

Status and redescription of the South American pest species *Agrotis robusta* (Lepidoptera: Noctuidae): a history of misidentifications

Estado y redescrición de *Agrotis robusta* (Lepidoptera: Noctuidae), especie plaga en América del Sur: una historia de errores de identificación

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Abstract. *Agrotis robusta* (Blanchard, 1852) (Lepidoptera: Noctuidae) is a species of economic importance in South America. This species is considered a pest on seedlings of several crops. *Agrotis robusta* is commonly confused with and treated as *A. malefida* Guenée in Boisduval and Guenée, 1852, and only a couple of works cite *A. robusta* for South America and none mention it as a species of economic importance. The aim of this work is to redescribe and illustrate the adult and male and female genitalia of *A. robusta*, and to provide an identification key to closely related pest species in South America with which *A. robusta* has been confused. Four new synonymies with *A. robusta* are established: *A. aureolum* Schaus, 1898, *Scotia koehleri* Berio, 1963, *S. (Feltia) fulvaurea* Köhler, 1966, and *S. (F.) ancasiensis* Köhler, 1966.

Key words: economic importance, *Agrotis malefida*, *A. ipsilon*, taxonomy.

Resumen. *Agrotis robusta* (Blanchard, 1852) (Lepidoptera: Noctuidae) es una especie de importancia económica en América del Sur. Esta especie es considerada plaga en almácigos de numerosos cultivos. *Agrotis robusta* es comúnmente confundida y tratada como *A. malefida* Guenée en Boisduval y Guenée, 1852; solamente unos pocos trabajos citan *A. robusta* para América del sur y en ninguno de ellos se la menciona como una especie de importancia económica. El objetivo de este trabajo es redescibir e ilustrar el adulto y los genitales del macho y de la hembra de *A. robusta*, así como proveer una clave de identificación de especies plagas cercanas en América del Sur con las cuales ha sido confundida *A. robusta*. Se establecen 4 nuevas sinonimias con *A. robusta*: *A. aureolum* Schaus, 1898, *Scotia koehleri* Berio, 1963, *S. (Feltia) fulvaurea* Köhler, 1966 y *S. (F.) ancasiensis* Köhler, 1966.

Palabras clave: importancia económica, *Agrotis malefida*, *A. ipsilon*, taxonomía.

Introduction

Agrotis Ochseneimer (Lepidoptera: Noctuidae) is a diverse (300 species) genus with a worldwide distribution, occurring in all continents except the poles. The genus belongs to the “cutworm” group (Lafontaine, 2004), *Agrotis* larvae cut shoots of seedlings causing, in most cases the death of the plant. Several species are considered pests for several crops (corn, tomato, potato, etc.) (Angulo and Quezada, 1975; Igarzábal et al., 1994; Pastrana, 2004). *Agrotis malefida* Guenée in Boisduval and Guenée, 1852 is distributed throughout the American continent excepting the Poles, and it is commonly cited as a pest species in

agricultural-oriented publications. A detailed study of the literature and specimens from different museums showed that specimens identified as *A. malefida* in Argentina, Chile, Paraguay, and Bolivia, in most cases, actually correspond to *A. robusta* (Blanchard, 1852). In museum collections, specimens of both species are usually mixed and identified as *A. malefida*, and same collections rarely have specimens identified as *A. robusta*. Moreover, *A. robusta* has been cited only a couple of times since its original description. Misidentification of these species makes it uncertain to establish which one or if both is the economically important species.

The aim of this work is to make a detailed redescription of *A. robusta*, with diagnostic characters, photos, a distributional map, and a key to differentiate this species from the closest pest species in South America.

Materials and methods

Dissections of genitalia were conducted as in Lafontaine (2004). The stain used in the dissections was Chlorazol Black E for female genitalia and male aedeagus. Genitalic morphological terminology and nomenclature of types of antennae follow Lafontaine (2004). The size of the longer antennal segment was calculated measuring its width including the branches and dividing it by the width of the central shaft.

Specimens used for this study are deposited in the entomological collections at the following institutions: Canadian National Collection of Insects, Ottawa, Ontario, Canada (CNC); Instituto Argentino de Investigaciones de las Zonas Áridas, CCT-CONICET Mendoza, Mendoza, Argentina (IADIZA); Instituto y Fundación Miguel Lillo, Tucumán, Argentina (IFML); Muséum National d'Histoire Naturelle, Paris, France (MNHN); and National Museum of Natural History, Smithsonian Institution, Washington, DC (USNM).

Redescription

Agrotis robusta (Blanchard, 1852) (Figs. 1-3)

Noctua robusta Blanchard, 1852: 75 pl. 6, fig. 9.

Agrotis aureolum Schaus, 1898: 107; Hampson, 1903: 368 (= *A. ypsilon* Rottenburg); Poole, 1989: 56 (= *A. ypsilon* Hufnagel). New synonym.

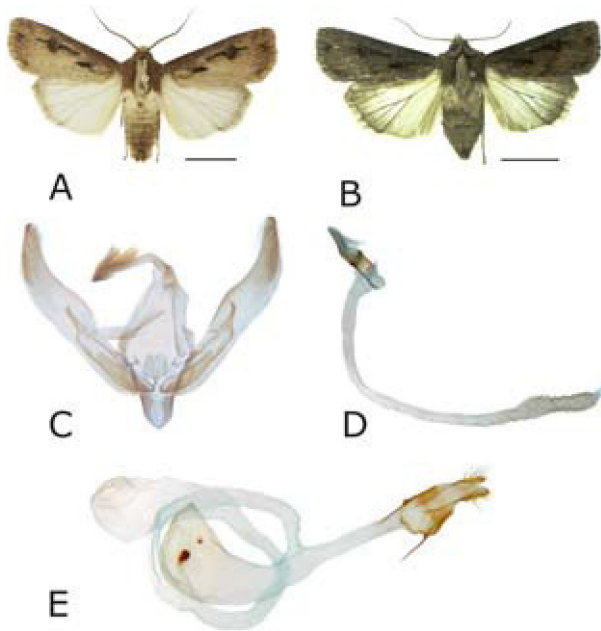


Figure 1. *Agrotis robusta*. A), male; B), female; C), male genitalia; D), eedeagus; E), female genitalia. Scale bar= 1cm.

Agrotis ypsilon robusta: Druce, 1881-1900: 281.

Agrotis robusta: Berg, 1882: 280 (= *Agrotis ypsilon* [Rottenburg]); Butler, 1882: 126 (= *Agrotis suffusa* [Denis and Schiffermüller]); Hampson, 1903: 368 (= *A. ypsilon* [Huf.]); Hampson, 1905: 702 (= *A. ypsilon* [Huf.]); Forbes, 1933: 19 (= *A. ypsilon* [Huf.]); Poole, 1989: 55 (= *A. malefida* Gn.).

Scotia koehleri Berio, 1963: 12, figs. 1-3; Köhler, 1967: 331, fig. 74; Margheritis and Rizzo, 1970: 164 (Aluminé Lake, Neuquén, Argentina). New synonym.

Scotia (Feltia) fulvaurea Köhler, 1966: 97, figs. 1, 3. New synonym.

Scotia fulvaurea form *extrema* Köhler, 1966: 100. Unavailable. According to the 15.2 ICZN article: “A new name published after 1960 expressly as the name of a “variety” or “form” is deemed to be infrasubspecific and as such is not regulated by the Code [Art. 1.1.1] and is excluded from its provisions [Arts. 1.3.4, 45.6.3]”.

Scotia (Feltia) ancastiensis Köhler, 1966: 101. New synonym.

Agrotis ancastiensis [*sic*]: Poole, 1989: 43 (new combination).

Agrotis fulvaurea: Hayward, 1969: 41 (hosts); Poole, 1989: 48 (world noctuids checklist); Pastrana, 2004: 155 (hosts).

Agrotis koehleri: Dapoto et al., 2003: 70.

Diagnosis. *Agrotis robusta* can be differentiated from other South American *Agrotis* species by the following combination of characters: 1) patagia and tegula darker than thorax; 2) subterminal line basally projected between M1-M2-M3 veins like 2 basally black and light brownish ended arrows, and 3) male genitalia *vesica* without basal spined band.

Male (Figs. 1A, 3I). Head. Palpus ventrally whitish; front smooth, without raised edge or central projection. Antenna bifasciculate, basal 2/3 biserrate, widest at 1/5, then it tapers gradually to the apex with the apical 1/3 filiform, widest segment 2 times as wide as central shaft, anterior process 2 times as wide as posterior process. Thorax. Light grayish brown; patagia with black middle line, basal half dark grayish brown and distal half brown; tegula brown, with black marginal line, only visible on some specimens. Forewing length 16.4-20.6 mm; ground color light grayish brown; subcostal band brown; basal area undifferentiated; basal line absent; antemedial line black, double, convex between veins, projected as a sharp tooth between 1A+2A vein and posterior margin, not reaching medial line; claviform spot black; orbicular spot oval stretched toward the reniform, light grayish brown with grayish center and bordered by a black line, some specimens with spot concolor with subcostal band, slightly differentiated by the black edge; reniform spot same color as orbicular

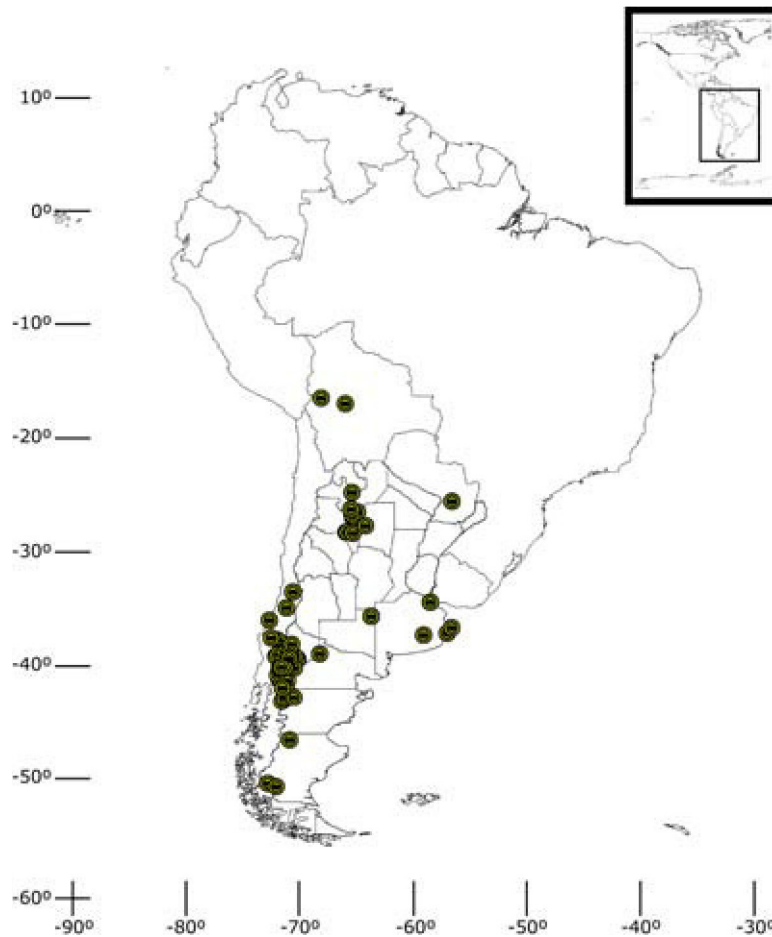


Figure 2. *Agrotis robusta*. Distribution map.

spot, external margin with a sharp strike projected between M1-M2 veins to the postmedial line; discal cell as ground color, with black strike of variable width joining both spots; medial line as a dark thick waved band; postmedial line black, double, concave between veins; subterminal line light brownish, strongly concave between veins, resembling clear arrows, basally projected between M1-M2-M3 veins as 2 basally black and light brownish ended arrows, projections never joining reniform strike; terminal line as darkish lunulae between veins; fringe as ground color with dark transversal lines at veins apex. Hindwing iridescent, some specimens diffuse brown near external margin; fringe iridescent. Abdomen. Light grayish brown with darker dorsal line. Genitalia (Figs. 1C, 3J). Uncus sinuous. Tegumen with strong “shoulders”. Juxta subrectangular, ventral 1/3 of lateral margin subquadrate projected and ventral margin projected as a sclerotized spine. Clavus slightly sclerotized, cylindrical, between 5 and 6 times as long as wide. Valve subrectangular, basal

half narrow, then widened, anterior margin convex near ampulla apex and posterior margin convex at valve dorsal half; cucullus apex strongly projected anterior dorsally; saccus strongly sclerotized, 3/5 times as wide as valve; ampulla inwards curved, 1/5 times as long as valve, basal 1/3 expanded then narrowed to 1/2 of its widest; saccus hemispherical, ventrally projected as a spine. Aedeagus (Figs. 1D, 3K) fully sclerotized; vesica 8 times as long as aedeagus, as 1 1/2 wide loops, basal swelling present, right basal diverticulum subtriangular, without any more diverticuli, basal spined band absent, vesica swelling on apical 1/4.

Female (Fig. 1B). Differences from male. Forewing length: 17.2-20.8 mm; antenna filiform; ground color grayish brown; and hindwing diffuse dark brown. Genitalia (Figs. 1E, 3L). Papillae anal slightly sclerotized, laterally 2 times as long as wide, with hair-like setae; posterior apophysis as long as anterior apophysis; ductus bursae 2 times as long as anterior apophysis, membranous; corpus bursae

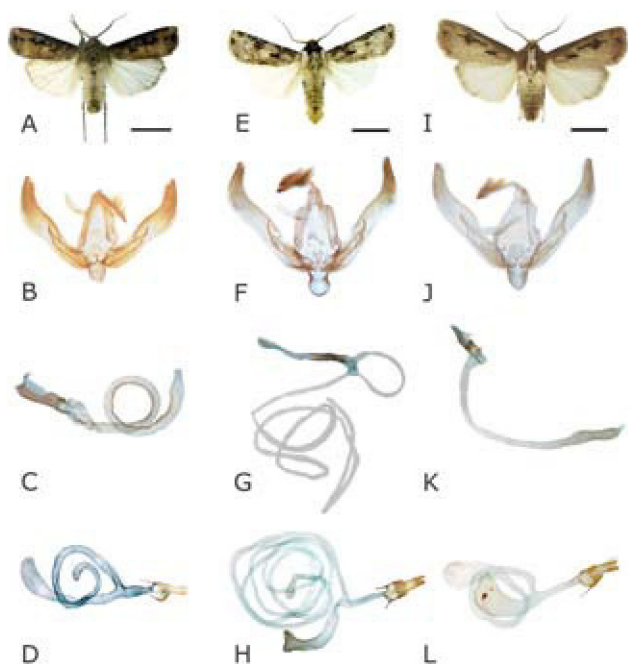


Figure 3. Adult, male genitalia, aedeagus, and female genitalia of: A-D, *Agrotis ipsilon*; E-H, *A. malefida*, and I-L, *A. robusta*. Scale bar= 1cm.

6 times as long as anterior apophysis, with 2 signa, apex subtriangular; appendix bursae between 4 and 5 times as long as corpus bursae, as 1 1/2 wide loop, apex globose; ductus seminalis originated laterally near apex of corpus bursae.

Taxonomic summary

Material examined. *Noctua robusta*: holotype: ♂ Chile (MNHN). Photo examined. *Agrotis aureolum*: holotype: ♂ [Brazil], Paraná, Castro (USNM). Examined. *Scotia koehleri*: holotype: ♂ [Argentina], Tandil, Buenos Aires III-IV-1953 (Walz) (Berio collection, Genoa, Italy). Allotype: ♀ same data. Paratype: 19♂ 11♀ [Argentina], Tandil, Buenos Aires III-IV-1953 (Walz) (Berio collection, Genoa, Italy). *Scotia (Feltia) fulvaurea*: holotype: ♂ [Argentina], Tucumán, Siambón 2 000 m snm 11-V (IFML). Examined. Paratype: 3♂ 3♀ [Argentina], Tucumán, Río Nío 1 000 m snm 12-V (IFML); 7♂ 5♀ [Argentina], Tucumán, Siambón 2 000 m snm 11-V (IFML), 3♂ 3♀ 11-V-1965 (IFML); ♂ [Argentina], Tucumán, [San Pedro de Colalao] 22-IV (IFML); 2♂ 2♀ [Argentina], Tucumán, San Pedro de Colalao 22-IV-1961 (IFML); ♂ [Bolivia], [Cochabamba], Alto Palmar - Chaparé 1 100 m snm (IFML); ♂ Bolivia, La Paz 3 600-4 000 m snm 25-VII-1954 (Forster) (IFML). Examined. *Scotia (Feltia) ancastiensis*: holotype: ♂ [Argentina], Catamarca, Sierra de Ancasti, El Alto 1 000 m snm 21-III (IFML). Examined. Paratype: ♂ [Argentina],

Catamarca, Sierra de Ancasti, El Alto 1 000 m snm 21-III (IFML). Examined.

Other material examined. **Argentina.** Buenos Aires. Tigre 7♂ II-1964 (IFML). Catamarca. El Rodeo 2 000 m snm 9♂ ♀ (IFML). Chubut. El Maitén 700 m snm 2♂ ♀ 16-I-1986 (M. y P. Gentili) (IADIZA). La Pampa. General Pico 5♂ 15-V-1967 (IFML). Neuquén. Pucará 3♂ 5♀ III-1959 (IFML); Pucará, Parque Nacional Lanín 2♂ 2♀ I-1951 (Schajovskoy) (IFML); San Martín de los Andes 647 m snm 2♂ 3♀ 31-I-1959 (M. Gentili) (IADIZA). Río Negro. El Bolsón, Cerro Piltriquitrón 1 000 m snm ♂ 2♀ 22-XII-1981 (M. y P. Gentili) (IADIZA); San Carlos de Bariloche, Colonia Suiza 810 m snm ♂ 9-I-1979 (Misión Científica Danesa) (CNC). Salta. Salta ♂ (Breyer) (IFML). Santa Cruz. El Turbio 200 m snm ♂ 20-I-1976 (M. Gentili) (IADIZA); Punta Bandera-Lago Argentino 3♂ I-1963 (IFML). Santiago del Estero. Frías ♂ 21-IV-1961 (IFML). Tucumán. Quebrada de Lules 2♂ II-1925 (IFML); Siambón 2 000 m snm 2♀ 11-V-1965 (IFML). **Chile.** Región del Maule. Curicó, 1km N Curicó 7♂ 2♀ 29-XI-1982 (R.L. Brown) (USNM). Región del Biobío. Ñuble, Alto Tregualemu, 500 mtrs, ca. 20 km SE Chovellen 3♂ 5♀ 26-27-I-1979 (D.M. Davis & B. Akebergs) (USNM). Región IX, Araucanía. Cautín, Fundo el Coigue, 500 mtrs 27 km NE Villarrica 379 m snm 3♂ 4♀ 28-II-3-III-1979 (D.M. Davis & B. Akebergs) (USNM); Malleco, Curacautín, Río Blanco 1 100 m snm ♂ ♀ II-1964 (Peña) (CNC). Región Metropolitana. Santiago, La Granja 2♂ ♀ 15-III-1969 (IFML). **Paraguay.** Caaguazú. Carumbé 2♂ 28-I-10-III-1965 (IFML).

Distribution. From Paraguay and Bolivia to southern Chile and Argentina (Fig. 2). In Argentina, it occurs in almost every province, from Salta to Santa Cruz. It is likely that it extends to southern Brazil and Uruguay, but we could not see specimens from these countries.

Biology. There are several publications dealing with the biology of this species. Angulo and Weigert (1975a) redescribed and provided a key to immature stages. Angulo and Quezada (1975) and Igarzábal et al. (1994) gave a detailed description of the immature stages, adults, and species life cycle. In these works, *A. robusta* is treated as *Feltia malefida*.

Hosts. Pastrana (2004) provided a hosts list for the species, conformed by 17 crop host species. Pastrana (2004) treated this species as *A. malefida* and *A. fulvaurea*.

Remarks. *Agrotis robusta* has been confused with *A. malefida* in several works. Here we cite works that carried out different studies on *A. robusta* treating it as *A. malefida* or *Feltia malefida* (correct identification cleared up by photos, drawing, or description published on each work): Köhler, 1945: 70, 97, 99; pl. I, figs. c and d (key for adults, male genitalia, and distribution on Argentina); Biezanko et

al., 1957: 58 (hosts); Köhler, 1967: 332, fig. 76 (paratype photo); Angulo and Quezada, 1975: 117-124, figs. 1, 2, 4, 6 (redescription of all stages and differences with *Agrotis ipsilon*); Angulo and Weigert, 1975a: 73, 74, 98, 126, 130, 134, figs. 21, 22, 45, 54, 65, 82, 95, 102, 116, 142, 143, 170, 174 (preimaginal stages); Angulo and Weigert, 1975b: 173 (aggression mimicry of larvae); Angulo, 1978: 15-16 (larvae and pupae); Angulo and Jana-Sáenz, 1984: 77-82, figs. 45-49 (larvae morpho-functionality); Angulo et al., 1986: 370, 372, figs. 8, 10 (metafurcaesternum); Parra et al., 1986: 90, figs. 40, 86-88 (redescription of both sexes); Artigas, 1994: 584-585, pl. 28, fig. 6 (diagnosis, life cycle, biological control, damages, hosts, economic importance, distribution, and international implications); Igarzábal et al., 1994: 101-103, figs. 3, 21, 39, 57, 75, 97-99 (behavior, biology, and larvae diagnosis and key); Olivares and Angulo, 1996: 175, figs. 84-89 (tympanic organ); Angulo and Olivares, 2001: 58 (pupae key); Carrillo et al., 2001: 27-31; Angulo and Olivares, 2002: 52 (specimens in the Universidad de Concepción, Chile); Pastrana, 2004: 157 (hosts) (Pastrana [2004] made a bibliographic compilation of host plants for Argentinean Lepidoptera, taking most of *A. malefida* data from Köhler's works. Köhler used to

misidentify *A. robusta* with *A. malefida* and that is why we think hosts information given on Pastrana's work it is referred to *A. robusta* and not to *A. malefida*.); and Angulo and Olivares, 2005: 138-139 (diagnosis, male genitalia).

Over the years researchers have confused *A. robusta* with *A. ipsilon* and *A. malefida*. In southern South America, specifically Argentina, Chile, Paraguay, and Bolivia, *A. malefida* is considered a pest of several crops, but in fact most of those specimens correspond to *A. robusta*. *Agrotis malefida* extends throughout the American continent except the Poles, but it is relatively rare in southern South America, supported on the number of specimens in collections. Even though we know that pest species are not always well represented in museum collections and this could be a sample bias, we think that evidence from different works, especially agricultural ones, supports this affirmation. Based on current evidence we think that *A. malefida* it is not a pest species in this region as could be *A. robusta*.

Agrotis robusta, *A. malefida*, and *A. ipsilon* (Hufnagel, 1766) are relatively large moths (forewing length between 16 and 20 mm) and can be identified with the following key:

Key to adult male and females of *A. robusta*, *A. malefida*, and *A. ipsilon*.

1. Forewing darker than ground color between base and postmedial line; thorax, patagia, and tegula of the same color (Fig. 3A); male genitalia with aedeagus vesica without diverticuli (Fig. 3C); female genitalia with appendix bursae between 1.5 and 2 times as long as corpus bursae length (Fig. 3D) *Agrotis ipsilon*
- 1'. Forewing without differentiated darker area between base and postmedial line; at list patagia of different color of thorax; male genitalia with aedeagus vesica with subtriangular right basal diverticuli; female genitalia with appendix bursae between 4 and 14 times as long as corpus bursae length 2
2. Patagia darker than thorax; tegula of same color as thorax, with a thick anterior dorsal line (Fig. 3E); male genitalia with aedeagus vesica 16 times as long as aedeagus length, with spined basal band (Fig. 3G); appendix bursae 14 times as long as corpus bursae length (Fig. 3H) *Agrotis malefida*
- 2'. Patagia and tegula darker than thorax (Fig. 3I); male genitalia with aedeagus vesica 8 times as long as aedeagus length, without spined basal band (Fig. 3K); appendix bursae between 4 and 5 times as long as corpus bursae length (Fig. 3L) *Agrotis robusta*

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