

Revision of the species of *Mythimna* Ochseneheimer, 1816 (*Pseudaletia* Franclemont, 1951) (Lepidoptera: Noctuidae: Noctuinae: Leucaniini) occurring in Brazil

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ABSTRACT

The genus *Mythimna* Ochseneheimer, 1816 groups approximately 270 species worldwide. This genus is subdivided into many subgenera and species-groups, with those species occurring in the Neotropical region included in the subgenus *Mythimna* (*Pseudaletia*) Franclemont, 1951. Species of this subgenus frequently reach high population levels, causing economic damage to Poaceae cultivars. Hence, it is crucial a well-defined taxonomy allowing rapid and precise identifications. However, the species of this subgenus are cryptic, their recognition requires molecular analyses and in-depth morphological studies, which has often resulted in misidentifications. In Brazil, the occurrence of the following species had been mentioned: *Mythimna* (*P.*) *adultera* (Schaus, 1894), *Mythimna* (*P.*) *roraimae* Franclemont, 1951, *Mythimna* (*P.*) *sequax* Franclemont, 1951, and *Mythimna* (*P.*) *unipuncta* (Haworth, 1809). Yet, until now, we lack a broader knowledge about the geographic distribution and taxonomy of these species. Thus, this study aims to revise the taxonomy of those species based on morphological and molecular (COI) data to provide an updated comprehension of this group in the country. The analysis of 1,664 specimens allowed us to confirm the presence of three species in the country: *Mythimna* (*P.*) *adultera*, *Mythimna* (*P.*) *sequax*, and *Mythimna* (*P.*) *unipuncta*. A **lectotype** for *Mythimna* (*P.*) *adultera* is designated; a new synonym is proposed: *Pseudaletia roraimae* **syn. nov.** of *Mythimna* (*P.*) *unipuncta*; and a new species, *Mythimna* (*P.*) *celiae* **sp. nov.** is described from Bagé, Rio Grande do Sul, Brazil.

Introduction

Mythimna Ochseneheimer, 1816 (Lepidoptera: Noctuidae: Noctuinae: Leucaniini) is a cosmopolitan genus that comprises approximately 270 species, grouped in subgenera and species-groups according to genitalia characters (Yoshimatsu, 1994, 1995; Yoshimatsu and Hreblay, 1998; Yoshimatsu and Legrain, 2001). This classification has been accepted in the most recent taxonomic studies, though it remains problematic (Hacker et al., 2002; Lafontaine and Schmidt, 2010).

The subgenus *Mythimna* (*Pseudaletia*) Franclemont, 1951 is represented by 17 species with occurrences in Neotropical and Oriental regions and Hawaii islands. It counts with the following distinguishing characters: a distinct and sclerotized valva with ampulla and clasper reduced in size (Hacker et al., 2002). Most of the 17 species belonging

to this subgenus are economically important (Hacker et al., 2002), and they frequently reach high population levels, which causes economic damage (Salvadori and Parra, 1990a, 1990b, 1990c; Rizzo and La Rossa, 1991; Capinera, 2006). The following species have been recorded in Brazil: *Mythimna* (*P.*) *unipuncta* (Haworth, 1809), *Mythimna* (*P.*) *adultera* (Schaus, 1894), *Mythimna* (*P.*) *sequax* Franclemont, 1951, and *Mythimna* (*P.*) *roraimae* Franclemont, 1951 (Franclemont, 1951). There are records of the occurrence of *Mythimna* (*P.*) *punctulata* (Blanchard, 1852) in Brazil, Chile, Peru (Artigas, 1994), and Argentina (Artigas, 1994; Pastrana, 2004). However, Franclemont (1951) and Angulo and Weigert (1977) mentioned its occurrence exclusively to Chile.

Mythimna (*P.*) *roraimae* is cited only in its original description (Franclemont, 1951) and the world catalog of Noctuidae (Poole, 1989), with distribution restricted to the type locality. On the other hand, *Mythimna* (*P.*) *sequax* is widely distributed in the American continent,

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from Southern Brazil, Northern of Argentina and Uruguay to United States of America: Florida and Texas (Franclemont, 1951; Heppner, 2007). It is economically important in Brazil, and for this reason, it has been cited hundreds of times in the literature (Gassen, 1984; Madruga et al., 2019). *Mythimna (P.) adultera* is a common species present from Southern Brazil, Uruguay, Paraguay to Northern part of Argentina. This species is considered of agricultural importance throughout its distribution (Gassen, 1984; Rizzo and La Rossa, 1991; Zerbino, 1991). Finally, *Mythimna (P.) unipuncta* is known worldwide as a pest (Pond, 1960, 1961; McNeil, 1987; Tavares et al., 1992; Capinera, 2006).

The wide geographic distribution of *Mythimna (P.) unipuncta*, associated with its economic importance and morphological similarity has led multiple authors to identification mistakes (Biezanko et al., 1949; Biezanko and Bertholdi, 1951; Bertels, 1956; Corseuil, 1958; Costa, 1958; Bertels and Baucke, 1966). The main association came from the works of Hampson (1905) and Draudt (1919), in which several species and forms were considered synonyms of *Cirphis unipuncta*. Since then, this has been a recurring problem, given that the species of this subgenus are highly similar, most of them distinguishable only through careful examination of their genitalia.

Franclemont (1951) revisited the “*unipuncta* group” based on morphological evidence, his results being valid to this day. Currently, new tools such as molecular studies have contributed to bringing light to the systematic of the genus (Sutrisno, 2012). But, up till now, we lack a broader knowledge of the geographic distribution and taxonomy of the Brazilian species. Considering their agricultural importance, it is crucial to have these two aspects well-defined, so that the identification of these species is rapid and reliable. This study aims to revise the species of *Mythimna (Pseudaletia)* occurring in Brazil, by using morphological and molecular (COI) characters to analyze and elucidate its current status and composition in the country.

Material and methods

Collections

The studied specimens belong to the following collections:

AMNH - American Museum of Natural History, New York, U.S.A.

CEUCS - Coleção Entomológica da Universidade de Caxias do Sul, Caxias do Sul, Rio Grande do Sul, Brazil.

CLAM - Coleção Alfred Moser, São Leopoldo, Rio Grande do Sul, Brazil.

DZUP - Coleção Entomológica Padre Jesus Santiago Moure, Departamento de Zoologia, Setor de Ciências Biológicas, Universidade Federal do Paraná. Curitiba, Paraná, Brazil.

CPAC - Coleção Entomológica da Embrapa Cerrados, Planaltina, Distrito Federal, Brazil.

IOC - Instituto Oswaldo Cruz. Rio de Janeiro, Rio de Janeiro, Brazil.

MECB - Museu Entomológico Ceslau Biezanko, Universidade Federal de Pelotas, Pelotas, Rio Grande do Sul, Brazil.

MCTP - Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil.

MGCL - McGuire Center for Lepidoptera and Biodiversity, University of Florida, Gainesville, Florida, U.S.A.

MNHN - Muséum national d'Histoire naturelle, Paris, France.

MNRJ - Museu Nacional. Universidade Federal do Rio de Janeiro, Rio de Janeiro, Rio de Janeiro, Brazil.

MZUSP - Museu de Zoologia, Universidade de São Paulo, São Paulo, São Paulo, Brazil.

NHMUK - The Natural History Museum, London, United Kingdom.

USNM - National Museum of Natural History, Smithsonian Institution. Washington D.C., U.S.A.

We also collected specimens using light traps model Pennsylvania (Frost, 1957), equipped with fluorescent and black lights, for five nights in each new moon between June, 2015 and May, 2016 in 15 Brazilian localities: Alto Alegre - Roraima; Rio Branco - Acre; Mojuí dos Campos - Pará; Porto Nacional - Tocantins; Petrolina - Pernambuco; Sinop - Mato Grosso; Planaltina - Distrito Federal; Chapadão do Sul and Miranda - Mato Grosso do Sul; Uberaba - Minas Gerais; Alegre and Domingos Martins - Espírito Santo; Londrina - Paraná; Passo Fundo, Vacaria and Bagé - Rio Grande do Sul. After screening and identification, the material was preserved wet (in alcohol 70%) or dry (entomological pins), and part of it was incorporated into the CPAC and DZUP collections.

The nomenclature adopted for venation and genitalia characters is referred to in Fig. 1. The abbreviations used throughout the text are as follows: apl. - applied; biol.- biology; geogr. distr. - geographic distribution; inv.- inventory; morph.- morphology; parasit. - parasitism.

The records of the geographic distribution of the species were taken from the labels of the examined material. The geographic coordinates were obtained through Google Earth, and the geographic distribution map was generated with SampleMapp (Shorthouse, 2010). The examined material corresponds only to specimens deposited in scientific collections. The classification follows Hacker et al. (2002) for genus and subgenus, and Lafontaine and Schmidt (2010) for higher taxonomic categories.

Mythimna (Pseudaletia) unipuncta is redescribed based on images and its catalog is restricted to the main taxonomic works. This was necessary because of the enormous number of taxonomic problems related to this species over time caused by the lack of examination of its type specimens. This problem renders the publications dealing with it untrustworthy, which is not the case for the other species.

Morphological and molecular analyses

A total of 1,664 specimens were examined and length of their forewing measured. For the genitalia character survey, 52 specimens were dissected as in Dias et al. (2017) with nomenclature of Franclemont (1951) and Hacker et al. (2002).

For the molecular analysis, 22 sequences of 658 base pairs of the mitochondrial DNA 'barcode' region of the cytochrome c oxidase subunit I (COI) gene were obtained and deposited in Genbank (Sayers et al., 2020). Additionally, were added for comparative analyses 21 sequences mined from Bold Systems (Ratnasingham and Hebert, 2007). Accession numbers and locality information provided in each cladogram. The data was edited in the program BioEdit (Hall, 2011) and analyzed using MEGA11 (Tamura et al., 2021). Evolutionary trees were inferred using the Neighbor-Joining and Maximum Likelihood algorithms in Tamura model 3-parameters with a gamma distribution with Invariant Sites (T92 + G + I), with bootstrap of 1,000 replicates. The initial trees for the heuristic search were automatically obtained by applying the algorithms Neighbor-Joining and BioNJ and by selecting the topology with the highest log-likelihood value. A discrete Gamma distribution was used to model the differences in the evolutionary rate between the sites (5 categories (+ G, parameter = 1,0000)). The trees were drawn in scale, with the average ramification length measured in the number of substitutions per site.

Intra and interspecific evolutionary divergences were estimated with MEGA11, using the same model and bootstrap. Positions containing gaps and missing data were deleted.

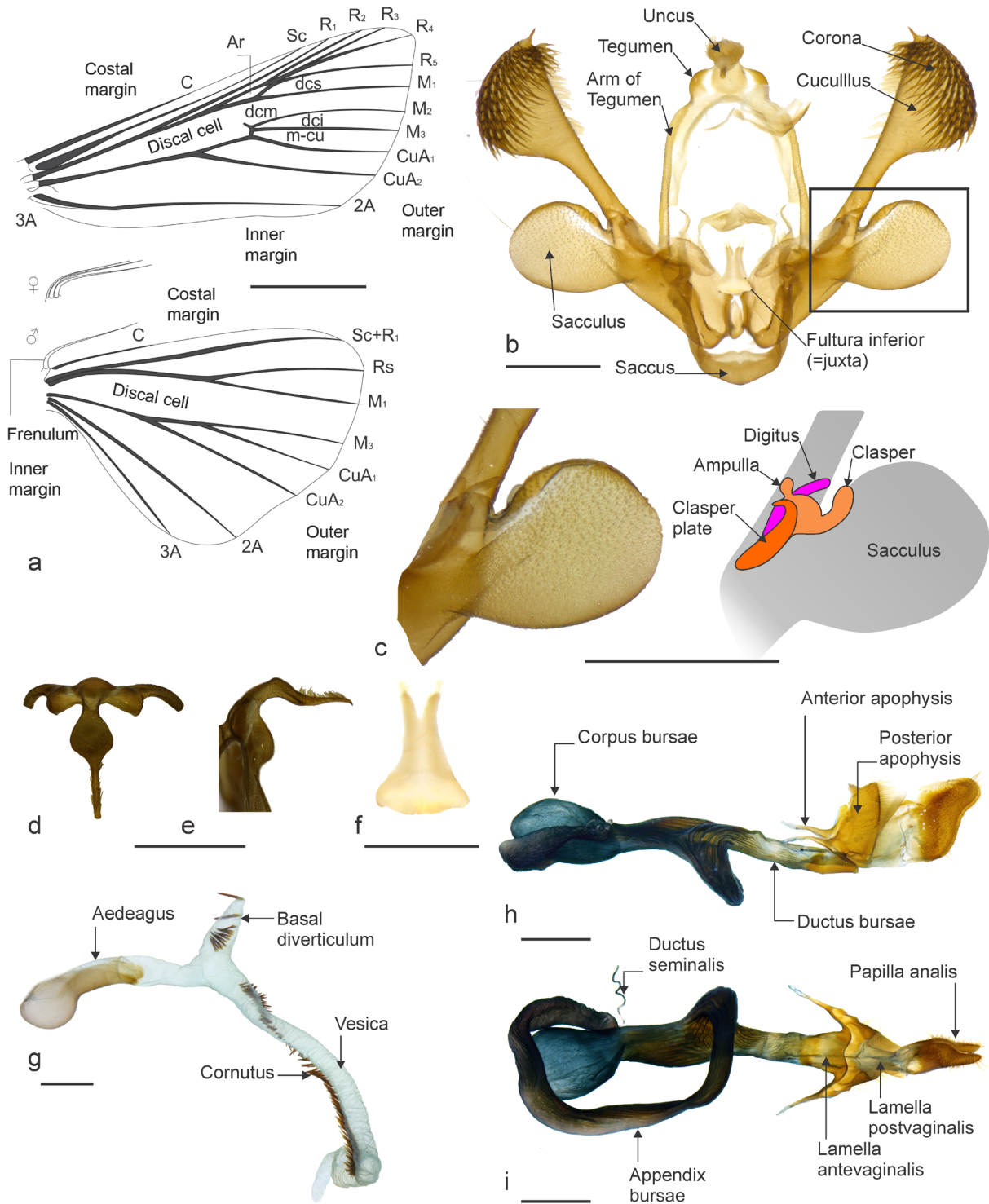


Figure 1 Nomenclature adopted for wing venation and genitalia, based on *Mythimna (P.) celiae* sp. nov. a, fore and hindwing, scale bar = 10mm; b, male genitalia in ventral view; c, ampulla, digitus, and clasper in inner lateral view of the valva, with a scheme on the right side; d, uncus in posterior view; e, uncus in lateral view; f, fultura inferior (=juxta); g, aedeagus with everted vesica in lateral view; h-i, female genitalia in lateral and ventral views, respectively. Scale bars b-e, g-i= 1mm, f = 0.5mm.

Results

***Mythimna* Ochsenheimer, 1816**

Mythimna Ochsenheimer, 1816. **Schmett. Europ.** 4, p. 78.- Walker, 1856. **List Spec. Lepid. Insects Coll. Brit. Mus.** 9, 72.- Draudt, 1919. **Gross-Schmetterlinge Erde** 7, 79.- Franclemont, 1951. **Proc. Ent. Soc.**

Wash. 53(2): 60.- Poole, 1989. **Lep. Cat. (n.s.) 118, Noctuidae 2,** 673; **syn.**: *Philostola* Billberg, 1820; *Hyperiodes* Warren, 1910.- Yoshimatsu, 1994. **Bull. Nat. Inst. Agro-Environ. Sci.** 11: 81.- Yoshimatsu, 1995. **Japn. J. Ent.** 63: 235.- Yoshimatsu and Legrain, 2001. **Entomol. Sci.** 4: 431.- Hacker *et al.* 2002. **Noctuidae Europaeae 4,** 168; **syn.**: *Philostola* Billberg, 1820; *Aletia* Hübner, [1821]; *Heliophila* Hübner, 1822; *Barolia* Moore, 1886; *Hyperiodes* Warren, 1910; *Hypopteridia* Warren, 1912;

Conithimna Beck, 1999; *Gruathimna* Beck, 1999; *Foehstia* Beck, 1999; *Pudotherimna* Beck, 1999; *Ferrathimna* Beck, 1999; *Allitoria* Beck, 1999.- Speidel and Naumann, 2004. **Syst. Biodivers.** 2(2): 195.- Fibiger and Lafontaine, 2005. **Esperiana** 11: 13.- Lafontaine and Schmidt, 2010. **ZooKeys** 40: 91.- Sutrisno, 2012. **HAYATI J. Biosc.**, 19(2): 65.

Mythimna (*Pseudaletia*) Franclemont, 1951

Pseudaletia Franclemont, 1951. **Proc. Ent. Soc. Wash.** 53(2): 63.- Franclemont and Todd, 1983. **Check List Lep. Amer. N. Mexico**, 150.- Poole, 1989. **Lep. Cat. (n.s.)** 118, **Noctuidae** 2, 843.

Mythimna (*Pseudaletia*); Zerbino, 1984. **Investig. Agron.** (Montevideo) 5: 17.- Terra and Zerbino, 1986. **Investig. Agron.** (Montevideo) 6: 49.- Holloway, 1989. **Moths of Borneo, Part 12, Malay. Nat. J.** 42(2-3): 57.- Yoshimatsu, 1994. **Bull. Nat. Inst. Agro-Environ. Sci.** 11: 81.- Hacker *et al.*, 2002. **Noctuidae Europaeae** 4, 178.- Barbut and Lalanne-Cassou, 2010. **L'Ent.** 66(3): 117.- Sutrisno, 2012. **HAYATI J. Biosc.** 19(2): 65.

Systematic history

Ochsenheimer described *Mythimna* in 1816 based on *Phalaena turca* Linnaeus, 1761, as the type species. Posteriorly, Franclemont (1951) described the genus *Pseudaletia* with *Noctua unipuncta* Haworth, 1809 as the type species. Franclemont and Todd (1983) and Poole (1989) maintained the status of genus for *Pseudaletia*. Zerbino (1984) and Terra and Zerbino (1986) cited *Pseudaletia* as a synonym of *Mythimna*. However, they mentioned that no taxonomic justification could be found

to include the South American species in the latter. Holloway (1989) cited *Pseudaletia* as subgenus of *Mythimna*. Yoshimatsu (1994) revised the species from Japan and Taiwan, finding genus *Mythimna* monophyletic and confirming the presence of seven subgenera, *Pseudaletia* among them. Finally, Hacker *et al.* (2002) followed the same hypothesis, citing the Neotropical species in the subgenus *Mythimna* (*Pseudaletia*).

Morphological characterization

The species of *Mythimna* are predominantly beige, a pattern that is generally mixed with dark scales. Many species are superficially similar, and the distinction often requires examination of the genitalia. As a standard, male and female genitalia differ in general appearance, with emphasis on the valva and its structures in males and the structure of the bursa copulatrix in females (Franclemont, 1951; Hacker *et al.*, 2002).

In the species of *Mythimna* (*Pseudaletia*), the forewings are narrower and have a sharper apex when compared to the wing morphology of the other subgenera. Its genitalia has the following synapomorphies: male genitalia with the harpe-ampulla complex reduced and modified, cucullus expanded, corona strong and extended, vesica usually with a basal diverticulum bearing a reduced, terminal cornutus. Female genitalia with appendix bursae deriving from the proximal part of ductus bursae (Hacker *et al.*, 2002).

Morphological and molecular analyses have agreed with the presence of four species in Brazil: *Mythimna* (*P.*) *unipuncta* (Haworth, 1809), *Mythimna* (*P.*) *adultera* (Schaus, 1894), *Mythimna* (*P.*) *sequax* Franclemont, 1951, and *Mythimna* (*P.*) *celiae* **sp. nov.** (Figs. 1-4; Table 1).

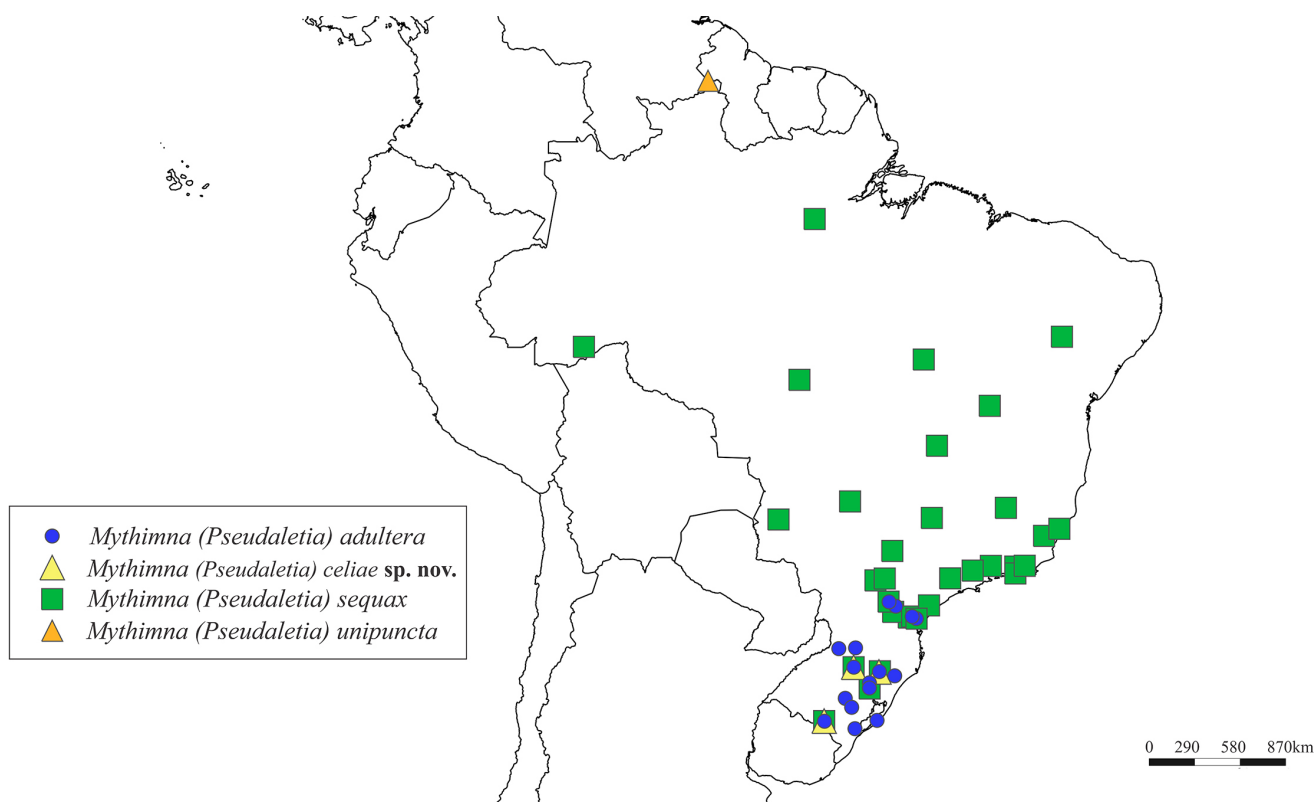


Figure 2 Geographic distribution of *Mythimna* (*Pseudaletia*) in Brazil.

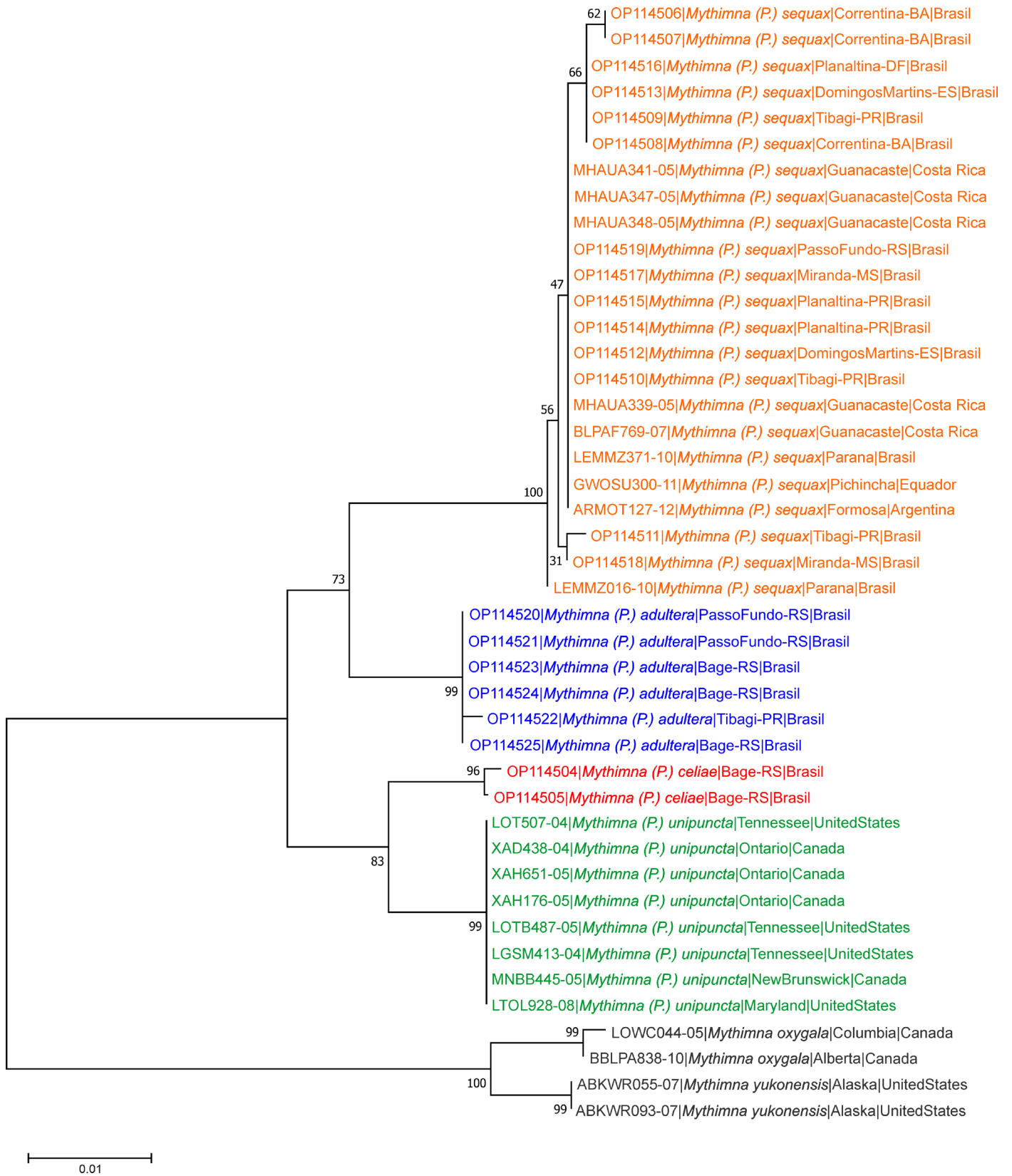


Figure 3 Evolutionary relationships of the taxa, using the Neighbor-Joining method. The optimal tree with the sum of the branch lengths = 0,14304783 is shown, bootstrap values are presented next to each ramification.

***Mythimna (Pseudaletia) unipuncta* (Haworth, 1809) (Figs. 5-7)**

Noctua unipuncta Haworth, 1809. **Lepid. Brit.** 2, 174.- Hampson, 1905. **Cat. Lep. Phalaenae** 5, 547.

Leucania impuncta [sic]; Stephens, 1829. **Illustr. Brit. Entomol.** 3, 80.

Leucania unipuncta; Stephens, 1829. **Illustr. Brit. Entomol.** 3, 338.- Butler, 1890. **Trans. Ent. Soc. Lond.** 1890(4), 661.- Hampson, 1894. **Fauna Brit. India** 2, 275; **syn.**: *Leucania extranea*, *Leucania antica*, *Leucania convectora*, *Leucania separata*, *Leucania adusta*, *Leucania consimilis*, *Leucania trifolii*, *Leucania saccharivora*.- McDunnough, 1938. **Mem. South. Calif. Acad. Sci.** 1, 77; **syn.**: *Leucania extranea*.- Koutsaftikis, 1974. **Ann. Goulandrakis Museum.** 2, 96.- Poole, 1989. **Lep. Cat. (n.s.)**

118, **Noctuidae** 2, 844; **syn.**: *Leucania extranea* Guenée, 1852, *Leucania antica* Walker, 1856, *Leucania unipuncta quechua* Franclemont, 1951, *Leucania unipuncta tseki* Koutsaftikis, 1974.

Leucania extranea Guenée, 1852. **Hist. Nat. Ins., Spec. Gén. Lépid.** 5, 77.- Walker, 1856. **List Spec. Lepid. Insects Coll. Brit. Mus.** 9, 93.- Hampson, 1894. **Fauna Brit. India** 2, 275.- Hampson, 1905. **Cat. Lep. Phalaenae** 6, 547.- Franclemont, 1951. **Proc. Ent. Soc. Wash.** 53, 65, lectotype, without sex or locality, deposited in USNM.- Viette, 1951. **Bull. mens. Soc. Linnéenne Lyon** 20(7), 159; lectotype female, Montevideo, coll. Feisthamel, MNHN.

Leucania antica Walker, 1856. **List Spec. Lepid. Insects Coll. Brit. Mus.** 9, 100.- Hampson, 1894. **Fauna Brit. India** 2, 275.- Hampson, 1905. **Cat. Lep. Phalaenae** 5, 547.



Figure 5 *Mythimna (Pseudaletia) unipuncta*. a - male lectotype in dorsal view. Scale bar = 1 cm. b: male genitalia in posterior view with aedeagus in lateral view. Specimen from NHMUK 010354729. There is no scale in the genitalia.



Figure 6 *Mythimna (Pseudaletia) unipuncta*. a: female in dorsal view. Scale bar = 1 cm. b: female genitalia in ventral view. Specimen identified as *Leucania antica* at the NHMUK 010915614. There is no scale of the genitalia.

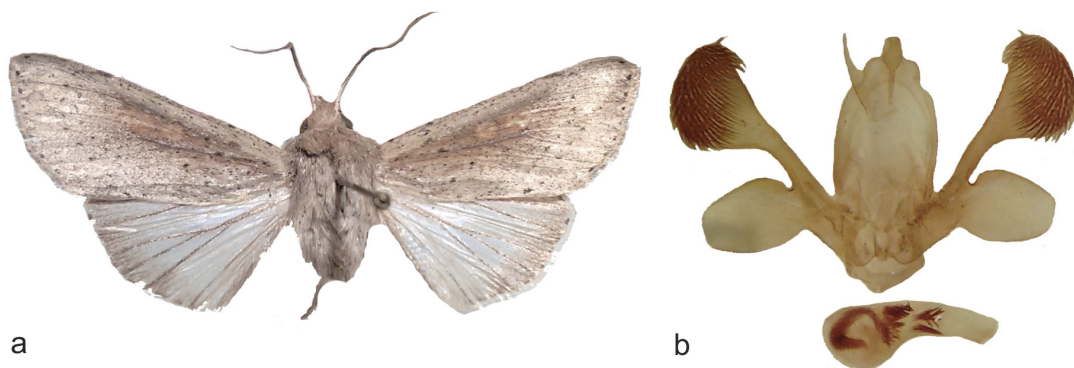


Figure 7 *Mythimna (Pseudaletia) unipuncta*. a: male in dorsal view. b: male genitalia in posterior view with aedeagus in lateral view. Holotype of *Pseudaletia roraimae* at the AMNH 29780. There are no scales.

Leucania unipuncta var. *antica*; Butler, 1890. **Trans. Ent. Soc. Lond.** **1890(4)**, 661.

Leucania unipuncta var. *extranea*; Butler, 1890. **Trans. Ent. Soc. Lond.** **1890(4)**, 662.

Cirphis unipuncta; Hampson, 1905. **Cat. Lep. Phalaenae** **5**, 547; **syn.**: *Spaelotis punctulata*, *Leucania extranea*, *Leucania antica*, *Leucania convecta*, *Leucania separata*, *Leucania consimilis*, *Leucania trifolii*, *Leucania saccharivora*, *Leucania adultera*.- Draudt, 1919. **Gross-Schmetterlinge Erde** **12**, 167; **syn.**: *Leucania extranea*, *Leucania antica*, *Leucania trifolii*, *Leucania adultera*.- Specht and Corseuil, 1996. **Biociências** **4(2)**, 146.

Leucania unipuncta [sic]; Franclemont, 1951. **Proc. Ent. Soc. Wash.** **53(2)**, 64.

Pseudaletia unipuncta; Franclemont, 1951. **Proc. Ent. Soc. Wash.** **53(2)**, 65, figs 10, 10a, 11, 11a (male gen.), 33 (female gen.); **syn.**: *Leucania extranea*.- Godfrey, 1972. **Tech. Bull.** **1450**, 86.- Nye, 1975. **Gen. Nam. Moth World** **1**, 410; lectotype male, Great Britain: [England] Anglia (BMNH).- Franclemont and Todd, 1983. **Check List Lep. Amer. N. Mexico**, 150.- Poole, 1989. **Lep. Cat. (n.s.)** **118**, **Noctuidae** **2**, 844; **syn.**: *Leucania extranea*, *Leucania antica*, *Pseudaletia unipuncta quechua*, *Leucania unipuncta tseki*.

Pseudaletia unipuncta antica; Franclemont, 1951. **Proc. Ent. Soc. Wash.** **53(2)**, 66, figs 12, 12a (male gen.), 34 (female gen.).

Pseudaletia unipuncta quechua Franclemont, 1951. **Proc. Ent. Soc. Wash.** **53(2)**, 67, figs 13, 13a (male gen.).

Pseudaletia roraimae Franclemont, 1951. **Proc. Ent. Soc. Wash.** **53(2)**, 68, figs 15, 15a (male gen.).- Poole, 1989. **Lep. Cat. (n.s.)** **118**, **Noctuidae** **2**, 844. **New synonymy**.

Leucania unipuncta tseki Koutsaftikis, 1974. **Ann. Goulandris Museum** **2**, 96.

Mythimna (Pseudaletia) roraimae; Hacker et al., 2002. **Noctuidae Europaeae** **4**, 168.

Mythimna (Pseudaletia) unipuncta; Hacker et al., 2002. **Noctuidae Europaeae** **4**, 179.

Mythimna unipuncta; Lafontaine and Schmidt, 2010. **Zookeys** **40**, 91.

Systematic history

Haworth (1809) described *Noctua unipuncta*, and later came the descriptions of *Leucania extranea* Guené, 1852 and *Leucania antica* Walker, 1856. Stephens (1829) transferred *N. unipuncta* to *Leucania*. Butler (1890) mentions *L. antica* and *L. extranea* as varieties of *L. unipuncta*. Hampson (1905) and Draudt (1919) transferred it to *Cirphis* Walker, 1865 and treat these variations, var. *saccharivora* Butler, 1882, var. *trifolii* Butler, 1882, var. *convector* Walker, 1857 and var. *separata* Walker, 1865, as synonyms of *Cirphis unipuncta*. Franclemont (1951) in a thorough study that included genitalia morphology, revealed the incorrect classification in *Cirphis*, given that the American species do not correspond to the description of this genus. Thus, Franclemont (1951) described the genus *Pseudaletia*, designating *Noctua unipuncta* as its type species; he also revalidated *Leucania antica* as a subspecies of *Pseudaletia unipuncta* and described *Pseudaletia unipuncta quechua* and *Pseudaletia roraimae*. *Leucania unipuncta tseki* was described by Koutsaftikis in 1974; this species and the above-mentioned subspecies were treated as synonyms of *Pseudaletia unipuncta* by Poole (1989), while Hacker et al. (2002) cited *unipuncta* in *Mythimna (Pseudaletia)*, and Lafontaine and Schmidt (2010) considered it in *Mythimna*.

Type material

Noctua unipuncta Haworth, 1809. Described from Anglia (England) without any mention of the number of specimens and sex. Lectotype

designated by Nye (1975) and deposited at the NHMUK, with the following labels: /NHMUK010354729/ Stainton Coll. 1893-134./ Type/ Agrotidae genitalia slide No. 896 ♂/ *unipuncta* [illegible]/.

Leucania extranea Guené, 1852. Described from North America, Brazil, Colombia, etc. (several collections), Java [Oceania], East Indies (Collections of the India Company), and Nouvelle Hollande [New York] (M.N. [MNHN]) without any mention of the number of specimens or their sex. Two lectotypes have been designated for this taxon, one by Franclemont (1951, published on April), without sex or locality, with the number 60993 and deposited at the USNM. The other was designated by Viette (1951, published on September); it is a female from Montevideo [Uruguay], from Feisthamel collection, deposited at the MNHN. Thus, the first designation is valid, confirming what had already been said by Poole (1989). The lectotype designated by Franclemont (1951) was not found in the above-mentioned collection (Paul Goldstein, curator of the collection, personal communication, 2018).

Leucania antica Walker, 1856. Described from the West Coast of the United States, without any mention of the number of specimens or their sex (NHMUK). Hampson (1905) cited 4 ♀ [syn]types from Venezuela deposited at the NHMUK; however, these specimens cannot belong to the type series, since they are not from the type locality. The series of syntypes from the West Coast of the US has not been found, rendering a lectotype designation impossible. In case its existence cannot be attested, a neotype should be designated.

Pseudaletia unipuncta quechua Franclemont, 1951. Subspecies described based on the male holotype from Incachaca, Cochabamba, Bolívia, a male from Napo, Ecuador, another male from Env[iron]. d'Ambato, Ecuador, two males and four females from Aqualani, Carabaya, Peru. Male holotype collected by J. Steinbach [leg], Type N°. 60994, deposited at the USNM with the following labels: /Incachaca Cochabamba Bolivia JSteinbach/ Collection WmSchaus/ ♂ Genitalia Slide: USNM 1182 J. G. Franclemont/ HOLOTYPE *Pseudaletia unipuncta quechua* J. G. Franclemont/ USNM (QRcode) 00973212/.

Pseudaletia roraimae Franclemont, 1951. Species described based on the male holotype from Monte Roraima, [Uiramutã], Roraima, Brazil, deposited at the AMNH, with the following labels: /Mt. Roraima, Brazil Alt. Summit 8860 No. 1927/ Acc. 29780 Tate No./ ♂ Genitalia Slide A-69 J.G. Franclemont/ HOLOTYPE *Pseudaletia roraimae* J.G. Franclemont/. / NO. A-69 TYPE *Pseudaletia roraimae* Braz[il]. Franc[lemont]. DATE 19 Jan 1951 J.G. FRANCLEMONT/.

Leucania unipuncta tseki Koutsaftikis, 1974. Subspecies described based on the male [holotype] from de Simi, Greece, deposited at the Goulandris Museum, Greece. The [holotype] could not be found (Maria Dimaki, curator of the collection, personal communication, 2018).

Diagnosis

Both sexes with beige or orange-beige forewings, mixed with dark scales. In males, cucullus with a straight dorsal margin, usually ending in a distal process; vesica with a basal diverticulum, bearing more than four cornuti, all closely positioned, the distalmost cornutus being thinner and longer.

Description

MALE. *Head*: Beige or orange-beige, mixed with dark scales of different hues. Eyes brown and pilose. Antenna beige dorsally and brown ventrally, both surfaces bearing microsetae. *Thorax*: Ground color as head; patagium with dark subapical line. Forewing: length 2cm (n=1). Ground color beige to orange-beige, mixed with dark scales of different hues, postmedial line as dark spots over the veins and terminal line

as dark spots between veins, other transversal lines absent; with an oblique line of dark scales from the apex to M_2 , rarely with an anterior area lighter than ground color; a dark patch with a spot of central white scales next to the bases of M_2 and M_3 ; dark patch over cubital vein absent in most specimens; orbicular and reniform spots circular, inconspicuous, orange with smooth darker center; subterminal area of the wing with white or light beige scales over the veins; fringe beige with dark medial and terminal lines. Hindwing: pale, with a marginal brown shading toward the base; fringe pale. *Abdomen*: Dorsally greyish-beige; ventral view as head, with two black transversal lines subventral. Genitalia: Tegumen and uncus fused, the former wider than base of uncus, ventral arms robust in posterior view, covered with setae near the articulation with the dorsal arm of saccus. Saccus round and bent toward the ventral arm of the tegumen, with an irregular distal portion, twisted toward its inner surface. Uncus elongated, flat and bent ventrally, widened on medial area, apical half abruptly narrowed to 1/5-1/6 of its width, covered with setae dorsally. Valva subtriangular; sacculus projected ventrally, forming an oval lobe; cucullus elongated, with a straight dorsal margin and usually ending in a distal process; distal portion lobate, corona present, with multiple rows of spines; clasper short; ampulla distinct, as a small ear-shaped dorsal projection; digitus slim, as long as clasper. Fultura inferior (=juxta) subtriangular, with approximately one third the length of the ventral arm of the tegumen and thrice as long as its smallest width, distal portion bifid. Aedeagus pipe-shaped; vesica tubular and elongate, with a continuous band of cornuti from posterior the diverticulum to subapical area, basal diverticulum elongate, with over four closely arranged cornuti, the distalmost thinner and longer than the others.

FEMALE. Similar to male. Forewing length 1.8cm (n=1). *Abdomen*: Genitalia almost totally sclerotized. Eighth tergite straight and narrow. Papilla analis subtriangular covered with setae. Lamella antevaginalis subrectangular. Ductus bursae sclerotized and with a wide fold at the last portion, which leads to appendix bursae; corpus bursae membranous and round; appendix bursae more than twice as long as ductus bursae, with its same width, sclerotized basally and with membranous apex. Ductus seminalis originating on appendix bursae apex.

Geographic distribution

Northern **U.S.A.** to North **Brazil** (Roraima), South and Southwest **Europe**, Western **Asia**, and **Central Africa** (Franclemont, 1951; Capinera, 2006).

Host plants

Native and cultivated grass (Poaceae) such as barley, corn, rye, oat, rice, sugar cane, sorghum, and wheat, but there are cases of damage to other cultures such as carrot, bean, cabbage, celery, cucumber, sweet potato, pepper, and watermelon (Capinera, 2006).

Discussion

Mythimna (P.) unipuncta, restricted to the extreme North of Brazil, is similar to *Mythimna (P.) sequax*, widely distributed in the country (Madruga et al., 2019). However, both species are easily distinguished from each other through the exam of their genitalia, especially male genitalia. The former species differs in the basal diverticulum, which bears a sequence with more than four closely arranged cornuti, while in *Mythimna (P.) sequax* it usually has one cornutus, rarely more, up to four. Yet, misidentifications are common in Brazilian collections,

and all the revised records are of *Mythimna (P.) sequax* or, still, of *Mythimna (P.) celiae* **sp. nov.**

Pseudaletia roraimae **syn. nov.** has the male genitalia very similar to that of *Mythimna (P.) unipuncta*, and according to Franclemont (1951), the difference between them is represented by the robustness of the genitalia of *P. roraimae*. However, considering that the species was described based on a single male from Monte Roraima, [Uiramutã], Brazil, and no other specimen could be found in either the examined collections or the material collected, including that collected close to the type locality (Alto Alegre - Roraima), we opted for synonymizing it under *Mythimna (P.) unipuncta*.

The original description of *Leucania extranea* Guenée, 1852 mentions that it occurs in Brazil; however, since this material could not be found and given that there was no mention to the specific collecting site, the distribution of *Mythimna (P.) unipuncta* in the country is restricted to the information of *Mythimna (P.) roraimae*.

Material examined

Images of the wings and genitalia of the lectotype of *Mythimna (P.) unipuncta*, of the "syntype" of *Leucania antica*, with the following labels: /NHMUK 010915614/ Type/ Agrotidae genitalia slide No 852/ Venezuela 47-9./ 52. *Leucania antica*./ and of the holotype of *Pseudaletia roraimae*, in addition to the illustrations in Franclemont (1951) and molecular data from Bold Systems.

Mythimna (Pseudaletia) adultera (Schaus, 1894) (Figs. 8, 9)

Leucania adultera Schaus, 1894. **Trans. Amer. Ent. Soc.** **21**, 232.- Hampson, 1905. **Cat. Lep. Phalaenae** **5**, 547.- Specht and Corseuil, 1996. **Biociências** **4(2)**, 146; inv., syst.

Cirphis unipuncta [misidentifications]; Biezanko *et al.*, 1949. **Agros** **2(3)**, 196; inv., host plant.- Biezanko and Bertholdi, 1951. **Agron.** **10(4)**, 244; **syn.**: *Cirphis extranea*, *Cirphis antica*, *Cirphis trifolii*; inv., host plant.- Bertels, 1956. **Ent. Agric. Sul-Brasileira**, 346; fig. 193 (egg, larva, pupa); morph., host plant.- Bertels and Baucke, 1966. **Pesq. agropec. bras.** **1**, 30; inv., host plant.- Specht and Corseuil, 1996. **Biociências** **4(2)**, 146; inv., syst.

Pseudaletia adultera; Franclemont, 1951. **Proc. Ent. Soc. Wash.** **53(2)**, 69, figs 16, 16a (male gen.), 36 (female gen.); syst.- Treat, 1966. **Jour. N. Y. Ent. Soc.** **74(3)**, 157 parasit.- Silva *et al.*, 1968. **Quarto Cat. Ins. Viv. Plantas Brasil** **2(1)**, 231; apl., host plant, inv., parasit.- Biezanko and Ruffinelli, 1971. **Centro Invest. Sanid. Veg. Montevideo, Ser. Zool. Agric., Publ. Técn.** **2**, 16-17; apl., host plant, inv., parasit.- Casella and Moratoria, 1971. **Rev. peruan. Ent.** **14(2)**, 259, figs 1-4 (pupa), 5-8 (larva); host plant.- Carvalho *et al.*, 1971. **Rev. Centro Ciências Rurais** **1(3)**, 17.- Morey, 1971. **Rev. peruan. Ent.** **14(2)**, 263.- Biezanko *et al.*, 1974. **Rev. Centro Ciências Rurais** **4(2)**, 118; host plant.- Corseuil and Cruz, 1975. **Rev. Faculdade de Agronomia UFRGS** **1(1)**, 19; inv.- Tarragó *et al.*, 1975. **Rev. Centro de Ciências Rurais** **5(2)**, 125; inv.- Link, 1977. **Rev. Centro de Ciências Rurais** **7(4)**, 331; inv.- Chiang, 1978. **Ann. Rev. Ent.** **23**, 105; apl., host plant.- Zerbino *et al.*, 1983. **Investig. Agron.** **4**, 20; apl.- Poole, 1989. **Lep. Cat. (n.s.)** **118, Noctuidae** **2**, 843.- Rizzo and La Rossa, 1991. **Rev. Fac. Agron.** **12(1)**, 39, figs 2 (male and female, pupa), 3 (male gen.); biol.- Zerbino, 1991. **INIA, Sér. Téc.** **9**, 1, figs 1 (larva), 2 (adult); biol., apl.- Igarzábal *et al.*, 1994. **Gayana Zool.** **58(2)**, 108, fig. 81 (larva); key.- Zerbino, 1994. **INIA, Sér. Téc.** **47**, 1; biol.- Specht and Corseuil, 1996. **Biociências** **4(2)**, 146; inv., syst.- Matrangolo *et al.*, 1997. **Pesq. agropec. bras.** **32(8)**, 777; host plant.- Ferreira, 1998. **Manual de Identificação de Pragas do Arroz, EMBRAPA**, 80, figs 74 (adult), 76 (larva); biol.- Specht and Corseuil, 2002b. **Rev. Bras. Zool.** **19(Supl.1)**, 286; inv.- Specht *et al.*, 2004. **R. Bras.**

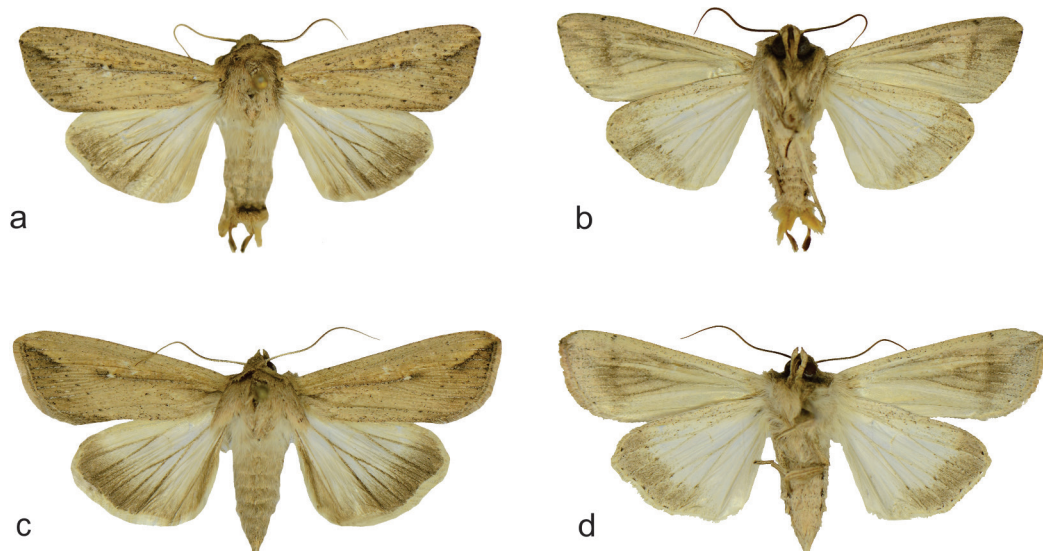


Figure 8 *Mythimna (Pseudaletia) adultera*. a-b, male in dorsal and ventral views; c-d, female in dorsal and ventral views. Specimen deposited at the DZUP. Scale bar = 1 cm.

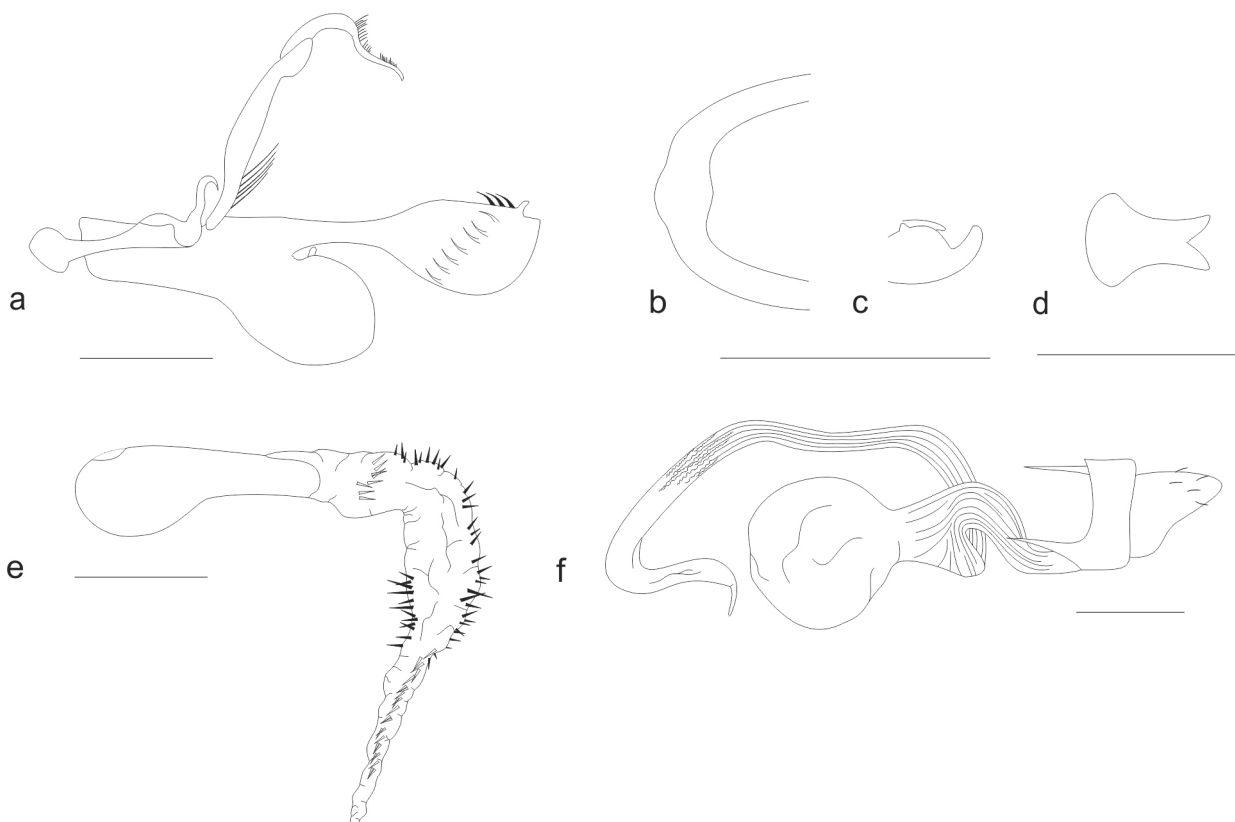


Figure 9 *Mythimna (Pseudaletia) adultera*. a, male genitalia in left lateral view; b, saccus in dorsal view; c, detail of the ampulla, digitus and clasper of the right valva in inner view; d, fultura inferior in dorsal view; e, aedeagus in left lateral view with everted vesica; f, female genitalia in left lateral view. Scale bars = 1 mm.

Agrociências 10(4), 398; inv., host plant.- Barnes and Convey, 2005. **Antartic Science** 17(3), 307; geogr. distr.- Specht et al., 2005. **Rev. Bras. Ent.** 49(1), 136; inv.- Fritz et al., 2008. **Oecol. Bras.** 12(4), 723; apl., host plant.- Hernandez et al., 2011. **Zootaxa** 2936, 11; parasit.- Fritz et al., 2013. **Intern. Jour. Trop. Ins. Sci.** 33(3), 179; apl.

Mythimna adultera; Zerbino, 1984. **Investig. Agron.** 5, 17; biol.- Terra and Zerbino, 1986. **Investig. Agron.** 6, 49; biol.- Fernandes et al., 2014. **EntomoBrasilis** 7(2), 128; parasit.

Pseudaletia [sic] adultera; Specht and Corseuil, 1996. **Biociências** 4(2), 146; inv., syst.

Mythimna (Pseudaletia) adultera; Hacker et al., 2002. **Noctuidae Europaeae** 4, 168.- Soria and DeGrande, 2011. **Rev. Bras. Milho e Sorgo** 10(2), 103; inv.

Systematic history

Leucania adultera was transferred to *Pseudaletia* by Franclemont (1951), and so far, it has been most often cited in this combination. Zerbino (1984) and Terra and Zerbino (1986) mention it in *Mythimna*.

Type material

Leucania adultera Schaus, 1894. Species described without any mention of the number of specimens or their sex. There is a male syntype from Castro, Paraná, Brazil, deposited at the USNM, with the following labels: /Castro. Paraná./ Collection WmSchaus/ *Leucania unipuncta* Haw./ *Leucania adultera* Type, Schs./ ♂ Genitalia Slide: USNM 1178 J. G. Franclemont/ Type No. 11175 U.S.N.M./ In order to guarantee the correct identification of the species, this specimen is here designated as the lectotype, and the following labels will be added to it: /Lectotypus/ Lectotypus *Leucania adultera* Schaus, 1894. Madruga, Specht, San Blas, Mielke & Casagrande det. 2022/. These labels will be sent to the Lepidoptera curator of the referred museum.

Diagnosis

Both sexes with greyish-beige forewings, usually mixed with dark scales and with a patch of dark scales over the cubital vein. In males, cucullus with a protuberant dorsal margin, ending in a truncate ventral process, ampulla absent (as a tiny ear-shaped dorsal projection on some specimens), digitus slim, half as long as clasper; vesica with basal diverticulum absent.

Description

MALE. *Head:* Greyish-beige, usually mixed with dark scales of different hues. Eyes brown, pilose. Antenna filiform, triangular in cross section, covered dorsally with beige scales, ventrally naked, with tiny chemoreceptive trichoid sensilla, more concentrated in the central part of the antennomer, and with longer lateral chemoreceptive trichoid sensilla, almost as long as antennomer width. *Thorax:* Ground color as head; patagium with dark subapical line. Forewing: length 1.6-1.8cm (n=29). Ground color greyish-beige, thickly mixed with dark scales of different hues; postmedial line as dark spots over the veins and terminal line as dark spots between veins, other transversal lines absent; with an oblique line of dark scales from the apex to M_2 , usually with an anterior area lighter than ground color; a dark patch with a spot of white central scales near the base of M_2 and M_3 , undifferentiable in some specimens; and a dark long patch usually covering cubital vein; orbicular and reniform spots circular, inconspicuous, orange with smooth darker center; subterminal area of the wing with white or light beige scales over the veins; fringe beige with dark medial and terminal lines. Hindwing pale, with a marginal brown shading toward the base, fringe pale. *Abdomen:* Greyish-beige in dorsal view; ventral view as head, with two black transversal lines subventral. Genitalia: Tegumen and uncus fused, the former wider than the base of uncus; ventral arms robust in posterior view, covered with setae near the articulation with the dorsal arms of saccus. Saccus round and bent towards the ventral arm of tegumen, irregular distally, twisted toward the inner surface. Uncus

elongated, flat and bent ventrally, widened on medial area, apical half abruptly narrowed to 1/6-1/7 of its width, covered with setae dorsally. Valva subtriangular; sacculus projected ventrally, forming an oval lobe; cucullus elongated, with dorsal margin protuberant and ending in a wide, single, truncated distal process, distal portion lobate, corona present, with multiple rows of spines; clasper short; ampulla absent on most specimens, as a tiny ear-shaped dorsal projection rarely; digitus slim, half as long as clasper. Fultura inferior (=juxta) subrectangular, approximately half the length of the ventral arms of tegumen and twice as long as its smallest width, distal portion bifid. Aedeagus pipe-shaped; vesica tubular, wide in basal third then abruptly narrowed to half its width and slightly widened apically, with a continuous band of cornuti, beginning in the right basal area, turning to the left dorsally, almost completing a spin, then in an almost straight line to the subapical area, subbasal cornuti larger than the others, basal diverticulum absent.

FEMALE. Similar to male, but antenna with tiny chemoreceptive trichoid sensilla only, longer lateral chemoreceptive trichoid absent and forewing less densely mixed with dark scales, which gives it a more "clean" and smooth appearance. Forewing length 1.3-2cm (n=35). *Abdomen:* Genitalia almost entirely sclerotized. Eighth tergite narrow and straight. Papilla analis subtriangular and covered with setae. Lamella antevaginalis subrectangular. Ductus bursae sclerotized, with a wide fold at its final portion leading to appendix bursae; corpus bursae membranous and round; appendix bursae more than twice the length of ductus bursae and half its width, sclerotized basally and with membranous apex. Ductus seminalis originating on appendix bursae apex.

Geographic distribution

Paraguay, Uruguay, Northern Argentina (Franclemont, 1951), and central Argentina (San Blas et al., 2021). **Brazil:** *Paraná:* Tibagi, Castro, Ponta Grossa, Quatro Barras, and Morretes; *Santa Catarina:* Seara; *Rio Grande do Sul:* Barracão, Rondinha, Alegrete, Santa Maria (Carvalho et al., 1971; Specht et al., 2004; Specht et al., 2005), Iraí, Passo Fundo, Vacaria, São José dos Ausentes, Bento Gonçalves, Salvador do Sul, Cachoeira do Sul, Encruzilhada do Sul, Tavares, Bagé, and Pelotas.

Host plants

Native and cultivated grasses such as oat, barley, canary grass, annual ryegrass, rye, wheat, corn, rice, sword grass and other grasses (Biezanko and Ruffinelli, 1971; Casella and Moratoria, 1971; Biezanko et al., 1974; Chiang, 1978; Matrangolo et al., 1997; Pastrana, 2004; Specht et al., 2004; Fritz et al., 2008).

Discussion

Mythimna (P.) adultera is usually smaller and greyer than the other species. The patch of dark scales over the cubital vein on the dorsal forewing is a determining character in both sexes, but it is not always clear, especially in females. The male genitalia is the most characteristic structure that allows the undoubted differentiation among all other South American species of the genus, in which the dorsal margin of cucullus is protuberant, the uncus and fultura inferior wider than in the other species and the vesica is tubular, without diverticulum, being the only species lacking this structure.

Material examined

BRAZIL - **Paraná: Morretes** - Parque Estadual Pico Marumbi, Pedra Lascada, 25°26'18.4"S, 48°55'09.6"W, 510m, 1 male, 2 females, 29-IX-3-X-2013, Silva *leg.*, (MZUSP); **Quatro Barras** - Banhado, 800m, 1 female, 30-X-1970, Becker & Laroca *leg.*, DZ 37.872 (DZUP); **Tibagi** - Parque Estadual do Guartelá, 24°33'44"S, 50°15'33"W, 950-1000m, 1 male, 25-27-VII-2017, Dantas, Dias, Dolibaina & Queiroz-S[antos] *leg.*, DZ 37.871 (DZUP). - **Santa Catarina: Seara** - Nova Teutônia, 27°11'S, 52°23'W, 300-500m, 1 male, V-1976, Fritz Plaumann *leg.*, DZ 37.895 (DZUP). - **Rio Grande do Sul: Bagé** - 31°21'4.94"S, 54°1'12.51"W, 232m, 1 female, 5-XII-2015, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert *leg.*, (CPAC), 1 female, 3 males, 2-II-2016, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert *leg.*, DZ 39.978 (DZUP, CPAC), 2 females, 4-II-2016, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert *leg.* (CPAC), 2 males, 6-II-2016, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert *leg.*, DZ 39.979 (DZUP, CPAC), 1 female, 2 males, 8-III-2016, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert *leg.*, DZ 39.976 (DZUP, CPAC), 1 male, 1 female, 14-IV-2016, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert *leg.* (CPAC), 1 male, 4-V-2016, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert *leg.*, DZ 37.896 (DZUP), 1 female, 25-XI-2016, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert *leg.* (CPAC), 1 male, 6-XII-2015, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert *leg.*, DZ 37.898 (DZUP), 31°18'57.08"S, 53°59'52.91"W, 242m, 1 male, 7-X-2015, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert *leg.*, DZ 37.893 (DZUP), 1 female, 2 males, 6-XII-2015, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert *leg.* (CPAC), 1 male, 7-XII-2015, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert *leg.*, DZ 37.870 (DZUP), 2 females, 11-III-2016, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert *leg.*, DZ 39.977 (DZUP, CPAC); **Bento Gonçalves** - 1 male, 19-IV-2004, Specht *leg.* (CEUCS); **Cachoeira do Sul** - 1 female, 21-V-1998, Specht *leg.*, 11558 (MCTP); **Encruzilhada do Sul** - 400-500m, 2 females, 2-3-XI-2000, A. Moser *leg.* (CLAM); **Iraí** - 1 female, 20-X-1998, J. A. Teston *leg.*, 11562 (MCTP); **Passo Fundo** - 28°13'50.67"S, 52°24'17.04"W, 671m, 1 male, 11-X-2015, P. R. V. S. Pereira *leg.*, DZ 37.900 (DZUP), 1 male, 8-XI-2015, P. R. V. S. Pereira *leg.* (CPAC), 1 female, 9-XI-2015, P. R. V. S. Pereira *leg.* (CPAC), 28°13'35.88"S, 52°24'13.05"W, 682m, 2 females, 9-X-2015, P. R. V. S. Pereira *leg.* (CPAC), DZ 37.892 (DZUP), 1 female, 11-X-2015, P. R. V. S.

Pereira *leg.*, DZ 37.877 (DZUP), 1 male, 14-II-2016, P. R. V. S. Pereira *leg.*, DZ 37.901 (DZUP), 2 females, 8-III-2016, P. R. V. S. Pereira *leg.* (CPAC), 1 female, 1 male, 10-III-2016, P. R. V. S. Pereira *leg.* (CPAC), 1 male, 11-III-2016, P. R. V. S. Pereira *leg.* (CPAC), 1 female 4-IV-2016, P. R. V. S. Pereira *leg.*, DZ 37.869 (DZUP), 1 female, 1-VI-2016, P. R. V. S. Pereira *leg.*, DZ 37.897 (DZUP); **Pelotas** - 1 female, 21-I-1951, C. Biezanko *leg.* (MECB), 1 female, 11-IX-1951, C. Biezanko *leg.* (MECB), 2 females, I-1954, ex. coll. F. Justus, DZ 37.874, DZ 37.873 (DZUP), 1 male, 6-XII-1957, J. Lucia Mantovani & C. Biezanko *leg.* (MECB); **Salvador do Sul** - 1 female, 14-IX-1995, A. Specht *leg.*, 4494 (MCTP), 2 males, 3 females, 4-XI-1997, A. Specht, 11560, 11569, 11563, 11568, 11564 (MCTP); **São José dos Ausentes** - Silveira, 1200m, 1 male, 28-31-I-2000, A. Moser *leg.*, 1769 (CLAM), Fazenda Potreirinhos, 1200m, 1 male, 5-7-XI-2004, A. Moser *leg.* (CLAM); **Tavares** - 1 female, 29-X-2010, ex larvae (CEUCS); **Vacaria** - 1 female, 19-III-2009, A. C. Formentini *leg.* (CEUCS).

Mythimna (Pseudaletia) sequax Franclemont, 1951 (Figs. 10, 11)

Pseudaletia sequax Franclemont, 1951. **Proc. Ent. Soc. Wash.** **53**(2), 70, figs 18, 18a (male gen.) e 38 (female gen.) - Biezanko and Ruffinelli, 1971. **Centro Invest. Sanid. Veg. Montevideo, Ser. Zool. Agric., Publ. Técn.** **2**, 17; apl., host plant., inv., parasit.- Carvalho *et al.*, 1971. **Rev. Centro Ciências Rurais** **1**(3), 17; inv.- Biezanko *et al.*, 1974. **Rev. Centro Ciências Rurais** **4**(2), 118; host plant.- Hayes, 1975. **Proc. Calif. Acad. Sci.** **40**(7), 150, fig. 44 (male dorsal); syst.- Chang and Sales, 1977. **J. Insect Physiol.** **23**, 159; biol.- Franclemont and Todd, 1983. **Check List Lep. Amer. N. Mexico**, 150.- Gonçalves, 1985. **Rev. Bras. Ent.** **29**, 31, figs 1, 2 (digestive tube); morph. - Poole, 1989. **Lep. Cat. (n.s.)** **118**, **Noctuidae** **2**, 844.- Buainain and Silva, 1990. **Pesqui. Agropecu. Bras.** **25**(2), 229; biol., host plant.- Salvadori and Parra, 1990a. **Pesqui. Agropecu. Bras.** **25**(12), 1693; apl., biol.- Salvadori and Parra, 1990b. **Pesqui. Agropecu. Bras.** **25**(12), 1679; apl., biol.- Salvadori and Parra, 1990c. **Pesqui. Agropecu. Bras.** **25**(12), 1701; apl., biol.- Dickel, 1991. **Tropical Lep.** **2**(1), 57, fig. 26 (male); geogr. distr.- Frank and McCoy, 1992. **Florida Entomologist** **75**(1), 12; geogr. distr.- Giannotti *et al.*, 1995. **An. Soc. Ent. Brasil** **24**(3), 460; parasit.- Foerster, 1996. **An. Soc. Ent. Brasil** **25**(1), 27; biol.- Specht and Corseuil, 1996. **Biociências** **4**(2), 146; inv., syst.- Matrangolo *et al.*, 1997. **Pesqui. Agropecu. Bras.** **32**(8), 773; host plant.- Polaszek and Foerster, 1997. **An. Soc. Ent. Brasil**

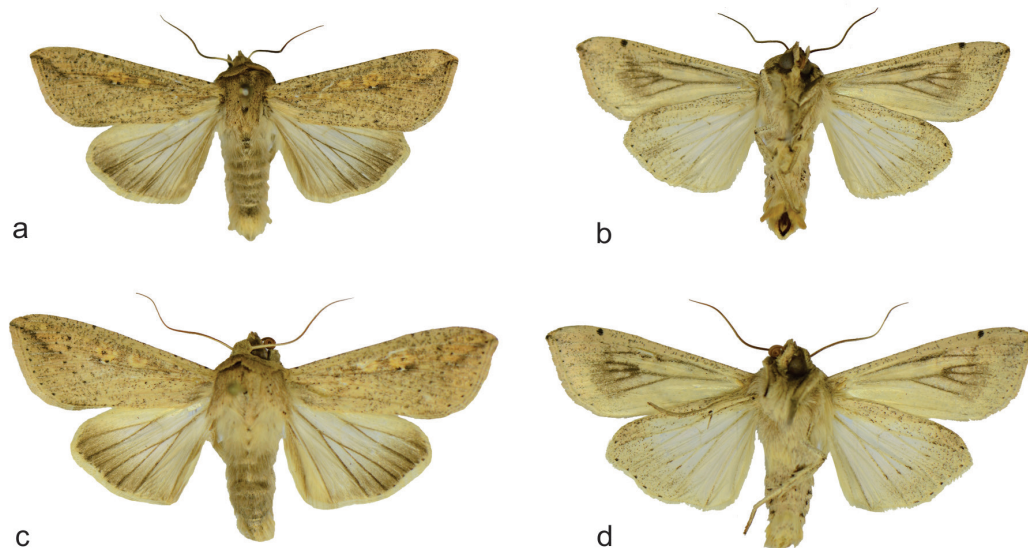


Figure 10 *Mythimna (P.) sequax*. a-b: male (DZ 39.925) in dorsal and ventral views; c-d: female (DZ 39.926) in dorsal and ventral views. Specimen deposited at the DZUP. Scale bar = 1cm.

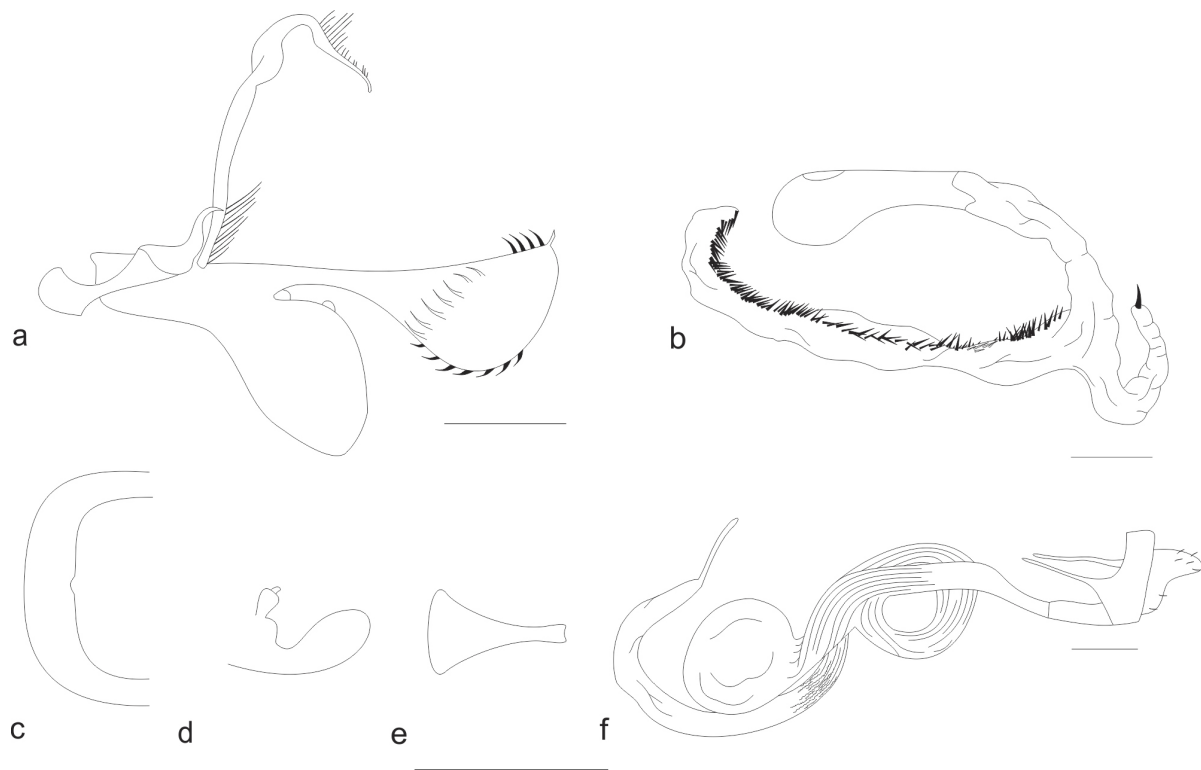


Figure 11 *Mythimna (P) sequax*. a, male genitalia in left lateral view; b, aedeagus in left lateral view with the vesica everted; c, saccus in dorsal view; d, detail of the ampulla, digitus and clasper of right valva in inner view; e, futura inferior in dorsal view; f, female genitalia in left lateral view. Scale bars = 1 mm.

26(1), 180; parasit.- Doetzer and Foerster, 1998. **An. Soc. Ent. Brasil** **27(2)**, 255; apl., parasit.- Ferreira, 1998. **EMBRAPA-CNPAF**, 80, figs 73 (adult), 75 (larva); apl.- Fontana et al., 1998. **Appl. Biochem. Biotech.** **70-72**, 74; apl.- Yamamoto et al., 1998. **Acta Biol. Par.** **27(1-4)**, 85; parasit.- Foerster et al., 1999a. **An. Soc. Ent. Brasil** **28(2)**, 243-249; apl., parasit.- Foerster et al., 1999b. **An. Soc. Ent. Brasil** **28(3)**, 485; apl., parasit.- Specht and Corseuil, 2002a. **Pesqui. Agropecu. Bras.** **37(1)**, 1; inv., host plant.- Specht and Corseuil, 2002b. **Rev. Bras. Zool.** **19(Supl.1)**, 286; inv.- Bittencourt et al., 2003. **Arq. Inst. Biol.** **70(1)**, 86; inv.- Ohashi and Urdampilleta, 2003. **RIA** **32(2)**, 121; ecol., parasit.- Specht et al., 2004. **R. Bras. Agrociencia** **10(4)**, 398; inv., host plant.- Specht et al., 2005. **Rev. Bras. Ent.** **49(1)**, 136; inv.- Grego et al., 2006. **Sci. Agric.** **63(4)**, 321; ecol., apl., host plant.- Torres et al., 2006. **CAB Reviews** **1(15)**, 5; apl.- Almeida et al., 2008. **Ethol.** **114**:449; biol.- Fritz et al., 2008. **Oecol. Bras.** **12(4)**, 723; apl., host plant.- Pereira et al., 2008. **Braz. Arch. Biol. Technol.** **51(2)**, 259, fig. 1b (parasitismo).- Conceição and Silva, 2011. **Campo Digit@l** **6(1)**, 23; apl.- Marchioro and Foerster, 2012a. **Agr. For. Entomol.** **14**, 29; apl., biol., host plant.- Marchioro and Foerster, 2012b. **Neotrop. Entomol.** **41**, 288; apl., biol.- Queiroz et al., 2012. **Rev. Bras. Zootec.** **41(2)**, 273; host plant.- Fritz et al., 2013. **Inter. Jour. Trop. Ins. Sc.** **33(3)**, 179; apl.- Almeida et al., 2014. **Braz. J. Biol.** **74(4)**, 985; inv.- Foerster et al., 2015. **BioControl** **60**, 9; apl., parasit.

Cirphis sequax; Corseuil and Cruz, 1975. **Rev. Facul. Agron. UFRGS** **1(1)**, 19; inv.- Specht and Corseuil, 1996. **Biociências** **4(2)**, 146; inv., syst.

Mythimna (Pseudaletia) sequax; Foerster et al., 2001. **Acta Biol. Par.** **30(1-4)**, 139; apl., parasit.- Foerster and Doetzer, 2002. **Neotrop. Ent.** **31(3)**, 405; apl., parasit.- Hacker et al., 2002. **Noctuidae Europaeae** **4**, 168.- Foerster and Doetzer, 2003. **Neotrop. Ent.** **32(1)**, 81; apl., parasit.- Yamamoto and Foerster, 2003. **Neotrop. Ent.** **32(3)**, 481; parasit.- Barbut and Lalanne-Cassou, 2010. **L'Ent.** **66(3)**, 117, figs 3, 4 (male, female), 6, 8 (male and female gen.); syst.- Soria and DeGrande, 2011. **Rev. Bras. Milho Sorgo** **10(2)**, 96; inv., host plant.

Mythimna sequax; Lafontaine and Schmidt, 2010. **Zookeys** **40**, 91; syst.- Bortolotto et al., 2015. **Cienc. Rural** **45(12)**, 2121; host plant.

Systematic history

Described in *Pseudaletia* by Franclemont (1951), as it has been most often cited until now.

Type material

Pseudaletia sequax Franclemont, 1951. Species described based on the male holotype from Jalapa, Veracruz, Mexico, deposited at the USNM, with the following labels: /Jalapa, Mex[jico], W. Schaus. / HOLOTYPE *Pseudaletia sequax* J. G. Franclemont/ USNMMENT 00973327/.

Diagnosis

Both sexes with forewings beige or orange-beige, mixed with dark scales similar to those of *Mythimna (P.) unipuncta*, differing from the latter in the genitalia. In males, the distal third of the cucullus with dorsal margin bent toward the dorsum, ending in a unique scythe-shaped distal process, vesica with basal diverticulum bearing one apical cornutus, rarely up to four cornuti apart from each other.

Description

MALE. *Head*: From beige to orange-beige, mixed with dark scales of different hues. Eyes brown, pilose. Antenna filiform, triangular in cross section, covered dorsally with beige scales, ventrally naked,

with tiny chemoreceptive trichoid sensilla, more concentrated in the central part of the antennomer, and with longer lateral chemoreceptive trichoid sensilla, almost as long as antennomer width. *Thorax*: Ground color as head; patagium with dark subapical line. Forewing: length 1.5-2.2cm (n=51). Ground color from beige to orange-beige, mixed with dark scales of different hues; postmedial line as dark spots over the veins and terminal line as dark spots between veins, other transversal lines absent; with an oblique line of dark scales from the apex to M_2 ; a dark patch with a spot of central white scales next to the bases of M_2 and M_3 ; dark patch covering cubital veins absent on most specimens orbicular and reniform spots circular, inconspicuous, orange with smooth darker center; subterminal area of the wing with white or light beige scales over the veins; fringe beige with dark medial and terminal lines. Hindwing pale, with marginal brown shading toward the base, fringe pale. *Abdomen*: Greyish-beige dorsally; ventrally as head, with two black transversal lines subventral. Genitalia: Tegumen and uncus fused, the former wider than the base of uncus; ventral arms slim in posterior view, covered with setae near the articulation with the dorsal arm of saccus. Saccus bent toward the ventral arms of the tegumen, irregular distally, twisted toward its inner surface. Uncus elongated, flat, and bent ventrally, widened on medial area, apical half abruptly narrowed to 1/5-1/6 of its width, covered with setae dorsally. Valva subtriangular; sacculus projected ventrally, forming an oval lobe; cucullus elongated, apical third with the dorsal margin bent dorsally and ending in a unique scythe-shaped distal process, corona present, with multiple rows of spines; clasper long and oval; ampulla distinct as a digitiform posterior projection; digitus slim, one third or less as long as clasper. Fultura inferior (=juxta) subtriangular, approximately one third the length of the ventral arms of the tegumen and approximately seven times as long as its smallest width, distal portion bifid. Aedeagus pipe-shaped; vesica tubular and elongate, of similar width throughout its length, with a continuous band of cornuti from the opposite side of the diverticulum to subapical area, basal diverticulum elongate, with a single cornutus, rarely with two, three, or four cornuti spaced among them.

FEMALE. Similar to male, but antenna with tiny chemoreceptive trichoid sensilla only, longer lateral chemoreceptive trichoid absent. Forewing length 1.6-2.2cm (n=40). *Abdomen*: Genitalia almost entirely sclerotized. Eighth tergite straight and narrow. Papilla analis subtriangular covered with setae. Lamella antevaginalis subrectangular. Ductus bursae sclerotized, with a narrow bifurcation at its middle portion, conducting to appendix bursae; corpus bursae membranous and round; appendix bursae with approximately twice the length of ductus bursae, but with the same width; sclerotized basally and with membranous apex. Ductus seminalis originating on appendix bursae apex.

Geographic distribution

Mythimna (P.) sequax is common in the American tropics and subtropics, occurring from Southern **U.S.A.** to Northern **Argentina** (Franclemont, 1951) and **Uruguay** (Biezanko and Ruffinelli, 1971). In **Brazil**, there are records for most states: *Roraima*: Alto Alegre; *Acre*: Rio Branco; *Mato Grosso*: Sinop; *Mato Grosso do Sul*: Chapadão do Sul and Miranda; *Tocantins*: Porto Nacional; *Distrito Federal*: Planaltina; *Pernambuco*: Petrolina; *Bahia*: Correntina and São Desidério; *Minas Gerais*: Santana do Riacho and Uberaba; *Espírito Santo*: Alegre and Domingos Martins; *Rio de Janeiro*: Cachoeiras de Macacu, Itatiaia, Petrópolis and Rio de Janeiro; *São Paulo*: Cajati, Campos do Jordão, Jundiá and São Bernardo do Campo; *Paraná*: Cornélio Procópio, Curitiba, Londrina, Morretes, Ponta Grossa and Quatro Barras; *Rio Grande do Sul*: Bagé, Passo Fundo, Salvador do Sul and Vacaria.

Host plants

Native and cultivated grasses (Poaceae) such as rice, oat, barley, wheat, corn, canary grass, annual ryegrass, rye, sugar cane, sword grass and other grasses (Biezanko et al., 1974; Buainain and Silva, 1990; Matrangolo et al., 1997; Specht and Corseuil, 2002a; Specht et al., 2004; Fritz et al., 2008; Bortolotto et al., 2015).

Discussion

The coloration of *Mythimna (P.) sequax* is variable; the dorsal forewing may be beige to orange-beige, variably mixed with dark scales. This species has been frequently confused with *Mythimna (P.) unipuncta* and *Mythimna (P.) celiae* sp. nov., but it can be distinguished by the genitalia structures, especially the male genitalia. The vesica has also a basal elongate diverticulum, but in the former it bears a single cornutus or rarely two, three or four, spaced among them, while in the other two it has more than four cornuti.

Material examined

BRAZIL - Roraima: Alto Alegre - 2°56'18.1"S, 61°00'18.0"W, 87m, 1 male, 14-VII-2015, E. G. F. de Moraes leg., DZ 39.946 (DZUP). - **Acre: Rio Branco** - 10°01'57.13"S, 67°37'36.87"W, 207m, 2 males, 16-VII-2015, M. Fazolin leg., DZ 37.899 (DZUP, CPAC), 10°01'58.09"S, 67°42'12.74"W, 183m, 1 female, 5-V-2016, M. Fazolin leg., DZ 39.963 (DZUP). - **Tocantins: Porto Nacional** - 10°30'36.678"S, 48°18'50.886"W, 212m, 1 female, 8-X-2015, B. A. Evangelista & D. B. Fragozo leg. (CPAC). - **Pernambuco: Petrolina** - 9°03'54.2"S, 40°10'23.6"W, 365,9m, 1 female, 9-XI-2015, E. A. dos Santos leg. (CPAC), 2 males, 10-XI-2015, E. A. dos Santos leg. (CPAC), 1 female, 13-XI-2015, E. A. dos Santos leg., DZ 39.958 (DZUP), 09°08'14.4"S, 40°18'07.4"W, 365,5m, 1 male, 12-IX-2015, J. B. G. Santos Filho leg., DZ 39.957, 1 male, 13-IX-2015, J. B. G. Santos Filho leg., DZ 39.954 (DZUP). - **Mato Grosso: Sinop** - 11°52'15.0"S, 55°36'2.19"W, 362m, 1 female, 1 male, 10-VI-2015, A. L. Filipiake, S. M. M. Rodrigues & R. M. Pitta leg. (CPAC), 1 male, 11-VI-2015, A. L. Filipiake, S. M. M. Rodrigues & R. M. Pitta leg., DZ 39.951, 1 female, 13-VI-2015, A. L. Filipiake, S. M. M. Rodrigues & R. M. Pitta leg., DZ 39.952 (DZUP). - **Distrito Federal: Planaltina** - 15°36'07.10"S, 47°42'46.67"W, 1007m, 1 male, 02-XI-2013, Specht leg. (CPAC), 1 male, 4-XII-2013, A. Specht leg., DZ 39.938 (DZUP), 1 male, 2-II-2014, A. Specht leg. (CPAC), 1 male, 27-IV-2014, A. Specht leg., DZ 39.934, 1 male, 28-IV-2014, A. Specht leg., DZ 39.947 (DZUP), 1 male, 4-V-2014, A. Specht leg. (CPAC), 1 male, 17-VIII-2014, A. Specht leg., DZ 39.940 (DZUP), 15°36'24.52"S, 47°44'42.45"W, 1169m, 1 male, 10-VI-2015, A. Specht leg. (CPAC), 1 female, 10-III-2016, A. Specht leg., DZ 39.936 (DZUP). - **Bahia: Correntina** - 13°45'24"S, 46°10'01"W, 970m, 1 male, 15-VI-2015, S. V. Paula-Moraes leg., DZ 39.939, 1 male, 15-IX-2015, S. V. Paula-Moraes leg., DZ 39.942 (DZUP); **São Desidério** - 13°18'60"S, 45°58'24"W, 879m, 1 male, 17-III-2015, C. Ceolin leg. (CPAC). - **Mato Grosso do Sul: Chapadão do Sul** - 18°46'49.6"S, 52°31'1.55"W, 806m, 1 female, 12-VI-2015, T. Taira leg., DZ 39.941 (DZUP), 1 female, 10-IX-2015, T. Taira leg. (CPAC), 1 female, 5-IV-2016, T. Taira leg., DZ 39.962 (DZUP), 1 male, 10-VII-2015, T. Taira leg. (CPAC), 18°46'30.09"S, 52°31'04.98"W, 804m, 1 male, 11-VII-2015, T. Taira leg. (CPAC); **Miranda** - 20°07'24.29"S, 56°37'15.66"W, 122m, 1 male, 12-VII-2015, H. V. B. Concone leg., DZ 39.923 (DZUP), 20°06'20.20"S, 56°36'52.62"W, 121m, 1 female, 4-II-2016, H. V. B. Concone leg. (CPAC), 1 male, 31-V-2016, H. V. B. Concone leg., DZ 39.945 (DZUP), 2 males, 1-VI-2016, H. V. B. Concone leg., DZ 39.960, DZ 46.908 (DZUP), 1 male, 2-VI-2016, H. V. B. Concone leg., DZ 39.959 (DZUP). - **Minas Gerais: Santana do Riacho** - Reserva Vellozia, 19°17'00"S, 43°35'34"W, 1100m, 1 male, 9-III-2017, M. Savaris leg., DZ 39.928 (DZUP);

Uberaba - 19°39'45.07"S, 47°57'39.16"W, 784m, 1 male, 9-X-2015, B. M. Moreira *leg.*, DZ 39.950 (DZUP), 1 male, 7-I-2016, B. M. Moreira *leg.* (CPAC), 19°39'14.36"S, 47°58'11.45"W, 819m, 1 female, 7-VII-2015, B. M. Moreira *leg.* (CPAC), 1 female, 16-XII-2015, B. M. Moreira *leg.*, DZ 39.948 (DZUP). - *Espírito Santo*: **Alegre** - 20°45'11.63"S, 41°29'23.28"W, 121m, 1 female, 1 male, 17-VI-2015, L. Mardgan, D. Pratisoli, J. R. Carvalho *leg.* (CPAC), DZ 39.961, 1 female, 9-X-2015, L. Mardgan, D. Pratisoli, J. R. Carvalho *leg.*, DZ 39.930 (DZUP); **Domingos Martins** - 20°22'17.3"S, 41°03'47.7"W, 950m, 1 male, 8-III-2016, J. S. Zanuncio Junior *leg.*, DZ 39.932, 1 female, 4-IV-2016, J. S. Zanuncio Junior *leg.*, DZ 39.931 (DZUP). - *Rio de Janeiro*: **Cachoeiras de Macacu** - 1 female, 16-IX-2012, N. Tangerini *leg.*, DZ 39.964 (DZUP); **Itatiaia** - 1 male, 12-13-IX-1950, Travassos, Albuquerque & Silva *leg.* (IOC), Parque Nacional do Itatiaia, 840m, 1 male, 8-XI-2011, Expedição Lab. Lep. MZUSP *leg.*, 2410m, 2 females, 1 male, 16-17-III-2013, Silva, Pinheiro & Muñoz *leg.* (MZUSP); **Petrópolis** - Independência, 1 female, 1930, Ferreira D'Almeida *leg.*, ex. coll. Gagarin DZ 37.876, 1 female, 19-II-1948, Gagarin *leg.*, ex. coll. Gagarin DZ 37.878 (DZUP); **Rio de Janeiro** - Tijuca, 1 male, 10-X-1916, Ferreira D'Almeida *leg.*, DZ 37.875 (DZUP). - *São Paulo*: **Cajati** - Parque Estadual Rio Turvo, Mirante do Aleixo, 24°43'48.081"S, 48°06'29.754"O, 1018m, 1 female, 1-3-XII-2013, Quintero & Silva *leg.* (MZUSP); **Campos do Jordão** - Parque Estadual Campos do Jordão, Mirante do Pau Arcado, 22°44'34.322"S, 45°35'46.88"O, 1815m, 1 male, 1 female, 18-19-V-2015, Quintero, Silva & Moraes *leg.* (MZUSP); **Jundiá** - Base Ecológica Serra do Japi, 23°11'8.547"S, 46°53'52.1"W, 3 females, 19-21-X-2012, Expedição Lab. Lep. MZUSP *leg.* (MZUSP); **São Bernardo do Campo** - Alto da Serra, 1 female, 1 male, 1927 (MZUSP). - *Paraná*: **Cornélio Procopio** - Parque Estadual Mata São Francisco, 23°08'59"S, 50°34'19"W, 656m, 1 male, 3-5-V-2016, Santos, Silva & Queiroz *leg.*, DZ 37.884 (DZUP); **Curitiba** - 900m, 1 male, 1 female, IX-2004, H. A. Vargas *leg.*, DZ 37.887, DZ 37.888 (DZUP); **Londrina** - 23°11'44.1"S, 51°10'33.5"W, 594m, 1 female, 10-VII-2015, D. R. Sosa-Gomez *leg.* (CPAC), 1 female, 10-VIII-2015, D. R. Sosa-Gomez *leg.* (CPAC), 1 female, 15-IX-2015, Sosa-Gomez *leg.*, DZ 39.956 (DZUP), 23°11'22.9"S, 51°10'18.7"W, 545m, 1 male, 18-IX-2015, D. R. Sosa-Gomez *leg.*, 1 male, 10-XI-2015, Sosa-Gomez *leg.* (CPAC), 1 male, 6-I-2016, Sosa-Gomez *leg.*, DZ 39.921 (DZUP); **Morretes** - Parque Estadual Pico Marumbi, Pedra Lascada, 25°26'18.4"S, 48°55'09.6"W, 510m, 2 males, 1 female, 29-IX-3-X-2013, Silva *leg.* (MZUSP), Estrada da Graciosa, 25°20'2.68"S, 48°53'54.44"W, 700m, 2 males, 14-VII-2017,

Dolibaina, C. Mielke, Siewert & St Laurent *leg.*, DZ 39.919, DZ 39.917 (DZUP); **Ponta Grossa** - 1 female, XI-1955, DZ 37.889, 1 male, XII-1958, ex. coll. F. Justus DZ 37.885 (DZUP); **Quatro Barras** - Banhado, 1 male, 5-VI-1970, Becker & Laroca *leg.*, DZ 37.883, 1 female, 28-XII-1970, Becker & Laroca *leg.*, DZ 37.882 (DZUP); **Tibagi** - Parque Estadual do Guartelá, 24°33'44"S, 50°15'33"W, 950-1000m, 5 males, 4 females, 25-27-VII-2017, Dantas, Dias, Dolibaina & Queiroz-S[antos] *leg.*, DZ 39.922, DZ 39.920, DZ 39.933, DZ 39.943, DZ 39.944, DZ 39.916, DZ 39.924, DZ 39.927, DZ 39.937 (DZUP). - *Rio Grande do Sul*: **Bagé** - 31°21'4.94"S, 54°1'12.51"W, 232m, 1 female, 8-XII-2015, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert *leg.* (CPAC); **Passo Fundo** - 28°13'50.67"S, 52°24'17.04"W, 671m, 1 female, 6-X-2015, P. R. V. S. Pereira *leg.*, DZ 39.955, 1 male, 6-XI-2015, P. R. V. S. Pereira *leg.*, DZ 39.926, 1 female, 12-XII-2015, P. R. V. S. Pereira *leg.*, DZ 39.929, 28°13'35.88"S, 52°24'13.05"W, 682m, 1 male, 6-I-2015, P. R. V. S. Pereira *leg.*, DZ 39.949 (DZUP), 1 male, 11-X-2015, P. R. V. S. Pereira *leg.* (CPAC), 1 male, 1 female, 9-XII-2015, P. R. V. S. Pereira *leg.* (CPAC), DZ 39.720, 1 male, 14-II-2016, P. R. V. S. Pereira *leg.*, DZ 39.925 (DZUP), 1 female, 11-II-2016, P. R. V. S. Pereira *leg.*, 1 female, 11-III-2016, P. R. V. S. Pereira *leg.*, 1 male, 12-III-2016, P. R. V. S. Pereira *leg.* (CPAC); **Salvador do Sul** - 1 female, 8-XI-1993, A. Specht *leg.*, 2546 (MCTP), 1 female, 4-X-1995, A. Specht *leg.*, 4497 (MCTP); **Vacaria** - 1 male, 12-II-2009, A. C. Formentini *leg.*; 1 male, 25-II-2009, A. C. Formentini *leg.* (CEUCS).

Mythimna (Pseudaletia) celiae sp. nov. (Figs. 1, 12)

urn:lsid:zoobank.org:pub:D5D278A9-5ADB-476F-BB20-08FA292D1434

Diagnosis

Both sexes with forewing ground color cream, usually mixed with dark scales, on most specimens without dark patch covering cubital vein. In males, cucullus with dorsal margin straight, ending in at least two distal processes, ampulla distinct, as a small ear-shaped dorsal projection, digitus slim, between a third of or as long as the clasper; vesica basal diverticulum elongate, with over four cornuti close to each other. Genitalia similar to *Mythimna (P.) unipuncta*, differing slightly in external morphology, DNA Barcode (COI) and specific localities.

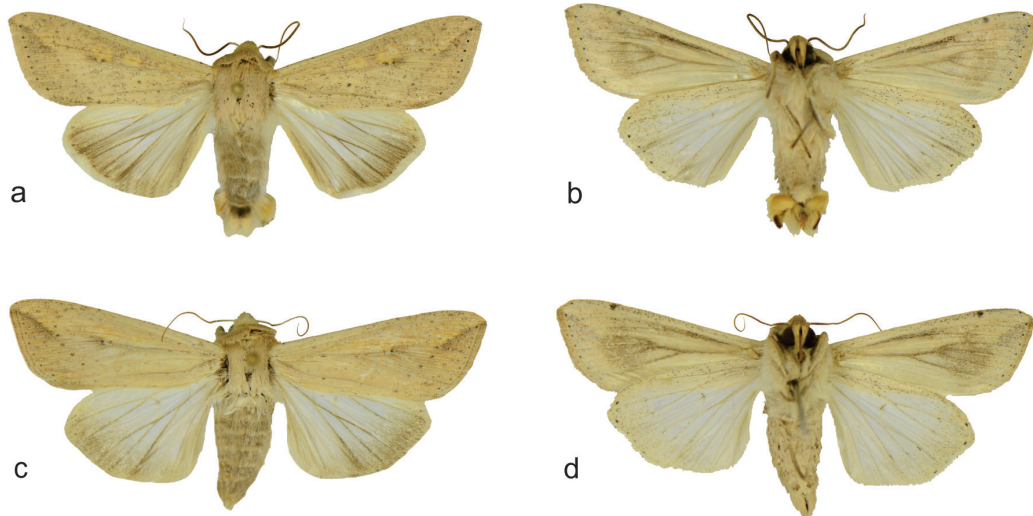


Figure 12 *Mythimna (P.) celiae* sp. nov. a-b, male (DZ 39.913) in dorsal and ventral views; c-d, female (DZ 39.911) in dorsal and ventral views. Specimen deposited at the DZUP. Scale bar = 1cm.

Description

MALE. *Head:* Cream, sometimes mixed with dark scales of different hues. Eyes brown, pilose. Antenna filiform, triangular in cross section, covered dorsally with beige scales, ventrally naked, with tiny chemoreceptive trichoid sensilla, more concentrated in the central part of the antennomer and with longer lateral chemoreceptive trichoid sensilla, half as long as antennomer width. *Thorax:* Ground color as head; patagium with dark subapical line. Forewing: length - 1.5-1.9cm (n=20). Ground color cream, varibale mixed with dark scales of different hues; postmedial line as dark spots over the veins and terminal line as dark spots between veins, other transversal lines absent; with an oblique line of dark scales from the apex to M_2 , on some specimens with an anterior area lighter than ground color; a dark patch with a spot of central white scales next to the bases of M_2 and M_3 , undifferentiable in many specimens; dark patch covering cubital veins absent on most specimens; orbicular and reniform spots circular, inconspicuous, orange with smooth darker center, undifferentiable in some specimens; subterminal area of the wing with white or light beige scales over the veins; fringe beige with dark medial and terminal lines. Hindwing pale, with marginal brown shading toward the base, fringe pale. *Abdomen:* Greyish-cream dorsally; ventral view as head, with two faint black transversal lines subventral. Genitalia: Tegumen and uncus fused, the first wider than the base of uncus; ventral arms of tegumen slim, covered with setae posteriorly, close to the articulation with the dorsal arms of saccus. Saccus subquadrangular and bent toward the ventral arms of the tegumen, irregular distally, twisted toward its inner surface. Uncus elongated, flat and bent ventrally, widened on medial area, apical half abruptly narrowed to 1/5-1/6 of its width, covered with setae dorsally. Valva subtriangular; sacculus projected ventrally forming an ovallobe; cucullus long, with a straight dorsal margin and ending in at least two distal processes, distal portion lobate, corona present, with multiple rows of spines; clasper short; ampulla distinct, as a small ear-shaped dorsal projection; digitus slim, 1/3 as long as the clasper, on some specimens it could be as long as clasper. Fultura inferior (=juxta) subtriangular, approximately one fourth the length of the ventral arms of tegumen and thrice as long as its smallest width, distal portion bifid. Aedeagus pipe-shaped; vesica tubular and elongate, slightly widened apically, with a continuous band of cornuti from posterior the diverticulum to subapical area, basal diverticulum elongate, with over four closely arranged cornuti, the distalmost thinner and longer than the others.

FEMALE. Similar to male, but antenna with tiny chemoreceptive trichoid sensilla only, longer lateral chemoreceptive trichoid absent. Forewing length 1.6-1.9cm (n=14). *Abdomen:* Genitalia almost entirely sclerotized. Eighth tergite straight and narrow. Papilla analis subtriangular covered with setae. Lamella antevaginalis subrectangular. Ductus bursae sclerotized, with a wide fold at its final portion leading to appendix bursae; corpus bursae membranous and round; appendix bursae with at least twice the length of ductus bursae, but with the same width, sclerotized basally and with membranous apex. Ductus seminalis originating on appendix bursae apex.

Geographic distribution

In Brazil, it is endemic to Rio Grande do Sul State, with records from Bagé, Passo Fundo, and Vacaria municipalities. It probably occurs in Uruguay and Northern Argentina as well, in view of the records of *Mythimna (P.) unipuncta* to these localities that are probably misidentifications.

Host plants

Unknown. Presumably grasses (Poaceae), as the other species in this study.

Etymology

Homage to Célia Pedrotti Madruga, the first author's beloved grandmother, whose life was spent in the same meadows where this moth occurs.

Discussion

Mythimna (P.) celiae sp. nov. has the forewings cream colored, variable mixed with dark scales of different hues, but considerably lighter than the other species and the cubital vein not covered by a dark patch. However, this is a variable character, rendering it not the most reliable character for the species identification. Regarding the genitalia, the species can be easily distinguished from *Mythimna (P.) adultera* and from *Mythimna (P.) sequax*, with no need of dissection; the former presents the final portion of the dorsal margin of the cucullus protuberant, while in the latter it is bent dorsally, while *Mythimna (P.) celiae* sp. nov. has the dorsal margin of the cucullus straight, similarly to *Mythimna (P.) unipuncta*. It can be distinguished from the latter in details, such as the presence of more than one distal process at the tip of the cucullus. During the examination of the material from collections, we found many specimens identified as *Mythimna (P.) unipuncta*, that are, in fact, *Mythimna (P.) celiae* sp. nov.

Comparisons were made between specimens of *Mythimna (P.) celiae* sp. nov. and the descriptions of *Mythimna (P.) punctulata* (Blanchard, 1852) that occurs in Chile (Blanchard, 1852; Butler, 1882; Franclemont, 1951; Angulo and Weigert, 1977; Parra et al., 1986; Poole, 1989; Artigas, 1994; Olivares et al., 2009) and, possibly, Argentina (Artigas, 1994; Pastrana, 2004), Brazil and Peru (Artigas, 1994). However, the comparative study both of the external morphology and the genitalia (Franclemont, 1951; Angulo and Weigert, 1977), indicated that none of the examined specimens are *Mythimna (P.) punctulata*. This reinforces the need for more comprehensive studies to elucidate whether the geographic distribution of *Mythimna (P.) punctulata* is restricted to Chile, or also covers eastern South America, as described in Artigas (1994).

Considering that *Mythimna (P.) adultera*, *Mythimna (P.) sequax* and *Mythimna (P.) celiae* sp. n. are sympatric in Rio Grande do Sul, Brazil, it stands to reason that the identification of the first two may be mistaken (ex. Biezanko et al., 1949; Biezanko and Bertholdi, 1951; Bertels, 1956; Corseuil, 1958; Costa, 1958; Bertels and Baucke, 1966). Likewise, the records for the neighboring countries Uruguay and Argentina of *Mythimna (P.) unipuncta* and/or *Mythimna (P.) punctulata* (Artigas, 1994; Pastrana, 2004) may be misidentifications.

In this work, the estimates of evolutionary divergence between the species have shown higher interspecific than intraspecific divergence, and both the tree build using neighbor-joining and the one using maximum likelihood distinguish *Mythimna (P.) celiae* sp. nov. from *Mythimna (P.) unipuncta*. Thus, despite the low sample number, molecular, morphological, and geographic distribution data contribute integratively to the diagnosis of *Mythimna (P.) celiae* sp. nov.

Type material

Male holotype deposited at the DZUP, with the following labels: / HOLOTYPE/ Brasil, Rio Grande do Sul, Bagé, 31°21'4.94"S, 54°1'12.51"W, 232m, 06-XI-2015, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert

leg./ DZ 39.913 | Holotypus *Mythimna (Pseudaletia) celiae* Madruga, Specht, San Blas, Mielke & Casagrande, 2022/

Female allotype deposited at DZUP, with the following labels: / ALLOTYPUS/ Brasil, Rio Grande do Sul, Bagé, 31°21'4.94"S, 54°1'12.51"W, 232m, 06-XI-2015, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert leg./ DZ 39.911 | Allotypus *Mythimna (Pseudaletia) celiae* Madruga, Specht, San Blas, Mielke & Casagrande, 2022/

Paratypes: BRAZIL - *Rio Grande do Sul*: **Bagé** - 31°18'57.08"S, 53°59'52.91"W, 242m, 1 female, 4-I-2016, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert leg., DZ 39.918, 1 male, 11-III-2016, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert leg., DZ 39.968 (DZUP), 31°21'4.94"S, 54°1'12.51"W, 232m, 1 female, 11-VI-2015, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert leg. (CPAC), 1 male, 11-VIII-2015, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert leg., DZ 39.966, 2 females, 1 male, 12-VIII-2015, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert leg., DZ 39.985 (DZUP, CPAC), 1 male, 13-VIII-2015, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert leg., DZ 37.891 (DZUP), 1 male, 14-VIII-2015, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert leg. (CPAC), 2 females, 7-X-2016, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert leg., DZ 39.984 (DZUP, CPAC), 1 female, 6-XI-2015, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert leg. (CPAC), 1 female, 6-XII-2015, R. N. Systi, J. U. P. Corrêa, M. A. P. da Silva & Harry Ebert leg. (CPAC); **Passo Fundo** - 28°13'35.88"S, 52°24'13.05"W, 682m, 1 female, 10-VIII-2015, P. R. V. S. Pereira leg., DZ 39.967, 1 male, 8-IX-2015, P. R. V. S. Pereira leg., DZ 37.890, 1 male, 8-X-2015, P. R. V. S. Pereira leg., DZ 39.988 (DZUP), 3 males, 1 female, 9-X-2015, P. R. V. S. Pereira leg. (CPAC), DZ 39.914, 2 females, 2 males, 11-X-2015, P. R. V. S. Pereira leg., DZ 39.905, DZ 39.915, DZ 39.904, DZ 39.907, 1 female, 2 males, 7-XI-2015, P. R. V. S. Pereira leg., DZ 39.987 (DZUP, CPAC), 1 male, 1 female, 9-XII-2015, P. R. V. S. Pereira leg., DZ 39.980 (DZUP, CPAC), 2 males, 1 female, 11-XII-2015, P. R. V. S. Pereira leg. (CPAC), 1 female, 5-I-2016, P. R. V. S. Pereira leg., DZ 39.982 (DZUP), 28°13'50.67"S, 52°24'17.04"W, 671m, 1 female, 9-X-2015, P. R. V. S. Pereira leg. (CPAC), 1 female, 10-X-2015, P. R. V. S. Pereira leg., DZ 39.986 (DZUP), 3 males, 5-XI-2015, P. R. V. S. Pereira leg. (CPAC), DZ 39.908, DZ 39.909 (DZUP), 1 female, 1 male, 9-XI-2015, P. R. V. S. Pereira leg. (CPAC), DZ 39.910 (DZUP), 2 females, 12-XII-2015, P. R. V. S. Pereira leg., DZ 39.912 (DZUP, CPAC), 1 female, 13-II-2016, P. R. V. S. Pereira leg., DZ 39.906, 1 male, 2 females, 11-II-2016, P. R. V. S. Pereira leg., DZ 39.983, DZ 39.981 (DZUP, CPAC), 1 male, 9-III-2016, P. R. V. S. Pereira leg. (CPAC); **Vacaria** - 1 male, 8-II-2009 (CEUCS), 1 female, 12-II-2009 (CEUCS), 1 female, 19-II-2009 (CEUCS), 1 male, 25-II-2009 (CEUCS).

Final considerations

The examination of the specimens available at several collections corroborated the understanding that, in Brazil, over the years, many individuals of *Mythimna (Pseudaletia)* were incorrectly identified as *Mythimna (Pseudaletia) unipuncta*, due to the fact that they form a complex of externally very similar species. This reinforces the need for the genitalia examination to achieve a more reliable specific identification. In this sense, even though the study of genitalia characters is a recurrent practice in the taxonomy of the group (Yoshimatsu, 1994, 1995; Yoshimatsu and Hreblay, 1998; Yoshimatsu and Legrain, 2001), it is important that, besides making the practical protocols available, publications with images and specific detailed descriptions are provided, including of immatures and adults of each species (Madruga et al., 2019). In Brazil and neighboring countries (CONESUL), given the greater occurrence and importance of these species, publications comparing all development stages of *Mythimna (P.) adultera*, *Mythimna (P.) celiae*, and *Mythimna (P.) sequax* are essential.

Particularly in Rio Grande do Sul, *Mythimna (P.) celiae* **sp. nov.** was the species most confused with *Mythimna (P.) unipuncta*. This probably happened because Gassen (1984) differentiated *Mythimna (P.) adultera* from *Mythimna (P.) sequax*. Hence, when researchers could not associate their specimens to one of these two species, they associated the then undescribed species to *Mythimna (P.) unipuncta*. Since *Mythimna (P.) celiae* **sp. nov.** has been collected in several localities in Rio Grande do Sul, including the biome Campos Sulinos, which is contiguous with Uruguay and Argentina, it is likely that the records of *Mythimna (P.) unipuncta* to this neighboring countries (e.g. Salas et al., 1998; Pastrana, 2004; Isas et al., 2016), are also misidentification. Similarly, the invalid lectotype of *Leucania extranea*, designated by Viette (IV-1951), which is a synonym of *Mythimna (P.) unipuncta*, from Montevideo, Uruguay, probably corresponds to *Mythimna (P.) celiae* **sp. nov.**

It is important to highlight that, although there has been structured collecting throughout the whole country and an examination of the available material in all Brazilian collections, *Mythimna (P.) unipuncta* has a single record in Uiramutã, Monte Roraima (Franclemont, 1951), in the extreme North of the country.

Besides morphology and geographic distribution, the species were separated through molecular analyses, DNA Barcode (COI). According to Ball and Armstrong (2006), molecular information may be highly precise, being a promising tool in the identification of pest insects. This method has already been used to differentiate species of *Mythimna* from Indonesia (Sutrisno, 2012). Moreover, the genetic structure of *Mythimna (P.) unipuncta* was studied in the archipelago of Azores, Portugal, in continental Portugal, and in Canada, with little differences being found between the populations (Vieira et al., 2003). The estimates of evolutionary divergence and the construction of evolutionary trees (Figs. 3-4), corroborate with morphological and distributional data, confirming that *Mythimna (P.) celiae* **sp. nov.** and *Mythimna (P.) unipuncta* are distinct species.

Mythimna punctulata (Blanchard, 1852) was mentioned for Brazil by Artigas (1994), but based on external morphology and genitalia, their occurrence was not confirmed in this study.

Our results, as suggested in the revision performed by Franclemont (1951), indicate the need of a Neotropical review, especially because of the historical misidentifications related to *Mythimna (P.) unipuncta* and because of the possible wider geographic distribution of *Mythimna (P.) celiae* **sp. nov.** toward Uruguay and Argentina. This full revision would have a local repercussion related to specific recognition and management of these species, as well as an international impact, for *Mythimna (P.) unipuncta*, considered present in all South American countries (CABI, 2019) in fact is not, its occurrence as a quarantine pest in South America should be reviewed.

In conclusion, the occurrence of the following species is confirmed to Brazil:

Mythimna (Pseudaletia) unipuncta (Haworth, 1809) - Brazil (Roraima)

Leucania extranea Guenée, 1852

Leucania antica Walker, 1856

Pseudaletia unipuncta quechua Franclemont, 1951

Leucania unipuncta tseki Koutsaftikis, 1974

Pseudaletia roraimae Franclemont, 1951, **syn. nov.**

Mythimna (Pseudaletia) adultera (Schaus, 1894) - Brazil (Paraná, Santa Catarina and Rio Grande do Sul)

Mythimna (Pseudaletia) sequax Franclemont, 1951 - Brazil

Mythimna (Pseudaletia) celiae Madruga, Specht, San Blas, Mielke & Casagrande **sp. nov.** - Brazil (Rio Grande do Sul).

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Conflicts of interest

The authors declare no conflicts of interest.

Author contribution statement

JMS, AS and MMC planned the work. JMS wrote the first draft of the manuscript with additions, critical revision and approval of the final version by AS, MMC, OHHM and GSB.

References

- Almeida, A. A., Lima, E. R., Reis Junior, R., 2008. Pupal period affects calling behavior of the wheat moth, *Pseudaletia sequax* (Lepidoptera: noctuidae). *Ethology* 114, 499-503. <https://doi.org/10.1111/j.1439-0310.2008.01492.x>.
- Almeida, L. P., Specht, A., Teston, J. A., 2014. Fauna of Noctuidae (Lepidoptera: Noctuoidea) in a pasture area in Altamira, Eastern Amazon, Pará, Brazil. *Braz. J. Biol.* 74 (4), 983-990. <https://doi.org/10.1590/1519-6984.07713>.
- Angulo, A. O., Weigert, G. T., 1977. *Pseudaletia punctulata* (Blanchard) y *Pseudaletia impuncta* (Guenée): nóctuidos hadeninos similares en Chile (Lepidoptera: Noctuidae). *Agro Sur* 5, 12-17.
- Artigas, J. N., 1994. Entomologia económica. Insectos de interés agrícola, forestal, médico y veterinário. Universidad de Concepción, Concepción.
- Ball, S. L., Armstrong, K. F., 2006. DNA barcodes for insect pest identification: a test case with tussock moths (Lepidoptera: Lymantriidae). *Can. J. For. Res.* 36, 337-350. <https://doi.org/10.1139/x05-276>.
- Barbut, J., Lalanne-Cassou, B., 2010. Description d'une nouvelle espèce de *Mythimna* Ochsenheimer, 1816, sous-genre *Pseudaletia* Franclemont, 1951 (Lepidoptera Noctuidae Hadeninae). *Entomologiste* 66 (3), 117-121.
- Barnes, D. K. A., Convey, P., 2005. Odyssey of stow-away noctuid moths to southern polar islands. *Antarct. Sci.* 17 (3), 307-311. <https://doi.org/10.1017/S0954102005002737>.
- Bertels, A., 1956. Entomologia agrícola sul-brasileira. Ministério da Agricultura, Rio de Janeiro. (Série Didática 16).
- Bertels, A., Baucke, O., 1966. Segunda relação das pragas das plantas cultivadas no Rio Grande do Sul. *Pesqui. Agropecu. Bras.* 1, 17-46.
- Biezanko, C. M., Bertholdi, R. E., Baucke, O., 1949. Relação dos principais insetos prejudiciais observados nos arredores de Pelotas nas plantas cultivadas e selvagens. *Agros* 2 (3), 156-213.
- Biezanko, C. M., Bertholdi, R. E., 1951. Principais noctuídeos prejudiciais às plantas cultivadas em arredores de Pelotas. *Agronomia* 10 (4), 235-246.
- Biezanko, C. M., Ruffinelli, A., 1971. Fauna de Lepidoptera del Uruguay: Agaristidae, Noctuidae et Thyatiridae. Ministério de Ganaderia y Agricultura, Centro de Investigación en Sanidad Vegetal, Montevideo.
- Biezanko, C. M., Ruffinelli, A., Link, D., 1974. Plantas y otras sustancias alimenticias de las orugas de los lepidopteros uruguayos. *Rev. Cent. Cienc. Rurais* 4 (2), 107-148.
- Bittencourt, M. A. L., Boaretto, L., Serafim, I., Berti Filho, E., 2003. Fauna de Lepidoptera associada a um ecossistema natural no Estado de São Paulo. *Arq. Inst. Biol. (Sao Paulo)* 70 (1), 85-87.
- Blanchard, C. E., 1852. Fauna Chilena Insectos, Orden VI, Lepidopteros. In: Gay, C. (Ed.), *Historia Física y Política de Chile*. Vol. 7. Casa del autor, Paris.
- Bortolotto, O. C., Menezes Junior, A. O., Hoshino, A. T., Salgado-Neto, G., 2015. Incidence of *Mythimna sequax* parasitized in wheat crop. *Cienc. Rural* 45 (12), 2121-2124. <https://doi.org/10.1590/0103-8478cr20141286>.
- Buainain, C. A., Silva, R. F. P., 1990. Nutrição de *Pseudaletia sequax* Franclemont, 1951 (Lepidoptera: Noctuidae) em trigo. *Pesqui. Agropecu. Bras.* 25 (2), 229-234.
- Butler, A. G., 1882. Heterocerous Lepidoptera collected in Chili by Thomas Edmonds. *Esq. Trans. Ent. Soc. Lond.* 30 (1), 113-139. <http://dx.doi.org/10.1111/j.1365-2311.1882.tb01566.x>.
- Butler, A. G., 1890. Further notes on the synonymy of the genera of Noctuides. *Trans. Entomol. Soc. Lond.* 38 (4), 653-691. <http://dx.doi.org/10.1111/j.1365-2311.1890.tb03033.x>.
- CABI – Invasive Species Compendium, 2019. *Mythimna unipuncta* (rice armyworm). Available in: <https://www.cabi.org/isc/datasheet/45094> (accessed 28 September 2021).
- Capinera, J. L., 2006. Armyworm, *Pseudaletia unipuncta* (Haworth) (Insecta: Lepidoptera: Noctuidae). UF/IFAS Extension, Florida. (EENY-098).
- Carvalho, S., Tarragó, M. F. S., Link, D., 1971. Captura de Noctuídeos através de armadilha luminosa. *Rev. Cent. Cienc. Rurais* 1 (3), 15-22.
- Casella, E. M., Moratoria, M. S., 1971. Morfología larval de dos Noctuidae perjudiciales al trigo (Lepidoptera, Noctuidae, Hadeninae). *Rev. Peru. Entomol.* 14 (2), 259-263.
- Chang, Y. C., Sales, J. B., 1977. Resting potential of the muscle of a moth larva: distinct fibre populations. *J. Insect Physiol.* 23, 159-164. [https://doi.org/10.1016/0022-1910\(77\)90025-7](https://doi.org/10.1016/0022-1910(77)90025-7).
- Chiang, H. C., 1978. Pest management in corn. *Annu. Rev. Entomol.* 23, 101-123. <https://doi.org/10.1146/annurev.en.23.010178.000533>.

- Conceição, L. L., Silva, C. M., 2011. O controle biológico e suas aplicações na cultura de cana-de-açúcar. *Campo Digit@l*. 6 (1), 14-25.
- Corseuil, E., 1958. Pragas do trigo. *Agrotecnia* 2 (4), 51-57.
- Corseuil, E., Cruz, F. Z., 1975. Insetos nocivos a cultura do trigo no Rio Grande do Sul. *Rev. Fac. Agron. UFRGS* 1 (1), 19-28.
- Costa, R. G., 1958. Alguns insetos e outros pequenos animais que danificam plantas cultivadas no Rio Grande do Sul. S.I.P.A., Porto Alegre.
- Dias, F. M., Specht, A., San Blas, G., Casagrande, M. M., Mielke, O. H., 2017. Resurgence of a forgotten Southern Brazil endemic species: taxonomic position, redescription, and spatio-temporal distribution of *Porosagrotis carolia* Schaus, 1929 (Lepidoptera: Noctuidae: Noctuinae). *Zootaxa* 4363 (3), 421-433. <https://doi.org/10.11646/zootaxa.4363.3.7>.
- Dickel, T. S., 1991. New records of noctuid moths from Florida. *Trop. Lepid.* 2 (1), 53-58.
- Doetzer, A. K., Foerster, L. A., 1998. Efeito do parasitismo por *Glyptapanteles muesebecki* (Blanchard) no consumo e utilização do alimento por *Pseudaletia sequax* Franclemont. *An. Soc. Entomol. Bras.* 27 (2), 225-264. <https://doi.org/10.1590/S0301-80591998000200012>.
- Draudt, M., 1919. Die gross-schmetterlinge amerikanischen faunengebietet. 7. Band: Eulenartige Nachtfalter. In: Seitz, A. (Ed.), *Die Gross-Schmetterlinge der Erde*. Alfred Kernen, Stuttgart, pp. 79-167.
- Fernandes, D. R. R., Onody, H. C., Lara, R. I. R., Perioto, N. W., 2014. Annotated checklist of brazilian Ophioninae (Hymenoptera: ichneumonidae). *EntomoBrasilis* 7 (2), 124-133. <https://doi.org/10.12741/ebrazilis.v7i2.330>.
- Ferreira, E., 1998. Manual de identificação de pragas do arroz. EMBRAPA-CNPAP, Santo Antônio de Goiás.
- Fibiger, M., Lafontaine, J. D., 2005. A review of the higher classification of the Noctuoidea (Lepidoptera) with special reference to the Holarctic fauna. *Espieriana* 11, 7-92.
- Foerster, L. A., 1996. Efeito da temperatura no desenvolvimento das fases imaturas de *Pseudaletia sequax* Franclemont (Lepidoptera: noctuidae). *An. Soc. Entomol. Bras.* 25 (1), 27-32. <https://doi.org/10.37486/0301-8059.v25i1.1086>.
- Foerster, L. A., Avanci, M. R. F., Doetzer, A. K., 1999a. Effect of temperature on the development and progeny production of *Glyptapanteles muesebecki* (Blanchard) (Hymenoptera: Braconidae) parasitizing larvae of *Pseudaletia sequax* Franclemont (Lepidoptera: Noctuidae). *An. Soc. Entomol. Bras.* 28 (2), 243-249. <https://doi.org/10.1590/S0301-80591999000200007>.
- Foerster, L. A., Doetzer, A. K., Avanci, M. R. F., 1999b. Capacidade reprodutiva e longevidade de *Glyptapanteles muesebecki* (Blanchard) (Hymenoptera: Braconidae) parasitando lagartas de *Pseudaletia sequax* Franclemont (Lepidoptera: Noctuidae). *An. Soc. Entomol. Bras.* 28 (3), 485-490. <https://doi.org/10.1590/S0301-80591999000300014>.
- Foerster, L. A., Doetzer, A. K., Avanci, M. R. F., 2001. Larval parasitoids of *Mythimna (Pseudaletia) sequax* Franclemont and the parasitism capacity of *Glyptapanteles muesebecki* (Blanchard) in time of exposition, temperature and host density. *Acta Biol. Parana.* 30 (1-4), 139-149. <https://doi.org/10.5380/abpr.v30i0.600>.
- Foerster, L. A., Doetzer, A. K., 2003. Biology of *Microplitis mediator* Haliday (Hymenoptera: Braconidae) parasitizing the wheat armyworm *Mythimna (Pseudaletia) sequax* Franclemont (Lepidoptera: Noctuidae). *Neotrop. Entomol.* 32 (1), 81-84. <https://doi.org/10.1590/S1519-566X2003000100011>.
- Foerster, M. R., Marchioro, C. A., Foerster, L. A., 2015. How *Trichogramma* survives during soybean off-season in Southern Brazil and the implications for its success as a biocontrol agent. *BioControl* 60, 1-11. <https://doi.org/10.1007/s10526-014-9616-5>.
- Fontana, J. D., Lanças, F. M., Passos, M., Cappelaro, E., Vilegas, J., Baron, M., Nosedá, M., Pomílio, A. B., Vitale, A., Webber, A. C., Maul, A. A., Peres, W. A., Foerster, L. A., 1998. Selective polarity and adsorption-guided extraction/purification of *Annona* sp. polar acetogenins and biological assay against agricultural pests. In: Finkelstein, M., Davison, B.H. (Eds) *Biotechnology for Fuels and Chemicals: Applied Biochemistry and Biotechnology*. Humana Press, Totowa, NJ, pp: 67-76. <https://doi.org/10.1007/BF02920124>
- Franclemont, J. G., 1951. The species of the *Leucania unipuncta* group, with a discussion of the generic names for the various segregates of *Leucania* in North America. *Proc. Entomol. Soc. Wash.* 53, 57-85.
- Franclemont, J. G., Todd, E. L., 1983. Noctuidae. In: Hodges, R.W. (Ed.), *Check List of the Lepidoptera of America North of Mexico*. E.W. Classey Limited and the Wedge Entomological Research Foundation, London, pp. 120-159.
- Frank, J. H., McCoy, E. D., 1992. The immigration of insects to Florida, with a tabulation of records published since 1970. *Insect Behav. Ecol.* 75 (1), 1-27. <https://doi.org/10.2307/3495477>.
- Fritz, L. L., Heinrichs, E. A., Machado, V., Andreis, T. F., Pandolfo, M., Salles, S. M., Oliveira, J. V., Fiuza, L. M., 2008. Agroecosistemas orizícolas irrigados: Insetos-praga, inimigos naturais e manejo integrado. *Oecol. Bras.* 12 (4), 720-732.
- Fritz, L. L., Heinrichs, E. A., Machado, V., Andreis, T. F., Pandolfo, M., Salles, S. M., Oliveira, J. V., Fiuza, L. M., 2013. Impact of lambda-cyhalothrin on arthropod natural enemy populations in irrigated rice fields in southern Brazil. *Int. J. Trop. Insect Sci.* 33 (3), 178-187. <https://doi.org/10.1017/S1742758413000192>.
- Frost, S. W., 1957. The pennsylvania insect light trap. *J. Econ. Entomol.* 50, 287-292. <https://doi.org/10.1093/jee/50.3.287>.
- Gassen, D. N., 1984. Insetos associados à cultura do trigo no Brasil. EMBRAPA-CNPQ, Passo Fundo (Circular Técnica 3).
- Giannotti, E., Prezoto, F., Machado, V. L. L., 1995. Foraging activity of *Polistes lanio lanio* (Fabr.) (Hymenoptera: vespidae). *An. Soc. Entomol. Bras.* 24 (3), 455-463. <https://doi.org/10.37486/0301-8059.v24i3.1052>.
- Godfrey, G., 1972. A review and reclassification of larvae of the subfamily Hadeninae (Lepidoptera, Noctuidae) of America North of Mexico. In: Jahn, O.L. (Ed.), *Photoelectric Color Sorting of Citrus Fruit*. U.S. Department of Agriculture, USA. (Tech. Bull. 1450).
- Gonçalves, I. S., 1985. Anatomia do tubo digestivo da larva de *Pseudaletia sequax* Franclemont, 1951 (Lepidoptera, Noctuidae). *Rev. Bras. Entomol.* 29 (1), 31-36.
- Grego, C. R., Vieira, S. R., Lourenção, A. L., 2006. Spatial distribution of *Pseudaletia sequax* Franclemont in triticale under no-till management. *Sci. Agric.* 63 (4), 321-327. <https://doi.org/10.1590/S0103-90162006000400002>.
- Guenée, A., 1852. Leucanidae. In: Boisduval, J.B.A.D., Guenée, A. (Eds), *Histoire Naturelle des Insectes. Species Général des Lépidoptères. Noctuérites*. Vol. 5. Librairie Encyclopédique de Roret, Paris, pp. 65-111.
- Hacker, H., Ronkay, K., Herblay, M., 2002. *Noctuidae Europaeae*. Vol. 4. Entomological Press, Soro.
- Hall, T., 2011. BioEdit: an important software for molecular biology. *GERF Bull. Biosci.* 2 (1), 60-61.
- Hampson, G. F., 1894. *The Fauna of British India, Including Ceylon and Burma*. Vol. 2. Taylor and Francis, London.
- Hampson, G. F., 1905. *Catalogue of the Lepidoptera Phalaenae in the British Museum*. Vol. 5. British Museum, London.
- Haworth, A. H., 1809. *Lepidoptera Britannica*. Vol. 2. Taylor, London.
- Hayes, A. H., 1975. The larger moths of the Galápagos Islands (Geometroidea: Sphingoidea & Noctuoidea). *Proc. Calif. Acad. Sci.* 40 (7), 145-208.
- Heppner, J. B., 2007. *Lepidoptera of Florida, Part 1: Introduction and Catalog*. Arthropods of Florida and Neighboring Land Areas. Vol. 17. Florida Department of Agriculture, Division of Plant Industry, Gainesville, Florida.

- Hernandes, F. A., Huff, J., Oconnor, B. M., 2011. Catalog of the Acari types deposited in the American Museum of Natural History, New York (Arthropoda: arachnida). *Zootaxa* 2936, 1-50. <https://doi.org/10.11646/zootaxa.2936.1.1>.
- Holloway, J. D., 1989. The moths of Borneo: Family Noctuidae, trifine subfamilies: Noctuinae, Heliiothinae, Hadeninae, Acronictinae, Amphipyrrinae, Agaristinae. *Malay. Nat. J.* 42 (2-3), 57-226.
- Igarzábal, D., Fichetti, P., Tognelli, M., 1994. Practical keys to identify Lepidoptera larvae in crops of agricultural importance in Cordoba (Argentina). *Gayana Zool.* 58, 99-142.
- Isas, M., Pérez, M. L. P., Salvatore, A., Gastaminza, G., Willink, E., White, W., 2016. Impacts of crop residue on damage by sugarcane pests during the tillering phase in Argentina. *Fla. Entomol.* 99, 1-5. <https://doi.org/10.1653/024.099.0102>.
- Koutsaftikis, A., 1974. Die Lepidopterenfauna der ostägäischen Insel Simi (Griechenland). *Ann. Goulandris Mus.* 2, 93-98.
- Lafontaine, J. D., Schmidt, B. C., 2010. Annotated check list of the Noctuoidea (Insecta, Lepidoptera) of North America north of Mexico. *ZooKeys* 40, 1-239. <https://doi.org/10.3897/zookeys.40.414>.
- Link, D., 1977. Abundância relativa de alguns Noctuidae, em armadilha luminosa, em Santa Maria, RS. *Rev. Cent. Cienc. Rurais* 7 (4), 331-351.
- Madruga, J., Specht, A., Salik, L. M. G., Casagrande, M. M., 2019. The external morphology of *Mythimna (Pseudaletia) sequax* (Lepidoptera: noctuidae). *Neotrop. Entomol.* 48, 834-852. <https://doi.org/10.1007/s13744-019-00703-7>.
- Marchioro, C. A., Foerster, L. A., 2012a. Importance of carbohydrate sources to the reproductive output of the wheat armyworm *Pseudaletia sequax*. *Agric. For. Entomol.* 14, 29-35. <https://doi.org/10.1111/j.1461-9563.2011.00548.x>.
- Marchioro, C. A., Foerster, L. A., 2012b. Performance of the wheat armyworm, *Pseudaletia sequax* Franclemont, on natural and artificial diets. *Neotrop. Entomol.* 41, 288-295. <https://doi.org/10.1007/s13744-012-0046-8>.
- Matrangolo, W. J. R., Cruz, I., Della Lúcia, T. M. C., 1997. Insetos fitófagos presentes em estilos-estigma e espigas de milho e avaliação de dano. *Pesqui. Agropecu. Bras.* 32 (8), 773-779.
- McDunnough, J., 1938. Check List of the Lepidoptera of Canada and United States of America. *Macrolepidoptera. Mem. S. Calif. Acad. Sci.* 1, 1-275.
- McNeil, J. N., 1987. The true army worm, *Pseudaletia unipuncta*: a victim of the Pied Piper or a seasonal migrant? *Insect Sci. Appl.* 8, 591-597. <https://doi.org/10.1017/S1742758400022657>.
- Morey, C. S., 1971. Biología de *Campoletis grioti* (Blanchard) (Hymen.: Ichneumonidae) parasite de la "lagarta cogollera del maíz" *Spodoptera frugiperda* (J. E. Smith). *Rev. Peru. Entomol.* 14 (2), 263-271.
- Nye, I. W. B., 1975. The Generic Names of Moths of the World. Noctuoidea: Noctuidae, Agaristidae and Nolidae. Vol. 1. British Museum, London.
- Ochsenheimer, F., 1816. *Schmetterlinge von Europa*. Vol. 4. Bernhard Fleischer Dem Tungern, Leipzig.
- Ohashi, D. V., Urdampilleta, J. D., 2003. Interacción entre insectos perjudiciales y benéficos en el cultivo de tabaco de Misiones, Argentina. *RIA* 32 (2), 113-124.
- Olivares, T. S., Angulo, A. O., Moreno, G., 2009. Diversidad de los Noctuidae en el corredor biológico Nevados de Chillán-Laguna del Laja (VIII Región, Chile) (Lepidoptera: Noctuidae). *SHILAP Revta. Lepid.* 37 (148), 389-404.
- Parra, L. E., Angulo, A. O., Jana-Sáenz, C., 1986. Lepidópteros de importancia agrícola: clave práctica para su reconocimiento en Chile (Lepidoptera. Noctuidae). *Gayana Zool.* 50 (1-4), 81-116.
- Pastrana, J. A., 2004. Los Lepidópteros Argentinos: sus plantas hospedadoras y otros substratos alimenticios. Sociedad Entomológica Argentina, Buenos Aires.
- Pereira, F. F., Zanuncio, T. V., Zanuncio, J. C., Pratisoli, D., Tavares, M. T., 2008. Species of Lepidoptera defoliators of *Eucalyptus* as new host for the parasitoid *Palmistichus elaeisis* (Hymenoptera: eulophidae). *Braz. Arch. Biol. Technol.* 51 (2), 259-262. <https://doi.org/10.1590/S1516-89132008000200004>.
- Polaszek, A., Foerster, L. A., 1997. *Telenomus cyamophylax*, n. sp. (Hymenoptera: Scelionidae) attacking eggs of the velvetbean caterpillar, *Anticarsia gemmatilis* Hübner (Lepidoptera: Noctuidae). *An. Soc. Entomol. Bras.* 26 (1), 177-181. <https://doi.org/10.1590/S0301-80591997000100023>.
- Pond, D. D., 1960. Life history studies of the armyworm, *Pseudaletia unipuncta* (Lepidoptera: Noctuidae), in New Brunswick. *Ann. Entomol. Soc. Am.* 53, 661-665. <https://doi.org/10.1093/aesa/53.5.661>.
- Pond, D. D., 1961. Frass studies of the armyworm, *Pseudaletia unipuncta*. *Ann. Entomol. Soc. Am.* 54, 133-140. <https://doi.org/10.1093/aesa/54.1.133>.
- Poole, R. W., 1989. *Lepidopterorum Catalogus: New Series*. Brill, New York.
- Queiroz, D. S., Casagrande, D. R., Moura, G. S., Silva, E. A., Viana, M. C. M., Ruas, J. R. M., 2012. Espécies forrageiras para produção de leite em solos de várzea. *Rev. Bras. Zootec.* 41 (2), 271-280. <https://doi.org/10.1590/S1516-35982012000200006>.
- Ratnasingham, S., Hebert, P. D. N., 2007. BOLD: the barcode of life data system. *Mol. Ecol. Notes* 7, 355-364. <https://doi.org/10.1111/j.1471-8286.2007.01678.x>.
- Rizzo, H. F., La Rossa, F. R., 1991. Aspectos morfológicos y biológicos de la "oruga militar verdadera" (*Pseudaletia adultera* (Schaus)) (Lep. Noctuidae). *Rev. Fac. Agron.* 12 (1), 39-46.
- Salas, H., Sotillo, S., Navarro, F., Gramajo, M. C., Willink, E., 1998. Complejo de orugas militares em caña de azúcar. *Av. Agroind.* 75, 13-16.
- Salvadori, J. R., Parra, J. R. P., 1990a. Efeito da temperatura na biologia e exigências térmicas de *Pseudaletia sequax* (Lep.: Noctuidae), em dieta artificial. *Pesqui. Agropecu. Bras.* 25 (12), 1693-1700.
- Salvadori, J. R., Parra, J. R. P., 1990b. Desempenho de *Pseudaletia sequax* (Lep.: Noctuidae) em dietas natural e artificiais. *Pesqui. Agropecu. Bras.* 25 (12), 1679-1686.
- Salvadori, J. R., Parra, J. R. P., 1990c. Seleção de dietas artificiais para *Pseudaletia sequax* (Lep.: noctuidae). *Pesqui. Agropecu. Bras.* 25 (12), 1701-1713.
- San Blas, G., Baudino, E. M., Dias, F. M. S., Dolibaina, D. R., Specht, A., Casagrande, M. M., Cornejo, P., Giraud, W. G., Mielke, O. H. H., 2021. Molecular characterization and phylogenetic assessment of agricultural-related noctuids (Lepidoptera: Noctuidae) of South America. *Rev. Bras. Entomol.* 65 (4), e20210104. <https://doi.org/10.1590/1806-9665-RBENT-2021-0104>.
- Sayers, E. W., Beck, J., Brister, J. R., Bolton, E. E., Canese, K., Comeau, D. C., Funk, K., Ketter, A., Kim, S., Kimchi, A., Kitts, P. A., 2020. Database resources of the national center for biotechnology information. *Nucleic Acids Res.* 48 (D1), D9-D16. <https://doi.org/10.1093/nar/gkz899>.
- Schaus, W., 1894. News species of noctuidae from tropical America. *Trans. Am. Entomol. Soc.* 21, 223-244.
- Shorthouse, D. P., 2010. SimpleMappr, An Online Tool to Produce Publication-Quality Point Maps. Available in: <http://www.simplemappr.net> (accessed 27 January 2022).
- Silva, A. G., Gonçalves, C. R., Galvão, D. M., Gonçalves, A. J. L., Gomes, J., Silva, N. M., Simoni, L., 1968. Quarto catálogo dos insetos que vivem nas plantas do Brasil, seus parasitos e predadores (1º tomo). Ministério da Agricultura, Rio de Janeiro.
- Soria, M. F., DeGrande, P. E., 2011. Artropodofauna associada a palhada em plantio direto. *Rev. Bras. Milho Sorgo* 10 (2), 96-107. <https://doi.org/10.18512/1980-6477/rbms.v10n2p96-107>.

- Specht, A., Corseuil, E., 1996. Lista documentada dos noctuóideos (Lepidoptera; Noctuidae) ocorrentes no Rio Grande do Sul. *Biociências* 4, 131-170.
- Specht, A., Corseuil, E., 2002a. Avaliação populacional de lagartas e inimigos naturais em azevém, com rede de varredura. *Pesqui. Agropecu. Bras.* 37 (1), 1-6. <https://doi.org/10.1590/S0100-204X2002000100001>.
- Specht, A., Corseuil, E., 2002b. Diversidade de noctuóideos (Lepidoptera, Noctuidae) em Salvador do Sul, Rio Grande do Sul, Brasil. *Rev. Bras. Zool.* 19 (Suppl.1), 281-298. <https://doi.org/10.1590/S0101-81752002000500022>.
- Specht, A., Silva, E. J. E., Link, D., 2004. Noctuóideos (Lepidoptera, Noctuidae) do Museu Entomológico Ceslau Biezanko, Departamento de Fitossanidade, Faculdade de Agronomia "Eliseu Maciel", Universidade Federal de Pelotas, RS. *Rev. Bras. Agrociência* 10 (4), 389-409.
- Specht, A., Teston, J. A., Di Mare, R. A., Corseuil, E., 2005. Noctuóideos (Lepidoptera, Noctuidae) coletados em quatro Áreas Estaduais de Conservação do Rio Grande do Sul, Brasil. *Rev. Bras. Entomol.* 49 (1), 130-140. <https://doi.org/10.1590/S0085-56262005000100015>.
- Speidel, W., Naumann, C. M., 2004. A survey of family-group names in noctuid moths (Insecta: Lepidoptera). *Syst. Biodivers.* 2 (2), 191-221. <https://doi.org/10.1017/S1477200004001409>.
- Stephens, J. F., 1829. *Illustrations of British Entomology*. Vol. 3. Baldwin and Cradock, London.
- Sutrisno, H., 2012. Molecular phylogeny of Indonesian armyworm *Mythimna* Guenée (Lepidoptera: Noctuidae: Hadeninae) based on COI gene sequences. *Hayati J. Biosci.* 19 (2), 65-72. <https://doi.org/10.4308/hjb.19.2.65>.
- Tamura, K., Stecher, G., Kumar, S., 2021. MEGA11: molecular evolutionary genetics analysis version 11. *Mol. Biol. Evol.* 38 (7), 3022-3027. <https://doi.org/10.1093/molbev/msab120>.
- Tarragó, M. F. S., Carvalho, S., Link, D., 1975. Levantamento da família Noctuidae, através de armadilhas luminosas, em Santa Maria, RS. *Rev. Cent. Cienc. Rurais* 5 (2), 125-130.
- Tavares, J., Oliveira, L., Anunciada, L., Vieira, V., 1992. *Mythimna unipuncta* (Haworth) (Lep., Noctuidae) nos Açores. I - Dinâmica das populações larvares e número de gerações. *Açoreana* 7, 415-425.
- Terra, A. L., Zerbino, M. S., 1986. Características biológicas de *Mythimna** (= *Pseudaletia*) *adultera* Schaus (Lep.: Noctuidae: Hadeninae) frente a dos tipos de alimento. *Investig. Agron.* 6, 49-53.
- Torres, J. B., Zanuncio, J. C., Moura, M. A., 2006. The predatory stinkbug *Podisus nigrispinus*: biology, ecology and augmentative releases for lepidopteran larval control in *Eucalyptus* forests in Brazil. *Perspect. Agric. Vet. Sci. Nutr. Nat. Resour.* 1 (15), 1-18. <https://doi.org/10.1079/PAVSNNR20061015>.
- Treat, A. E., 1966. A new *Blattisocius* (Acarina: Mesostigmata) from noctuid moths. *J. N.Y. Entomol. Soc.* 74, 143-159.
- Vieira, V., Pintureau, B., Tavares, J., McNeil, J. N., 2003. Differentiation and gene flow among island and mainland populations of the true armyworm, *Pseudaletia unipuncta* (Haworth) (Lepidoptera: noctuidae). *Can. J. Zool.* 81, 1367-1377. <https://doi.org/10.1139/z03-115>.
- Viette, P., 1951. Sur quelques noctuelles décrites par Guénée (1852-1854). *Bull. Mens. Soc. Linn. Lyon* 20 (7), 159-162. <https://doi.org/10.3406/linly.1951.7422>.
- Walker, F., 1856. List of the Specimens of Lepidopterous Insects in the Collection of the British Museum. The trustees of the British Museum, London.
- Yamamoto, A. C., Doetzer, A. K., Foerster, L. A., 1998. Efeito da temperatura no desenvolvimento de *Euplectrus ronnai* (Brèthes) (Hymenoptera, Eulophidae) parasitando lagartas de *Pseudaletia sequax* Franclemont (Lepidoptera, Noctuidae) e impacto do parasitismo no consumo alimentar do hospedeiro. *Acta Biol. Parana.* 27 (1-4), 85-95. <https://doi.org/10.5380/abpr.v27i0.673>.
- Yamamoto, A. C., Foerster, L. A., 2003. Reproductive biology and longevity of *Euplectrus ronnai* (Brèthes) (Hymenoptera: eulophidae). *Neotrop. Entomol.* 32 (3), 481-485. <https://doi.org/10.1590/S1519-566X2003000300016>.
- Yoshimatsu, S., 1994. A revision of the genus *Mythimna* (Lepidoptera: Noctuidae) from Japan and Taiwan. *Bull. Nat. Inst. Agro-Environmental Sci.* 11, 81-323.
- Yoshimatsu, S., 1995. Notes on the genus *Mythimna* (Lepidoptera, Noctuidae) from North Borneo, with description of a new species. *Jap. J. Entomol.* 63 (1), 235-241.
- Yoshimatsu, S., Hreblay, M., 1998. A revision of the subgenus *Morphopoliana* of the genus *Mythimna* (Lepidoptera: Noctuidae) from Taiwan and Japan. *Entomol. Sci.* 1, 597-603.
- Yoshimatsu, S., Legrain, A., 2001. Review of the Genus *Mythimna* Ochschenheimer (Lepidoptera, Taiwan, Noctuidae, Hadeninae) in Taiwan, with description of a new species and checklis. *Entomol. Sci.* 4 (4), 431-437.
- Zerbino, M. S., Luizzi, D. V., Perea, C. F., 1983. Simulación de daños de "lagartas" (Lepidoptera, Noctuidae) em trigo. *Investig. Agron.* 4, 20-24.
- Zerbino, M. S., 1984. Evaluación de momentos e intensidades de defoliación en trigo. *Investig. Agron.* 5, 17-19.
- Zerbino, M. S., 1991. Lagarta de los Cereales. Unidad de Difusión e Información Tecnológica del INIA, Instituto Nacional de Investigación Agropecuaria, Montevideo. (Serie Técnica 9).
- Zerbino, M. S., 1994. La lagarta de los cereales *Pseudaletia adultera* Schaus y su relación con los grados-día. Instituto Nacional de Investigación Agropecuaria, Montevideo. (Serie Técnica 47).