locality: Buenos Aires, Argentina. The lectotype is designated to ensure nomenclatural stability in this taxonomically confusing genus.

Material Examined. ARGENTINA: Cordoba, nr. Arias (RBS 430f/RBS 431m, BMNH); Mendoza (RBS 387m, BMNH), Falkland Islands, East Island (RBS 422f, BMNH), Tunugan River (RBS 439m, BMNH). BOLIVIA: La Paz, Est. Exp. Pateaemaya (46945m/46946f, USNM). COLOMBIA: Bogotá (RBS 427m, BMNH) La Plata (RBS 428m, BMNH). ECUADOR: Pinnllar (RBS 363m, MNHP), Quito (RBS 368m, MNHP), Rio Bamba (RBS 369m, MNHP). PERU: Arequipa (RBS 312m, MNHP); Carabaya: Limbani (46983m, USNM), Agualani (RBS 451f, BMNH); Junin (46984m, USNM).

Distribution. Colombia through southern Chile, eastward to Argentina (Falkland Islands).

Discussion. *C. incommoda* varies slightly in coloration from lighter to medium brown. Females tend to be larger, and have darker hindwings than males.

Acknowledgments

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