

STATE RESEARCH INSTITUTE NATURE RESEARCH CENTRE



NEOTROPICAL NEPTICULIDAE

(A Pictorial Monograph Introducing
an Electronic Identification Tool)

by
**Jonas R. Stonis,
Andrius Remeikis,
Arūnas Diškus**

Vilnius,
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Abstract

The publication deals with 228 species of Nepticulidae (or pygmy moths) from the Neotropics (i.e., the Neotropical and Ando-Patagonian regions) and adjacent areas. The species are illustrated with photographs or drawings of adult forewings, the male genitalia and, if available, leaf mines. In addition to the illustrated species review, the monograph announces about the launching of the first electronic diagnostic system (a free electronic tool on the internet) designed for the identification of species of Nepticulidae and includes chapters on the global biodiversity inventory, the collecting of adults and larvae of pygmy moths, preparation of micro-mounts of genitalia structures of Nepticulidae, global generic composition of the family, some particularities of Nepticulidae biology, a unique morphology guide based on the forewing pattern and male genitalia, descriptions of four newly named species, and a taxonomic checklist of the species currently known from the Neotropics and adjacent areas.

Santrauka

Monografijoje rašoma apie biologinės inventORIZacijos reikšmę, pateikiami patikslinti Neotropinio bei Andų ir Patagonijos biogeografinių regionų žemėlapiai, aprašomos mažųjų gaubtagalvių (Nepticulidae) biologijos ir paplitimo ypatybės, pateikiama naujausia pasaulinės Nepticulidae faunos genčių koncepcija, aptariama rūšių grupių pripažinimo problema, apibūrinama monografijos faktinė medžiaga ir detalios aprašomi tyrimų metodai. Šiame leidinyje pateikiamas originalus Nepticulidae morfologinių struktūrų vadovas ir nuoroda į diagnostikos priemonę – pirmąją elektroninę Nepticulidae rūšių identifikavimo sistemą, kuri valdoma ir kuria naudojamosi pasitelkiant ir išmaniuosius prietaisus. Pagrindinėje monografijos dalyje aprašomos keturios naujos mokslui rūšys, pateikiamas naujausiais tyrimais pagrįstas Neotropinio regiono Nepticulidae taksonominis sąrašas ir visų šiuo metu žinomų Nepticulidae rūšių apžvalga. Kiekviena monografijoje pateikta rūšis yra gausiai iliustruota. Rūšių iliustraciniuose maketuose pavaizduotos visų Centrinės ir Pietų Amerikos Nepticulidae rūšių minos mitybinių augalų lapuose, suaugėlių išorės ir genitalinės struktūros, įvardijant vaizduojamų mikropreparatų numerius ir jų deponavimo institucijas, nurodant duomenis apie žinomus trofinius ryšius, geografinį paplitimą ir rekomenduojamą literatūrą.

REVEALING GLOBAL BIODIVERSITY: NEPTICULIDAE

Inventorying of Biodiversity

(by Jonas R. Stonis)

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The time for exploring Earth's species and mapping their distribution in the biosphere has arrived (Wheeler *et al.*, 2012b). The current life poses new, often existential, challenges related to climate change, the global biodiversity crisis as well as shortage of skilled professionals. The development of society is inconceivable without research and cognition of the structural elements of living nature, i.e., ecosystems and species (especially those of economic significance) (Stonis *et al.*, 2022). The inventory of biodiversity is important not only because it gives knowledge of nature that surrounds us but also because of it provides tools for invoking prompt measures for the preservation of biodiversity. It is of utmost importance to understand the complicated mechanisms of the global biota. Because of the current fragmentation and destruction of natural habitats and global climate change, biodiversity is undergoing dramatic changes. Therefore, researchers in the field of biotaxonomy seem to be racing against time.

Therefore, it may appear that there is no longer a need to advocate for biodiversity inventories because so many various authors have already mentioned this topic. Nevertheless, in recent papers on Nepticulidae or related lepidopteran families, we were stressing again and again the importance of efficient biodiversity inventories (Stonis *et al.*, 2020; Dobrynina *et al.*, 2021, 2022). However, probably the best ever motivation for the inventorying of biodiversity and confronting challenges was provided by Q. D. Wheeler and his numerous co-authors in their paper “Mapping the biosphere: exploring species to understand the origin, organization and sustainability of biodiversity” (Wheeler *et al.*, 2012b). Millions of the world's species still await discovery and documenting, and the task to describe and monitor the Earth's biodiversity is immense (Zhang, 2008, 2011; Cutko, 2009; La Salle *et al.*, 2009; Pereira *et al.*, 2010; Wheeler *et al.*, 2012a, 2012b), but the speed is far from satisfactory (Schmeller *et al.*, 2017). To speed up the global inventorying, the integration of the DNA barcoding into an ongoing inventory has been actively propagated (notably Janzen *et al.*, 2009; Miller, 2015; Miller *et al.*, 2016; Aagaard *et al.*, 2017), and some seriously controversial attempts were recently undertaken (Dobrynina *et al.*, 2021). It is particularly the case of a minimalist revision with the description of about four hundred new species of Costa Rican braconid parasitoid wasps (Sharkey *et al.*, 2021) rejecting the usual standards for species description (Dobrynina *et al.*, 2021).

According to Wheeler *et al.* (2012b), the exploration of the biosphere is much like exploring the Universe. The more we learn, the more complex and surprising the biosphere and its story turn out to be (Wheeler *et al.*, 2012b). The closure of this knowledge gap, also known as the Linnean shortfall (Brito, 2010; Hortal *et al.*, 2015) or Wallacean shortfall (Hortal *et al.*, 2015), will require a strong renewed effort in the exploration and taxonomy as well as continuing effort to catalogue the existing biodiversity data in publicly available databases (Mora *et al.*, 2011; Wheeler *et al.*, 2012a; Dobrynina *et al.*, 2022). The availability (and quality) of such information seems to be essential for our general understanding how global biota functions (Pereira *et al.*, 2010). The documenting (description)

of new taxa (species in particular), as well as collecting and accumulation of various data about their ecological niches (including trophic relationships, i.e., feeding preferences), are fundamental tasks to be done for getting general knowledge about endangered segments of biodiversity (Dubois, 2011; Crisci *et al.*, 2020). According to Vane-Wright (1992, 1996), this task is right within the field of biological systematics or taxonomy and has the ultimate goal of documenting and realizing the actual extent and significance of global biodiversity. Even in the 21st century, we still lack a clear picture of the total number of species in, probably, the majority of organism groups (Larsen *et al.*, 2017) occurring both in terrestrial and aquatic habitats in order to reveal the composition (structure) and function of the Earth's ecosystems (May, 2011).

Another problem is that both regional or global species inventories are often restricted within groups of organisms which are the biggest, most “showy” or of the highest agricultural or medicinal priority (including vascular plants, butterflies, birds and mammals), and much less attention is paid to the remaining part of biodiversity (Puplesis, 2002; Hawksworth, 2011).

The world's smallest moths (Lepidoptera, also called Microlepidoptera) are also among these largely neglected and yet unstudied organisms. Nevertheless, data about these minusculous moths, like data on other organisms, can provide unique support for various hypotheses about the general genesis of the global biota and can also be used as outstandingly handy tools for rapid monitoring and actions to preserve biodiversity (Stonis *et al.*, 2020). The first attempts to realize this have already been undertaken. Endobiotic (i.e., living in plant tissues, internal) insects are not only an integral part of every terrestrial biota, biome, ecosystem, and many habitats but also important indicators of faunogenetic processes (Diškus & Stonis, 2012). Moreover, given that tiny leaf-mining Lepidoptera (such as Nepticulidae) are pests or potential pests of some cultivated and diverse wild aromatic, medicinal or otherwise significant plants (Kuznetsov & Puplesis, 1994; Stonis *et al.*, 2019, 2021a), various data about instar stages of these insects can also be highly useful and even of economic importance.

It should be noted that Nepticulidae are highly specialized, with many apomorphic features, but a phylogenetically primitive Lepidoptera family, which includes the world's smallest moths (Stonis *et al.*, 2021b). Recently, in the paper “What are the smallest moths (Lepidoptera) in the world?” (Stonis *et al.*, 2021b), we reported that about half of the world's total Nepticulidae species have a forewing length of less than 2.2 mm and a wingspan of less than 5 mm. The family is also very rich in small-size record holders with the lower limit for a known forewing length 1.13–1.3 mm, and a minimal wingspan 2.7–2.8 mm (Stonis *et al.*, 2021b).

The Nepticulidae larvae have a specific and highly specialized life mode: they are obligatory miners in green (photosynthetic) plant tissues. Because of the larval life mode in plant tissues and changes in larval morphology, these insects are somewhat similar to parasites, but they are not considered parasites by many researchers (including the authors of this publication). On the other hand, being extremely small and larvae living in plant tissues, they are still understudied in many regions of the world: not only in the tropics and tropics but also in some parts of the Boreal region. There is also a serious lack of qualified specialists and available diagnostic tools that could be used not only by biotaxonomists but also by other users (including foresters, gardeners, conservationists, and educators).

It was estimated recently (Dobrynina *et al.*, 2022) that by the end of 2021, a thousand of Nepticulidae species were described; on average, it makes about four species a year. Given that the first species of Nepticulidae was described in 1767, the history of the family's global research counts about 255 years (Fig. 1). To date, two time periods, early 20th and early 21st centuries, seem to be the

most productive (Fig. 1). However, the authors of the study Dobrynina *et al.* (2022) also pointed out that there is great difference in the average of species described per year between the early 20th and early 21st centuries, and that, in general, the speed of discoveries tends to accelerate.

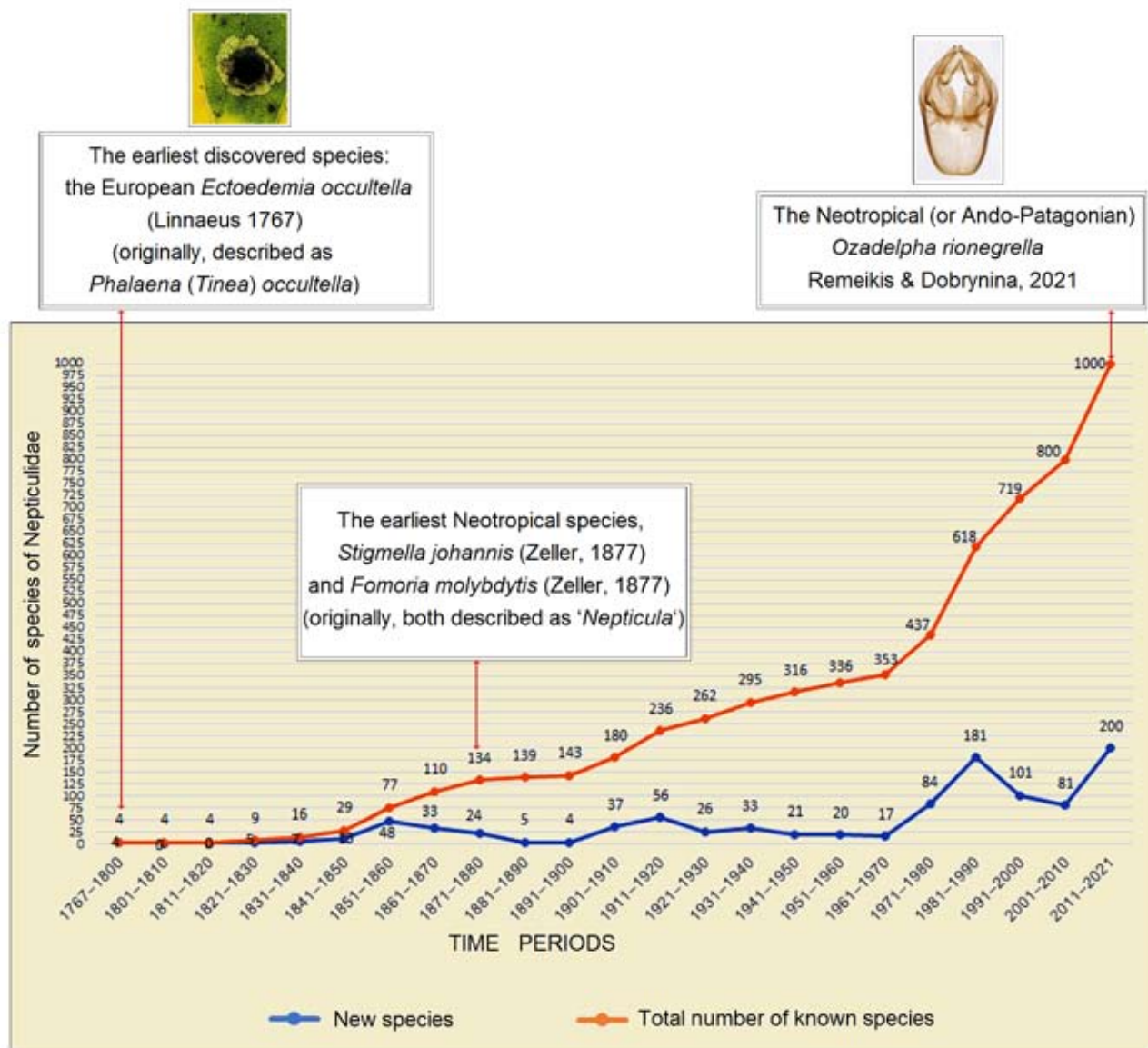


Figure 1. Dynamics of new Nepticulidae species discoveries and rise of the cumulative number of species during various time periods (after Dobrynina *et al.*, 2022; modified).

The early stage of the Neotropical Nepticulidae research has been briefly outlined by Puplesis & Robinson (2000) and later continued by Stonis *et al.* (2016). The authors reported that the first two species documented from the Neotropics, *Stigmella johannis* and *Fomoria molybditis*, had been described by Zeller (1877) (as belonging to *Nepticula*) from Colombian material collected by Johann and Nolcken in 1871 (Puplesis & Robinson, 2000). Subsequently, five more species were described from Peru and two, from Guyana by Meyrick (1915); however, one of the Guyanese species (the externally purple shiny *Enteucha cyanochlora*) was incorrectly placed in the Lyonetiidae and recognized as a species of the pygmy moth family only about 70 years later (Davis, 1985). According to Puplesis & Robinson (2000), after Meyrick's descriptions, before the boom of investigations

in the 21st century, there were, in fact, no investigations of the Neotropical Neptculidae, except for sporadic descriptions of a few new species from the Caribbean (Forbes & Leonard, 1930) and Argentina (Meyrick, 1931; Bourquin, 1962) and a few descriptions of neptculid taxa with obvious Neotropical affinities from Florida, USA (Davis, 1978; Wilkinson, 1981).

The summarizing of the inventory of the global Neptculidae allowed to estimate that, to date, a total of 131 individual researchers participated in the description of the world's fauna of Neptculidae (Dobrynina *et al.*, 2022). The publication by Dobrynina *et al.* (2022) names the researchers who have made the biggest contribution to the inventory of the global Neptculidae (Fig. 2) and the related Opostegidae and Tischeriidae (see Dobrynina *et al.* 2022). The provided graph includes only those

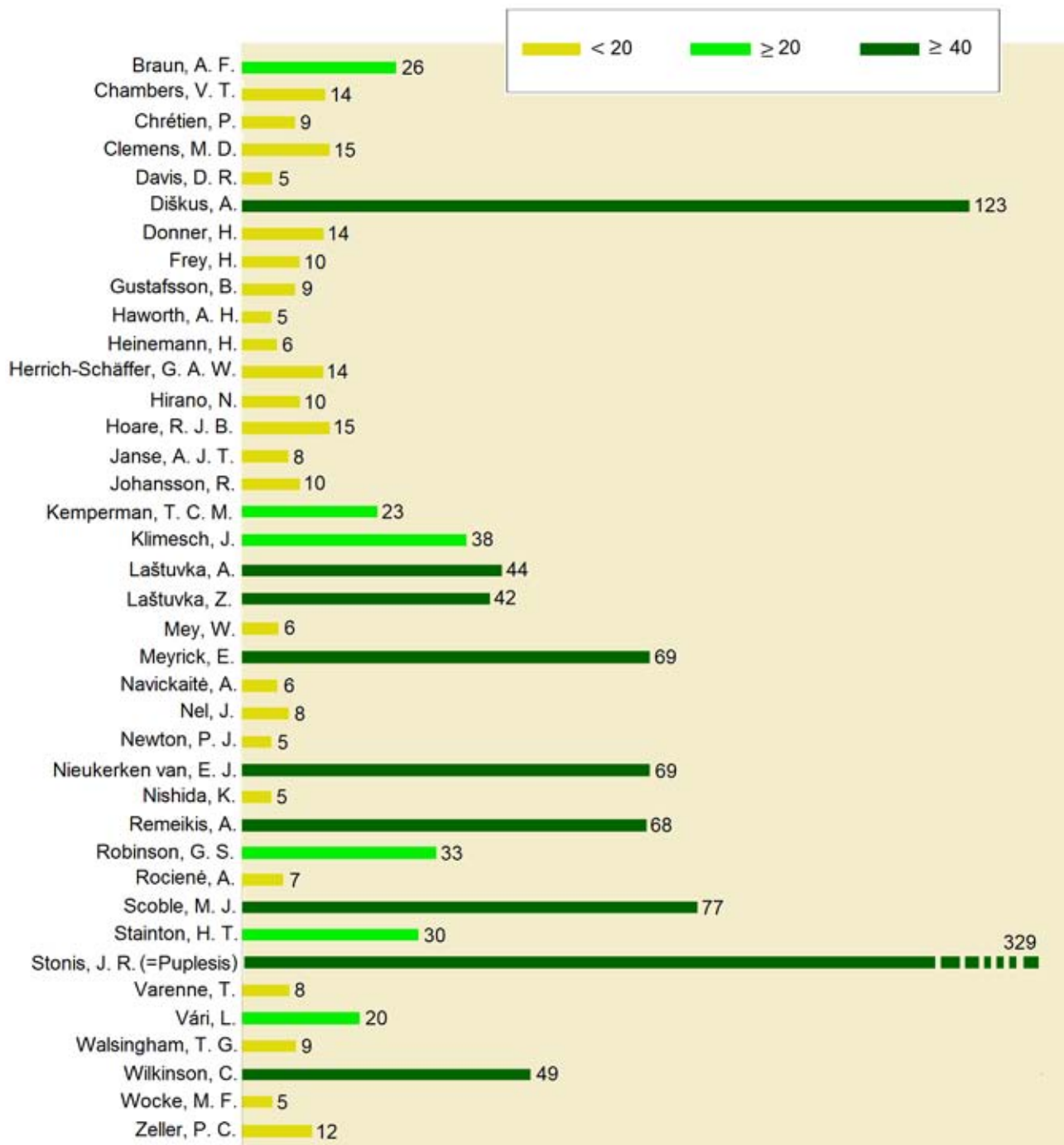


Figure 2. Individual researchers who made the largest contribution as authors or co-authors to the discovery and description of the global fauna of Neptculidae (Note. The graph does not include researchers who described fewer than five new species) (after Dobrynina *et al.*, 2022).

authors who described at least five Nepticulidae species (there are, in total, 39 such authors). Among these researchers, nine authors participated in the description of ≥ 40 species, and a few, according to Dobrynina *et al.* (2022) made an exceptional contribution to the taxonomic inventory of the global Nepticulidae (Fig. 2).

Investigations continue and gather momentum in spite of the paucity of qualified experts and insufficient funding (it is still not uncommon for enthusiasts of biodiversity research to not only face bureaucratic obstacles but also to self-finance their field work).

Within this project, a team of authors, in cooperation and collaboration with various foreign colleagues, sought to develop and provide a freely available tool for today's consumers for the identification of known Nepticulidae taxa. Therefore, together with this pictorial monograph, the first electronic diagnostic system for Nepticulidae species has been created and uploaded, and it will be accessible via mobile electronic devices. A such freely accessible, user-friendly and involving system is an innovative product of biotaxonomy that provides today's consumers with a means to identify Nepticulidae. The current publication and the electronic diagnostic system for Nepticulidae are intended to provide a foundation upon which we and others can build a more detailed account of the diversity of the Neotropical Nepticulidae. We hope that this publication and the electronic diagnostic system will stimulate further studies in Neotropical Nepticulidae and contribute to a more detailed account of the diversity of the Neotropical and the world's leaf-mining insects in general.

References

- Aagaard, K., Berggren, K., Hebert, P.D.N., Sones, J., McClenaghan, B. & Ekrem, T. (2017) Investigating suburban micromoth diversity using DNA barcoding of malaise trap samples. *Urban Ecosystems*, 20, 353–361. <https://doi.org/10.1007/s11252-016-0597-2>
- Bourquin, F. (1962) Microlepidopteros nuevos con sus biologias. *Revista de la Sociedad Entomologica Argentina*, 23, 31–46. <https://www.biotaxa.org/RSEA/issue/view/4667>
- Brito, D. (2010) Overcoming the Linnean shortfall: Data deficiency and biological survey priorities. *Basic and Applied Ecology*, 11 (8), 709–713. <https://doi.org/10.1016/j.baae.2010.09.007>
- Crisci, J., Katinas, L., Apodaca, M.J. & Hoch, P.C. (2020) The end of Botany. *Trends in Plant Science*, 25 (12), 1173–1176. <https://doi.org/10.1016/j.tplants.2020.09.012>
- Cutko, A. (2009) *Biodiversity Inventory of Natural Lands: A How-To Manual for Foresters and Biologists*. NatureServe, Arlington, Virginia, 32 pp. https://www.natureserve.org/sites/default/files/biodiversityinventorymanual_main.pdf
- Davis, D.R. (1985) A re-examination of *Enteucha cyanochlora* Meyrick and its subsequent transfer to the Nepticulidae (Lepidoptera: Nepticuloidea). *Proceedings of the Entomological Society of Washington*, 87 (1), 142–145. <https://www.biodiversitylibrary.org/page/16218435#page/150/mode/1up>
- Davis, D.R. (1978) New leaf-mining moths of the family Nepticulidae from Florida. *The Florida Entomologist*, 61 (4), 209–224. <https://doi.org/10.2307/3494210>
- Diškus, A. & Stonis, J.R. (2012) *Leaf-mining insects of Lithuania. The Nepticulidae (Lepidoptera): taxonomy, chorological composition and trophic relationships. Monograph*. Lututė Publishers, Kaunas, 220 pp. [in Lithuanian]
- Dobrynina, V., Baryshnikova, S., Budrys, E., Rimšaitė, J. & Bidzilya, O. (2021) Taxonomic papers as published products of the biodiversity inventory: if not the Impact Factor (IF) or Quartiles (Q), then what determines their importance estimated on the basis of the Research Interest Score? *Biologija*, 67 (2), 93–113. <https://doi.org/10.6001/biologija.v67i2.4454>
- Dobrynina, V., Stonis, J.R., Diškus, A., Solis, M.A., Baryshnikova, S.V. & Young-Min, S. (2022) Global Nepticulidae, Opistegidae, and Tischeriidae (Lepidoptera): temporal dynamics of species descriptions and their authors. *Zootaxa*, 5099 (4), 450–474. <https://doi.org/10.11646/zootaxa.5099.4.2>
- Dubois, A. (2011) Describing a New Species. *TAPROBANICA The Journal of Asian Biodiversity*, 2 (1), 6–24.

- Forbes, W.T.M. & Leonard, M.D. (1930) A new leaf-miner of cotton in Porto Rico (*Nepticula gossypii* n. sp.). *Journal of the Department of Agriculture, Porto Rico*, 14, 149–157.
- Hawksworth, D.L. (2011) Biodiversity and conservation of insects and other invertebrates. *Biodiversity and Conservation*, 20, 2863–2866. <https://doi.org/10.1007/s10531-011-0178-x>
- Hortal, J., de Bello, F., Diniz-Filho, J.A.F., Lewinsohn, T.M., Lobo, J.M. & Ladle, R.J. (2015) Seven shortfalls that beset large-scale knowledge of biodiversity. *Annual Review of Ecology, Evolution and Systematics*, 46, 523–549. <https://doi.org/10.1146/annurev-ecolsys-112414-054400>
- Janzen, D.H., Hallwachs, W., Blandin, P., Burns, J.M., Cadiou, J.M., Chacon, I., Dapkey, T., Deans, A.R., Epstein, M.E., Espinoza, B., Franclemont, J.G., Haber, W.A., Hajibabaei, M., Hall, J.P., Hebert, P.D., Gauld, I.D., Harvey, D.J., Hausmann, A., Kitching, I.J., Lafontaine, D., Landry, J.F., Lemaire, C., Miller, J.Y., Miller, J.S., Miller, L., Miller, S.E., Montero, J., Munroe, E., Green, S.R., Ratnasingham, S., Rawlins, J.E., Robbins, R.K., Rodriguez, J.J., Rougerie, R., Sharkey, M.J., Smith, M.A., Solis, M.A., Sullivan, J.B., Thiaucourt, P., Wahl, D.B., Weller, S.J., Whitfield, J.B., Willmott, K.R., Wood, D.M., Woodley, N.E. & Wilson, J.J. (2009) Integration of DNA barcoding into an ongoing inventory of complex tropical biodiversity. *Molecular Ecology Resources*, 9 (1), 1–26. <https://doi.org/10.1111/j.1755-0998.2009.02628.x>
- Kuznetsov, V.I. & Puplesis, R. (1994) Fam. Nepticulidae (Stigmellidae)—pygmy moths. In: Kuznetsov, V.I. (Ed.), *Insects and mites—pests of agricultural plants. Lepidoptera*, 3 (1). Nauka Publishers, St. Petersburg, pp. 12–23. [in Russian]
- La Salle, J., Wheeler, Q., Jackway, P., Winterton, S., Hobern, D. & Lovell, D. (2009) Accelerating taxonomic discovery through automated character extraction. *Zootaxa*, 2217 (1), 43–55. <https://doi.org/10.11646/zootaxa.2217.1.3>
- Larsen, B., Miller, E.C., Rhodes, M.K. & Wiens, J.J. (2017) Inordinate fondness multiplied and redistributed: the number of species on Earth and the new pie of life. *The Quarterly Review of Biology*, 92 (3), 229–265. <https://doi.org/10.1086/693564>
- May, R.M. (2011) Why Worry about How Many Species and Their Loss? *PLoS Biol*, 9 (8), e1001130. <https://doi.org/10.1371/journal.pbio.1001130>
- Meyrick, E. (1915) Descriptions of South American Micro-Lepidoptera. *The Transactions of the Entomological Society of London*, 48, 201–256. <https://doi.org/10.1111/j.1365-2311.1915.tb02527.x>
- Meyrick, E. (1931) Micro-Lepidoptera from South Chile and Argentina. *Anales del Museo Nacional de Historia Natural, Buenos Aires*, 36, 377–415.
- Miller, S.E. (2015) 22 – DNA barcoding in floral and faunal research. In: Watson, M.F., Lyal, C.H.C. & Pendry, C.A. (Eds.), *Descriptive Taxonomy: the Foundation of Biodiversity Research*. Cambridge University Press, Cambridge, p. 296–311. <http://dx.doi.org/10.1017/CBO9781139028004.028>
- Miller, S.E., Hausmann, A., Hallwachs, W. & Janzen, D.H. (2016) Advancing taxonomy and bioinventories with DNA barcodes. *Philosophical Transactions of the Royal Society B*, 371 (1702), 20150339. <https://dx.doi.org/10.1098%2Frstb.2015.0339>
- Mora, C., Tittensor, D.P., Adl, S., Simpson, A.G.B. & Worm, B. (2011) How Many Species Are There on Earth and in the Ocean? *PLoS Biol*, 9 (8), e1001127. <https://doi.org/10.1371/journal.pbio.1001127>
- Pereira, H., Belnap, J., Brummitt, N., Collen, N., Ding, H., Gonzales-Espinosa, M., Gregory, R., Honrado, J., Jongman, R.H.G., Julliard, R., McRae, L., Proença, V., Rodrigues, P., Opige, M., Rodríguez, J., Schmeller, D.S., van Swaay, C. & Vieira, C. (2010) Global Biodiversity Monitoring. *Frontiers in Ecology and the Environment*, 8 (9), 459–460. <https://doi.org/10.1890/10.WB.23>
- Puplesis, R. (2002) *Biodiversity: an introduction to global animal and plant diversity*. Lututė Publishers, Kaunas, 154 pp. [in Lithuanian]
- Puplesis, R. & Robinson, G.S. (2000) A review of the Central and South American Nepticulidae (Lepidoptera) with special reference to Belize. *Bulletin of the Natural History Museum, London, Entomology*, 69 (1), 3–114.
- Schmeller, D.S., Böhm, M., Arvanitidis, C., Barber-Meyer, S., Brummitt, N., Chandler, M., Chatzinikolaou, E., Costello, M.J., Ding, H., García-Moreno, J., Gill, M., Haase, P., Jones, M., Julliard, R., Magnusson, W.E., Martin, C.S., McGeoch, M., Mihoub, J.-B., Pettorelli, N., Proença, V., Peng, C., Regan, E., Schmiedel, U., Simaika, J.P., Weatherdon, L., Waterman, C., Xu, H. & Belnap, J. (2017) Building capacity in biodiversity monitoring at the global scale. *Biodiversity and Conservation*, 26, 2765–2790. <https://doi.org/10.1007/s10531-017-1388-7>

- Sharkey, M.J., Janzen, D.H., Hallwachs, W., Chapman, E.G., Smith, M.A., Dapkey, T., Brown, A., Ratnasingham, S., Naik, S., Manjunath, R., Perez, K., Milton, M., Hebert, P., Shaw, S.R., Kittel, R.N., Solis, M.A., Metz, M.A., Goldstein, P.Z., Brown, J.W., Quicke, D.L.J., van Achterberg, C., Brown, B.V., Burns, J.M. (2021) Minimalist revision and description of 403 new species in 11 subfamilies of Costa Rican braconid parasitoid wasps, including host records for 219 species. *ZooKeys*, 1013, 1–665. <https://doi.org/10.3897/zookeys.1013.55600>
- Stonis, J.R., Diškus, A., Dobrynina, V., Remeikis, A. & Buchner, P. (2022) *A guide to leaf mines of the Lithuanian Nepticulidae (introducing an electronic identification tool)*. Gamtos tyrimų centras, Vilnius, 122 pp. [in Lithuanian] <https://doi.org/10.35513/2022.Nepticulidae>
- Stonis, J.R., Diškus, A., Fernández-Alonso, J.L., Remeikis, A. & Solis, M.A. (2021a) New leaf-mining Nepticulidae (Lepidoptera): potential pests of aromatic Lamiaceae plants from equatorial Andes. *Zootaxa*, 4926 (3): 363–383. <https://doi.org/10.11646/zootaxa.4926.3.3>
- Stonis, J.R., Diškus, A., Remeikis, A., Gerulaitis, V. & Karsholt, O. (2016) Leaf-mining Nepticulidae (Lepidoptera) from record high altitudes: documenting an entire new fauna in the Andean páramo and puna. Monograph. *Zootaxa*, 4181 (1), 1–94. <http://doi.org/10.11646/zootaxa.4181.1.1>
- Stonis, J.R., Diškus, A., Remeikis, A., Solis, M.A. & Katinas, L. (2020) Exotic-looking Neotropical Tischeriidae (Lepidoptera) and their host plants. *ZooKeys*, 970, 117–158. <https://doi.org/10.3897/zookeys.970.54801>
- Stonis, J.R., Remeikis, A., Diškus, A., Baryshnikova, S. & Solis, M.A. (2021b) What are the smallest moths (Lepidoptera) in the world? *Zootaxa*, 4942 (2), 269–289. <https://doi.org/10.11646/zootaxa.4942.2.8>
- Stonis, J.R., Remeikis, A., Diškus, A., Orlovskytė, S., Vargas, S.A. & Solis, M.A. (2019) A new leafmining pest of guava: *Hesperolyra guajavifoliae* sp. nov., with comments on the diagnostics of the endemic Neotropical genus *Hesperolyra* van Nieukerken (Lepidoptera, Nepticulidae). *ZooKeys*, 900, 87–110. <https://doi.org/10.3897/zookeys.900.46332>
- Vane-Wright, R.I. (1992) Systematics and global biodiversity strategy. *Antenna*, 16, 49–56.
- Vane-Wright, R.I. (1996) Systematics and the Conservation of Biological Diversity. *Annals of the Missouri Botanical Garden*, 83 (1), 47–57. <https://doi.org/10.2307/2399967>
- Wheeler, Q., Bourgoin, T., Coddington, J., Gostony, T., Hamilton, A., Larimer, R., Polaszek, A., Schauff, M. & Solis, M.A. (2012a) Nomenclatural benchmarking: the role of digital typification and telemicroscopy. *ZooKeys*, 209, 193–202. <https://doi.org/10.3897/zookeys.209.3486>
- Wheeler, Q.D., Knapp, S., Stevenson, D.W., Stevenson, J., Blum, S.D., Boom, B.M., Borisy, G.G., Buizer, J.L., de Carvalho, M.R., Cibrian, A., Donoghue, M.J., Doyle, V., Gerson, E.M., Graham, C.H., Graves, P., Graves, S.J., Guralnick, R.P., Hamilton, A.L., Hanken, J., Law, W., Lipscomb, D.L., Lovejoy, T.E., Miller, H., Miller, J.S., Naeem, S., Novacek, M.J., Page, L.M., Platnick, N.I., Porter-Morgan, H., Raven, P.H., Solis, M.A., Valdecasas, A.G., van der Leeuw, S., Vermeulen, N., Vogel, J., Walls, R.L., Wilson, E.O. & Woolley, J.B. (2012b) Mapping the biosphere: exploring species to understand the origin, organization, and sustainability of biodiversity. *Systematics & Biodiversity*, 10 (1), 1–20. <https://doi.org/10.1080/14772000.2012.665095>
- Wilkinson, C. (1981) A supplement to the genus *Ectoedemia* Busck (Nepticulidae: Lepidoptera) in North America, dealing with some difficult species and also some new ones. *Tijdschrift voor Entomologie*, 124 (3), 93–110. <http://biostor.org/reference/49900>
- Zeller, P.C. (1877) Exotische Microlepidoptera. II. *Horae Societatis Entomologicae Rossicae*, 13, 289–493. <http://biodiversitylibrary.org/page/12834243>
- Zhang, Z.-Q. (2008) Accelerating biodiversity descriptions and transforming taxonomic publishing: The first decade of Zootaxa. *Zootaxa*, 2896 (1), 1–7. <https://doi.org/10.11646/zootaxa.2896.1.1>
- Zhang, Z.-Q. (2011) Describing unexplored biodiversity: Zootaxa in the International Year of Biodiversity. *Zootaxa*, 2768 (1), 1–4. <https://doi.org/10.11646/zootaxa.2768.1.1>

Neotropical and Ando-Patagonian Regions

(by Jonas R. Stonis)

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For simplicity and convenience to users, all species included in this pictorial monograph are presented as “neotropical”. However, despite the long-standing tradition of treating America down from tropical Mexico to the southern borders of Argentina and Chile as a single biogeographical region (the Neotropics), the authors of the current publication adhere to the two-region concept recognizing two biogeographical regions (the Neotropical and Ando-Patagonian, with the South American transition zone (see Morrone, 2014, 2015) (Figs 3–6). As we already wrote earlier (Stonis *et al.*, 2017), the Andes, the world’s longest continental mountain range with a continuous range of highlands along the western coast of South America, initially were reported as a subregion of the Neotropical region by the Sclater-Wallace system (Sclater, 1899; Wallace, 1876) (see Morrone, 2014, 2015). However, in the most recent biogeographic regionalization provided by Morrone (2014, particularly 2015), the High Andes is recognized as the South American transition zone (Fig. 4) or a subregion in the Andean biogeographical region separate from the Neotropical biogeographical region (Stonis *et al.*, 2017) (Figs 5, 6). Therefore, following Morrone (2015), we also considered the Andes, including the Páramo, Nazca (or “Desert” in Morrone, 2015), Puna, Atacama, Prepuna, and Monte provinces (all recognized by Morrone, 2015) the South American transition zone belonging to the Ando-Patagonian region. If we strictly follow terminology by Morrone (2015), the name of the Ando-Patagonian region would be “the Andean region”; however, because of some visual resemblance with a transitional zone, we preferred rejecting the name and called the region as the Ando-Patagonian region.

References

- Morrone, J.J. (2014) Biogeographical regionalisation of the Neotropical region. *Zootaxa*, 3782 (1), 1–110. <http://dx.doi.org/10.11646/zootaxa.3782.1.1>
- Morrone, J.J. (2015) Biogeographical regionalisation of the Andean region. *Zootaxa*, 3936 (2), 207–236. <https://doi.org/10.11646/zootaxa.3936.2.3>
- Sclater, P.L. (1858) On the general geographic distribution of the members of the class Aves. *Proceedings of the Linnean Society of London, Zoology*, 2, 130–145. <http://dx.doi.org/10.1111/j.1096-3642.1858.tb02549.x>
- Stonis, J.R., Remeikis, A., Diškus, A. & Gerulaitis, V. (2016) The Ando-Patagonian *Stigmella magnispinella* group (Lepidoptera, Nepticulidae) with description of new species from Ecuador, Peru and Argentina. *Zootaxa*, 4200 (4), 561–579. <http://doi.org/10.11646/zootaxa.4200.4.7>
- Stonis, J.R., Remeikis, A., Diškus, A. & Megeran, N. (2017) New species of leaf-mining Nepticulidae (Lepidoptera) from the Neotropical and Ando-Patagonian regions, with new data on host-plants. *Zootaxa*, 4272 (1), 1–39. <https://doi.org/10.11646/zootaxa.4272.1.1>
- Wallace, A.R. (1876) *The geographical distribution of animals*. Vol. I & II. Harper and Brothers, New York, 576 + 650 pp.



Figure 3. Two-region concept recognizing two biogeographical regions (the Neotropical and Ando-Patagonian, with the South American transition zone (after Stonis *et al.*, 2017 and Morrone, 2014).



Figure 4. The South American transition zone of the Ando-Patagonian region, with provinces of the Transition zone (after Stonis *et al.*, 2016 and Morrone, 2015, modified).



Figures 5, 6. Geographical maps: 5 – distribution of the recently documented *Stigmella magnispinella* group, a species group occurring in the South American transition zone and the Ando-Patagonian region (Stonis *et al.*, 2016); 6 – biogeographical provinces of the Ando-Patagonian Region (after Stonis *et al.*, 2016, and Morrone, 2014, 2015, modified).

Peculiar Pygmy Moths (Nepticulidae)

(by J. R. Stonis, A. Remeikis, A. Diškus)

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The authors of the current publication think that there is nothing more interesting and beautiful in the world of Lepidoptera than the pygmy moths (Nepticulidae), as well as Opostegidae, a sister family of white eye-cap moths, and, according to Arūnas Diškus, Tischeriidae, a distantly related family of trumpet moths.

Recently, before the current publication, Nepticulidae counted 1,000 described species globally (Dobrynina *et al.*, 2022); now, together with three newly named *Stigmella* and one *Ectoedemia* species, the world's pygmy moths count 1,004 species.

The Nepticulidae family comprises some of the smallest known Lepidoptera. Recently, in our paper (Stonis *et al.*, 2021b), we reported that the family is very rich in small-size record holders; the lower limit for a known forewing length is 1.13–1.3, and a minimal wingspan is 2.7–2.8 mm. The extremely small species, with a forewing length of less than 1.8 mm or a wingspan less than 4.0 mm comprise about 12 % of the global fauna (Stonis *et al.*, 2021b). In the above-mentioned paper, we provided a measurement update for the Mexican *Stigmella maya* Remeikis & Stonis, one of the tiniest species with a forewing length of 1.3 mm and wingspan of 2.8 mm and listed other Nepticulidae species with the minimal recorded forewing length: the European *Johanssoniella acetosae* (Stainton), the Peruvian *Simplimorpha kailai* Stonis & Diškus, the Mediterranean *Stigmella diniensis* (Klimesh), and the Mediterranean *Parafomoria liguricella* (Klimesh) (Stonis *et al.*, 2021b). Nevertheless, although Nepticulidae are especially famous for their extremely small or very small moths, adults of some species are real “monsters” among pygmy moths and can reach 10–12.5 mm in wingspan (Wilkinson, 1981; Stonis *et al.*, 2021b). We expect that there are probably many more extremely small (or large) species in the tropics, including the Neotropics, and with further study of the world fauna of the family, these small-size records may be shattered on discoveries of new species (Stonis *et al.*, 2021b).

Larvae of a vast majority of the Nepticulidae species are leaf miners; the remaining species mine in the stem, buds, young bark of trees or in maple samaras (see a pictorial guide by Stonis *et al.*, 2022). A few of Nepticulidae taxa are gall inducers (notably, some *Ectoedemia* species and particularly *Stigmella gallicola* van Nieukerken & Nishida, which was recently reported from Costa Rica, Central America by van Nieukerken *et al.*, 2016).

From a human economic point of view, Nepticulidae are plant pests or potential pests because they damage some cultivated and numerous ornamental, aromatic, medicinal and forest plants. They may be economically important because of possible invasions or epizootics. Living under the epidermis and producing variously shaped leaf mines, larvae cause damage to the host plant. According to Stonis *et al.* (2021b), although Nepticulidae adults are among the smallest lepidopterans, a leaf mine produced by a tiny larva can be relatively large on a single leaf. Such a leaf mine can cause significant damage to the leaf, especially to smaller leaves because the larva consumes much of the photosynthetic tissues. Leaf mines usually are not very abundant, but during a significant population increase or explosion, damage to the entire host plant may be severe. For example, in Far East Russia, Puplesis (1985) reported about 400–500 leaf mines of *Ectoedemia picturata* Puplesis, 1985 on a

single compound leaf of a cultivated *Rosa rugosa*, which is a source of edible rose hips rich in vitamin C (Dimitrov *et al.*, 1980; Stonis *et al.*, 2021a). In the latter case, larval abundance was so high that complete development of the larvae became impossible, and the foliage of observed plants lost their green colour (photosynthetic parenchyma) and became brown (Puplesis, 1994; Stonis *et al.*, 2021a). The authors' field observations, at least in the case of some Palaearctic species of *Fomoria*, reveal that leaf mines can also cause premature abscission of leaves, and the defoliation of trees can lead to the reduction in the yield of a fruit product (e.g., Hyerdahl & Dutcher, 1985; Alford, 2012).

Climate change may lead to the development of additional generations, which may significantly increase the population of pests and their possible damage to host plants. We assume that because of the climate change and the intensification of trade with tropical and subtropical countries and the increase in the flow of travellers, the risk of accidental spread of alien pests to local faunas has also increased (Diškus & Stonis, 2012; Navickaitė, 2014). However, there is no evidence supporting such an assumption, and further research is necessary. As it was reported previously (Puplesis & Diškus, 2003), oligophagous species, together with their host plants, can be accidentally introduced in new regions and begin feeding on hitherto uncharacteristic local plants (Puplesis & Diškus, 2003) as it was observed in the case of the European *Stigmella plagicollella* (Stainton), which was registered feeding on alien host plants introduced to Europe from East Asia (J. R. Stonis, unpublished). The engaging of new host plants is the most possible outcome in the case of species which are not strictly trophically specialized, and especially those feeding on plants from Rosaceae family (including *Malus*, *Pyrus*, *Prunus*, *Rosa*, etc.). On the other hand, species which are trophically related to the aforementioned Rosaceae, make a large portion (almost one-fifth of the world's currently trophically studied Nepticulidae species) and predominate in the Holarctics (the Nearctic and Palaearctic regions) (Puplesis & Diškus, 2003). To prevent the accidental introduction of pests and apply quarantine measures effectively, it is necessary to know not only the species of the pests and their biology but also the distribution areas and trophic specialization of all potentially dangerous species (Diškus & Stonis, 2012). Data on the trophic relationships of organisms (especially monophagous and oligophagous) allow us not only defining ecological adaptations of an individual species but also choosing more efficient ways to regulate their abundance. In contrast to the Holarctic fauna, Rosaceae-feeding Nepticulidae in the Neotropics are either understudied (Stonis *et al.*, 2016a) or less common.

About half of the Nepticulidae taxa from the Neotropics have no host-plant data: 63.4 % of the species occurring in temperate habitats and 46.6 % of the species occurring in predominantly tropical habitats (Remeikis *et al.*, 2016). Unfortunately, such species without host-plant data known, i.e., with descriptions solely based on adult characters and genitalia morphology, limit our understanding of these taxa. It was hypothesized that host-plant distribution ranges can provide clues to potential distribution ranges of newly discovered trophically specialized Nepticulidae or other phytophagous microlepidopterans (Stonis *et al.*, 2019a, 2020, 2021a).

Previously, there were no attempts to analyze trophic relationships of the Neotropical Nepticulidae because of a lack of host-plant data. However, the first attempt was made recently by the publishing of a paper about pronounced feeding strategies of Nepticulidae in Central and South America based on results of a preliminary trophic analysis (Figs 7–10) (Remeikis *et al.*, 2016). It appeared that the majority of the species in the Neotropics (*sensu lato*) are trophically associated with either Asterids (Asteridae, 41.5 %) or Rosids (Rosidae, 54.8 %); only a small fraction (3.7 %) is trophically associated with host-plants from other subclasses (Remeikis *et al.*, 2016). The data on the Nepticulidae fauna of predominantly tropical habitats were compared with the data from temperate habitats of South

America (Remeikis *et al.*, 2016). The analysis also indicated that páramo and puna were characterized by a rather low generic diversity of host-plants, mostly belonging to the Asteraceae family (40.1 %) and much less to other families (e.g., Euphorbiaceae, Scrophulariaceae, Grossulariaceae, etc.). When compared with the Holarctics, the conducted host-plant analysis showed some unexpected but pronounced feeding tendencies of the Neotropical Nepticulidae: in contrast to the Holarctic fauna, where only 0.2 % of Nepticulidae species were associated with the Asterales order, in the Neotropics, 24 % of the species were Asterales feeders (Fig. 11) (Remeikis *et al.*, 2016). The Lamiales feeders are also very abundant (accounting for about 14.3 % of all tropically investigated Neotropical species) and they demonstrated a striking difference when two faunas, Holarctic and Neotropical, were compared (Remeikis *et al.*, 2016).

The discovered, unexpectedly rich but previously overlooked fauna of Asteraceae feeders in the Neotropics (Figs 13–15) was within the focus of the recent paper “Asteraceae: Host to the Greatest Diversity of Leafmining Nepticulidae (Lepidoptera) in South America?” by Jonas R. Stonis, Arūnas Diškus, Liliana Katinas, and M. Alma Solis (Fig. 12) (Stonis *et al.*, 2018a). The authors reviewed all currently known records of Asteraceae-feeding Nepticulidae from the Neotropics, described new species of *Stigmella* from equatorial South America and asked a question: why the *Stigmella* species (Nepticulidae) have been so successful on Asteraceae? The authors supposed that it could be related to the origin of Asteraceae plants in South America and their extreme diversity there (Stonis *et al.*, 2018a).

The description of Urticaceae-feeding Nepticulidae fauna from South America has been an interesting and rather unexpected discovery (Stonis *et al.*, 2017). In the paper “The mystery of the tiny Urticaceae-feeders: documentation of the first leaf-mining Nepticulidae species from equatorial America associated with *Phenax*, *Boehmeria* and *Pilea*” (Figs 16–24), the authors discussed all findings of the Urticaceae-feeding Nepticulidae in the world (it was surprising to learn that all hitherto known records of the Urticaceae-feeding Nepticulidae come from regions around the Pacific). The authors described new species and asked a question: what makes Urticaceae-feeding Nepticulidae unusual? (Stonis *et al.*, 2017). As regards the methodology, it was useful to learn that during the preparation of the manuscript, Jonas R. Stonis and Alexander K. Monro searched for Nepticulidae leaf mines on Urticaceae in the herbarium of the Royal Botanic Gardens, Kew (London), and their search resulted in the discovery of a linear leaf mine belonging to an unknown *Stigmella* species feeding on *Boehmeria ulmifolia* Wedd., Urticaceae (Stonis *et al.*, 2017). This means that such an alternative method of research can also work.

Recently, some attention was also paid to the Rosaceae-feeding Nepticulidae in South America (Stonis *et al.*, 2016a). It should be mentioned that Rosaceae is the predominant host-plant family of Nepticulidae in the Palaearctics (Puplesis, 1994). In the paper by Stonis *et al.* (2016a), the authors reviewed all findings from the Neotropics and described new *Stigmella* and *Ectoedemia* species trophically associated with *Rubus* L. and *Hesperomeles* Lindl. as well as documented leaf mines on other plant genera; all of them, according to the authors, belong to unknown Rosaceae-feeding taxa (Stonis *et al.*, 2016a).

Within the family Rosaceae, the genus *Polylepis* Ruiz & Pav belongs to the tribe Sanguisorbeae (the section *Elongatae*) (Simpson, 1986). It is interesting and phylogenetically important that the Andean endemic *Polylepis* is most closely related to the shrubby genus *Acaena*, which comprises about a hundred species mainly from New Zealand, Australia and South Africa. Despite the fact that *Polylepis* forests constitute natural but threatened vegetation in much of the High Andes (Figs 25, 26) and are very important for their ecological functions, no leaf-mining Nepticulidae associated with

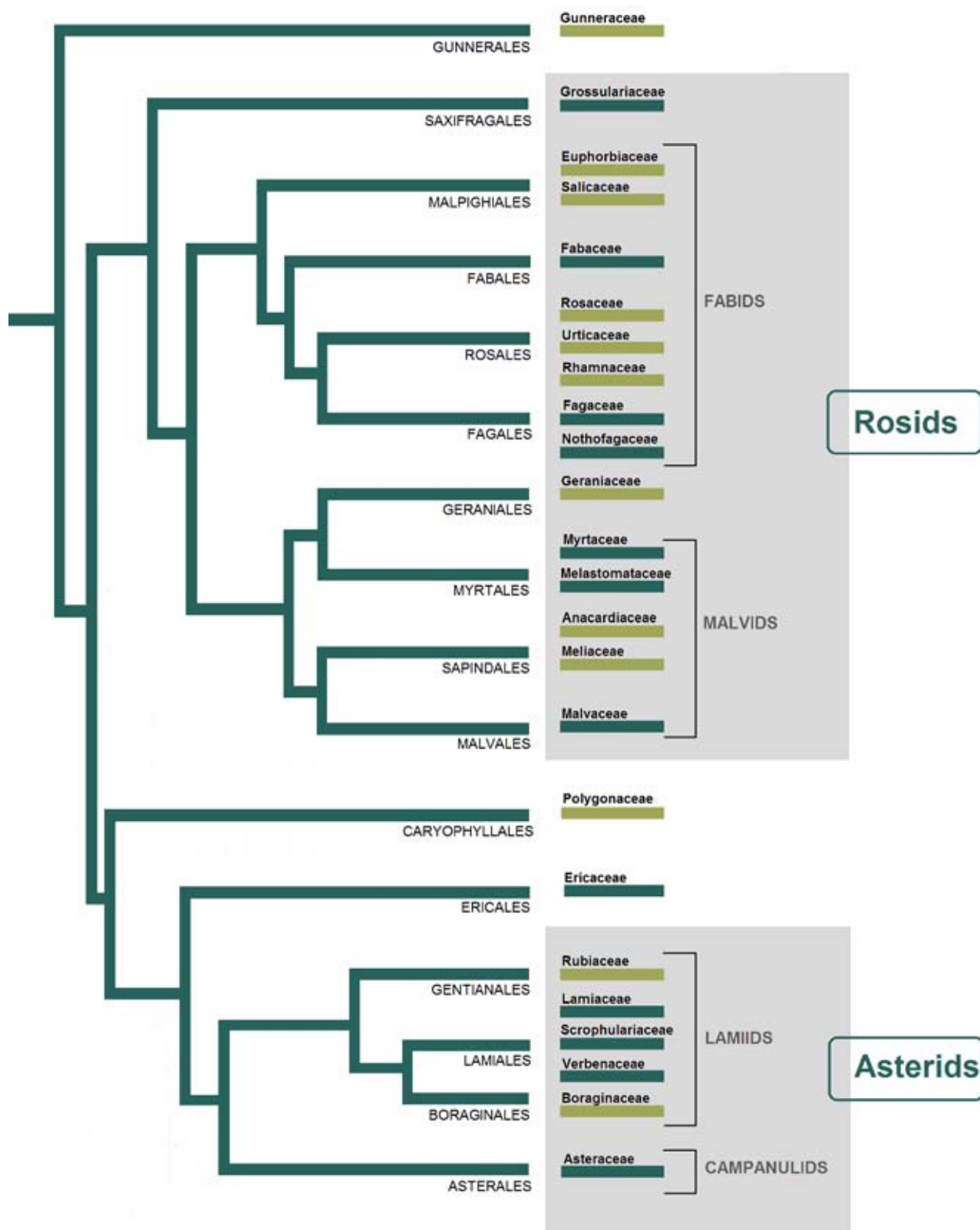
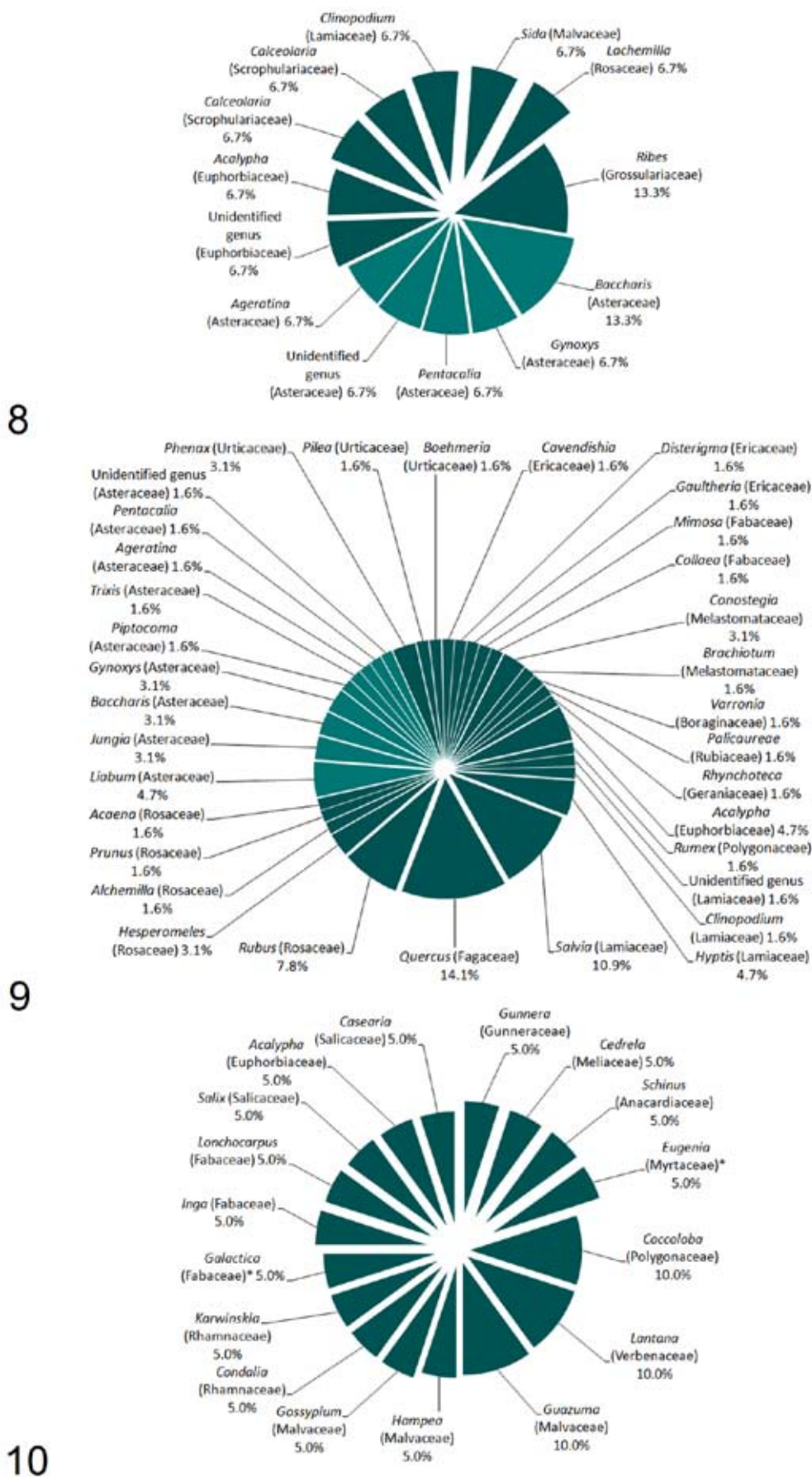


Figure 7. Plant clades engaged by the Neotropical Nepticulidae (from the published preliminary trophic analysis by Remeikis *et al.*, 2016).



Figures. 8–10. Trophic relationships of the Neotropical Nepticulidae occurring in different habitats: 8 – páramo and puna; 9 – tropical montane forests, including cloud forest habitats; 10 – tropical lowland forests, including rainforest habitats and tropical coastal zone (Remeikis *et al.*, 2016).

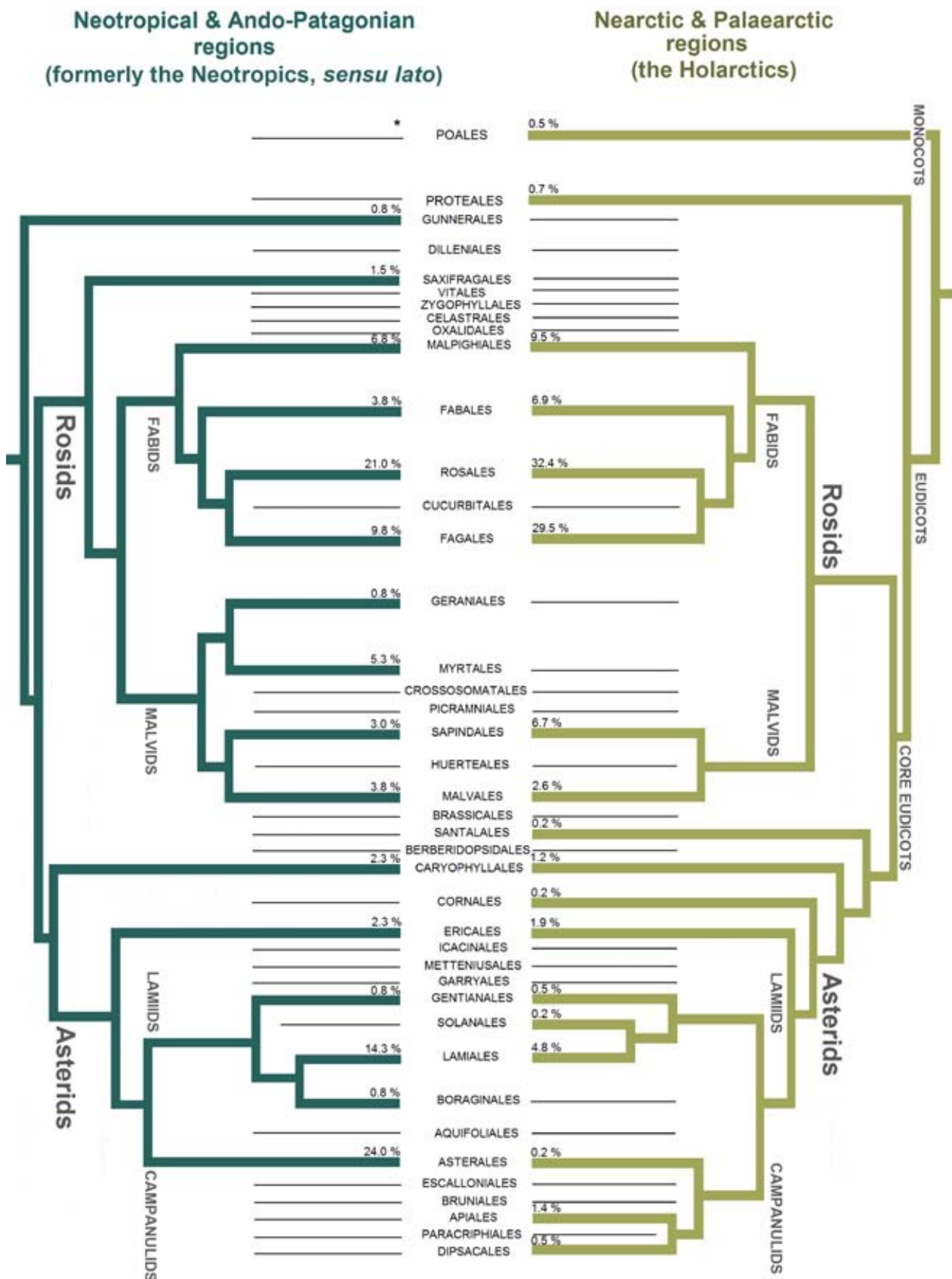


Figure 11. Comparison of plant clade engagement by Nepticulidae in the Neotropical (*sensu lato*), and the Holarctic regions (* E. J. van Nieuwerkerken, pers. comm.) (from the published preliminary trophic analysis by Remeikis *et al.*, 2016).

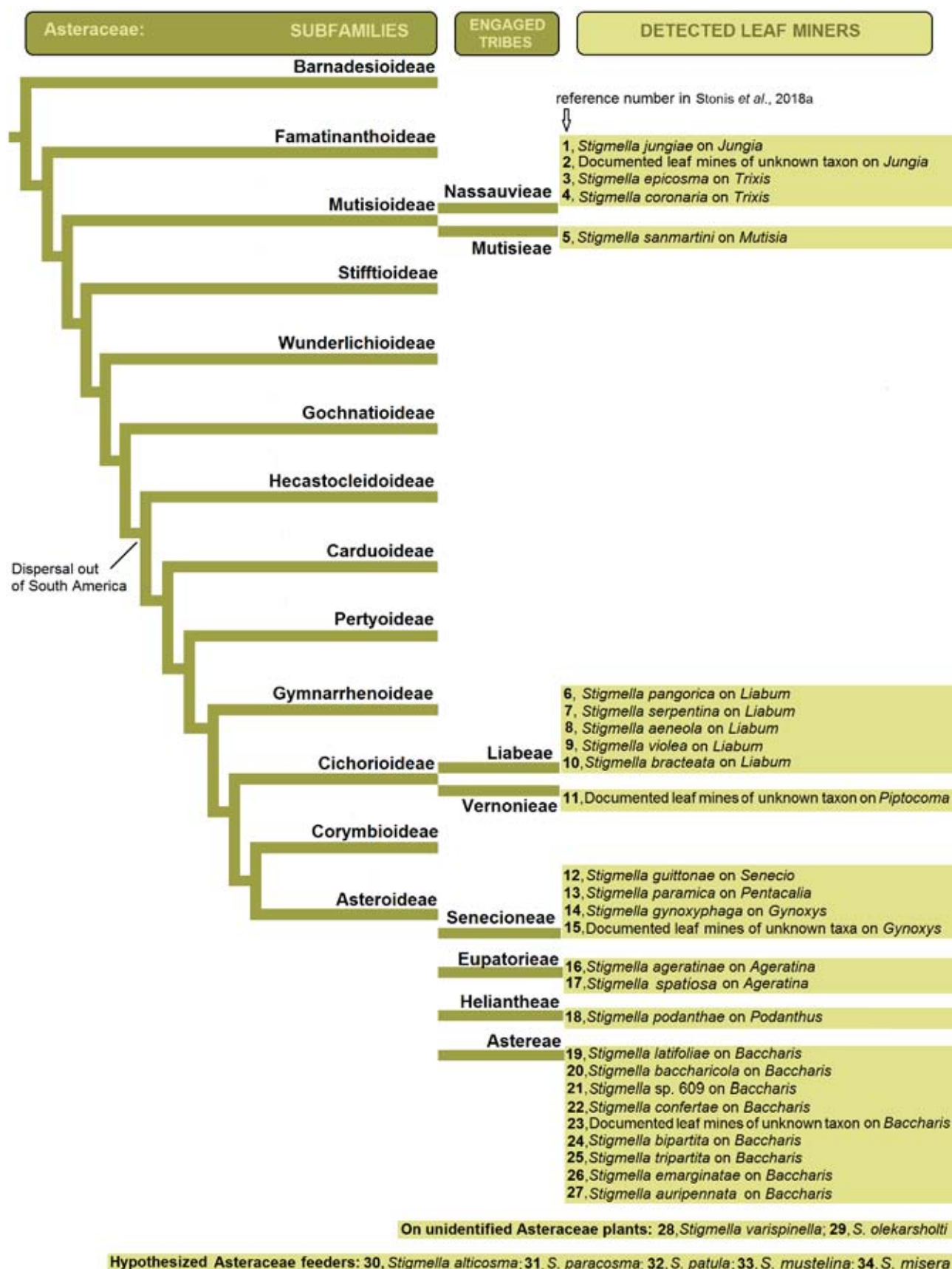
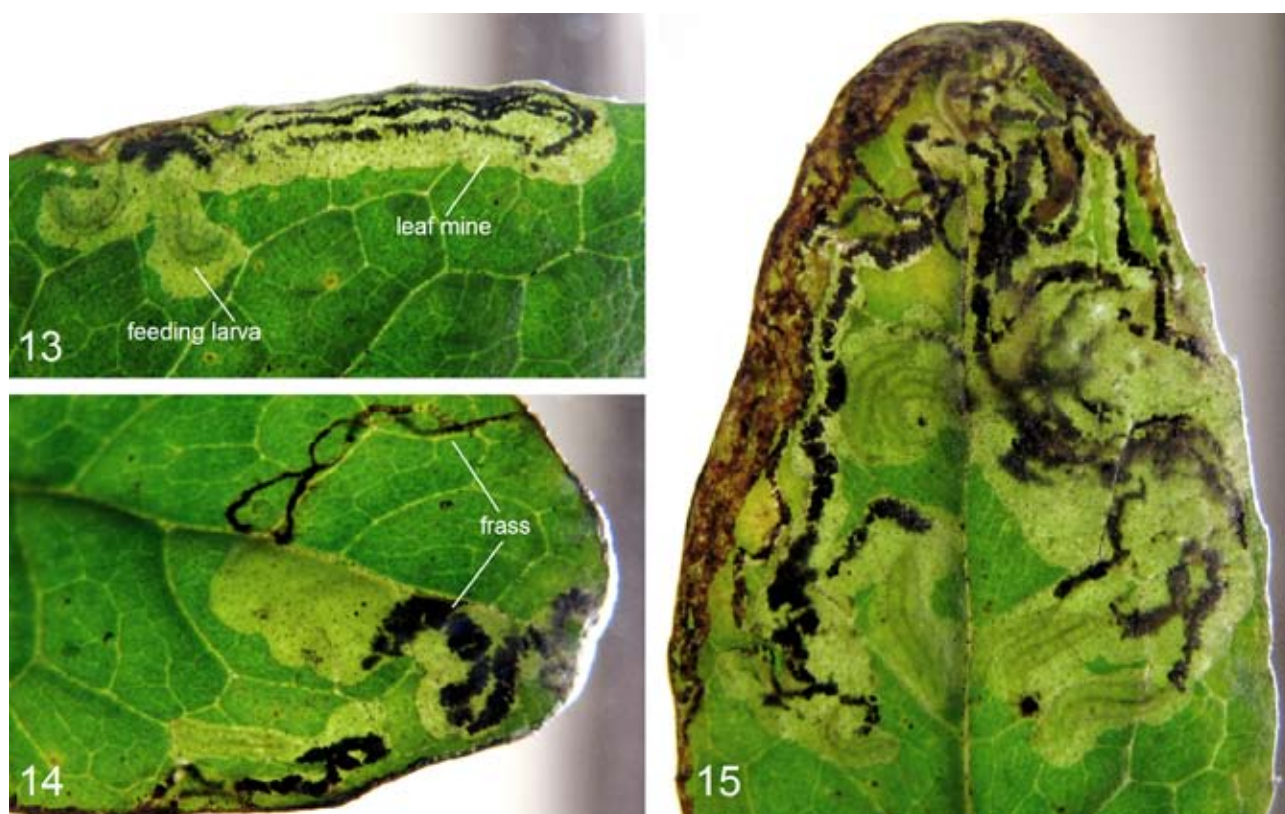


Figure 12. Asteraceae clades engaged by leaf-mining Nepticulidae (from the published trophic analysis by Stonis et al., 2018a).

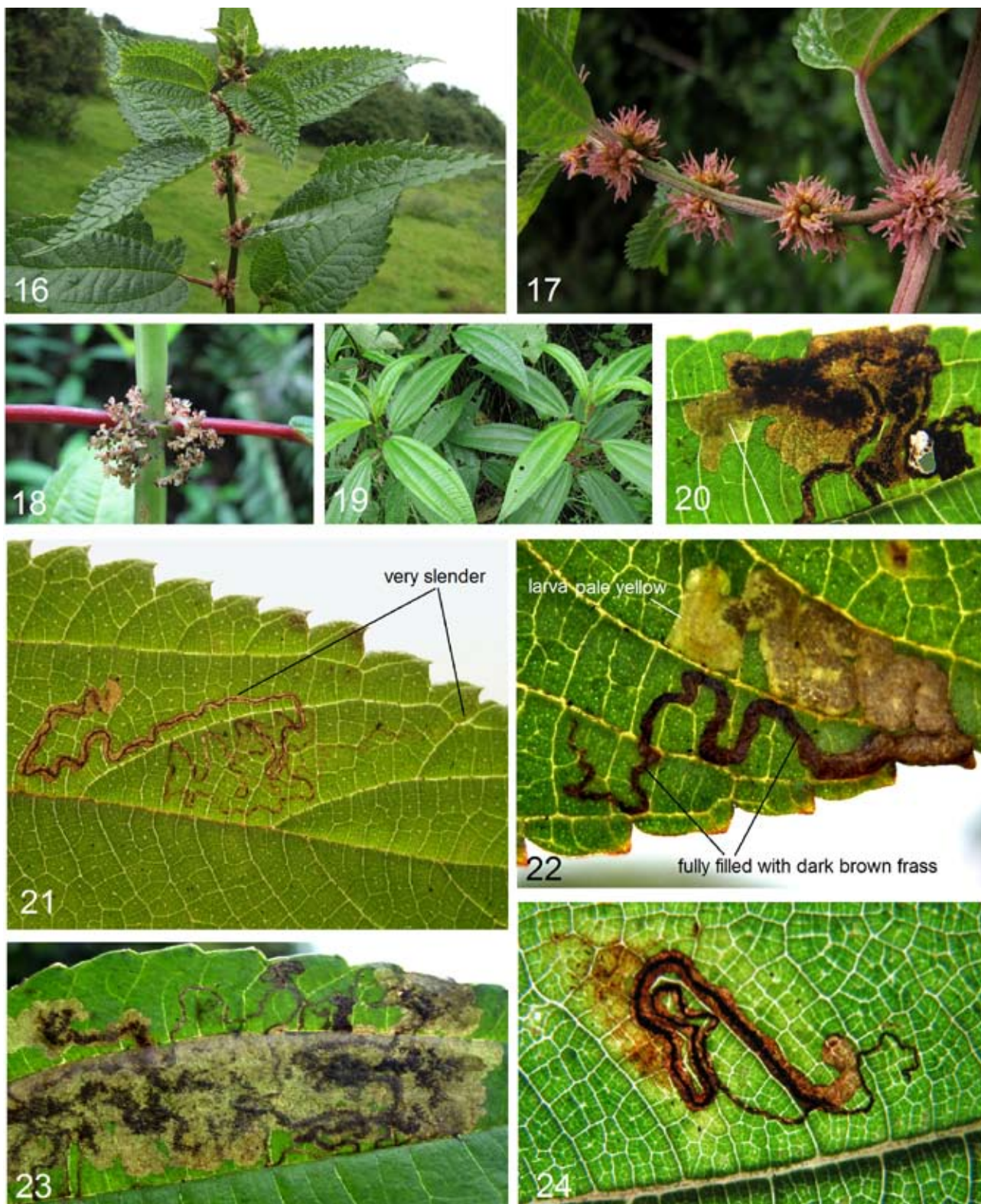


Figures 13–15. Leaf mines of unknown Nepticulidae taxon with feeding larvae on unidentified Asteraceae plant, Napo Province, Ecuador (Stonis *et al.*, 2018a).

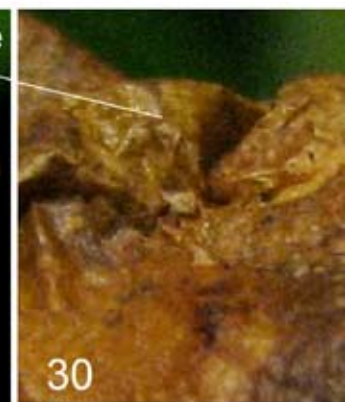
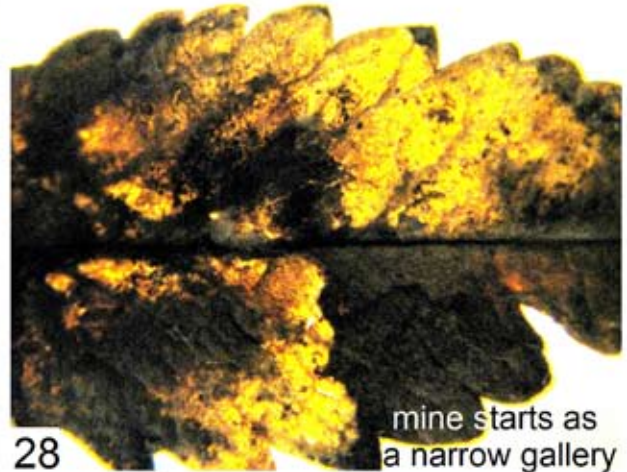
Polylepis as a host plant were recorded until recently. In the paper “Do leaf-mining Nepticulidae occur in the natural but so threatened Andean *Polylepis* forests?” (Stonis *et al.*, 2016b), the authors, for the first time, reported their discoveries of the *Polylepis*-feeding Nepticulidae species in Ecuador and Peru. *Stigmella polylepiella* Diškus & Stonis was reported as a highly abundant species with mass mining of *Polylepis racemosa* in the Andes NW of Cuzco (Figs 27–31). In contrast to the authors’ expectations, the first discoveries of leaf-mining Nepticulidae on *Polylepis* revealed that all the discovered species feeding on *Polylepis* are not closely related but indicate unexpectedly great morphological diversity (Stonis *et al.*, 2016b).

As it was mentioned in the beginning of the chapter, many species of Nepticulidae were considered pests of wild and cultivated plants. Plants of the Lamiaceae, or mint family, are used worldwide for medicinal, culinary and / or magical and religious purposes as well as in pesticides and as ornamental plants (see Stonis *et al.*, 2021a). Until recently, almost nothing was known about Nepticulidae as leaf miners of aromatic Lamiaceae (except for a single species described as feeding on *Clinopodium* in Peru). Nevertheless, it was expected that Nepticulidae feeding on economically important species of the mint family might be diverse in the Neotropics. In the recent paper “New leaf-mining Nepticulidae: potential pests of aromatic Lamiaceae plants from equatorial Andes” (Stonis *et al.*, 2021a), four new species of leaf-mining Nepticulidae feeding on beneficial plant genera of the Andean *Minthostachys* and *Clinopodium* were described (Figs 32–39). These aromatic Lamiaceae plants are valuable for their essential oils (see Stonis *et al.*, 2021a).

Recently, a new pest of guava (*Psidium guajava* L.), *Hesperolyra guajavifoliae* Stonis & Vargas, was discovered and described from western Colombia (Stonis *et al.*, 2019b) (Figs 45–47). Guava, or guayaba (Figs 43, 44) is an important shrub or small tree cultivated for its fruit in many tropical countries; in some countries, this plant is also used in local traditional ethnopharmacology for



Figures 16–24. Some examples of Urticaceae host plants and leaf mines on Urticaceae plants: 16, 17 – host plant *Phenax hirtus* (Sw.) Wedd.; 18, 19 – same, *Pilea* sp.; 20 – leaf mine of *Stigmella auripurpurata* Diškus & Stonis; 21 – same, *S. singularia* Diškus & Stonis; 22 – leaf mine of undescribed *Stigmella* taxon on *Phenax hirtus* from Pichincha Province, NW Alóag, Ecuador; 23 – leaf mine of *S. auripurpurata*; 24 – *S. boehmeriphaga* Diškus & Stonis, a leaf mine on *Boehmeria* sp. (after Stonis *et al.*, 2017). Note. The authors also searched for Nepticulidae leaf mines on Urticaceae in the herbarium of the Royal Botanic Gardens, Kew (London).



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Figures 25–31. Nepticulidae on *Polylepis*: 25, 26 – *Polylepis* forest in the Ecuadorian High Andes; 27–30 – leaf mines of *Stigmella polylepiella* Diškus & Stonis on *Polylepis racemosa*, the Andes NW of Cuzco, Peru; 31 – cocoon spinned inside the leaf mine of *S. polylepiella* (after Stonis *et al.*, 2016b).



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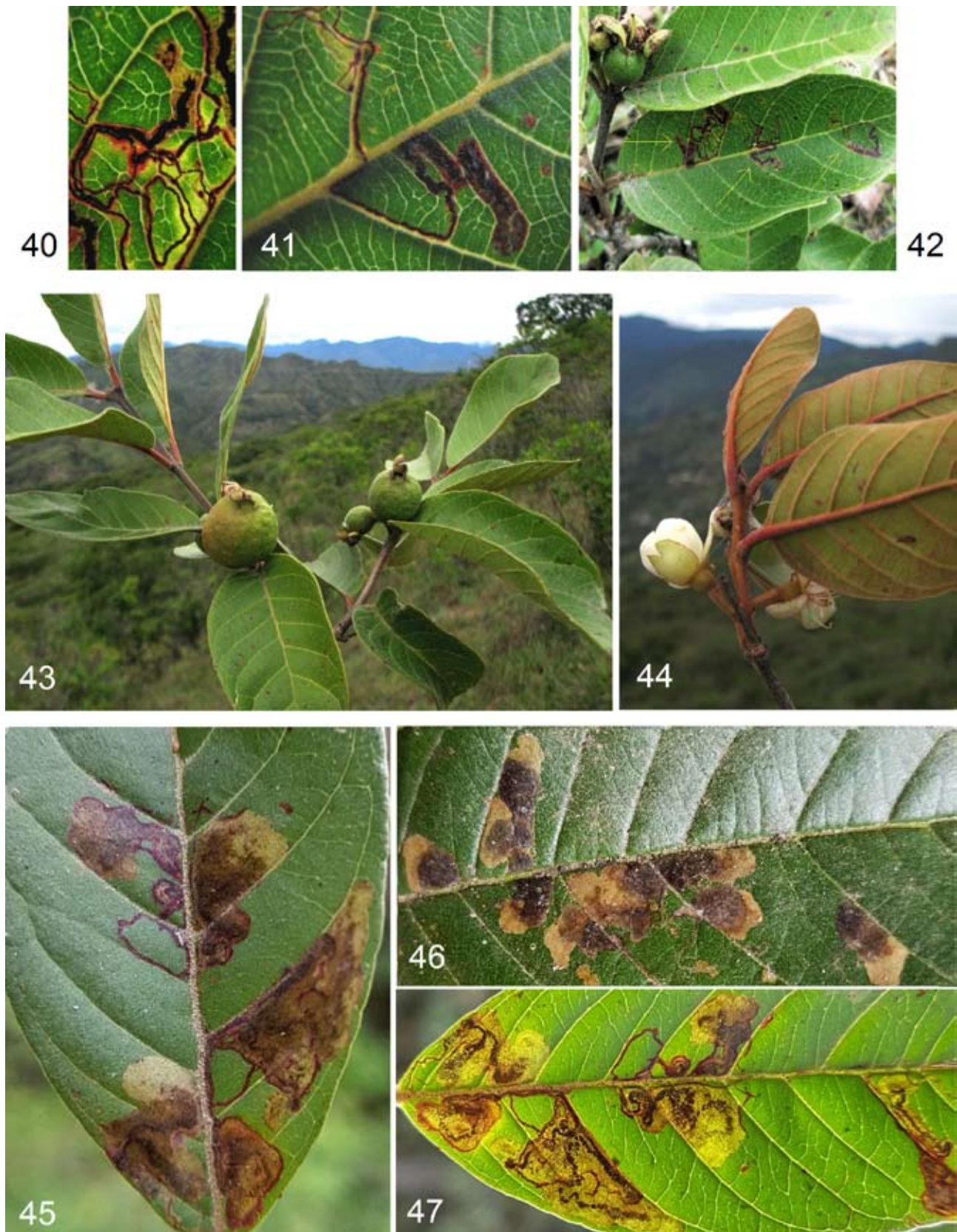


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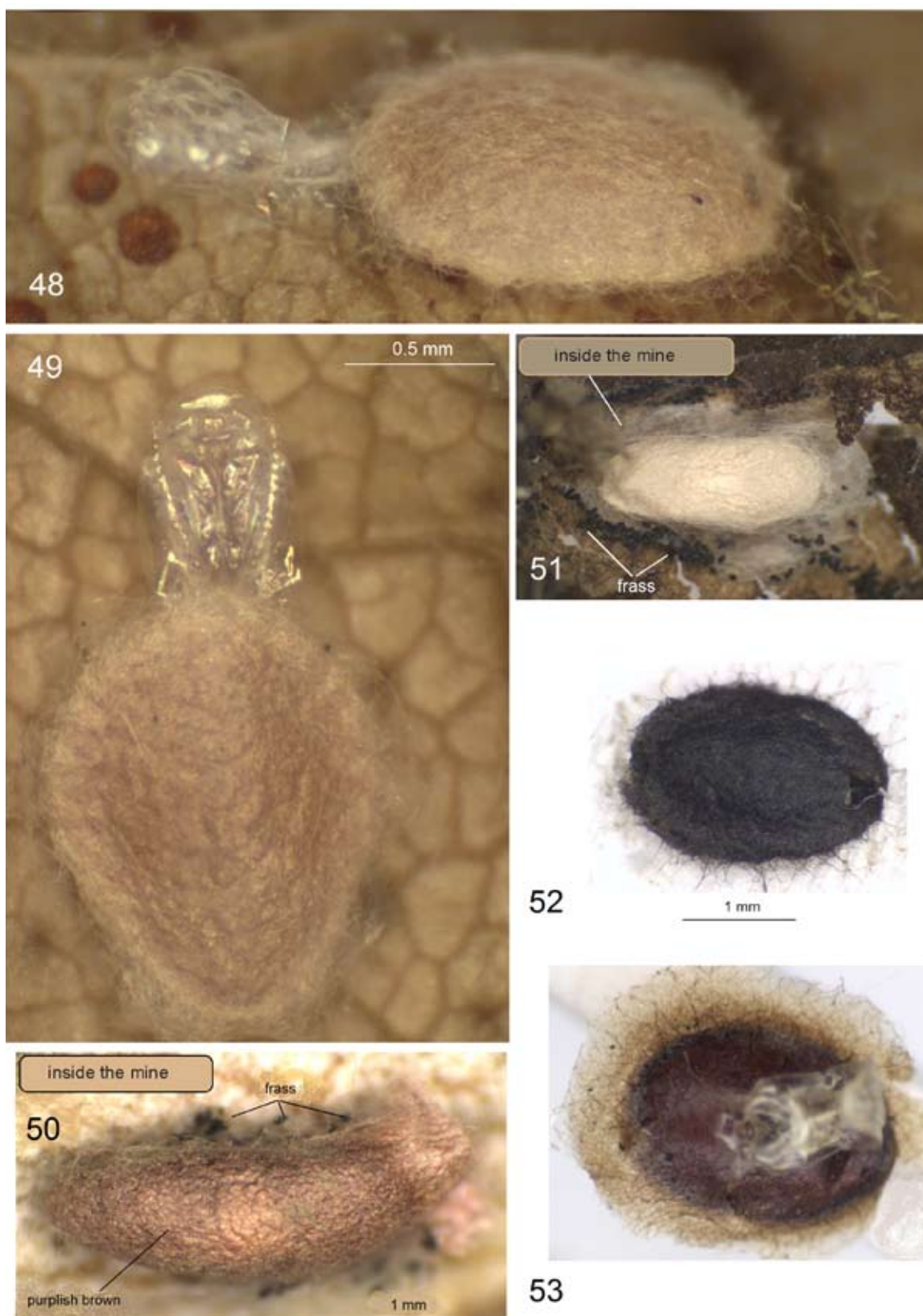


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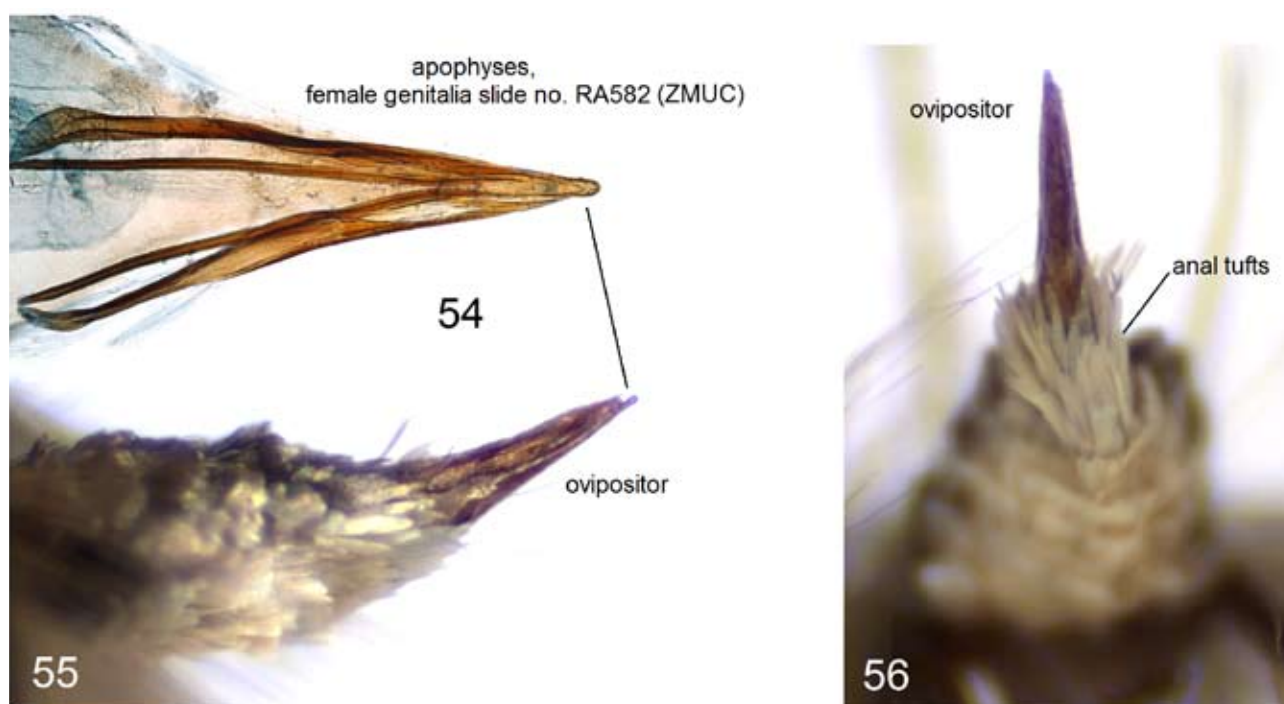
Figures 32–39. The Andean Nepticulidae on aromatic Lamiaceae plants: 32, 36 – the host plant *Minthostachys mollis* (Kunth.) Griseb; 33 – leaf mines of *Stigmella aromatica* Diškus & Stonis; 34 – same, *Stigmella odora* Diškus & Stonis; 35 – same, *S. mentholica* Diškus & Stonis; 37, 38 – same, *S. aromatica*; 39 – same, *S. odora* (after Stonis *et al.*, 2021a, modified).



Figures 40–47. Leaf mines produced by guava-feeding Nepticulidae larvae: 40–42 – leaf mines of *Ozadelpha guajavae* (Puplesis & Diškus) from the Ecuadorian Andes; 43, 44 – the host-plant *Psidium guajava* (growing wild); 45–47 – leaf mines of *Hesperolyra guajavifoliae* Stonis & Vargas, a newly discovered pest of from western Colombia (after Remeikis *et al.*, 2014 and Stonis *et al.*, 2019b).



Figures 48–53. “Traditional” and unusually shaped or coloured cocoons of the Neotropical Nepticulidae: 48, 49 – *Acalyptis minimus* Diškus & Stonis from Ecuador (Stonis *et al.*, 2018c); 50 – *Stigmella polylepiella* Diškus & Stonis from Peru (Stonis *et al.*, 2016b); 51 – *Stigmella rubiphagiella* Diškus & Stonis from Ecuador; 52 – *Ectoedemia morae* Diškus & Stonis from Ecuador (Stonis *et al.*, 2016a); 53 – *Simplimorpha nielseni* Remeikis & Stonis, a leaf miner of *Myrceugenia planipes*, Myrtaceae, from Argentina (published in the paper “A Gondwanan concept of *Simplimorpha* Scoble: a step toward clarity in the generic diagnostics of global Nepticulidae” by Stonis *et al.*, 2018b).



Figures 54–56. Unusual, remarkably long ovipositor of females of an undescribed *Stigmella* species from the Peruvian Andes (Remeikis *et al.*, 2016).

dealing with numerous medical issues (Gutiérrez *et al.*, 2008). Before this discovery of *Hesperolyra guajavifoliae*, another guava-feeding pest had been known from equatorial South America, *Ozadelpha guajavae* (Puplesis & Diškus) (Figs 40–42) (Puplesis *et al.*, 2002; Remeikis *et al.*, 2014).

In addition to the discovered various new pests on cultivated or other beneficial plants and the documented great host-plant diversity of the Neotropical Nepticulidae, there were some other particularities of the Neotropical Nepticulidae revealed. Although a vast majority of Nepticulidae larvae leave the leaf mine before pupation and spin a cocoon outside the leaf mine, at least a couple documented Neotropical species (the Ecuadorian *Stigmella rubiphagiella* Diškus & Stonis (Stonis *et al.*, 2016a) and the Bolivian *S. polylepiella* Diškus & Stonis (Stonis *et al.*, 2016b) were found spinning cocoons inside their leaf mines (Figs 50, 51). Nepticulidae cocoons also exhibited certain diversity of shape: elongated, with a rim or “traditional”, oval-shaped (Figs 48–53). Although Nepticulidae females usually are not characterized by a well-developed, long and protruding ovipositor, females of some Andean pygmy moths were recently documented with remarkably long ovipositor (Figs 54–56).

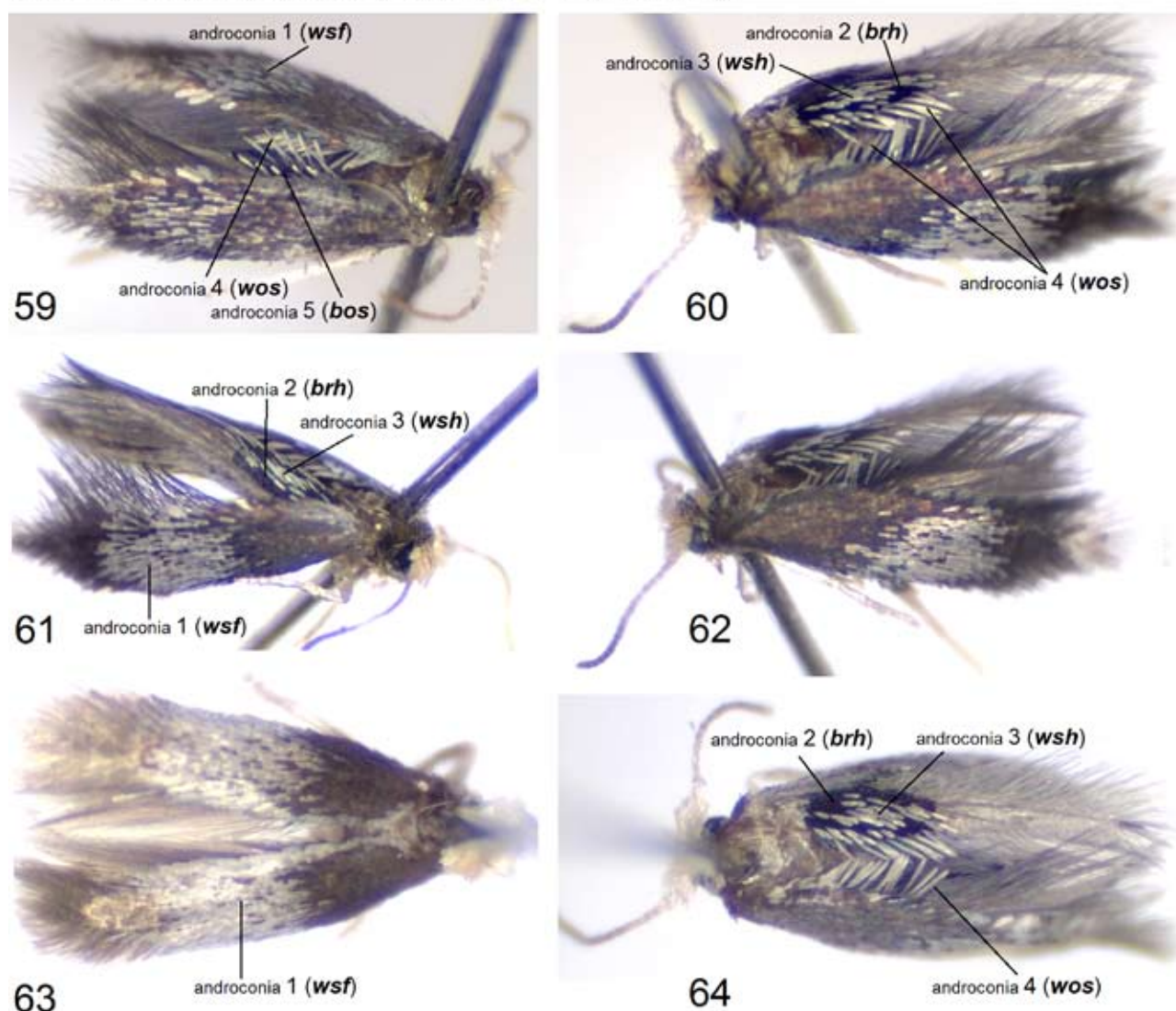
In the recent paper “*Stigmella pruinosa*, a species feeding on *Guazuma* and exhibiting extraordinary sexual dimorphism, now known to be occurring from Mexico to Colombia” (Stonis *et al.*, 2019c), the authors studied a Colombian sample of *Stigmella pruinosa* Puplesis & Robinson and documented an outstanding sexual dimorphism of this species (Figs 57–73). Previously, numerous cases of various sexual dimorphism were known in Nepticulidae, but this case of the Neotropical *S. pruinosa* is rather exclusive, and, according to Stonis *et al.* (2019c), not previously known on such a scale among the world’s Nepticulidae. Males of this species possess seven different androconia, and it makes the male adults very ornate (Figs 60, 68, 70).

Recently, some odd-looking, morphologically outstanding Nepticulidae species were described from South America, including *Ectoedemia bulbosa* Remeikis & Stonis from Chile (Osorno) and *Fomoria cornijuxtata* Remeikis & Stonis from Argentina (Neuquén) (Figs 74–77) (Stonis & Remeikis, 2018). The taxonomic positions of these species are still uncertain and, therefore, treated as provisional.

Female (57, 58):

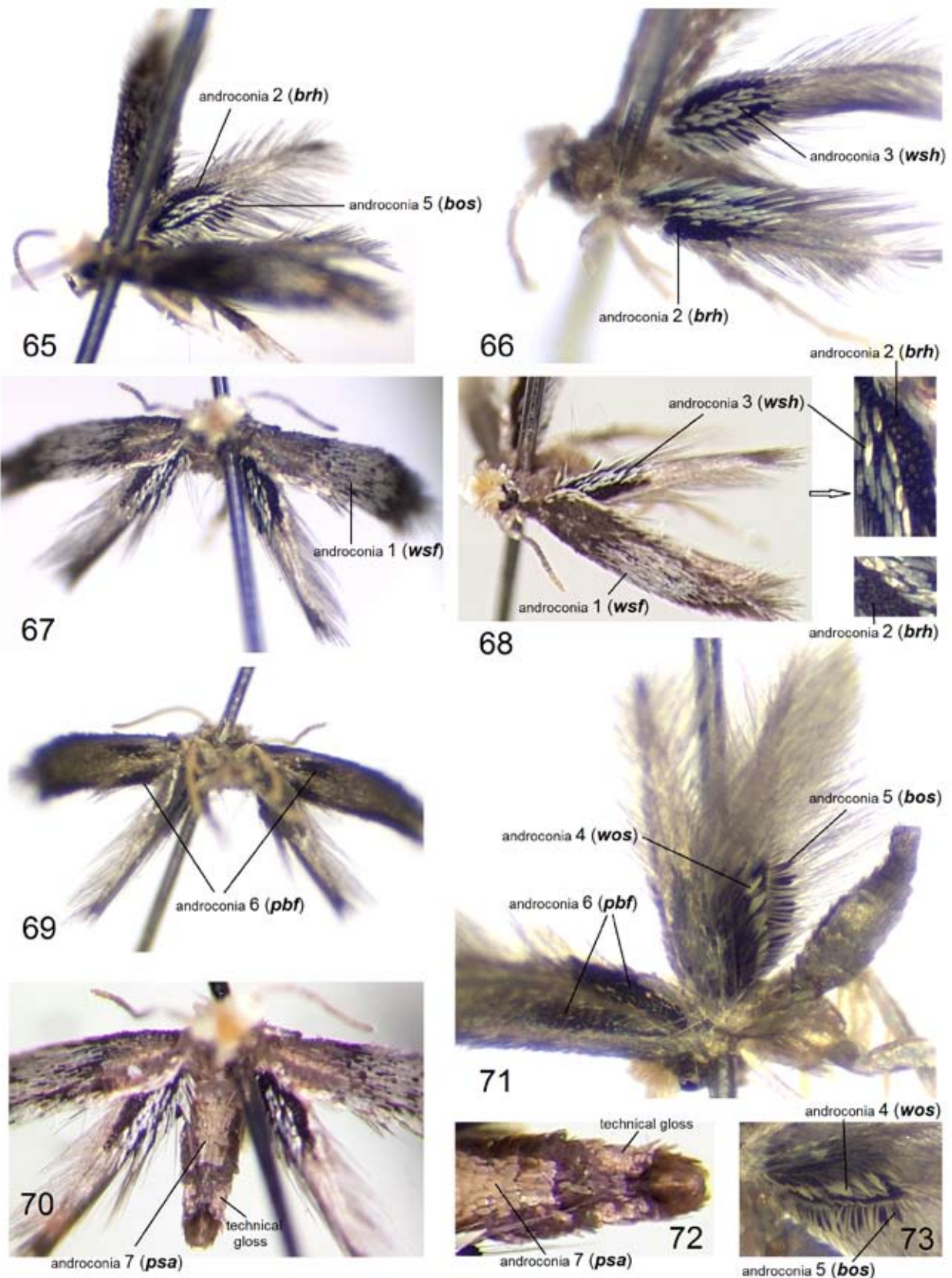


Male (59–64) (often with stronger purple iridescence on the forewing):

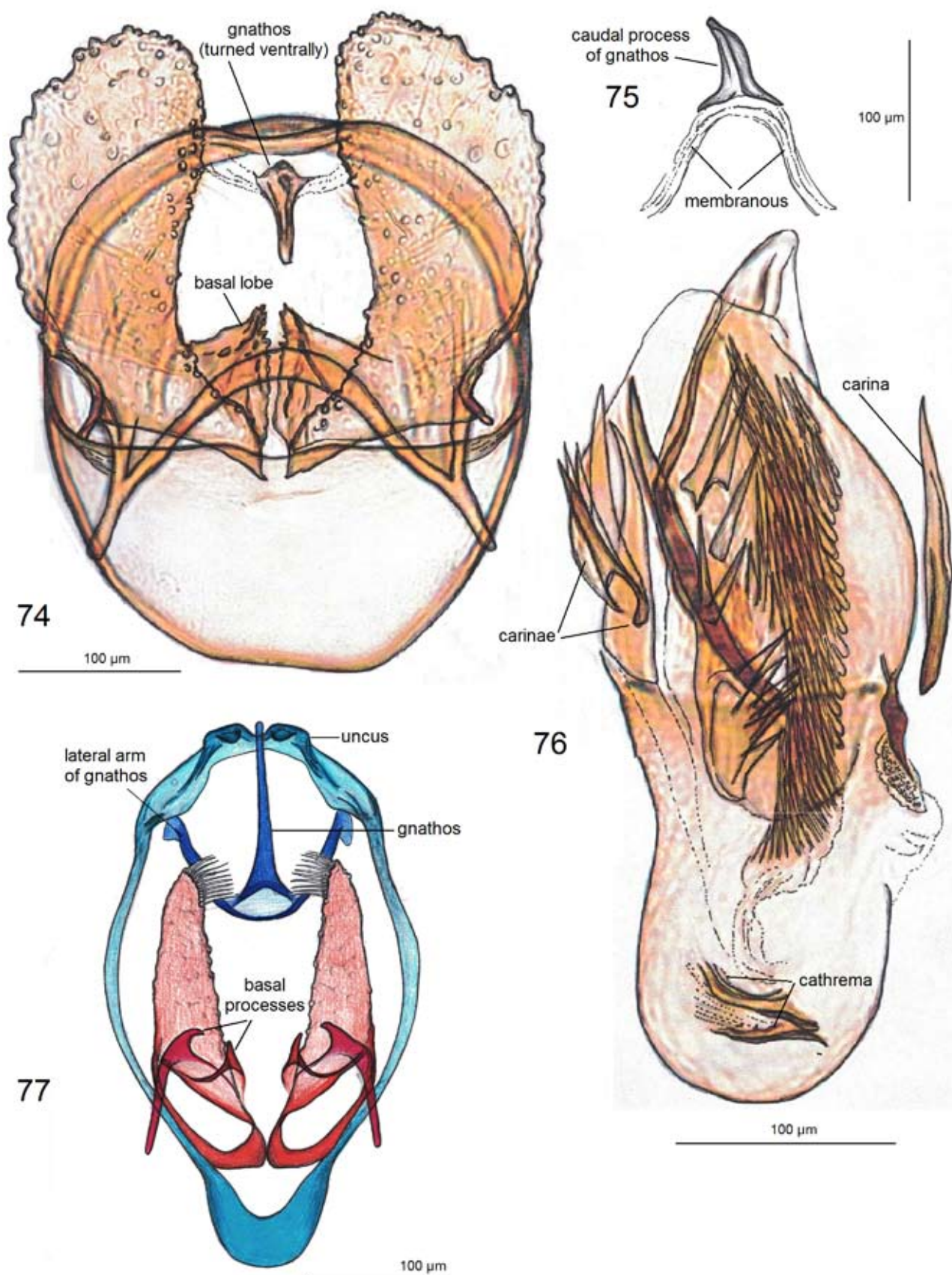


For the androconia 6 (*pbf*) and 7 (*psa*), see Figs 65–73

Figures 57–64. Sexual dimorphism of adults of *Stigmella pruinosa* Puplesis & Robinson: 57, 58 – females; 59–64 – males: androconia 1 (*wsf*), white slender scales on the forewing; androconia 2 (*brh*), black rounded scales on the hindwing; androconia 3 (*wsh*), white slender scales on the hindwing; androconia 4 (*wos*), white overlapping slender scales on the hindwing; androconia 5 (*bos*), black overlapping slender scales on hindwing (from Stonis *et al.*, 2019c).



Figures 65–73. Male adults of *Stigmella pruinosa* Puplesis & Robinson: 65–68 – upper side; 69, 71, 73 – underside; 70, 72 – abdomen. Androconia 1 (*wsf*), white slender scales on the forewing; androconia 2 (*brh*), black rounded scales on the hindwing; androconia 3 (*wsh*), white slender scales on the hindwing; androconia 4 (*wos*), white overlapping slender scales on the hindwing; androconia 5 (*bos*), black overlapping slender scales on the hindwing; androconia 6 (*pbf*), patches of black scales on the forewing underside; androconia 7 (*psa*), pale scales on the upper side of abdomen (from Stonis *et al.*, 2019c).



Figures 74–77. Odd-looking Nepticulidae species recently described from South America: 74–76 – *Ectoedemia bulbosa* Remeikis & Stonis from Chile; 77 – *Fomoria cornijuxtata* Remeikis & Stonis from Argentina (from Stonis & Remeikis, 2018); generic positions of these two species are still uncertain, provisional.

For a long period of time, the Neotropics, though a vast and with a hugely diverse biota, was comparatively poorly explored regarding the collection and study of Nepticulidae. We believe that the present effort can improve our understanding of the family Nepticulidae and will encourage future investigations of these peculiar micro lepidopterans. Relatively sparse sampling of pygmy moths in the Neotropics, despite the vast potential of their climatic conditions, habitats, and host plants, suggests that what we currently observe in the region is just the tip of a hidden iceberg.

References

- Alford, D.V. (2012) *Pests of ornamental trees, shrubs and flowers: A Colour Handbook*. CRC Press, Boca Raton, Florida, 480 pp. <https://doi.org/10.1201/b15136>
- Dimitrov, S., Popova, M., Gramatikov, D. & Boyadzhieva, M. (1980) Technology for rose hip production. *Ovoshcharstvo*, 59 (12), 26–30 [in Bulgarian]
- Diškus, A. & Stonis, J.R. (2012) *Leaf-mining insects of Lithuania. The Nepticulidae (Lepidoptera): taxonomy, chorological composition and trophic relationships. Monograph*. Lututė Publishers, Kaunas, 220 pp. [in Lithuanian]
- Dobrynina, V., Stonis, J.R., Diškus, A., Solis, M.A., Baryshnikova, S.V. & Young-Min, S. (2022) Global Nepticulidae, Opostegidae, and Tischeriidae (Lepidoptera): temporal dynamics of species descriptions and their authors. *Zootaxa*, 5099 (4), 450–474. <https://doi.org/10.11646/zootaxa.5099.4.2>
- Gutiérrez, R.M., Mitchell, S. & Solis, R.V. (2008) *Psidium guajava*: A review of its traditional uses, phytochemistry and pharmacology. *Journal of Ethnopharmacology*, 117, 1–27. <https://doi.org/10.1016/j.jep.2008.01.025>
- Heyerdahl, R. & Dutcher, J.D. (1985) Management of the pecan serpentine leafminer (Lepidoptera: Nepticulidae). *Journal Economic Entomology*, 78, 1121–1124. <https://doi.org/10.1093/jee/78.5.1121>
- Navickaitė, A. (2014) Euronemoralinės faunos mažųjų gaubtagalvių (Insecta, Lepidoptera, Nepticulidae) taksonominė ir chorologinė analizė bei trofiniai ryšiai: Daktaro disertacija. Lietuvos edukologijos universiteto leidykla, Vilnius, 326 pp. [in Lithuanian]
- Nieukerken, E.J. van, Doorendeerd, C., Nishida, K. & Snyers, C. (2016) New taxa, including three new genera show uniqueness of Neotropical Nepticulidae (Lepidoptera). *ZooKeys*, 628, 1–63. <https://doi.org/10.3897/zookeys.628.9805>
- Puplesis, R. (1985) New species of the nepticulid moths (Lepidoptera, Nepticulidae) from southern Far East and Tadzhikistan. *Proceedings of the Zoological Institute USSR Academy of Sciences*, 134, 59–72. [in Russian]
- Puplesis, R. (1994) *The Nepticulidae of Eastern Europe and Asia: western, central and eastern parts*. Backhuys Publishers, Leiden, 291 pp., 840 figs.
- Puplesis, R. & Diškus, A. (2003) *The Nepticuloidea & Tischerioidea (Lepidoptera) — a global review, with strategic regional revisions*. Lututė Publishers, Kaunas, 512 pp.
- Puplesis, R., Diškus, A. & Robinson, G.S. (2002) New Neotropical Nepticulidae (Lepidoptera) from the western Amazonian rainforest and the Andes of Ecuador. *Bulletin of the Natural History Museum, London, Entomology*, 71 (1), 19–58. <https://doi.org/10.1017/S0968045402000020>
- Remeikis, A., Diškus, A. & Stonis, J.R. (2016) Preliminary trophic analysis of leaf-mining Nepticulidae: pronounced feeding strategies in Middle and South America? *Biologija*, 62 (4), 207–214. <https://doi.org/10.6001/biologija.v62i4.3411>
- Remeikis, A., Stonis, J.R., Diškus, A. & Davis, D.R. (2014) The first photographic documentation and new data on *Enteucha guajavae* (Lepidoptera, Nepticulidae), a pest of guava from equatorial America. In: Stonis, J.R., Hill, S.R., Diškus, A. & Auškalnis, T. (Eds.), *Selected abstracts and papers of the First Baltic International Conference on Field Entomology and Faunistics*. Edukologija Publishers, Vilnius, pp. 65–74.
- Simpson, B.B. (1986) Speciation and specialization of *Polylepis* in the Andes. In: Vuilleumier, F. & Monasterio, M. (Eds.), *High altitude tropical biogeography*. Oxford University Press, Oxford, pp. 304–316.
- Stonis, J.R., Diškus, A., Dobrynina, V., Remeikis, A. & Buchner, P. (2022) *A guide to leaf mines of the Lithuanian Nepticulidae (introducing an electronic identification tool)*. Gamtos tyrimų centras, Vilnius, 122 pp. [in Lithuanian] <https://doi.org/10.35513/2022.Nepticulidae>
- Stonis, J.R., Diškus, A., Fernández-Alonso, J.L., Remeikis, A. & Solis, M.A. (2021a) New leaf-mining Nepticulidae (Lepidoptera): potential pests of aromatic Lamiaceae plants from equatorial Andes. *Zootaxa*, 4926 (3), 363–383. <https://doi.org/10.11646/zootaxa.4926.3.3>

- Stonis, J.R., Diškus, A., Katinas, L. & Solis, M.A. (2018a) Asteraceae: host to the greatest diversity of leafmining Nepticulidae (Lepidoptera) in South America? *Proceedings of the Entomological Society of Washington*, 120 (4), 856–902. <https://doi.org/10.4289/0013-8797.120.4.856>
- Stonis, J.R., Diškus, A., Remeikis, A. & Cumbicus Torres, N. (2016a) Rosaceae-feeding Nepticulidae (Lepidoptera) of South America: some taxonomic and trophic diversity revealed. *Biologija*, 62 (4), 215–232. <https://doi.org/10.6001/biologija.v62i4.3412>
- Stonis, J.R., Diškus, A., Remeikis, A. & Karsholt, O. (2016b) Do leaf-mining Nepticulidae occur in the natural but so threatened Andean *Polylepis* forests? *Biologija*, 62 (2), 83–97. <http://dx.doi.org/10.6001/biologija.v62i2.3334>
- Stonis, J.R., Diškus, A., Remeikis, A., Katinas, L., Cumbicus Torres, N., Schuster, J. & Puplesyte-Chambers, J. (2019a) Diagnostics of new species of Neotropical Tischeriidae (Lepidoptera), with the first record of *Coptotriche* Walshingham from South America. *Zootaxa*, 4691 (1), 1–32. <https://doi.org/10.11646/zootaxa.4691.1.1>
- Stonis, J.R., Diškus, A., Remeikis, A. & Monro, A.K. (2017) The mystery of the tiny Urticaceae-feeders: documentation of the first leaf-mining Nepticulidae (Lepidoptera) species from equatorial America associated with *Phenax*, *Boehmeria* and *Pilea*. *Biologija*, 63 (2), 105–125. <https://doi.org/10.6001/biologija.v63i2.3523>
- Stonis, J.R., Diškus, A., Remeikis, A. & Solis, M.A. (2018b) A Gondwanan concept of *Simplimorpha* Scoble (*sensu lato*): a step toward clarity in the generic diagnostics of global Nepticulidae (Lepidoptera). *Zootaxa*, 4521 (2), 151–182. <https://doi.org/10.11646/zootaxa.4521.2.1>
- Stonis, J.R., Diškus, A., Remeikis, A., Solis, M.A. & Katinas, L. (2020) Exotic-looking Neotropical Tischeriidae (Lepidoptera) and their host plants. *ZooKeys*, 970, 117–158. <https://doi.org/10.3897/zookeys.970.54801>
- Stonis, J.R., Diškus, A. & Solis, M.A. (2018c) Two new Fabaceae-feeding Nepticulidae (Lepidoptera) from the Western Hemisphere, including a potential pest of the economically important *Centrolobium* Mart. ex Benth. *Proceedings of the Entomological Society of Washington*, 120 (4), 842–855. <https://doi.org/10.4289/0013-8797.120.4.842>
- Stonis, J.R. & Remeikis, A. (2018) Odd species of Nepticulidae (Lepidoptera) from the American rainforest and southern Andes. *Zootaxa*, 4392 (3), 458–468. <https://doi.org/10.11646/zootaxa.4392.3.2>
- Stonis, J.R., Remeikis, A., Diškus, A., Baryshnikova, S. & Solis, M.A. (2021b) What are the smallest moths (Lepidoptera) in the world? *Zootaxa*, 4942 (2), 269–289. <https://doi.org/10.11646/zootaxa.4942.2.8>
- Stonis, J.R., Remeikis, A., Diškus, A., Orlovskytė, S., Vargas, S.A. & Solis, M.A. (2019b) A new leafmining pest of guava: *Hesperolyra guajavifoliae* sp. nov., with comments on the diagnostics of the endemic Neotropical genus *Hesperolyra* van Nieukerken (Lepidoptera, Nepticulidae). *ZooKeys*, 900, 87–110. <https://doi.org/10.3897/zookeys.900.46332>
- Stonis, J.R., Remeikis, A. & Vargas, S. (2019c) *Stigmella pruinosa* (Lepidoptera: Nepticulidae), a species feeding on *Guazuma* and exhibiting extraordinary sexual dimorphism, now known to be occurring from Mexico to Colombia. *Biologija*, 65 (3), 151–164. <https://doi.org/10.6001/biologija.v65i3.4084>
- Wilkinson, C. (1981) A supplement to the genus *Ectoedemia* Busck (Nepticulidae: Lepidoptera) in North America, dealing with some difficult species and also some new ones. *Tijdschrift voor Entomologie*, 124 (3), 93–110.

Nepticulidae from Record High Altitudes

(by J. R. Stonis, A. Diškus, A. Remeikis)

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Recently, in the monograph “Leaf-mining Nepticulidae from record high altitudes: documenting an entire new fauna in the Andean páramo and puna” (Stonis *et al.*, 2016c), the first attempt to describe high-altitude fauna and demonstrate an example of the diversity of nepticulids from the High Andes was undertaken. The authors stated that although many questions remained unanswered (such as host-plant relationships of many High Andean species), 29 species of Nepticulidae discovered in the northern Andean bush and grass páramo and the central Andean puna at altitudes above 3,700 m represented the world’s highest-altitudinal Nepticulidae fauna (Stonis *et al.*, 2016c).

The Andes or Los Andes is the world’s longest continental mountain range with a continuous range of highlands along the western coast of South America. The Andes also contain the highest peaks in the Western Hemisphere (Denevan, 2016) and it is a region of climatic extremes. During much of the Earth’s history, the global climate was much warmer than today. However, the previous several million years have been characterized by general global cooling (Shackleton *et al.*, 1990). The Andes were glaciated about 20 times during the last 2 MY (Hooghiemstra *et al.*, 1994). These cycles involved very sudden shifts between markedly different climatic periods, which were cold / dry, cold / humid, warm / dry and warm / humid (van der Hammen & Cleef, 1986). Nowadays, permanent ice can usually be found in mountains above 5,000 m; however, for several periods in previous epochs, a large part of the Peruvian / Bolivian high plateaus and most of the Cordilleras were covered by ice, in some valleys with glaciers down to below 3,500 m (Fjeldså & Kessler, 1996).

According to Fjeldså & Kessler (1996), the Andean vegetation is an important regional factor along with the vast forests of the Amazon Basin, which loose moisture through evapo-transpiration. This creates daily cycles of cooling, with formation of fog and afternoon rain as the air rises up the Amazon slopes. Small forest patches can be found above the usual tree-line (at 3,500 m). These forests consist mainly of evergreen trees of *Polylepis* (Rosaceae) (Fig. 85), which are well adapted to growing under extreme climatic conditions in these zones characterized by regular frost (Fjeldså & Kessler, 1996). Although there have been no Nepticulidae species described as *Polylepis*-feeders yet among the High-Andean fauna at elevations above 3,700 m, a few species feeding on *Polylepis racemosa* Ruiz & Pav. and *P. pauta* Hieron have been described from elevations of 2,850–3,400 m. *Polylepis*-feeding species might occur in higher altitudes as their host-plants do. Indeed, according to the data provided in the recent monograph (Stonis *et al.*, 2016c), the first leaf mines of an unknown Nepticulidae taxon at elevation of 4,100 m (Peru, on *Polylepis racemosa*) have already been documented.

Many High Andean forests have very high biological diversity, including high diversity of plants. The position of the Andes at the Equator (Fig. 90), which provides large amounts of sunlight for energy, as well as rather extreme temperatures and excessive UV radiation, make a unique climate. It is believed that such a climate can explain the great speed of evolution in the high Andean ecosystem (Madriñán *et al.*, 2013).

After Stonis *et al.* (2016c), the absolute height record belongs to *Stigmella nivea* Remeikis & Stonis, which was collected at an elevation of 4,700 m (Fig. 89). For comparison, the highest record from the Himalaya is *Stigmella fibigeri* Puplesis & Diškus (2003), which comes from altitude of 2,950 m (Fig. 90).



Figure 78. The Andean shrub and grass páramo habitat, SE of Papallacta Pass (Ecuador: Napo Province) at altitudes about 3700–3800 m, 0°21'45"S, 78°11'35"W (from Stonis *et al.*, 2016c).

Except for one species, all species recorded from the High Andes belonged to *Stigmella* Schrank, including twenty-two species described as new taxa in Stonis *et al.* (2016c). Host plants of some twenty species recorded in the High Andes remain unknown. However, some tendencies of trophic relationships were preliminary predicted by Stonis *et al.* (2016c) by drawing on ten species whose host-plants were known. The authors reported that the species associated with Asteraceae might prevail (five species had already been detected on *Pentacalia*, *Baccharis*, *Gynoxys*, and *Ageratina* plants); only a few were found associated with Calceolariaceae (two species on *Calceolaria* plants), Lamiaceae (one species on *Clinopodium* plants), and Rosaceae (one species on *Lachemilla* and *Polylepis* plants).

Páramo comprises numerous grass and shrub dominated habitats (Figs 79–88) and can be divided into three altitudinal zones on the basis of on both altitude and vegetation structure (Harling, 1979; Kessler, 2002; Andean Páramo, 2016): superpáramo (usually at about 4,500–4,800 m); grass páramo (usually at about 3,500–4,100 m); and subpáramo, which usually occurs at 3,000–3,500 m and is the most diverse and a shrub-dominated zone. In the Andes, the high-altitude Nepticulidae fauna engages various habitats from northern shrub and grass páramo in Ecuador to moist puna in southeastern Peru and western Bolivia. All currently known High-Andean species are described from two biogeographical provinces: the Páramo and Puna belonging to the South American transition zone (Fig. 4) (Stonis *et al.*, 2016c).

Compared with the Boreal (Nearctic) or lowland Neotropical fauna, almost no specific features of ecology of the high-Andean Nepticulidae have been revealed (Stonis *et al.*, 2016c). However, some newly discovered females possess a relatively long and distinctly protruding ovipositor that is generally not characteristic for the majority of Nepticulidae; only some such species were known (e.g., some species from the predominantly Holarctic *Stigmella salicis* group).



Figures 79–83. The grass páramo habitat near volcano Chimborazo (Ecuador: Chimborazo Province) at altitudes about 3980–4000 m (1°31'20"S, 78°50'27"W and 1°45'41"S, 78°48'51"W (from Stonis *et al.*, 2016c).



Figures 84–88. The shrub páramo habitat and *Polylepis* forest near volcano Antisana and Papallacta Pass (Ecuador: Napo Province) at altitudes about 3700–3900 m, 0°21'45"S, 78°11'35"W: 84 – a view of the volcano Antisana; 85 – a relict stand of the high-Andean *Polylepis*; 86–88, the northern Andean shrub páramo, SE of Papallacta Pass (from Stonis *et al.*, 2016c).

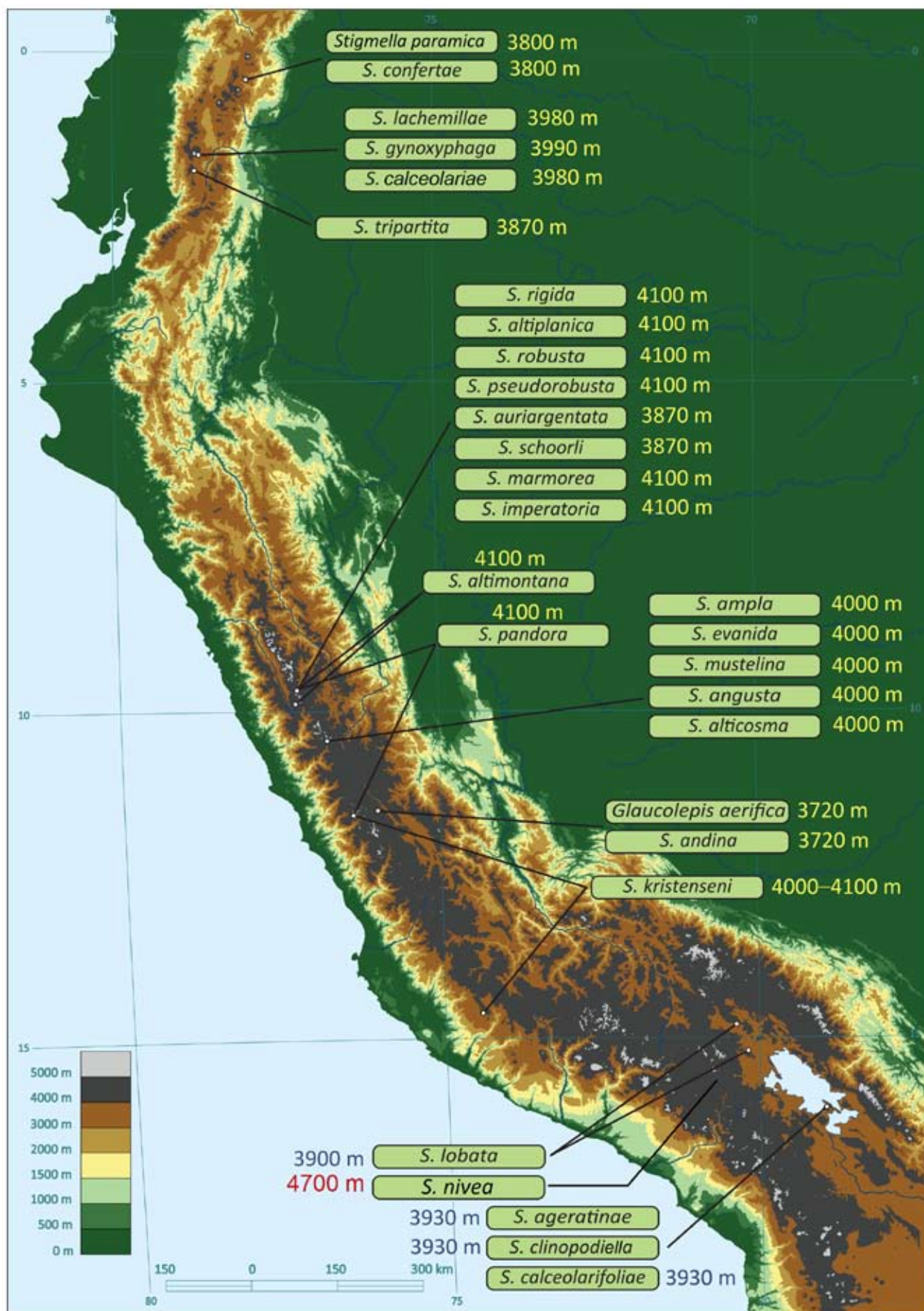


Figure 89. Distribution map of the high-Andean Nepticulidae with height records (from Stonis *et al.*, 2016c).

Some high-Andean Nepticulidae exhibit rather distinct sexual dimorphism: *Stigmella andina*, *S. auriargentata*, *S. lachemillae*, *S. calceolariae*. In the case of some high-Andean species (*S. lachemillae*, *S. auriargentata*, and *S. pandora*), females were unexpectedly found to be smaller than males (Stonis *et al.*, 2016c, 2021).

It is interesting that the high-Andean Nepticulidae species were collected mainly during two time periods (about 60 % in January–February and about 30 % in March–May); a few are known from July (6 %), and very few from November (3 %) (Stonis *et al.*, 2016c). However, it does not probably indicate seasonality but rather reflects the time of collecting.

It is peculiar that some species of the high-Andean Nepticulidae have been observed mining in great abundance. However, according to Arūnas Diškus, the rearing of adults from mining larvae of *Baccharis* or *Polylepis*-feeding *Stigmella* in the páramo is usually disappointing: even when samples are exceptionally large, up to hundreds of mining larvae, only a few larvae (or none) may develop to adults because most of the larvae die and / or pupae stop developing and die within the pupal case. The causes for this phenomenon are unknown and certainly not related to parasitoids (Stonis *et al.*, 2016b, 2016c, 2016d). According to Stonis *et al.* (2016b), it is possible that these high-altitude species require special environmental or climatic conditions during their development.

Although the high-Andean fauna is species-rich, generic composition of this fauna is rather uniform: except for one, all species belong to the genus *Stigmella* Schrank (Fig. 89), and such a dominance of *Stigmella* in the High Andes is not an artefact (Stonis *et al.*, 2016c). This genus is the world's most widespread genus of Nepticulidae occurring from the tundra and boreal forests to tropical rainforest or semi deserts (Stonis *et al.*, 2016c). According to Stonis *et al.* (2016c), among the discovered high-Andean *Stigmella* species, very many are quite similar and therefore probably closely related. Such a large portion of probably young species may be explained by the geological history and physical particularities of the Andes: the region is very diverse topographically (orographically) and climatically. Some discovered species resemble the Holarctic *S. salicis* and other species groups in some way, but in fact belong to other, endemic Neotropical groups of *Stigmella*. Among similar species that are hypothesized as young, a few of the discovered high-Andean *Stigmella* species exhibit a remarkable range of morphological structures, including *S. kristenseni* Diškus & Stonis possessing a unique spinose inner process on the valva, rather unique phallus, and unusual vinculum in the male genitalia (Stonis *et al.*, 2016c).

The absence of *Ectoedemia* Busck in the high-Andean fauna is rather unexpected, and the reason for this might be the under sampling (Stonis *et al.*, 2016c). This neticulid genus is very common in most boreal areas of North America and Eurasia, but only a single species, *E. morae* Diškus & Stonis (Stonis *et al.*, 2016a), was recently discovered from the equatorial Andes (lower altitudes, not the High Andes).



Figures 90–93. The Andean Nepticulidae researchers: 90 – the Andes and the Himalaya & Tibetan Plateau, with its own record of *Stigmella fibigeri* Puplesis & Diškus from the altitude of 2,950 m; 91 – the volcano Chimborazo, 6,268 m, the highest mountain near the Equator and the highest in the Andes north of Peru, and Arūnas Diškus, a passionate initiator of the high-Andean Nepticulidae project; 92 – the project especially owes to Ole Karsholt (ZMUC) for his highly resultative and valuable collecting in the central Andes (from Stonis *et al.*, 2016c); 93 – Andrius Remeikis, Ole Karsholt (in the centre), and Jonas R. Stonis, Copenhagen, 2016 (from Stonis *et al.*, 2017).

References

- Andean Páramo. (2016) Available from: <http://www.biome-explorer.net/Paramo/Andean%20Paramo.html> (accessed 10 June 2022)
- Denevan, W.M. (2016) Andes Mountains, Mountain system, South America. Available from: <http://www.britannica.com/place/Andes-Mountains> (accessed 10 June 2022)
- Fjeldså, J. & Kessler, M. (1996) *Conserving the Biological Diversity of Polylepis Woodlands of the Highland of Peru and Bolivia: a Contribution to Sustainable Natural Resource Management in the Andes*. Nordeco, Denmark, 250 pp.
- Hammen, T. van der & Cleef, A.M. (1986) Development of the high Andean Páramo flora and vegetation. In: Vuilleumier, F. & Monasterio, M. (Eds.), *High Altitude Tropical Biogeography*. Oxford University Press, Oxford, UK, pp. 153–201.
- Harling, G. (1979) The vegetation types of Ecuador – a brief survey. In: Larsen, K. & Holm-Nielsen, L.B. (Eds.), *Tropical Botany*. Academic Press, London, pp. 165–174.
- Hooghiemstra, H., Hoorn, M.C., Helmens, K.F., Wyninga, V.M., Ran, E.T.H.H., Cleef, A.M., Kuhry, P. & van der Hammen, T. (1994) Miocene to Pleistocene geo-ecological development of Amazonian and Andean Colombia: tectonics, basin development, migration, evolution and climatic change. In: Herngreen, J.F.W. (Ed.), *Volume of Abstracts 4th European Palaeobotanical and Palynological Conference*. Stichting Geologie en Paleontologie, Heerlen, pp. 39–43.
- Kessler, M. (2002) The elevational gradient of Andean plant endemism: varying influences of taxon-specific traits and topography at different taxonomic levels. *Journal of Biogeography*, 29 (9), 1159–1165. <https://doi.org/10.1046/j.1365-2699.2002.00773.x>
- Madriñán, S., Cortés, A.J. & Richardson, J.E. (2013) Páramo is the world's fastest evolving and coolest biodiversity hotspot. *Frontiers in Genetics*, 4, 192. <http://dx.doi.org/10.3389/fgene.2013.00192>, PMID: PMC3793228
- Puplesis, R. & Diškus, A. (2003) *The Nepticuloidea & Tischerioidea (Lepidoptera) – a global review, with strategic regional revisions*. Lututė Publishers, Kaunas, 512 pp.
- Shackleton, N.J., Berger, A. & Peltier, W.R. (1990) An alternative astronomical calibration of the lower Pleistocene timescale based on ODP Site 677. *Transactions of the Royal Society of Edinburgh: Earth Sciences*, 81 (4), 251–261. <https://doi.org/10.1017/S0263593300020782>
- Stonis, J.R., Diškus, A., Remeikis, A. & Cumbicus Torres, N. (2016a) Rosaceae-feeding Nepticulidae (Lepidoptera) of South America: some taxonomic and trophic diversity revealed. *Biologija*, 62 (4), 250–267. <https://doi.org/10.6001/biologija.v62i4.3412>
- Stonis, J.R., Diškus, A., Remeikis, A., Davis, D.R., Solis, M.A. & Cumbicus Torres, N. (2016b) The first record of *Baccharis* L. (Asteraceae) as a host-plant genus for Nepticulidae (Lepidoptera), with description of new *Stigmella* species from South America. *Zootaxa*, 4136 (1), 101–128. <http://doi.org/10.11646/zootaxa.4136.1.4>
- Stonis, J.R., Diškus, A., Remeikis, A., Gerulaitis, V. & Karsholt, O. (2016c) Leaf-mining Nepticulidae (Lepidoptera) from record high altitudes: documenting an entire new fauna in the Andean páramo and puna. Monograph. *Zootaxa*, 4181 (1), 1–94. <https://doi.org/10.11646/zootaxa.4181.1.1>
- Stonis, J.R., Diškus, A., Remeikis, A. & Karsholt, O. (2016d) Do leaf-mining Nepticulidae occur in the natural but so threatened Andean *Polylepis* forests? *Biologija*, 62 (2), 83–97. <http://dx.doi.org/10.6001/biologija.v62i2.3334>
- Stonis, J.R., Diškus, A., Remeikis, A., Karsholt, O. & Cumbicus Torres, N. (2017) Illustrated review of the leaf-mining Nepticulidae of the central Andes (Peru and Bolivia). Monograph. *Zootaxa*, 4257 (1), 1–70. <https://doi.org/10.11646/zootaxa.4257.1.1>
- Stonis, J.R., Remeikis, A., Diškus, A., Baryshnikova, S. & Solis, M.A. (2021) What are the smallest moths (Lepidoptera) in the world? *Zootaxa*, 4942 (2), 269–289. <https://doi.org/10.11646/zootaxa.4942.2.8>

Updated Generic Composition of the Global Nepticulidae

(by J. R. Stonis, A. Diškus, A. Remeikis)

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In this chapter, we present the current generic composition of the global Nepticulidae based on data of our morphological, biological as well as some molecular research, with no intent to discuss here a rather complicated publishing history regarding various concepts of the genera of Nepticulidae. An example of this complicated history was provided in the recently published paper “First record of the genus *Etainia* with four species new to Korea” by Shin *et al.* (2022): “The genus *Etainia* Beirne, 1945 (= *Obrussa* Braun, 1915, preoccupied), a small taxon of pygmy moths, has been described by B. P. Beirne by drawing on the European *Lyonetia sericopeza* Zeller possessing two large apodemes in the male genitalia (Beirne, 1945). Because of the striking morphological autapomorphies as well as the unique biology of the species (see Puplesis, 1994: fig. 40; Puplesis & Diškus, 1996), the genus was usually accepted and treated as a good genus (Braun, 1915; Wilkinson & Scoble, 1979; Scoble, 1983; Puplesis & Ivinskis, 1985; Puplesis, 1994; Puplesis & Diškus, 1996, 1997, 2003; Sinev, 2008; Navickaite *et al.*, 2011). Nevertheless, some researchers, particularly E. J. van Nieukerken, opposed and treated *Etainia* as a subgenus of *Ectoedemia* Busck (Johansson *et al.*, 1990; Nieukerken & Laštůvka, 2002; Hirano, 2013). Recently, on the basis of molecular phylogeny, the genus status was finally recognized (Nieukerken *et al.*, 2016a); the same applies for the case of *Glaucolepis* Braun.

In the Catalogue by van Nieukerken *et al.* (2016a), the use of the subgenus category was fully abandoned, which is practical and makes taxonomy more simple. Therefore, we partially accepted it for the convenience of potential users. We do not longer include a subgenus name in the full name of a species for its “trivial usage” but still provide subgeneric categories in the generic checklist below. The idea to abandon subgenera in Nepticulidae should be supported, but to do that by simple rising of almost every former subgenera to full genus (van Nieukerken *et al.*, 2016a) appears to be rather discussable.

Family **Nepticulidae** Stainton, 1854



Genus ***Simplimorpha*** Scoble, 1983

Subgenus ***Simplimorpha*** Scoble, 1983

Simplimorpha Scoble, 1983: 15.

Type species: *Stigmella lanceifoliella* Vári, 1955: 331–332.

Note. For the new, Gondwanan, concept of the genus, see Stonis *et al.*, 2018b: 490).

Subgenus ***Roscidotoga*** Hoare, 2000 (downgraded to a subgenus by Stonis *et al.*, 2018b)

Roscidotoga Hoare, 2000: 293–294.

Type species: *Roscidotoga callicomae* Hoare, 2000: 295–296.

Subgenus *Myrtinepticula* Stonis & Diškus, 2018

Myrtinepticula Stonis & Diškus, in Stonis *et al.*, 2018b: 158–159.

Type species: *Simplimorpha* (*Myrtinepticula*) *cercaria* Diškus & Stonis, in Stonis *et al.*, 2018b: 159–163.

Note. For common, trivial, use, for such species like *Simplimorpha* (*Myrtinepticula*) *cercaria* Diškus & Stonis, we prefer to provide *Simplimorpha cercaria* Diškus & Stonis (with “*Myrtinepticula*” omitted).

Genus *Pectinivalva* Scoble, 1983

Subgenus *Pectinivalva* Scoble, 1983

Pectinivalva Scoble, 1983: 12–13.

Type species: *Pectinivalva commoni* Scoble, 1983: 13.

Subgenus *Casanovula* Hoare, 2013

Casanovula Hoare in Hoare & van Nieuwerkerken, 2013: 24–26.

Type species: *Pectinivalva* (*Casanovula*) *brevipalpa* Hoare, in Hoare & van Nieuwerkerken, 2013: 27–29.

Note. To abandon the subgenus rank, *Casanovula* Hoare and *Menurella* Hoare were raised to the genus rank (van Nieuwerkerken *et al.*, 2016a). However, these genera have not been recognized and accepted by us; for the new concept of *Pectinivalva* Scoble (*sensu lato*), see Stonis *et al.*, 2018b: 175–177, figs 130–159.

Subgenus *Menurella* Hoare, 2013

Menurella Hoare in Hoare & van Nieuwerkerken, 2013: 35–37.

Type species: *Pectinivalva* (*Menurella*) *scotodes* Hoare, in Hoare & van Nieuwerkerken, 2013: 37–41.

Genus *Johanssoniella* Koçak, 1981

Johanssonia Borkowski, 1972: 702–705.

Type species: *Nepticula acetosae* Stainton, 1854: 303.

Johanssoniella Koçak, 1981: 99 (replacement name for *Johanssonia* Borkowski).

Type species: *Nepticula acetosae* Stainton, 1854: 303.

Note. For the new diagnostics of *Johanssoniella*, see the pictorial key by Stonis *et al.*, 2018a.

Genus *Brachinepticula* Stonis & Diškus, 2018

Brachinepticula Stonis & Diškus, in Stonis *et al.*, 2018a: 101–104.

Type species *Brachinepticula plurilobata* Diškus & Stonis, in Stonis *et al.*, 2018a: 106–111.

Genus *Enteucha* Meyrick, 1915

Enteucha Meyrick, 1915: 241.

Type species: *Enteucha cyanochlora* Meyrick, 1915: 241.

Artaversala Davis, 1978: 219, 221.

Type species: *Artaversala gilvafascia* Davis, 1978: 221–223.

Note. For the new concept of *Enteucha*, see the pictorial key by Stonis *et al.*, 2018a.

Genus *Manoneura* Davis, 1979

Manoneura Davis, 1979: 276. Replacement name for *Oligoneura* Davis.

Type species: *Oligoneura basidactyla* Davis, 1978: 218–219.

Oligoneura Davis, 1978: 217–218.

Type species: *Oligoneura basidactyla* Davis, 1978: 218–219.

Note. The generic status was restored by Stonis *et al.*, 2018a. *Manoneura*, a distinct, endemic Neotropical genus with striking autapomorphic characters, was twice incorrectly synonymised with *Enteucha* by van Nieuwerkerken (1986) and van Nieuwerkerken *et al.*, 2016a). For an updated concept of the restored *Manoneura*, see the pictorial key by Stonis *et al.*, 2018a.

Genus *Varius* Scoble, 1983

Varius Scoble, 1983: 14.

Type species: *Stigmella ochnicola* Vári, 1955: 336–337.

Genus *Areticulata* Scoble, 1983

Areticulata Scoble, 1983: 40–41.

Type species: *Areticulata leucosideae* Scoble, 1983: 40–41.

Genus *Ozadelpha* van Nieuwerkerken, 2016

Ozadelpha van Nieuwerkerken, in van Nieuwerkerken *et al.*, 2016b: 26–28.

Type species: *Ozadelpha conostegiae* van Nieuwerkerken & Nishida, in van Nieuwerkerken *et al.*, 2016b: 28–35.

Genus *Stigmella* Schrank, 1802

Stigmella Schrank, 1802: 169.

Type species: *Phalaena (Tinea) anomalella* Goeze, 1783: 168.

Nepticula Heyden, 1843: 208.

Type species: *Tinea aurella* Fabricius, 1775: 666.

Dysnepticula Börner, 1925: 370.

Type species: *Phalaena (Tinea) anomalella* Goeze, 1783: 168.

Astigmella Puplesis, 1984: 111 (*syn.* by van Nieuwerkerken, 1986: 7; Note: the latter synonymisation unjustified and possibly unnecessary).

Type species: *Astigmella dissona* Puplesis, 1984: 112.

Genus *Bohemannia* Stainton, 1859

Bohemannia Stainton, 1859: 439.

Type species: *Nepticula quadrimaculella* Boheman, 1853: 67.

Scoliaula Meyrick, 1895: 727–728. Unnecessary replacement name for *Bohemannia* Stainton.

Genus *Ectoedemia* Busck, 1907

Subgenus *Ectoedemia* Busck, 1907

Ectoedemia Busck, 1907: 97–98.

Type species: *Ectoedemia populella* Busck, 1907: 98–99.

Dechtiria Beirne, 1945: 204.

Type species: *Tinea subbimaculella* Haworth, 1828: 583.

Note. In the Catalogue by van Nieuwerkerken *et al.* (2016a), the use of the subgenus category was fully abandoned, which is practical. We accepted only partially. We do not longer include a subgenus name in the full name of a species for its “trivial usage” but list subgeneric categories in the checklist.

Subgenus *Zimmermannia* Hering, 1940

Zimmermannia Hering, 1940: 266.

Type species: *Ectoedemia liebwerdella* Zimmermann, 1940: 265.

Note. Recently, *Zimmermannia* was raised to the genus rank (van Nieuwerkerken *et al.*, 2016a). However, here, we downgraded *Zimmermannia* to the subgenus because of the presence of identical carinae and fully reduced uncus in both taxa, *Zimmermannia* and *Ectoedemia* (*sensu stricto*).

Genus *Hesperolyra* van Nieuwerkerken, 2016

Hesperolyra van Nieuwerkerken, in van Nieuwerkerken *et al.*, 2016b: 44–48.

Type species: *Fomoria diskusi* Puplesis & Robinson, 2000: 43.

Genus *Fomoria* Beirne, 1945

Fomoria Beirne, 1945: 208–209.

Type species: *Nepticula weaveri* Stainton, 1855: 49.

Laqueus Scoble, 1983: 20.

Type species: *Nepticula grandinosa* Meyrick, 1911: 236.

Muhabbetana Koçak & Kemal, 2007: 5. Replacement name for *Laqueus* Scoble, 1983.

Note. To abandon the subgenus rank, *Muhabbetana* Koçak & Kemal (= *Laqueus* Scoble) was raised to the genus rank (van Nieukerken *et al.*, 2016a). However, here, we do not recognize the new status of *Muhabbetana* because the morphological characters, as well as the species geographical ranges of the so called *Muhabbetana* and *Fomoria*, do not indicate two separate taxa of the genus rank. Even subgenera within *Fomoria* would be impracticable and would cause difficulties for diagnostics.

Genus *Acalyptris* Meyrick, 1921

Acalyptris Meyrick, 1921: 410.

Type species: *Acalyptris psammophricta* Meyrick, 1921: 410.

Microcalyptris Braun, 1925: 224 (*syn.* by van Nieukerken, 1986: 14).

Type species: *Microcalyptris scirpi* Braun, 1925: 225.

Weberia Müller-Rutz, 1934: 122; homonym (*syn.* by van Nieukerken, 1986: 14).

Type species: *Weberia platani* Müller-Rutz, 1934a: 122–123.

Niepeltia Strand, 1934: 241. Replacement name for *Weberia* Müller-Rutz (*syn.* by van Nieukerken, 1986: 14).

Weberina Müller-Rutz, 1934b: 148. Replacement name for *Weberia* Müller-Rutz. (*syn.* by van Nieukerken, 1986: 14).

Genus *Parafomoria* van Nieukerken, 1983

Parafomoria van Nieukerken, 1983: 454–458.

Type species: *Nepticula helianthemella* Herrich-Schäffer, 1860: 60.

Parafomoria Borkowski, 1975: 498 (unavailable name).

Genus *Trifurcula* Zeller, 1848

Trifurcula Zeller, 1848: 330–331.

Type species: *Oecophora pallidella* Duponchel, 1843: 339.

Levarchama Beirne, 1945: 206.

Type species: *Nepticula cryptella* Stainton, 1856: 41 (*syn.* by Johansson, 1971).

Genus *Glaucolepis* Braun, 1917

Glaucolepis Braun, 1917: 201.

Type species: *Nepticula saccharella* Braun, 1912: 97–100.

Fedalmia Beirne, 1945: 207 (*syn.* by Puplesis, 1985).

Type species: *Nepticula headleyella* Stainton, 1854: 298.

Sinopticala Yang, 1989: 79, 81 (*syn.* by van Nieukerken & Puplesis, 1991).

Type species: *Sinopticala sinica* Yang, 1989: 80, 82.

Neotrifurcula van Nieukerken, in van Nieukerken *et al.*, 2016b: 36, 37; *syn.* by Stonis *et al.*, 2017: 490.

Type species: *Neotrifurcula gielisorum* van Nieukerken, in van Nieukerken *et al.*, 2016b: 38–39.

Note. For the new concept of the genus with the synonymisation of *Neotrifurcula*, see Stonis *et al.*, 2017: 490

Genus *Etainia* Beirne, 1945

Etainia Beirne, 1945: 208.

Type species: *Lyonetia sericopeza* Zeller, 1839: 215.

Obrussa Braun, 1915: 196–197 (preoccupied; *syn.* with *Etainia* Beirne by van Nieukerken, 1986: 16).

Type species: *Nepticula ochrefasciella* Chambers, 1873: 128.

References

- Beirne, B.P. (1945) The male genitalia of the British Stigmellidae (Nepticulidae) (Lep.). *Proceedings of the Royal Irish Academy, (B)*, 50 (9), 191–218. <https://www.jstor.org/stable/20490833>
- Boheman, C.H. (1853) Entomologiska Anteckningar under en resa i Södra Sverige 1851. *Kungliga Svenska Vetenskaps-Akademiens Handlingar*, 1852, 55–210. <https://doi.org/10.5962/bhl.title.35818>
- Borkowski, A. (1972) Studien an Nepticuliden (Lepidoptera). Teil IV. Bemerkungen zur Nomenklatur und Systematik der Familie Nepticulidae. *Polskie Pismo Entomologiczne*, 42 (3), 689–709.
- Borkowski, A. (1975) Studien an Nepticuliden (Lepidoptera). Teil VI. Die Verbreitung der Nepticuliden in Polen. *Polskie Pismo Entomologiczne*, 45, 487–535.
- Börner, C. (1925) 22 Ordn. Lepidoptera, Schmetterlinge. In: Brohmer, P. (Ed.), *Fauna von Deutschland, Ein Bestimmungsbuch unserer heimischen Tierwelt*. 3. Quelle & Meyer, Leipzig, pp. 358–387.
- Braun, A.F. (1912) Notes on North American species of *Nepticula*, with descriptions of new species (Lepidoptera). *The Journal of the Cincinnati Society of Natural History*, 21 (3), 84–101. <http://biodiversitylibrary.org/page/12268566>
- Braun, A.F. (1915) New genera and species of Tineina. *Canadian Entomologist*, 47 (6), 188–197. doi: 10.4039/ent47188-6
- Braun, A.F. (1917) Nepticulidae of North America. *Transactions of the American Entomological Society*, 43 (2), 155–209, pls. 5–8. <http://biostor.org/reference/98155>
- Braun, A.F. (1925) Microlepidoptera of Northern Utah. *Transactions of the American Entomological Society*, 51 (3), 183–226.
- Busck, A. (1907) New American Tineina. *Proceedings of the Entomological Society of Washington*, 8 (3/4), 86–99. <http://biodiversitylibrary.org/page/2345065>
- Chambers, V.T. (1873) Micro-lepidoptera. *The Canadian Entomologist*, 5 (7), 124–128. <https://doi.org/10.4039/Ent5124-7>
- Davis, D.R. (1978) New leaf-mining moths of the family Nepticulidae from Florida. *Florida Entomologist*, 61 (4), 209–224. <https://www.jstor.org/stable/3494210?seq=1>
- Davis, D.R. (1979) *Manoneura*, a new name to replace the generic homonym *Oligoneura* Davis (Lepidoptera: Nepticulidae). *The Florida Entomologist*, 62 (3), 276. <https://doi.org/10.2307/3494067>
- Duponchel, P.A.J. (1843) Nocturnes, Supplément 4. In: Godart, J.-B. (Ed.), *Histoire naturelle des Lépidoptères ou papillons de France*. Méquignon-Marvis, Paris, pp. 305–512. <http://www.biodiversitylibrary.org/item/39620>
- Fabricius, J.C. (1775) *Systema entomologiae, sistens Insectorum Classes, Ordines, Genera, Species*. Kortii, Flensburgi et Lipsiae, 832 pp. <http://www.biodiversitylibrary.org/item/82400>
- Goeze, J.A.E. (1783) *Entomologische Beyträge zu des Ritter Linné zwölften Ausgabe des Natursystems*, 3 (4). Weidmanns Erben und Reich, Leipzig, 178 pp. <http://biodiversitylibrary.org/page/32010985>
- Haworth, A.H. (1828) *Lepidoptera Britannica; sistens digestionem novam Lepidopterorum quae in Magna Britannia reperiuntur*, 4. J. Murray, London, pp. 513–609.
- Heyden, von C. (1843) Vierte Sitzung, am 23. September. *Amtlicher Bericht über die zwanzigste Versammlung der Gesellschaft deutscher Naturforscher und Aerzte zu Mainz*, 20, 208–209. <https://www.biodiversitylibrary.org/page/10935453>
- Herrich-Schäffer, G.A.W. (1860) Revision der Europäischen Schmetterlingfauna. *Correspondenzblatt für Sammler von Insecten, insbesondere von Schmetterlingen*, 1 (8), 59–61.
- Hirano, N. (2013) Nepticulidae. In: Hirowatari, T., Nasu, Y., Sakamaki, Y. & Kishida, Y. (Eds.), *Nihon-san garui hyojun zukan (The standard of moths in Japan)*. Gakken Kyoiku Shuppan, Tokyo, pp. 80–96, pls. 3–03–3–06. [In Japanese]
- Hoare, R.J.B. (2000) A new genus of primitive Nepticulidae (Lepidoptera) from eastern Australia, with a revised diagnosis of nepticulid subfamilies. *Zoological Journal of the Linnean Society*, 128 (3), 289–317. <https://doi.org/10.1006/zjls.1998.0189>
- Hoare, R.J.B. & Nieuwerkerken, E.J. van (2013) Phylogeny and host-plant relationships of the Australian Myrtaceae leafmining moth genus *Pectinivalva* (Lepidoptera, Nepticulidae), with new subgenera and species. *Zookeys*, 278, 1–64. <https://doi.org/10.3897/zookeys.278.4743>
- Johansson, R. (1971) Notes on Nepticulidae (Lepidoptera) I. A revision of the *Nepticula ruficapitella* group.

- Entomologica Scandinavica*, 2 (4), 241–262. <https://doi.org/10.1163/187631271X00257>
- Johansson, R., Nielsen, E.S., Nieukerken, E.J. van & Gustafsson, B. (1990) The Nepticulidae and Opostegidae (Lepidoptera) of north west Europe. *Fauna Entomologica Scandinavica*, 23 (1/2), 1–739.
- Koçak, A.Ö. (1981) On the nomenclature of some genera of Lepidoptera. *Priamus*, 1 (3), 97–109.
- Koçak, A.Ö. & Kemal, M. (2007) Replacement names for some Microlepidoptera (Lepidoptera). *Miscellaneous Papers Centre for Entomological Studies*, 105, 5–7.
<https://archive.org/stream/CentreForEntomologicalStudiesAnkaraMiscellaneousPapers105>
- Meyrick, E. (1895) *A handbook of British Lepidoptera*. Macmillan & Co, London, vi+843 pp.
<https://doi.org/10.5962/bhl.title.8019>
- Meyrick, E. (1911) Descriptions of Transvaal Micro-Lepidoptera. *Annals of the Transvaal Museum*, 2, 218–240.
<http://biodiversitylibrary.org/page/50495141>
- Meyrick, E. (1915) Descriptions of South American Micro-Lepidoptera. *The Transactions of the Entomological Society of London*, 48, 201–256. <https://doi.org/10.1111/j.1365-2311.1915.tb02527.x>
- Meyrick, E. (1921). *Exotic Microlepidoptera*, 2 (13), 385–416.
- Müller-Rutz, J. (1934a) Ueber Microlepidopteren. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*, 16 (2), 118–128, pl. 111. <http://dx.doi.org/10.5169/seals-400814>
- Müller-Rutz, J. (1934b) Berichtigung. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*, 16 (3), 148.
- Navickaitė, A., Diškus, A., Stonis, J.R. & Dobrynina, V. (2011) Taxonomic catalogue of the world Nepticuloidea and Tischerioidea (Lepidoptera) described by members of the Biosystematics Research Group (Lithuania) up to 2009. *Acta Zoologica Lituanica*, 21 (2), 113–132. <https://doi.org/10.2478/v10043-011-0014-2>
- Nieukerken, E.J. van (1983) The Cistaceae-feeding Nepticulidae (Lepidoptera) of the western Palaearctic region. *Systematic Entomology*, 8, 453–478. <https://doi.org/10.1111/j.1365-3113.1983.tb00495.x>
- Nieukerken, E.J. van (1986) Systematics and phylogeny of Holarctic genera of Nepticulidae (Lepidoptera, Heteroneura: Monotrysia). *Zoologische Verhandelingen*, 236 (1), 1–93.
<https://repository.naturalis.nl/pub/317599>
- Nieukerken, E.J. van, Doorendeerd, C., Hoare, R.J.B. & Davis, D.R. (2016a) Revised classification and catalogue of global Nepticulidae and Opostegidae (Lepidoptera: Nepticuloidea). *ZooKeys*, 628, 65–246.
<https://doi.org/10.3897/zookeys.628.9799>
- Nieukerken, E.J. van, Doorendeerd, C., Nishida, K. & Snyers, C. (2016b) New taxa, including three new genera show uniqueness of Neotropical Nepticulidae (Lepidoptera). *ZooKeys*, 628, 1–63.
<https://doi.org/10.3897/zookeys.628.9805>
- Nieukerken, E.J. van & Laštůvka, A. (2002) *Ectoedemia (Etainia) obtusa* (Puplesis & Diškus, 1996) new for Europe: taxonomy, distribution and biology (Nepticulidae). *Nota lepidopterologica*, 25 (2/3), 87–95.
<http://biostor.org/reference/143089>
- Nieukerken, E.J. van & Puplesis, R. (1991) Taxonomy and distribution of the *Trifurcula (Glaucolepis) raikhonae* group (Lepidoptera: Nepticulidae). *Tijdschrift voor Entomologie*, 134, 201–210. <http://biostor.org/reference/49992>
- Puplesis, R. (1984) New species of nepticulids (Lepidoptera, Nepticulidae) from southern Primorye. *Entomologicheskoe Obozrenie*, 63 (1), 111–125. [in Russian]
- Puplesis, R.K. (1985) *Moli-malyutki (Lepidoptera, Nepticulidae) Pribaltiki i Dal'nego Vostoka*. Avtoreferat. Ordena Trudovogo Krasnogo Znameni Zoologicheskii Institut AN SSSR, Leningrad, 23 pp. [in Russian]
- Puplesis, R. (1994) *The Nepticulidae of Eastern Europe and Asia: western, central and eastern parts*. Backhuys Publishers, Leiden, 291 pp., 840 figs.
- Puplesis, R. & Diškus, A. (1996) First record of the genus *Etainia* Beirne from Central Asia with descriptions of two new species and some provisional notes on the world fauna (Lepidoptera: Nepticulidae). *Phegea*, 24 (1), 41–48.
http://www.phegea.org/Phegea/1996/Phegea24-1_41-48.pdf
- Puplesis, R. & Diškus, A. (1997) Sem. Nepticulidae – neptikulidy. In: Ler, P.A. (Ed.), *Key to the insects of Russian Far East. Trichoptera and Lepidoptera*, 5 (1). Dal'nauka Publishers, Vladivostok, pp. 302–319. [in Russian]
- Puplesis, R. & Diškus, A. (2003) *The Nepticuloidea & Tischerioidea (Lepidoptera) — a global review, with strategic regional revisions*. Lututė Publishers, Kaunas, 512 pp.

- Puplesis, R. & Ivinskis, P.P. (1985) Review of nepticulid moths fauna of the *Obrussa* Braun genus in the USSR and a description of 4 new species—*Obrussa capesella* sp. n., *O. tigrinella* sp. n., *O. peterseni* sp. n., *O. sabina* sp. n. *Lietuvos TSR Mokslų Akademijos darbai* (C), 4 (92), 36–46. [in Russian]
- Puplesis, R. & Robinson, G.S. (2000) A review of the Central and South American Nepticulidae (Lepidoptera) with special reference to Belize. *Bulletin of the Natural History Museum, London, Entomology*, 69 (1), 3–114.
- Schrank, F. von Paula (1802) Durchgedachte Geschichte der in Baiern einheimischen und zahmen Thiere. *Fauna Boica*, 2 (2). J.W. Krüll, Ingolstadt, 412 pp. <https://doi.org/10.5962/bhl.title.44923>
- Scoble, M.J. (1983) A revised cladistic classification of the Nepticulidae (Lepidoptera) with descriptions of new taxa mainly from South Africa. *Transvaal Museum Monograph*, 2 (1), 1–105. https://hdl.handle.net/10520/AJA090799001_84
- Shin, Y.-M., Byun, B.-K. & Lee, B.-W. (2022) First record of the genus *Etainia* (Lepidoptera: Nepticulidae) with four species new to Korea. *Journal of Asia-Pacific Biodiversity*, 15 (1), 59–69. <https://doi.org/10.1016/j.japb.2021.11.001>
- Sinev, S.Yu. (2008) Tischeriidae. In: Sinev, Yu.S. (Ed.), *Catalogue of the Lepidoptera of Russia*. KMK Scientific Press, St. Petersburg, Moscow, pp. 27.
- Stainton, H.T. (1854) *Insecta Britannica. Lepidoptera: Tineina*. Lovell Reeve, London, i–viii + 313 pp. <https://doi.org/10.5962/bhl.title.9558>
- Stainton, H.T. (1855) Lepidoptera. The new British species in 1854. *Entomologist's Annual*, 1855, 62–72. <http://biodiversitylibrary.org/page/10427580>
- Stainton, H.T. (1856) Lepidoptera. New British species in 1855. *Entomologist's Annual*, 1856, 26–45. <http://biodiversitylibrary.org/page/10427732>
- Stainton, H.T. (1859) *A Manual of British butterflies and moths*, 2. Cooke & Son, London, xi + 480 pp. <https://books.google.nl/books?id=xv0GAQAIAAJ&hl=nl&pg=PR1#v=onepage&q&f=false>
- Stonis, J.R., Diškus, A., Remeikis, A. & Solis, M.A. (2018a) The American *Brachinepticula* gen. nov. and *Manoneura* Davis (Nepticulidae): a new generic concept based on a reinforced cathrema in the phallus. *Biologija*, 64 (2), 99–128. <https://doi.org/10.6001/biologija.v64i2.3735>
- Stonis, J.R., Diškus, A., Remeikis, A. & Solis, M.A. (2018b) A Gondwanan concept of *Simplimorpha* Scoble (*sensu lato*): a step toward clarity in the generic diagnostics of global Nepticulidae (Lepidoptera). *Zootaxa*, 4521 (2), 151–182. <https://doi.org/10.11646/zootaxa.4521.2.1>
- Stonis, J.R., Remeikis, A., Diškus, A. & Solis, M.A. (2017) The American species of the genus *Glaucolepis* Braun, 1917 (*Neotrifurcula* van Nieukerken, syn. nov.) (Lepidoptera: Nepticulidae). *Zootaxa*, 4338 (3), 489–506. <https://doi.org/10.11646/zootaxa.4338.3.5>
- Strand, E. (1934) *Niepeltia* novum genus Lepidopterorum. *Internationale Entomologische Zeitschrift*, 28 (19), 241.
- Vári, L. (1955) South African Lepidoptera 1. Descriptions of new leafmining Tineina. *Annals of the Transvaal Museum*, 22 (3), 331–351.
- Wilkinson, C. & Scoble, M.J. (1979) The Nepticulidae (Lepidoptera) of Canada. *Memoirs of the Entomological Society of Canada*, 111, 1–129, pls. 10. <https://doi.org/10.4039/entm111107fv>
- Yang, C.-K. (1989) *Sinoptacula sinica* (Lepidoptera: Nepticulidae), a new genus and species from China. *Entomotaxonomia*, 11 (1/2), 79–82.
- Zeller, P.C. (1839) Versuch einer naturgemässen Eintheilung der Schaben. *Isis von Oken*, 32 (3), 167–224. <https://biostor.org/reference/99970>
- Zeller, P.C. (1848) Die Gattungen der mit Augendeckeln versehenen blattminirenden Schaben. *Linnaea Entomologica*, 3, 248–344, pl. 242. <http://biodiversitylibrary.org/page/44017229>
- Zimmermann, F. (1940) Eine neue Nepticulide aus Deutschland (Lep.), *Ectoedemia liebwerdella* spec. nov. (Lep.). *Mitteilungen aus dem Zoologischen Museum in Berlin*, 24 (2), 264–265.

Species Groups in Nepticulidae

(by J. R. Stonis, A. Diškus, A. Remeikis)

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Species groups (or complexes) are purely informal units combined by researchers for practical reasons. In Nepticulidae, species groups are widely used for diagnostic purposes and have a long-lasting tradition (e.g., Johansson, 1971; Wilkinson & Scoble, 1979; Scoble, 1983; van Nieukerken, 1985, 1990, 2007; Kemperman & Wilkinson, 1985; Schoorl & Wilkinson, 1986; Johansson *et al.*, 1990; Puplesis, 1991, 1994; van Nieukerken & Puplesis, 1991; Laštůvka & Laštůvka, 2000; Puplesis & Robinson, 2000; Puplesis & Diškus, 1996, 2003; van Nieukerken *et al.*, 2016; Stonis & Diškus, 2018; Stonis *et al.*, 2017a, 2020a, 2020b, etc.).

Currently, because of the growing number of species and the tremendous morphological and ecological diversity of pygmy moths that has been revealed, the combining of species into groups became a necessity. Sometimes, to make orientation easier, there is a need for species complexes within species groups.

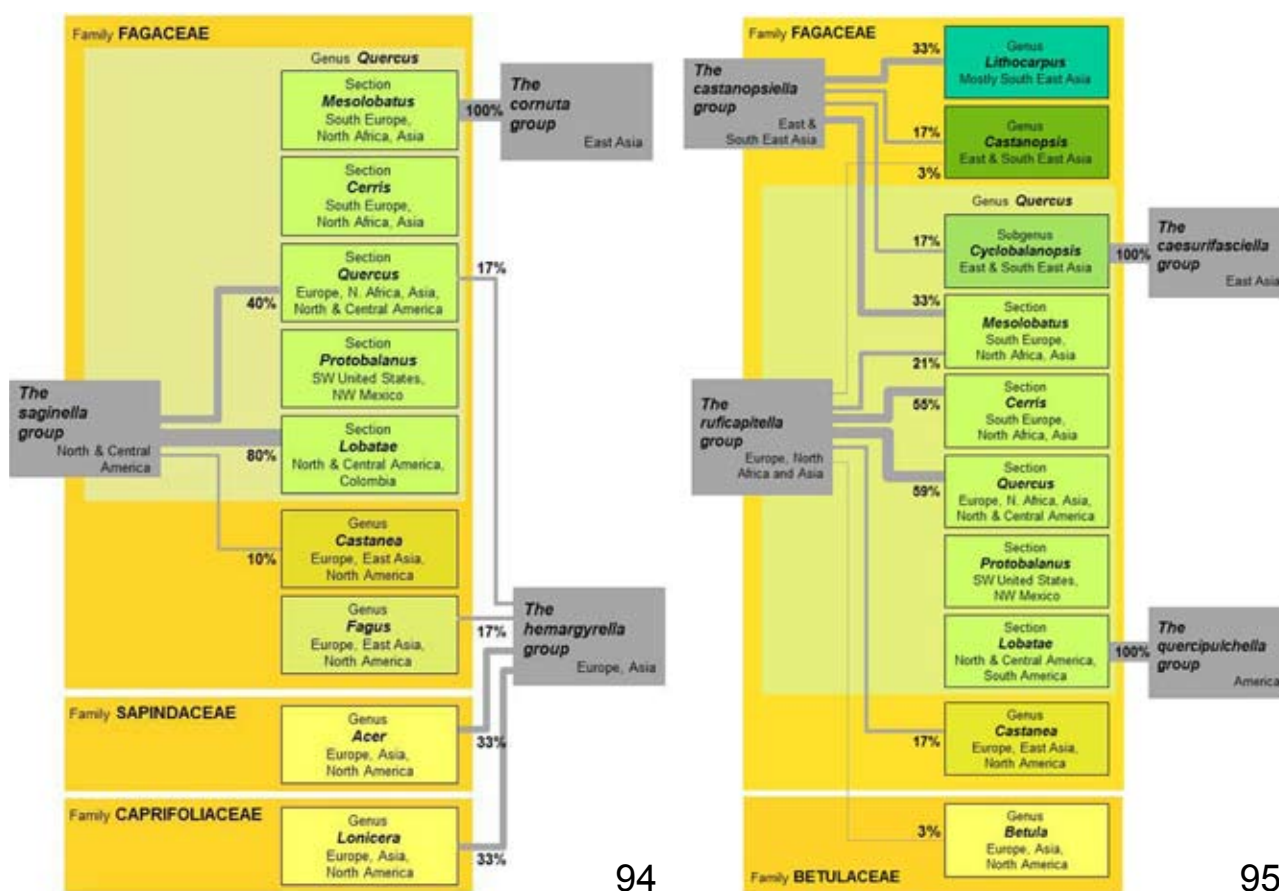
A species group: a combined, designated but informal assemblage (not governed by the provisions of the International Code of Zoological Nomenclature) of species sharing similar diagnostic (especially morphological and biological) characters which differ from other species or groups of species within the same genus. Species groups are not necessarily monophyletic clusters but are designated as such for convenience. However, the ideal case would be when species groups are not only uniform, easily diagnosed but also represent monophyletic entities (phylogenetic clades).

A species complex: a cluster of uniform, hardly differentiated, sibling or cryptic species within a species group (“a taxonomic puzzle”). The best explanation of the essence of such species complexes was provided by van Nieukerken *et al.* (2016); for the examples, see van Nieukerken *et al.* (2012), a large published work dealing with the complexes of the European *Ectoedemia*. Some complexes within the Neotropical species groups were already designated or discussed by Stonis & Remeikis (2015) and particularly by Stonis & Remeikis (2016) in the paper “Southern Andean *Stigmella sinuosa* complex: unrevealing problematic taxonomy with a pictorial key of adults?”. As regards the paper by Stonis & Remeikis (2015), it should be noted that the Caribbean *Acalyptis bicornutus* complex, formerly designated within the *A. peteni* group was recently upgraded to a separate species group (not a complex) and renamed as the *Acalyptis statuarius* species group (Stonis *et al.*, 2020a).

A satellite species: a species which shares only some diagnostic characters with a certain species group (and cannot be attributed to any other species group). The term “satellite” means that this species is not attributed to any species group, but, by some features, resembles a certain group.

Since species groups in Nepticulidae are highly valuable for diagnostic purposes and make the orientation easier, especially in such large genera as *Stigmella* with currently 514 species worldwide, the designation of species groups was widely applied to the research of the Neotropical Nepticulidae. In the paper “Description of new species of oak leaf-miners, with notes on the species groups of *Stigmella* Schrank associated with *Quercus* as a host plant”, seven species groups of oak-feeding *Stigmella* were reviewed with illustrated sets of morphological characters designed for easier diagnostics (Stonis *et al.*, 2013). This paper also included two groups from America: the *saginella* and the *quercipulchella*. According to the authors (Stonis *et al.*, 2013), all seven species groups oak-

feeding *Stigmella* worldwide exhibited slightly different host-plant preferences (Figs 94, 95), with the most restricted feeding preferences for the Nearctic-Neotropical *quercipulchella* group.



Figures 94, 95. An attempt to analyse the trophic relationships of *Quercus*-feeding species groups of *Stigmella* (from Stonis *et al.*, 2013).

In the paper “Ten new species from the Patagonian Andes (Argentina and Chile), mostly belonging to a newly designated *Stigmella purpurimaculæ* group” by Stonis *et al.* (2014), the *purpurimaculæ* group was designated for the species which possess remarkable genitalia characters: the partially reduced tube of the phallus, the dentate cornuti, and the strongly developed utriculus in the female genitalia, which can be equal to or longer than the corpus bursae (Stonis *et al.*, 2014). Although at the time of the publication of this paper, the host-plant preferences were unknown (only expected), now it became evident that at least some of the species attributed to this morphologically particular group trophically are associated with *Nothofagus* spp., Nothofagaceae (Arūnas Diškus, unpublished), i.e., the host plants of the particular, Gondwanan, distribution.

The recent findings of taxa belonging to the newly designated the *S. magnispinella* group (Stonis *et al.*, 2016) presented a case of a rather uncomplicated species differentiation, where species are easily diagnosed by species-specific morphological characters of the male genitalia (Figs 96, 97).

To make diagnostics easier, ten new *Stigmella* species groups were designated in the monograph “Illustrated review of the leaf-mining Nepticulidae of the central Andes (Peru and Bolivia)” by Stonis *et al.* (2017a). The authors indicated or highlighted clearly different clusters of possibly related species and organized all the central Andean species into thirteen species groups (Fig. 98). According to Stonis *et al.* (2017a), some of them may represent monophyletic entities. Afterwards, it was hypothesized that all species which possess only two horn-like cornuti in the male genitalia

and are trophically associated with Asteraceae plants can be attributed to a separate species group of specialized Asteraceae-feeders, the *S. bipartita* species group (Stonis *et al.*, 2017b).

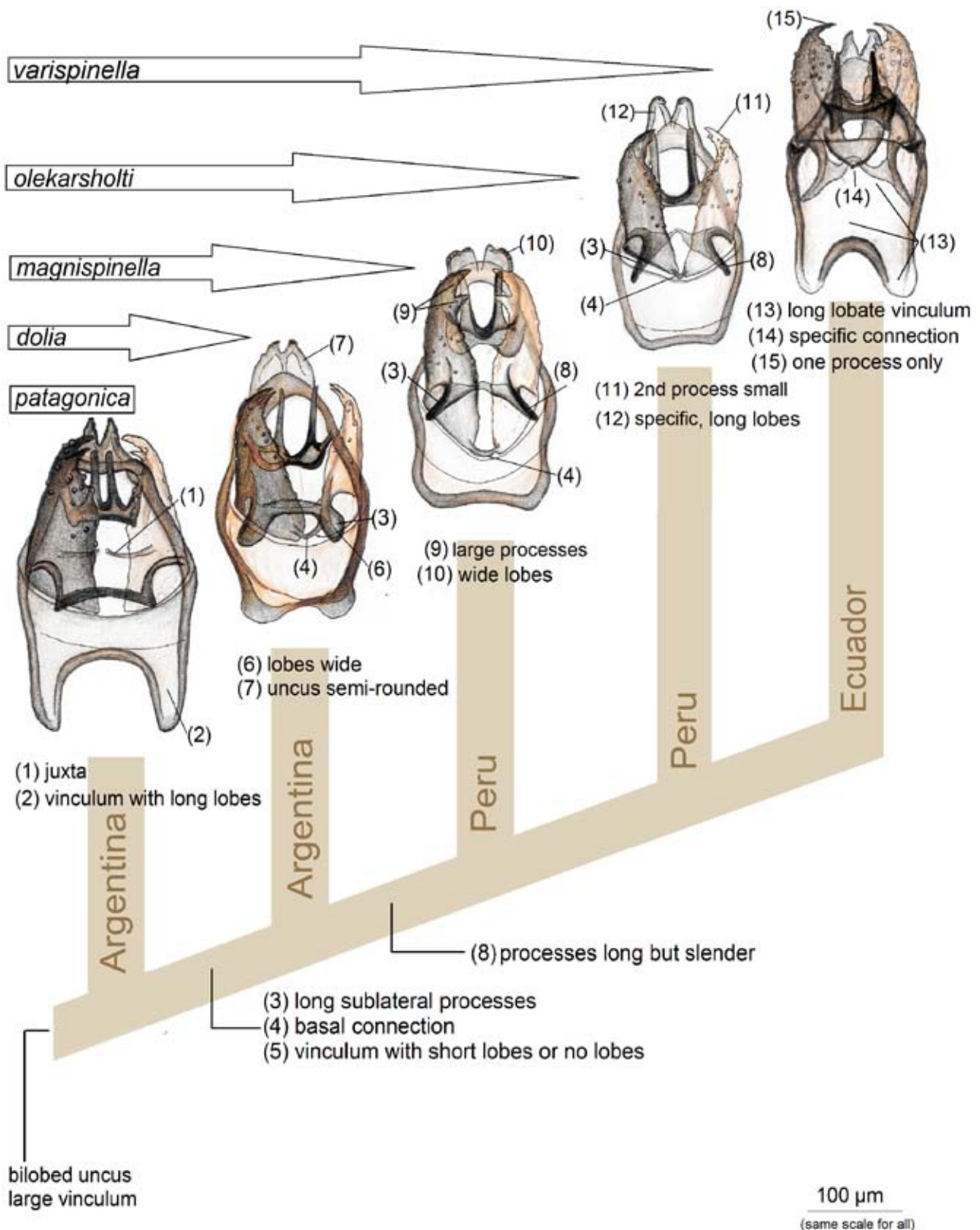


Figure 96. The *Stigmella magnispinella* group, a species group designated by Stonis *et al.*, 2016.

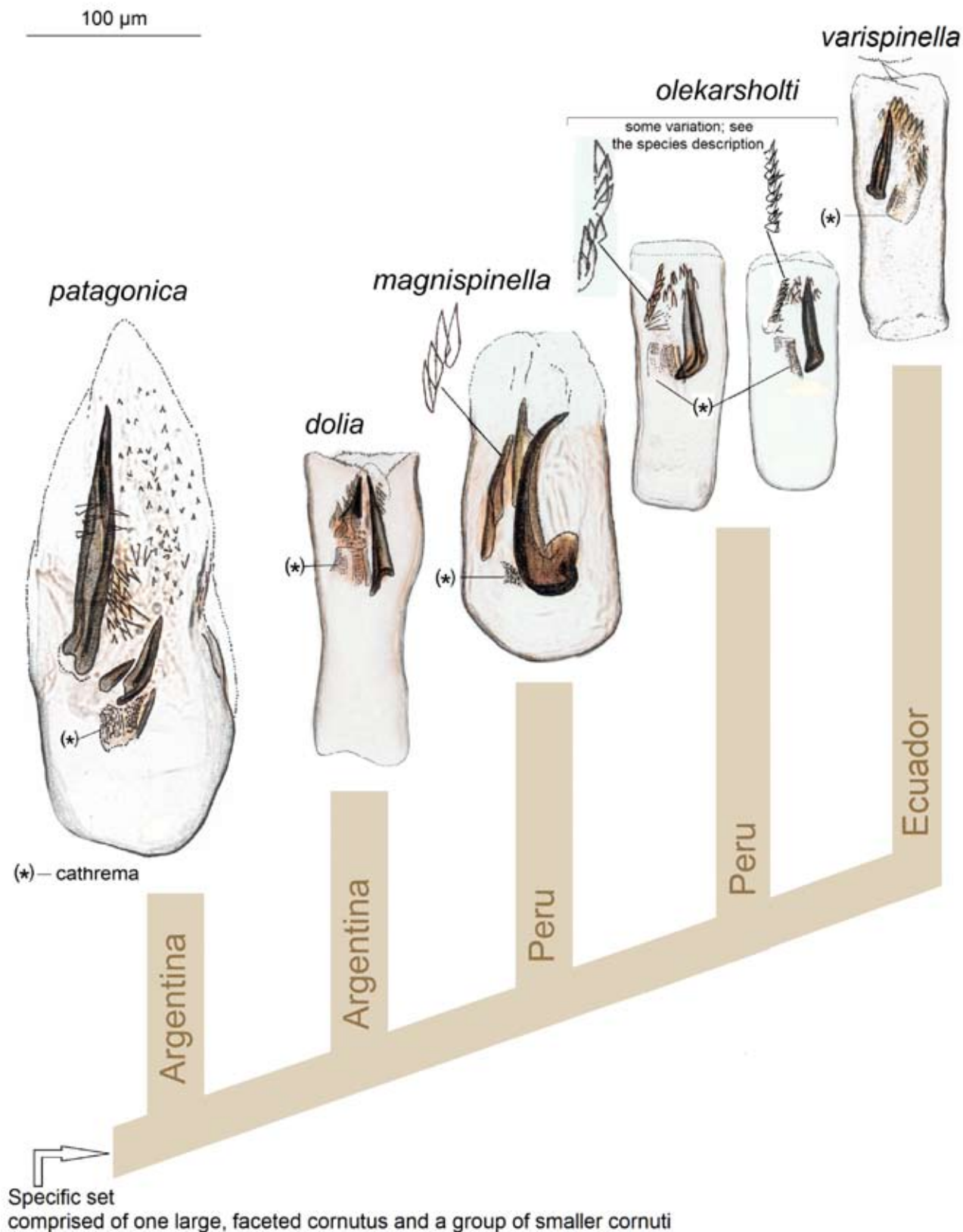


Figure 97. The *Stigmella magnispinella* group presents a case of a rather uncomplicated species differentiation (from Stonis *et al.*, 2016).

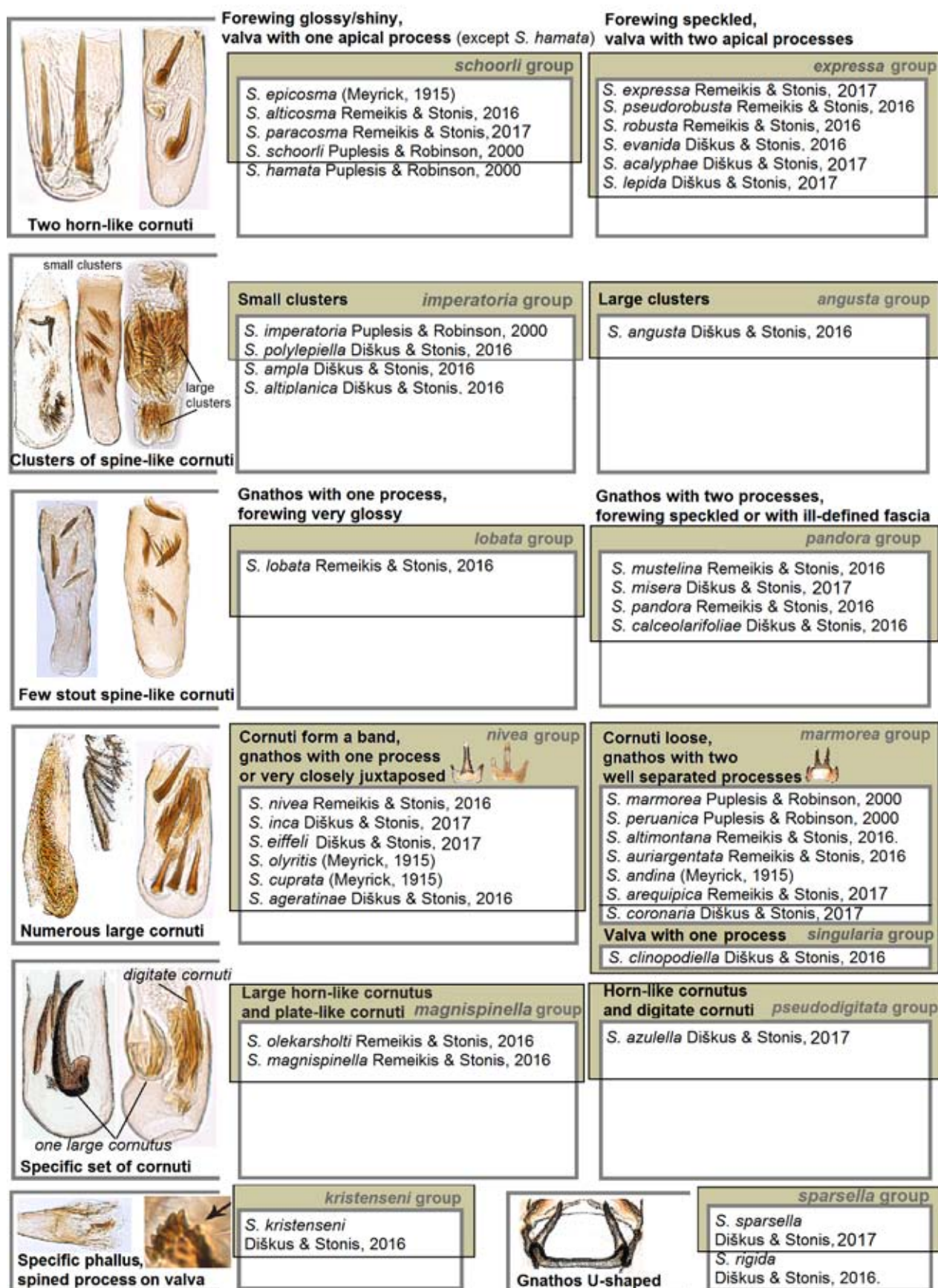


Figure 98. An attempt to provide a pictorial key to the species groups designated in the monograph “Illustrated review of the leaf-mining Nepticulidae of the central Andes (Peru and Bolivia)” by Stonis *et al.* (2017a); now the species groups have been revised (see the Checklist).

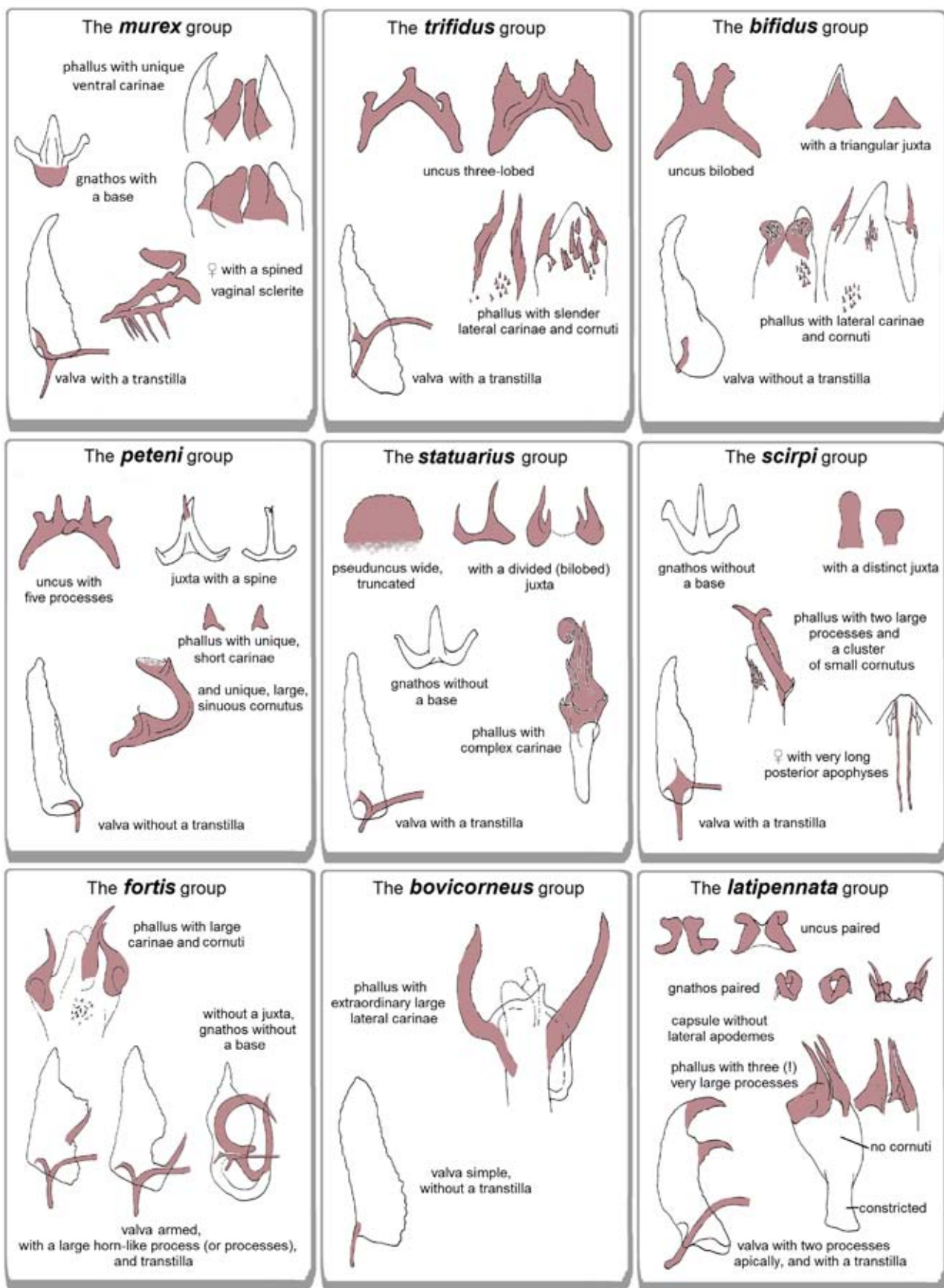


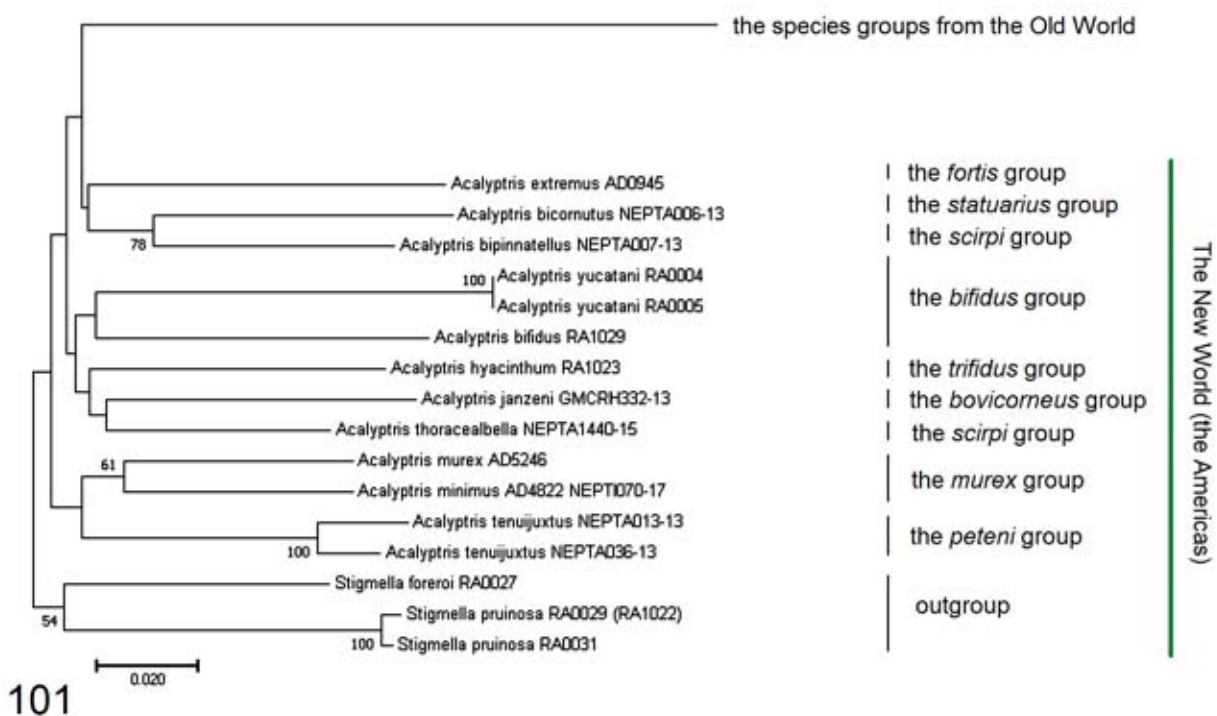
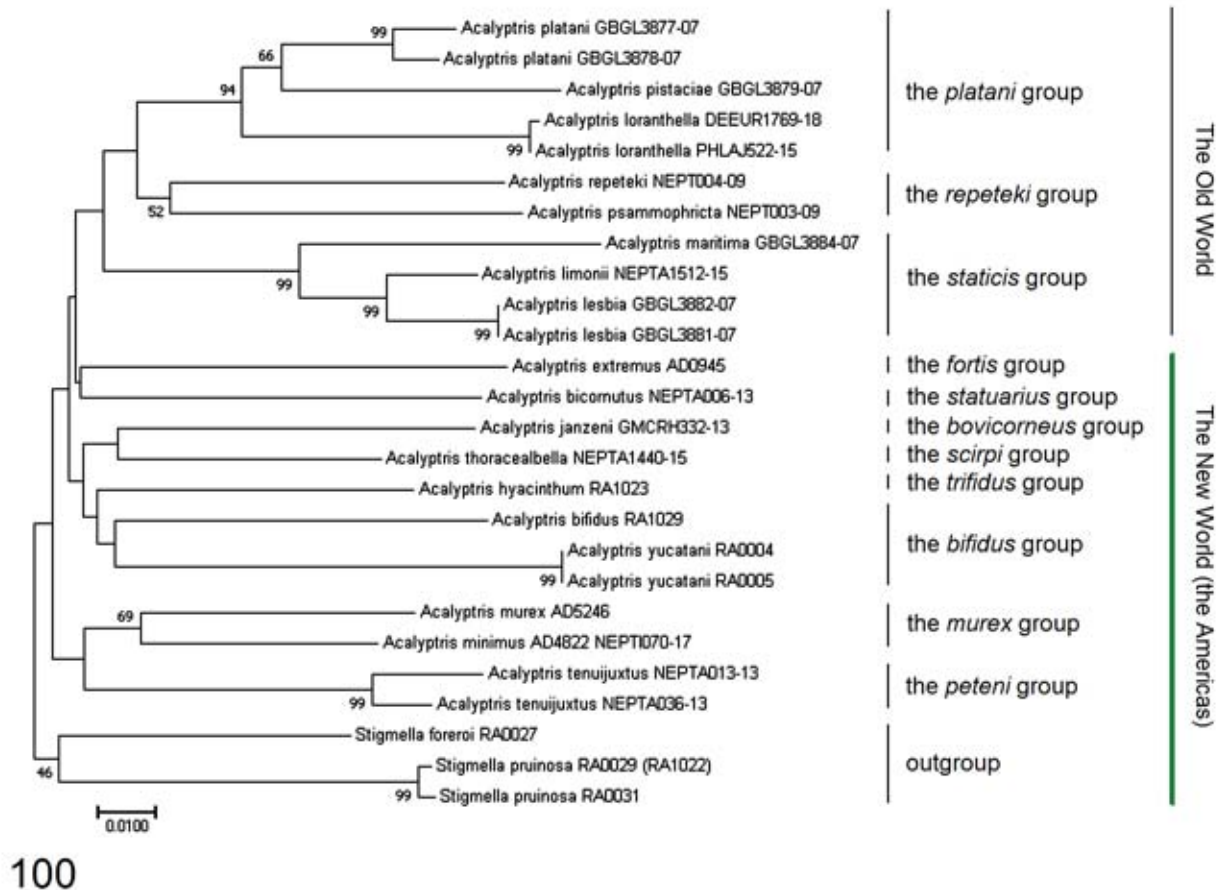
Figure 99. A pictorial key to all groups of the American *Acalyptris* (from Stonis *et al.*, 2020a).

Recently, in the paper “Diagnostics and updated catalogue of *Acalyptris* Meyrick, the second largest genus of Nepticulidae in the Americas” (Stonis *et al.*, 2020a), five new species groups in *Acalyptris* were designated, and a pictorial diagnostic scheme for all nine species groups of the American fauna was provided (Fig. 99).

Although species groups are purely diagnostic to help a potential user navigate the diversity and identify species, still there is a wish (not a requirement) to have species groups monophyletic. According to Stonis *et al.* (2020a), despite the striking characters of the genitalia of American *Acalyptris* species groups and their intrinsic value for their diagnostics, some of the groups (e.g., *A. bovicorneus*) may be paraphyletic. Unfortunately, up to date, molecular studies provided limited assistance because only a small proportion of American (and Neotropical) species were sequenced (Stonis *et al.*, 2020a). It was interesting to find that the *murex* group clusters with the *peteni* group. It is possible that the unique ventral carinae of the *murex* species group and the small carinae of the *peteni* species group are of the same origin. Moreover, at least one species in the *murex* species group possesses a cornutus similar to the sinuous cornutus of the *peteni* species group. As regards the potential sister group relationship between the *scirpi* and the *bovicorneus* species groups or the *trifidus* and the *bifidus* species groups, the morphology of the male genitalia, specifically the similarity of the carinae of the phallus, supported molecular results (Fig. 100) (Stonis *et al.*, 2020a). In the alternative phylogenetic tree provided by Stonis *et al.* (2020) (Fig. 101), the general “picture” was similar, especially as regards the *murex* and *peteni* species groups, but other groups mentioned above clustered slightly differently (and it was less supported by morphological data).

References

- Johansson, R. (1971) Notes on Nepticulidae (Lepidoptera) I. A revision of the *Nepticula ruficapitella* group. *Entomologica Scandinavica*, 2 (4), 241–262. <https://doi.org/10.1163/187631271X00257>
- Johansson, R., Nielsen, E.S., Nieuwerkerken, E.J. van & Gustafsson, B. (1990) The Nepticulidae and Opostegidae (Lepidoptera) of north west Europe. *Fauna Entomologica Scandinavica*, 23 (1/2), 1–739.
- Kemperman, T.C.M. & Wilkinson, C. (1985) Japanese species of the genus *Stigmella* (Nepticulidae: Lepidoptera) [with biological data provided by Kuroko, H. & Kumata, T.]. *Insecta Matsumurana* n. s., 32, 1–107. <http://hdl.handle.net/2115/9830>
- Laštůvka, A. & Laštůvka, Z. (2000) The *Ectoedemia* (*Fomoria*) *weaveri*-group of the southern Balkans with description of two new species (Lepidoptera, Nepticulidae). *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 48 (3), 19–26. <https://eurekamag.com/research/003/579/003579044.php>
- Nieuwerkerken, E.J. van (1985) A taxonomic revision of the Western Palaearctic species of the subgenera *Zimmermannia* Hering and *Ectoedemia* Busck s. str. (Lepidoptera, Nepticulidae), with notes on their phylogeny. *Tijdschrift voor Entomologie*, 128 (1), 1–164. <https://biostor.org/reference/61076>
- Nieuwerkerken, E.J. van (1990) The *Trifurcula subnitidella* group (Lepidoptera: Nepticulidae): taxonomy, distribution and biology. *Tijdschrift voor Entomologie*, 133 (2), 205–238. <https://biostor.org/reference/49974>
- Nieuwerkerken, E.J. van (2007) *Acalyptris* Meyrick: revision of the *platani* and *staticis* groups in Europe and the Mediterranean (Lepidoptera: Nepticulidae). *Zootaxa*, 1436 (1), 1–48. <https://doi.org/10.11646/zootaxa.1436.1.1>
- Nieuwerkerken, E.J. van, Doorenweerd, C., Hoare, R.J.B. & Davis, D.R. (2016) Revised classification and catalogue of global Nepticulidae and Opostegidae (Lepidoptera: Nepticuloidea). *ZooKeys*, 628, 65–246. <https://doi.org/10.3897/zookeys.628.9799>
- Nieuwerkerken, E.J. van, Doorenweerd, C., Stokvis, F.R. & Groenenberg, D.S.J. (2012) DNA barcoding of the leaf-mining moth subgenus *Ectoedemia* s. str. (Lepidoptera: Nepticulidae) with COI and EF1- α : two are better than one in recognising cryptic species. *Contributions to Zoology*, 81 (1), 1–24. <https://doi.org/10.1163/18759866-08101001>
- Nieuwerkerken, E.J. van & Puplesis, R. (1991) Taxonomy and distribution of the *Trifurcula* (*Glaucolepis*) *raikhonae* group (Lepidoptera: Nepticulidae). *Tijdschrift voor Entomologie*, 134, 201–210. <http://biostor.org/reference/49992>



Figures 100, 101. Two versions of the Neighbour-Joining trees dealing with some species groups of the American *Acalyptris* (from Stonis *et al.*, 2020a).

- Puplesis, R. (1991) The *Stigmella paradoxa* species-group (Lepidoptera: Nepticulidae) in the USSR. *Entomologica scandinavica*, 22 (1), 123–127. <https://doi.org/10.1163/187631291X00345>
- Puplesis, R. (1994) *The Nepticulidae of Eastern Europe and Asia: western, central and eastern parts*. Backhuys Publishers, Leiden, 291 pp., 840 figs.
- Puplesis, R. & Diškus, A. (1996) A review of the *Stigmella sorbi* species-group with descriptions of two new species from Turkmenistan and Tadjikistan (Lepidoptera: Nepticulidae). *Phegea*, 24 (4), 171–182. http://www.phegea.org/Phegea/1996/Phegea24-4_171-182.pdf
- Puplesis, R. & Diškus, A. (2003) *The Nepticuloidea & Tischerioidea (Lepidoptera) — a global review, with strategic regional revisions*. Lututė Publishers, Kaunas, 512 pp.
- Puplesis, R. & Robinson, G.S. (2000) A review of the Central and South American Nepticulidae (Lepidoptera) with special reference to Belize. *Bulletin of the Natural History Museum, London, Entomology*, 69 (1), 1–114. <http://www.biodiversitylibrary.org/part/76459>
- Schoorl, J.W. & Wilkinson, C. (1986) The *Stigmella betulicola* species-group in Europe (Lepidoptera: Nepticulidae). *Journal of Natural History*, 20 (1), 225–244. <https://doi.org/10.1080/00222938600770181>
- Scoble, M.J. (1983) A revised cladistic classification of the Nepticulidae (Lepidoptera) with descriptions of new taxa mainly from South Africa. *Transvaal Museum Monograph*, 2 (1), 1–105. https://hdl.handle.net/10520/AJA090799001_84
- Stonis, J.R. & Diškus, A. (2018) *Acalyptis amazonensis* sp. nov.: documentation of another leaf-mining species supplementing the unique but disputable *A. latipennata* group (Lepidoptera: Nepticulidae). *Biologija*, 64 (3), 191–202. <https://doi.org/10.6001/biologija.v64i3.3824>
- Stonis, J.R., Diškus, A., Remeikis, A., Karsholt, O. & Cumbicus Torres, N. (2017a) Illustrated review of the leaf-mining Nepticulidae of the central Andes (Peru and Bolivia). Monograph. *Zootaxa*, 4257 (1), 1–70. <https://doi.org/10.11646/zootaxa.4257.1.1>
- Stonis, J.R., Diškus, A., Remeikis, A., Navickaitė, A. & Rocienė, A. (2013) Description of new species of oak leaf-miners (Lepidoptera: Nepticulidae), with notes on the species groups of *Stigmella* Schrank associated with *Quercus* as a host-plant. *Zootaxa*, 3737 (3), 201–222. <https://doi.org/10.11646/zootaxa.3737.3.1>
- Stonis, J.R., Diškus, A., Remeikis, A., Vargas, A.S. & Solis, M.A. (2020a) Diagnostics and updated catalogue of *Acalyptis* Meyrick, the second largest genus of Nepticulidae (Lepidoptera) in the Americas. *Zootaxa*, 4748 (2), 201–247. <https://doi.org/10.11646/zootaxa.4748.2.1>
- Stonis, J.R. & Remeikis, A. (2015) The first records on the genus *Acalyptis* from the Caribbean (Lepidoptera: Nepticulidae). *Zootaxa*, 4057 (1), 79–90. <https://doi.org/10.11646/zootaxa.4057.1.4>
- Stonis, J.R. & Remeikis, A. (2016) Southern Andean *Stigmella sinuosa* complex (Lepidoptera, Nepticulidae): unraveling problematic taxonomy with a pictorial key of adults? *Zootaxa*, 4136 (2), 309–322. <http://doi.org/10.11646/zootaxa.4136.2.3>
- Stonis, J.R., Remeikis, A. & Davis, D.R. (2014) Ten new species from the Patagonian Andes (Argentina and Chile), mostly belonging to a newly designated *Stigmella purpurimaculae* group (Lepidoptera: Nepticulidae). *Zootaxa*, 3887 (3), 321–353. <https://doi.org/10.11646/zootaxa.3887.3.3>
- Stonis, J.R., Remeikis, A., Diškus, A. & Gerulaitis, V. (2016) The Ando-Patagonian *Stigmella magnispinella* group (Lepidoptera, Nepticulidae) with description of new species from Ecuador, Peru and Argentina. *Zootaxa*, 4200 (4), 561–579. <http://doi.org/10.11646/zootaxa.4200.4.7>
- Stonis, J.R., Remeikis, A., Diškus, A. & Megoran, N. (2017b) New species of leaf-mining Nepticulidae (Lepidoptera) from the Neotropical and Ando-Patagonian regions, with new data on host plants. *Zootaxa*, 4272 (1), 1–39. <https://doi.org/10.11646/zootaxa.4272.1.1>
- Stonis, J.R., Remeikis, A., Diškus, A. & Navickaitė, A. (2020b) Documenting new and little known leaf-mining Nepticulidae from middle and southwestern areas of the Asian continent. *Zootaxa*, 4881 (3), 401–452. <https://doi.org/10.11646/zootaxa.4881.3.1>
- Wilkinson, C. & Scoble, M.J. (1979) The Nepticulidae (Lepidoptera) of Canada. *Memoirs of the Entomological Society of Canada*, 111, 1–129, pls 10. <https://doi.org/10.4039/entm111107fv>

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MATERIAL AND METHODS

Material and Specimen Depositories

The publication deals with all currently known 228 species of Nepticulidae from the Neotropics (i.e., the Neotropical and Ando-Patagonian regions) and adjacent areas. The vast majority of the species were discovered, dissected, studied, described, and previously published by the authors of the current pictorial monograph (including J. R. Stonis, formerly R. Puplesis). Illustrations of a few Neotropical and some from the adjacent USA were partially re-produced, some with various modifications, from the publications by Davis (1978), Wilkinson & Scoble (1979), Wilkinson & Newton (1981), and van Nieukerken *et al.* (2016).

Abbreviations:

BRG* – Biosystematic Research Group, currently based at the State Research Institute Nature Research Centre, Vilnius, Lithuania;

LEU – Lithuanian University of Educational Sciences, Vilnius, Lithuania (formerly abbreviated as VPU) (now closed down, with scientific collections transferred to ZMUC or temporarily in the possession of the BRG* and NRC);

NHMUK (formerly BMNH) – The Natural History Museum, London, United Kingdom;

NNM (formerly RMNH) – National Natuurhistorisch Museum, Naturalis, Leiden, Netherlands;

NMNH – National Museum of Natural History, formerly the U.S. National Museum of Natural History, Washington D.C. (USNM);

MfN – Museum für Naturkunde, Berlin, formerly known as the Museum der Naturkunde für Humboldt Universität zu Berlin or Museum für Naturkunde – Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin (in the past, variously abbreviated as LIEB, MFNB, MHB, MHUB, MNB, MNHU, MNHUB, NHMU, NKMB, ZMB, ZMHB, ZMHU, ZMHUB, ZMNB), Germany;

MPUJ – Laboratorio de Entomología, UNESIS, Departamento de Biología, Pontificia Universidad Javeriana, Bogotá, Colombia; also known as MPUJ_ENT – Colección de Entomología, Museo Javeriano de Historia Natural, Pontificia Universidad Javeriana, Bogotá, Colombia;

NRC* – State Research Institute Nature Research Centre, Vilnius, Lithuania;

USNM – see NMNH;

ZIN – Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia;

ZMUC – Zoological Museum, Natural History Museum of Denmark, Copenhagen, Denmark.

* Because of the current situation, all published or unpublished materials collected by the BRG and earlier declared as belonging to ZIN have not been transferred to ZIN but are temporarily in the possession of the BRG and NRC and are awaiting further re-deposition. The fact of such a re-deposition (time and names of institutions of permanent placement, e.g., MfN) will be separately announced in other publication(s) by members of the BRG (e.g., Stonis *et al.*, Remeikis *et al.*, Diškus *et al.*).

References

- Davis, D.R. (1978) New leaf-mining moths of the family Nepticulidae from Florida. *The Florida Entomologist*, 61 (4), 209–224. <https://doi.org/10.2307/3494210>
- Nieukerken, E.J. van, Doorenweerd, C., Nishida, K. & Snyers, C. (2016) New taxa, including three new genera show uniqueness of Neotropical Nepticulidae (Lepidoptera). *ZooKeys*, 628, 1–63. <https://doi.org/10.3897/zookeys.628.9805>
- Wilkinson, C. & Newton, P.J. (1981) The micro-lepidopteran genus *Ectoedemia* Busck (Nepticulidae) in North America. *Tijdschrift voor Entomologie*, 124 (2), 27–92. <http://biostor.org/reference/49899>
- Wilkinson, C. & Scoble, M.J. (1979) The Nepticulidae (Lepidoptera) of Canada. *Memoirs of the Entomological Society of Canada*, 111, 1–129, pls. 10. <https://doi.org/10.4039/entm111107fv>

Collecting of Nepticulidae Adults

(by J. R. Stonis, A. Remeikis)

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According to our fieldwork experience, the vast majority of pygmy moths are successfully attracted to light (Figs 102–113). However, these tiny lepidopterans are very sensitive to strong wind, presence of extraneous light sources or moonlight, and generally to low temperatures. Therefore, light traps may be ineffective for collecting if weather or other conditions are unfavorable. The collecting methods were briefly outlined in Puplesis (1994), Puplesis & Robinson (2000), Puplesis & Diškus (2003), and Diškus & Stonis (2012), Stonis *et al.* (2019, 2020a, 2020b). During our studies, we were attracting moths by light from a Philip bulb ML 220–230 V, 160 W, suspended in front of a white screen and powered from electricity mains (Figs 103–105); in countries with 110 V electricity power, a voltage transformer was necessary. Additionally, when electricity mains were unavailable, we used an old-fashioned fluorescent lanterns (Figs 109, 111) powered by D batteries of a dry cell, widely known as flashlight batteries. Despite the fact that light from the lanterns were not strong, these lanterns were useful and attracted some valuable material. In contrast to these old-fashioned fluorescent lamps, any modern LED-technology lamp failed to attract Nepticulidae. The currently advertised LepiLED lamp (Fig. 112) is lightweight, small, operated with a voltage 5–13 V DC from powerbank batteries and purposely designed for the sampling of nocturnal insects (Brehm, 2017). However, our attempts to collect Nepticulidae with LepiLED were not successful.

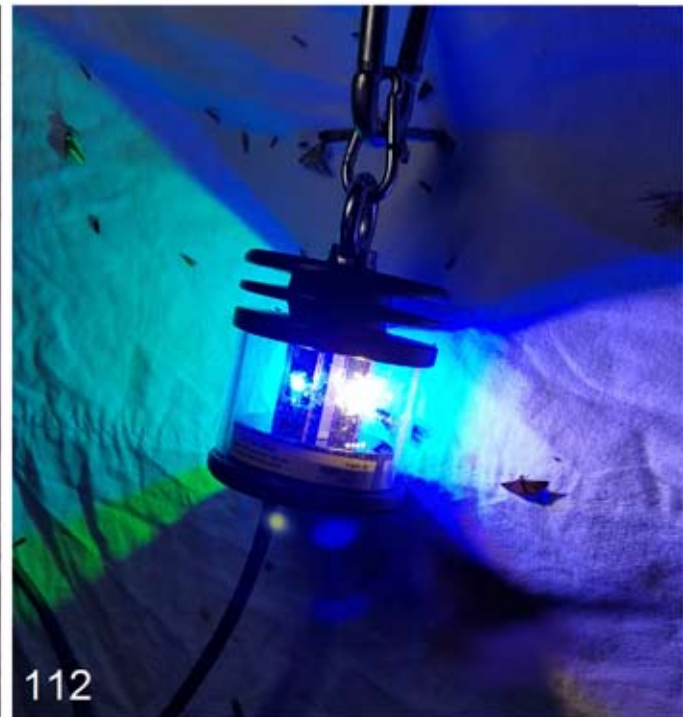
In high mountainous areas, light traps were not found useful because of frequent dense fog (or showers) and low temperatures at dusk. In these cases, following O. Karsholt (ZMUC), moths were collected by an insect net by sweeping the vegetation (both at ground level and somewhat higher at branches of various bushes when insects flew freely, especially in the morning sunshine (Stonis *et al.*, 2016). Sweeping the vegetation with an insect net can only be used when the vegetation is dry as specimens easily become damaged when the net is wet (Stonis *et al.*, 2016).

Very few specimens in Andean areas of South America were caught with a Malaise trap, but they appeared to be in bad condition, with scales partially rubbed. The collected specimens were usually set immediately after collection session (Stonis *et al.*, 2019) or left in a refrigerator till morning.

As regards the Nepticulidae adult pinning and setting techniques, they differ only slightly from the “traditional” techniques used in other taxonomic groups of the so-called Microlepidoptera, but the pinning appears to be impossible without the finest minute-pins and a stereoscopic microscope. These techniques have been briefly discussed by Puplesis (1994) and Puplesis & Diškus (2003).



Figures 102–108. Moth collecting: 102, 104 – the field assistant Franklin Jesus Galindo Meza (Cali) and Sergio A. Vargas (Jardín Botánico de Bogotá) at our fieldwork in Valle del Cauca, Colombia; 103, 105 – Philip bulb ML 220–230 V, 160 W; 106, 107 – habitats in Valle del Cauca; 108 – J. R. Stonis.



Figures 109–113. Moth collecting: 109 – collecting with a fluorescent lantern in the Ecological Park Fundo San José, La Merced, Peru; 110 – the Peruvian Selva Alta; 111 – despite the light from such old-fashioned fluorescent lanterns is not strong, these lanterns attract some moths; 112 – in contrast to the lantern in Fig. 111, the LepiLED, when used simultaneously and the same site, attracted significantly fewer moths and neither of them were nepticulids; 113 – the collecting in the Neotropics can be both exiting and disappointing, but never easy.

References

- Brehm, G. (2017) A new LED lamp for the collection of nocturnal Lepidoptera and a spectral comparison of light-trapping lamps. *Nota Lepidopterologica*, 40 (1), 87–108. <https://doi.org/10.3897/nl.40.11887>
- Diškus, A. & Stonis, J.R. (2012) *Leaf-mining insects of Lithuania. The Nepticulidae (Lepidoptera): taxonomy, chorological composition and trophic relationships. Monograph*. Lututė Publishers, Kaunas, 220 pp. [in Lithuanian]
- Puplesis, R. (1994) *The Nepticulidae of Eastern Europe and Asia: western, central and eastern parts*. Backhuys Publishers, Leiden, 291 pp., 840 figs.
- Puplesis, R. & Diškus, A. (2003) *The Nepticuloidea & Tischerioidea (Lepidoptera) — a global review, with strategic regional revisions*. Lututė Publishers, Kaunas, 512 pp.
- Puplesis, R. & Robinson, G.S. (2000) A review of the Central and South American Nepticulidae (Lepidoptera) with special reference to Belize. *Bulletin of the Natural History Museum, London, Entomology*, 69 (1), 3–114.
- Stonis, J.R., Diškus, A., Remeikis, A., Gerulaitis, V. & Karsholt, O. (2016) Leaf-mining Nepticulidae (Lepidoptera) from record high altitudes: documenting an entire new fauna in the Andean páramo and puna. *Monograph. Zootaxa*, 4181 (1), 1–94. <https://doi.org/10.11646/zootaxa.4181.1.1>
- Stonis, J.R., Diškus, A., Remeikis, A. & Lewis, O.T. (2020a) Exceptional diversity of Tischeriidae (Lepidoptera) from a single tropical forest site in Belize, Central America. *European Journal of Taxonomy*, 723, 33–76. <https://doi.org/10.5852/ejt.2020.723.1143>
- Stonis, J.R., Remeikis, A., Diškus, A., Vargas, S.A. & Solis, M.A. (2020b) Opostegidae (Lepidoptera) of the Americas: updated catalog, diagnostics, and new species descriptions. *Proceedings of the Entomological Society of Washington*, 122 (4), 929–972. <https://doi.org/10.4289/0013-8797.122.4.929>
- Stonis, J.R., Remeikis, A. & Vargas, S. (2019) Colombian Nepticuloidea and Tischerioidea: a small step out of obscurity? *Biologija*, 65 (2), 48–55. <https://doi.org/10.6001/biologija.v65i2.4023>

Rearing of Nepticulidae Adults from Mining Larvae

(by A. Diškus, J. R. Stonis)

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Rearing of adults from mining larvae is time and labour consuming (Figs 114–135), but a very significant method for collecting Nepticulidae material. It enables us not only getting premium quality collection material (samples of high morphological quality) but also define ecological and biological characteristics of Nepticulidae: data on the host plant, type of the damage (mine), the life cycle, as well as colour and shape of the cocoon, etc. (Puplesis & Diškus, 2003; Stonis *et al.*, 2016b; Stonis *et al.*, 2019). Rearing of adults from mining larvae could be done both in the natural conditions (environment) and indoors. The description of this method can be found in the publications by Diškus & Stonis (2012) and Stonis *et al.* (2018). Recently, it was also described in great detail (in Lithuanian) by Stonis *et al.* (2022), where the European temperate fauna of Nepticulidae was reviewed.

In our study (Stonis *et al.*, 2016b), registration of traces of larval activity (the mines or leaf miners) was done by thorough inspection of damaged parts of host plants or potential host plants (Fig. 114). In general, Nepticulidae mines are most frequently found in leaves, and only occasionally in green stems, young bark, buds of apple and maple trees or maple fruits (samaras) (Johansson *et al.*, 1990; Stonis *et al.*, 2022).

One mine contains only a single larva. Even with the naked eye it was easy to determine, when holding a damaged leaf against the light, whether the mine was empty or contained a feeding or dead larva (Fig. 115). Feeding larvae were transparent and usually of pale green to bright green or pale yellow to bright yellow in colour. Dead larvae were motionless (when examining the leaf mine with a magnifying glass), dark throughout or in parts (spotty) and of reddish brown or yellowish brown colour, sometimes black.

The most suitable larvae for rearing of adults were those of the last instars and there was less danger that the leaf (or another part) requiring lengthy preservation as substrate for the larva would dry out or get mouldy before pupation.

The discovered mines were documented by photographing and/or taking the most evident samples of empty mines for identifying the plant species. During the study, almost every sample of the species was raised separately (Stonis *et al.*, 2016b). Leaf mines should be collected very carefully: samples might easily be mixed up if two different species mine on the same host plant at the same time and produce closely similar (or variable) leaf mines. Nevertheless, during our investigation, especially in the early stage of the project, there were instances of rearing adults of two different species from the same sample (Stonis *et al.*, 2016b).

During our fieldwork, every sample had a record sheet or fieldwork card for registering data.

For rearing mining larvae, only chemically clean Petri dishes or larger plastic rearing containers were used. In order to prevent the formation of cocoons on the walls of Petri dishes, a large piece of absorptive paper or non-perfumed napkin was applied. To imitate the forest floor, the bottom of the container was wadded with scraps of non-perfumed absorptive paper, leaves of a host plant or, occasionally, pieces of peat moss (Puplesis, 1994). The leaves were placed in gently compressed layers (Stonis *et al.* (2016b). Larvae usually spin cocoons in between close layers of leaves of the plant or pieces of the absorptive paper; otherwise, within a coarse or spongy mass, they have difficulties

in spinning cocoons and usually perish (Diškus & Stonis, 2012). If only a single damaged leaf was found, clean and smooth leaves of the host plant (or other chemically “neutral” plant) were put in layers in the Petri dish or plastic container. In such a way, more moisture was preserved, and the host plant was prevented from desiccating. If there was excess moisture or condensation on the lid of the Petri dish or plastic container, it was ventilated. And, conversely, if the leaves started to dry out, a moistened cotton or absorptive paper wad was added into the dish or container. The Petri dish or container with the alive material was kept in the shade or in a dark place. After 5–6 days, the containers were checked for cocoons (Figs 123, 124). If checked earlier, some still spinning larvae can be disturbed and consequentially lost; if checked later, some mould may develop.

The compressed leaves were carefully taken out with tweezers, and both sides were carefully examined. Every found cocoon was cut out together with a small (about 1 cm) piece of the leaf or absorptive paper and placed into a small glass test tube (Fig. 124) or clean Petri dish, where they were kept in the room temperature until adults emerged (Fig. 126). The expected time for adults to emerge from cocoons was 8–15 days (indoors) for summer generations; cocoons of the species which hibernated and were to emerge only next year, were kept in a refrigerator at about +6–10°C (Puplesis & Diškus, 2003).

To prevent cocoons from desiccating, a moistened wad of absorptive paper was added (Fig. 127), and, if in a Petri dish, the cut parts of leaves were laid at a distance from each other to prevent the formation and spread of mould.

Usually, there is no difficulty with rearing adult Nepticulidae from mining larvae using the described method. However, there were reports that, in case of the South American *Polylepis*-feeding species occurring in the Andean páramo or puna (Stonis *et al.*, 2016b) and *Baccharis*-feeding species from páramo (Stonis *et al.*, 2016a), the rearing of adults from larvae can be a great challenge. During our previous fieldwork, even in the case of exceptionally large collected samples, up to a few hundreds of mining larvae, only a few or no adults were obtained: either larvae died or pupae ceased developing (Stonis *et al.*, 2016a, 2016b).

References

- Diškus, A. & Stonis, J.R. (2012) *Leaf-mining insects of Lithuania. The Nepticulidae (Lepidoptera): taxonomy, chorological composition and trophic relationships*. Monograph. Lututė Publishers, Kaunas, 220 pp. [in Lithuanian]
- Johansson, R., Nielsen, E.S., Nieuken, E.J. van & Gustafsson, B. (1990) The Nepticulidae and Opostegidae (Lepidoptera) of north west Europe. *Fauna Entomologica Scandinavica*, 23 (1/2), 1–739.
- Puplesis, R. & Diškus, A. (2003) *The Nepticuloidea & Tischerioidea (Lepidoptera) — a global review, with strategic regional revisions*. Lututė Publishers, Kaunas, 512 pp.
- Stonis, J.R., Diškus, A., Carvalho Filho, F. & Lewis, O.T. (2018) American Asteraceae-feeding *Astrotischeria* species with a highly modified, three-lobed valva in the male genitalia (Lepidoptera, Tischeriidae). *Zootaxa*, 4469 (1), 1–69. <https://doi.org/10.11646/zootaxa.4469.1.1>
- Stonis, J.R., Diškus, A., Dobrynina, V., Remeikis, A. & Buchner, P. (2022) *A guide to leaf mines of the Lithuanian Nepticulidae* (Introducing an electronic identification tool). Nature Research Centre, Vilnius, 122 pp. <https://doi.org/10.35513/2022.Nepticulidae>
- Stonis, J.R., Diškus, A., Remeikis, A., Davis, D.R., Solis, M.A. & Cumbicus Torres, N. (2016a) The first record of *Baccharis* L. (Asteraceae) as a host-plant genus for Nepticulidae (Lepidoptera), with description of new *Stigmella* species from South America. *Zootaxa*, 4136 (1), 101–128. <http://doi.org/10.11646/zootaxa.4136.1.4>
- Stonis, J.R., Diškus, A., Remeikis, A., Gerulaitis, V. & Karsholt, O. (2016b) Leaf-mining Nepticulidae (Lepidoptera) from record high altitudes: documenting an entire new fauna in the Andean páramo and puna. Monograph. *Zootaxa*, 4181 (1), 1–94. <http://doi.org/10.11646/zootaxa.4181.1.1>
- Stonis, J.R., Remeikis, A. & Vargas, S. (2019) Colombian Nepticuloidea and Tischerioidea: a small step out of obscurity? *Biologija*, 65 (2), 48–55. <https://doi.org/10.6001/biologija.v65i2.4023>



Figures 114–121. Rearing of adults from larvae: 114 – inspection of potential host plants; 115 – it is easy to determine the state of a larva when holding a damaged leaf against the light; 116 – only chemically clean Petri dishes or plastic containers with a flat bottom should be used; 117, 118 – in order to prevent the formation of cocoons on the walls, a non-perfumed absorptive paper can be used; 119 – the bottom of the container should be wadded with scraps of non-perfumed absorptive paper and leaves (120) of the host plant; 121 – the leaves with mining larvae should be placed in layers.



Figures 122–128. Rearing of adults from larvae: 122 – leaves should be placed in gently compressed layers because the larvae usually spin cocoons between layers of leaves of plants or pieces of absorptive paper; 123 – after 5–6 days, the rearing container should be checked for cocoons; 124, 125 – every cocoon should be cut out together with a small piece of the leaf or absorptive paper and placed into a small glass test tube or a clean Petri dish; 126 – the expected time for adults to emerge from cocoons usually is 8–15 days (indoors) for summer generations; however, cocoons of the species which hibernate and are to emerge only in the subsequent year, should be kept in a refrigerator at about $+6-10^{\circ}\text{C}$; 127 – to prevent cocoons from desiccating, a moistened wad of absorptive paper or cotton should be added; 128 – an emerged adult.



Figures 129–135. Rearing adults from mining larvae in the Neotropics: 129, 133 – Arūnas Diškus, Ecuador in 2005; 130 – leaf mines with larvae of *Stigmella paramica* Diškus & Stonis; 131, 132 – Bolivia, Yungas Province; 134 – Andrius Remeikis collecting *S. lamiacifoliae* in Colombia in 2013; 135 – a fragment of a leaf mine of *Stigmella* sp.

Specimen Documentation and Micro-Mounts of Genitalia Structures Adopted for the Minute Lepidoptera

(by J. R. Stonis, A. Diškus, A. Remeikis)

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The procedure of preparing a micro-mount of genitalia structures of the so called Microlepidoptera was described by Robinson (1976), adopted for Nepticuloidea by Johansson *et al.* (1990), and afterwards published by Stonis *et al.* (2014) with special reference to the techniques accepted in our research projects.

In the studies of the smaller Lepidoptera, in particular Nepticulidae, describing external characters is insufficient, and mounts of genitalia have to be prepared (Stonis *et al.*, 2014). The diagnostics of the Nepticulidae species most often relies on the characters of male (sometimes female) genitalia, which, compared with other morphological structures, are distinguished by high species specificity (Puplesis & Robinson, 2000; Puplesis & Diškus, 2003). A reliable species identification and description of the Neotropical Nepticulidae is usually impossible without the examining of genitalia structures (Diškus & Stonis, 2012). It has been noticed that characters of the male genitalia of Nepticulidae are less variable and diagnostic at the level of species or higher taxonomic rank (Puplesis & Diškus, 2003; Navickaitė, 2014). The shape of the valva, transtilla, vinculum, uncus, gnathos, and phallus (especially cornuti on vesica) are the most important diagnostic characters of Nepticulidae species.

The stages of preparing a temporary micro-mount of genitalia structures used in our research projects were the following Stonis *et al.* (2014):

Step 1: Under a stereoscopic microscope, by using a handled minutien pin, the abdomen of the moth was snapped off by gentle movements up and down; a sticky white plastic was placed under the microscope to prevent accidental loss of the abdomen.

Step 2: The snapped abdomen was put into a test tube by using a handled minutien pin slightly moistened with glycerol or water; about 1 ml of potassium hydroxide (10 % KOH) was dripped into the test tube over the abdomen with a pipette.

Step 3: The test tube was heated on an open flame or in boiling water; the abdomen was boiled for a few minutes in the test tube until it became transparent; during the boiling, the test tube was shaken to prevent squirting out of air bubbles together with the valuable abdomen.

Step 4: The content of the test tube was poured out into a clean small Petri dish and after that, by using a preparation needle, transferred to another dish with distilled or boiled water.

Step 5: By gently moving the handled minutien pin, the abdomen was rinsed.

Step 6: A drop of glycerol was dripped on a clean cavity-slide (i.e., on a microscope slide with a shallow depression), which was covered with a cover slip in such a way as to leave part of the glycerol drop uncovered.

Step 7: The rinsed mount was transferred into the glycerol drop and cautiously pushed under the cover slip with a handled minutien pin; the mount was pushed between the slide and cover slip ventral part upside; for this purpose, a stereoscopic binocular microscope with the magnification of 28–56 times was used, while the temporary micro-mount was examined by using a study microscope with higher magnification. In our studies, temporary slides were examined in detail using a Leica

DM2500 microscope or, occasionally, Lomo MBI-10 microscope with a high magnification (Stonis *et al.*, 2014).

Step 8: The temporary micro-mounts were stored in supersaturated sugar solution (i.e., in sugar crystal) or, most often, in a glycerol drop: in a minute test tube or, most usually, in a pit of cut plastic strip covered with another strip of the same kind (as described in Puplensis, 1994).

Temporary slides in glycerol were very useful for examining of genitalia from different angles, including a lateral view of a genital capsule; however, unlike with permanent slides in Euparal, they were less suitable for detailed documentation or photography of overlapping sclerites and for comparison of morphological structures among different slides. The storage of temporary slides in glycerol is not entirely safe, and storage in sugar crystal is not convenient for further re-examination of the mount. Therefore, all our genital mounts were transferred into permanent mounts (slides).

The stages of preparing permanent micro-mounts of genitalia structures in the current project were the following Stonis *et al.* (2014):

Step 1: The genital armature stored in glycerol was rinsed with distilled or boiled water in a small Petri dish and put with a handled minutien pin into a pit (depression) of a clean cavity-slide. The depression half filled with 30 % ethanol (ethyl alcohol) solution; after that, genitalia were separated from an abdomen pelt under a stereoscopic microscope.

Step 2: After the dissection, the genitalia and the abdomen or pelt were put into a depression of a clean cavity-slide with 70 % ethanol and the mount was cautiously rinsed; the scales adhering to the pelt were cleaned by using a very small and very fine paintbrush and / or a very thin and sharp-handled minutien pin.

Step 3: After partial dehydration, the pelt and female genitalia (in rare cases, also male genitalia) were stained by adding a drop of alcohol solution of *Chlorazol Black* (Direct Black 38/Azo Black) (Stonis *et al.*, 2014).

Step 4: The final dehydration of the genitalia and abdomen pelt was done by dripping pure (99 %) ethanol over the mount; the mount was cautiously rinsed using a handled minutien pin.

Step 5: A small drop of Euparal (if thicker than fresh honey, it was diluted with Euparal Essence) was dripped on the clean slide.

Step 6: By using a stereoscopic microscope, the genitalia and pelt were put into a Euparal drop and covered with a very small cover slip. The genitalia were fixed ventral part upside; occasionally, some sclerites were disassembled (dissected) from the capsule; phallus was usually removed from the capsule; the pelt or loose sclerites of the genitalia armature (e.g., removed phallus) were fixed under a separate cover slip, always on the same slide.

Step 7: The mount was labelled (a paper label was glued on the slide); each prepared permanent micro-mount was numbered, and the numbers were recorded in a slide data base (Stonis *et al.*, 2014).

Step 8: It was noticed (Stonis *et al.*, 2014) that it is more correct to photograph permanent genital mounts immediately after the preparation. In our study, the genital micro-mounts were examined using a Leica DM2500 microscope and a Leica DFC420 digital camera connected to a microscope and computer; each photograph of the genitalia slide was supplied with the slide number and species name (or any other precise identification data if species name was not yet available).

Step 9: Mounts (slides) were placed onto a special card or plastic slide tray and dried for 2–3 months at room temperature or for a minimum of 20 days in a heating oven (at +50–60° C) (Stonis *et al.*, 2014).

Only temporary mounts in glycerol (or in a drop of Euparal uncovered with a cover slip) provide an opportunity to examine and photograph the morphological structures laterally or to image morphologically interesting or diagnostically important sclerites from all sides, whereas it is impossible to roll and observe or photograph laterally the structures in a permanent mount (Stonis *et al.*, 2014). The published examples of such rolled and photographed genitalia in temporary mounts in Euparal can be found in Stonis *et al.* (2019) or, in case of Tischeriidae, in Stonis *et al.* (2018).

However, fine structures of temporary mounts which, when stored in glycerol, are not so clearly visible as those in a permanent, a highly transparent Euparal mount. On the other hand, temporary mounts preserve the natural structure of highly spatial genitalia of Nepticulidae, i. e., they do not get distorted. Moreover, temporary mounts allow re-examining and documenting the spatial characters. For this reason, it has been recommended (Stonis *et al.*, 2014) that the initial observation and photographic documentation should be started in temporary mounts (in glycerol or, even better, in a drop of Euparal uncovered with a cover slip).

In our research projects, permanent slides were photographed and studied using a Leica DM2500 microscope and a Leica DFC420 digital camera.

Protocols for documentation. The forewing length was expressed as a range, where the availability of material made it possible, and measured along the costa from the very wing base to the apex of the fringe. It was noticed that the wingspan should not be measured from the tip of the left wing to the tip of the right wing since tiny specimens of pygmy moths are rarely spread neatly enough to get precise measurements in this way. Instead, to get the wingspan length, we simply doubled a precisely measured forewing length and added the thorax width (Stonis *et al.*, 2021). In our projects, adults of pygmy moths were usually measured using a Lomo MBS-10 stereomicroscope, but sometimes it was repeated for confirmation of the measurements by a Leica S6D stereoscopic microscope with an attached Leica DFC290 digital camera.

Adults were photographed using a Leica S6D stereoscopic microscope with the attached Leica DFC290 digital camera. Occasionally, a Russian Lomo MBS10 stereoscopic microscope with a temporarily attached cellular telephone, Samsung Galaxy S7 with a camera were used to get photographs of adult moths or cocoons.

The descriptive terminology of morphological structures follows Johansson *et al.* (1990), Puplesis & Robinson (2000), and Puplesis & Diškus (2003), except for the term “aedeagus”, which is called here, as well as in our recent publications, “phallus” and the term “cilia”, which is called here, as well as in our recent publications, “fringe”.

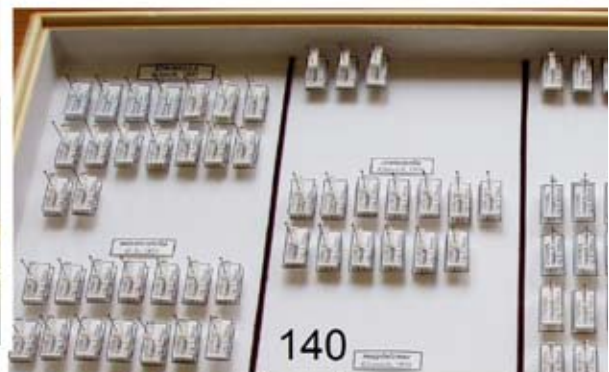
Size categories for small moths. To clarify our terminology regarding the term “smallest Lepidoptera”, we introduced the following key to indicate different size categories of small moths (Stonis *et al.*, 2021):

medium small (wingspan > 6.0 mm);

small (wingspan = 5.0–6.0 mm);

very small (wingspan = 4.0–4.9 mm);

extremely small (wingspan < 4.0 mm) (it also includes small-size record holders).



Figures 136–140. Preparation of permanent genitalia micro-mounts: Andrius Remeikis (136) and Arūnas Diškus (138), authors of the current publication.

References

- Diškus, A. & Stonis, J.R. (2012) *Leaf-mining insects of Lithuania. The Nepticulidae (Lepidoptera): taxonomy, chorological composition and trophic relationships*. Monograph. Lututė Publishers, Kaunas, 220 pp. [in Lithuanian]
- Johansson, R., Nielsen, E.S., Nieuwerkerken, E.J. van & Gustafsson, B. (1990) The Nepticulidae and Opostegidae (Lepidoptera) of north west Europe. *Fauna Entomologica Scandinavica*, 23 (1/2), 1–739.
- Navickaitė, A. (2014) Euronemoralinės faunos mažųjų gaubtagalvių (Insecta, Lepidoptera, Nepticulidae) taksonominė ir chorologinė analizė bei trofiniai ryšiai: Daktaro disertacija. Lietuvos edukologijos universiteto leidykla, Vilnius, 326 pp. [in Lithuanian]
- Puplėsis, R. & Diškus, A. (2003) *The Nepticuloidea & Tischerioidea (Lepidoptera) — a global review, with strategic regional revisions*. Lututė Publishers, Kaunas, 512 pp.
- Puplėsis, R. & Robinson, G.S. (2000) A review of the Central and South American Nepticulidae (Lepidoptera) with special reference to Belize. *Bulletin of the Natural History Museum, London, Entomology*, 69 (1), 3–114.
- Puplėsis, R. (1994) *The Nepticulidae of Eastern Europe and Asia: western, central and eastern parts*. Backhuys Publishers, Leiden, 291 pp., 840 figs.
- Robinson, G.S. (1976) The preparation of slides of Lepidoptera genitalia with special reference to the Microlepidoptera. *Entomological Gazette*, 27, 127–32. http://idtools.org/id/leps/tortai/Robinson_1976.pdf
- Stonis, J.R., Diškus, A., Carvalho Filho, F. & Lewis, O.T. (2018) American Asteraceae-feeding *Astrotischeria* species with a highly modified, three-lobed valva in the male genitalia (Lepidoptera, Tischeriidae). *Zootaxa*, 4469 (1), 1–69. <https://doi.org/10.11646/zootaxa.4469.1.1>
- Stonis, J.R., Diškus, A., Remeikis, A. & Navickaitė, A. (2014) Study methods of Nepticulidae: micro-mounts of genitalia structures. In: Stonis, J.R., Hill, S.R., Diškus, A. & Auškalnis, T. (Eds.), *Selected abstracts and papers of the First Baltic International Conference on Field Entomology and Faunistics*. Edukologija Publishers, Vilnius, pp. 32–35.
- Stonis, J.R., Remeikis, A., Diškus, A., Baryshnikova, S. & Solis, M.A. (2021) What are the smallest moths (Lepidoptera) in the world? *Zootaxa*, 4942 (2), 269–289. <https://doi.org/10.11646/zootaxa.4942.2.8>
- Stonis, J.R., Remeikis, A., Diškus, A., Orlovskytė, S., Vargas, S.A. & Solis M.A. (2019) A new leafmining pest of guava: *Hesperolyra guajavifoliae* sp. nov., with comments on the diagnostics of the endemic Neotropical genus *Hesperolyra* van Nieuwerkerken (Lepidoptera, Nepticulidae). *ZooKeys*, 900, 87–110. <https://doi.org/10.3897/zookeys.900.46332>

SPECIES IDENTIFICATION TOOL ACCESSIBLE WITH SMART ELECTRONIC DEVICES

(by A. Remeikis, J. R. Stonis)

Cite as: Remeikis, A. & Stonis, J.R. (2022) Species identification tool accessible with smart electronic devices. *In:* Stonis, J.R., Remeikis, A. & Diškus, A. *Neotropical Nepticulidae: a pictorial monograph introducing an electronic identification tool*. Vilnius, Nature Research Centre, 76–80 pp.

To help researchers identify the Nepticulidae species by providing easier generic or species diagnostics and to encourage Nepticulidae research worldwide (not only in the Neotropics), we have published some papers containing pictorial tools for species or diagnostics. An example of such a pictorial diagnostic key is the recently published identification scheme for the species of *Ozadelpha*, a small endemic Neotropical genus (Fig. 141) (Remeikis & Dobrynina, 2022).

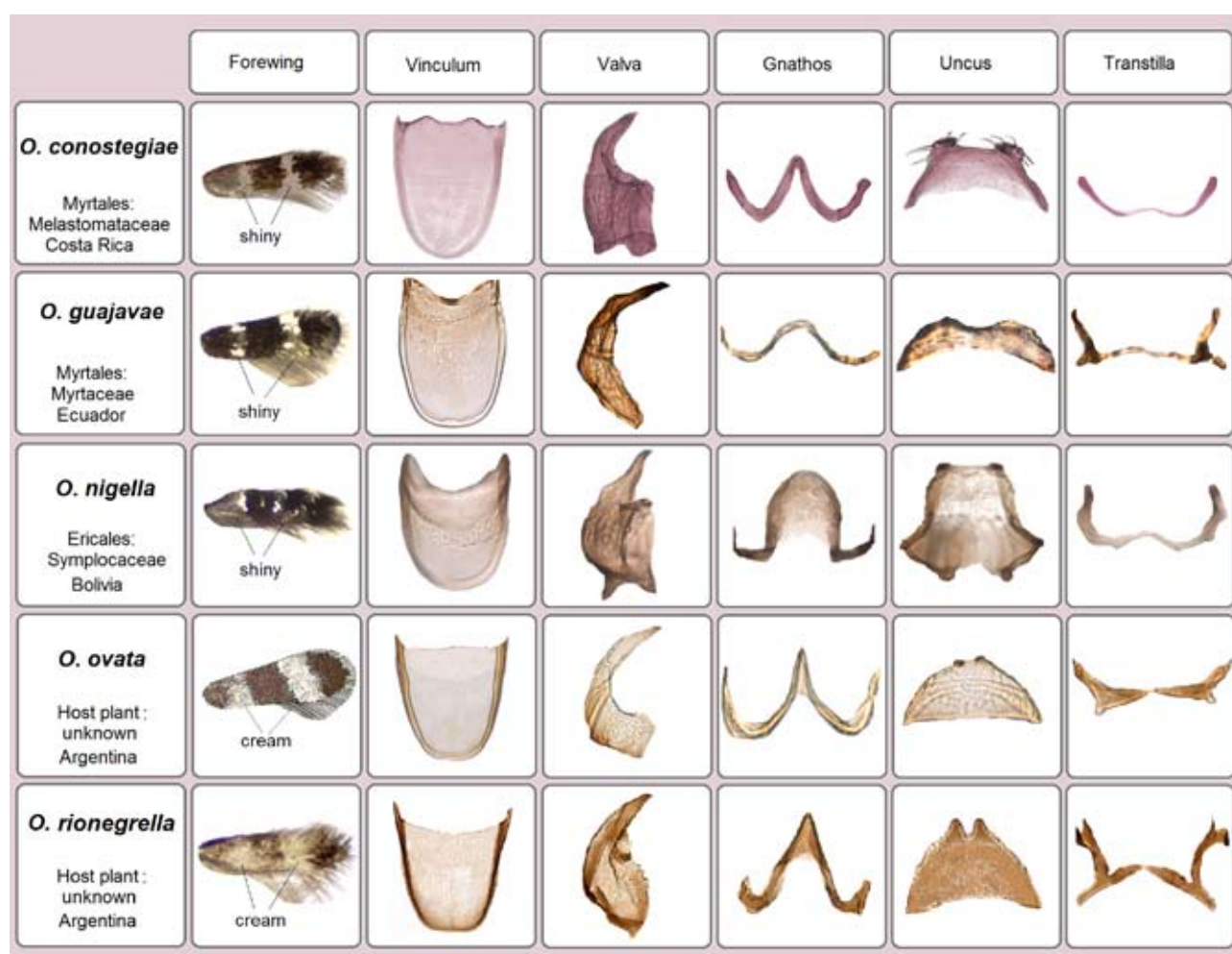


Figure 141. A recently published pictorial diagnostic key to the species of the Neotropical genus *Ozadelpha* (from Remeikis & Dobrynina, 2022).

In the current publication, we announce about (and provide a link to) the first-ever identification system for Nepticulidae species, an electronic diagnostic tool based on the male genitalia and forewing pattern (Fig. 142). This diagnostic tool is available without registration and for free and can be used on a variety of smart electronic devices. Because of the customizable functional layout of “Responsive

Web Design”, this diagnostic system adapts itself to the screen size of each smart device such as a mobile phone. It can be openly accessed at: <https://www.nepticulidaespecies.info>



Figure 142. The home page of the electronic diagnostics tool “Leaf-mining Nepticulidae of the world: the updated generic composition and a tool for species diagnostics”.

This diagnostic tool is based on ten groups of characters or sections: “Host-plant family”, “Forewing”,

“Tegumen”, “Uncus”, “Gnathos”, “Valva”, “Juxta”, “Transtilla”, “Vinculum”, and “Phallus”.

All other diagnostic characters such like an adult’s head scaling, type and morphological particularities of leaf mines, and the female genitalia were ignored not because these features are either less important in the description or too complex for practical use but because the focus was on maximal simplicity of the diagnostic tool. Since references were provided for each Nepticulidae species, a potential user will find an additional information (including female descriptions or illustrations) in the recommended literature, e.g., original descriptions or exhaustive re-descriptions of the taxa.

When starting the identification, the user selects the region and opens ten sections of characters, in each of which a list of options is provided. In each section, only one option can be selected. If accidentally the user selects a second option within the same section, the first option by the user will be automatically eliminated.

If the user has doubts about the options in the section “Host-plant family”, it is recommended to select the neutral option “Not selected or unknown”. In the further search, it is better to omit unclear sections (or options in the sections) because the incorrect tags may eliminate the “right” (needed) species from the field of the search. It is not necessary to make a selection of options in each section of the characters. The choice of options should be made only in the sections that are completely clear to the user. The more sections are included, the more accurate result of the identification will be retrieved. Therefore, before using the electronic identification tool, it is recommended to study “Morphology Guide” available at the right corner of the top bar of the electronic system or provided in this current publication in the chapter below.

Nevertheless, an inaccurate result of the search, when the search yields several similar species, is also interesting and important. In this case, users, by drawing on the provided illustrations of similar species, can choose the most fitting species by themselves. Thus, the diagnostic tool is like a “biotaxonomy toy” and, therefore, is rather involving.

To identify the species of Nepticulidae, a user is to start with the selection of a host-plant family (if the host plant is known to them). The list of options of this section provides only some but most important plant families in the alphabetic order: Anacardiaceae, Asteraceae, Betulaceae, Ericaceae, Fabaceae, Fagaceae, Lamiaceae, Malvaceae, Myrtaceae, Rhamnaceae, Rosaceae, Salicaceae, Sapindaceae (=Aceraceae), Ulmaceae (=Cannabaceae), and Urticaceae. All other families, not included in this list, are “hidden” under the option “Another family, not included in this list”.

All further steps of the species identification with this diagnostic tool are presented following the “Morphology Guide” (attached to the system).

This Nepticulidae diagnostic tool may also work in another way. To find a certain known species, a user can use the search box at the bottom of the identification table (see Fig. 143). For example, if a user wants to find *Stigmella polylepiella* (like any other species from the provided “Checklist”), they enter “polylepiella” (or the first letters of the name), and the electronic system retrieves the appropriate species. However, when searching for a species, the genus name should be omitted.

Along with “Morphology Guide” and recommendations how to cite this tool (at the top bar), as well as “Methods and Techniques”, “Genera of the Global Nepticulidae”, “Taxonomic Checklists of the Species”, and “Recommended Literature” are provided at the bottom section of the tool (Fig. 144).

This diagnostic tool is designed for a wide range of potential users: not only experienced researchers working in the field of biodiversity but also anyone interested in wildlife.

This electronic identification tool, like the parallelly and simultaneously launched “Diagnostics of leaf mines of the Lithuanian Nepticulidae” (<https://leafmines.info>, see advertised in Stonis *et al.*,

LEAF-MINING NEPTICULIDAE OF THE WORLD

updated generic composition and a tool for species diagnostics

SELECT THE REGION

This Website provides authoritative information on the current taxonomy of Nepticulidae and aims to help identify the species mostly on the basis of male genitalia characters

One option can be selected in each section;
it is not necessary to make a selection
in each section of the characters.

SELECT THE CHARACTERS AND IDENTIFY	
HOST-PLANT FAMILY	select hostplant
FOREWING	select character(s)
TEGUMEN	select character(s)
UNCUS	select character(s)
GNATHOS	select character(s)
VALVA	select character(s)
JUXTA	select character(s)
TRANSTILLA	select character(s)
VINCULUM	select character(s)
PHALLUS	without distinctive carinae / s. c. with distinctive carinae / s. c.
OR FIND A KNOWN SPECIES	
SPECIES NAME	type a species name without genus
SEARCH	

type a species without the genus name

METHODS & TECHNIQUES

GENERA OF NEPTICULIDAE

BIODIVERSITY INVENTORY
&
CHECKLISTS OF THE SPECIES

RECOMMENDED LITERATURE

Figure 143. The diagnostic box (identification table) of the electronic diagnostics tool “Leaf-mining Nepticulidae of the world: the updated generic composition and a tool for species diagnostics”.

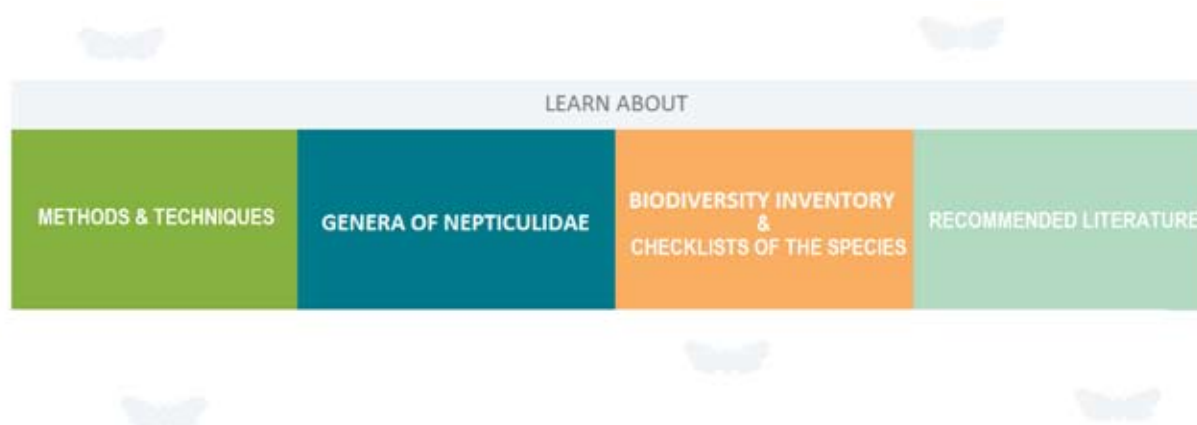


Figure 144. The supplements provided in the electronic diagnostics tool “Leaf-mining Nepticulidae of the world: the updated generic composition and a tool for species diagnostics”.

2022) was specifically designed to identify Nepticulidae; therefore, both these tools are unique not only by their scientific content but also by the governance of the content. Therefore, the intellectual property rights for the development of this electronic system as an IT product are: © Remeikis, A., Remeikienė A. (2022) *Leaf-mining Nepticulidae of the world: updated generic composition and a tool for species diagnostics*. Electronic Identification Tool. Available at <https://www.nepticulidaespecies.info>.

Meanwhile, the bibliography of the scientific content of this tool as a scientific publication is the following: Remeikis, A. & Stonis J. R. (2022) *Leaf-mining Nepticulidae of the world: updated generic composition and a tool for species diagnostics*. Available at <https://www.nepticulidaespecies.info>.

References

- Remeikis, A. & Dobrynina, V. (2022) Differentiation of the Andean *Ozadelpha ovata* and *O. rionegrella* sp. nov. (Lepidoptera, Nepticulidae) based on characters of the male genitalia. *Zootaxa*, 5016 (2), 283–288. <https://doi.org/10.11646/zootaxa.5016.2.8>
- Stonis, J.R., Diškus, A., Dobrynina, V., Remeikis, A. & Buchner, P. (2022) *A guide to leaf mines of the Lithuanian Nepticulidae* (Introducing an electronic identification tool). Nature Research Centre, Vilnius, 122 pp. <https://doi.org/10.35513/2022.Nepticulidae>

PICTORIAL MORPHOLOGY GUIDE OF NEPTICULIDAE BASED ON THE FOREWING PATTERN AND MALE GENITALIA

(by Jonas R. Stonis & Andrius Remeikis)

Cite as: Stonis, J.R. & Remeikis, A. (2022) Pictorial morphology guide of Nepticulidae based on the forewing pattern and male genitalia. In: Stonis, J.R., Remeikis, A. & Diškus, A. *Neotropical Nepticulidae: a pictorial monograph introducing an electronic identification tool*. Vilnius, Nature Research Centre, 81–96 pp.

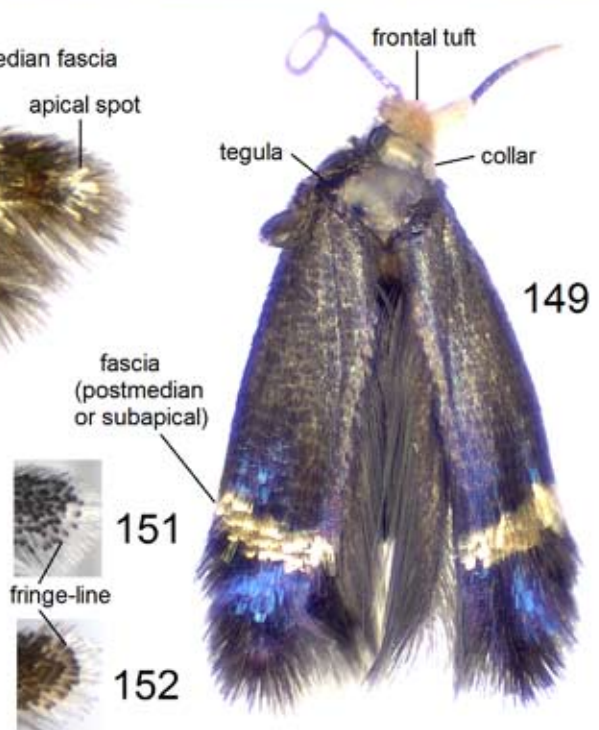
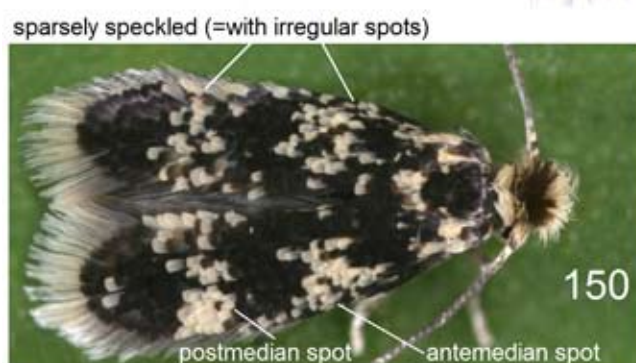
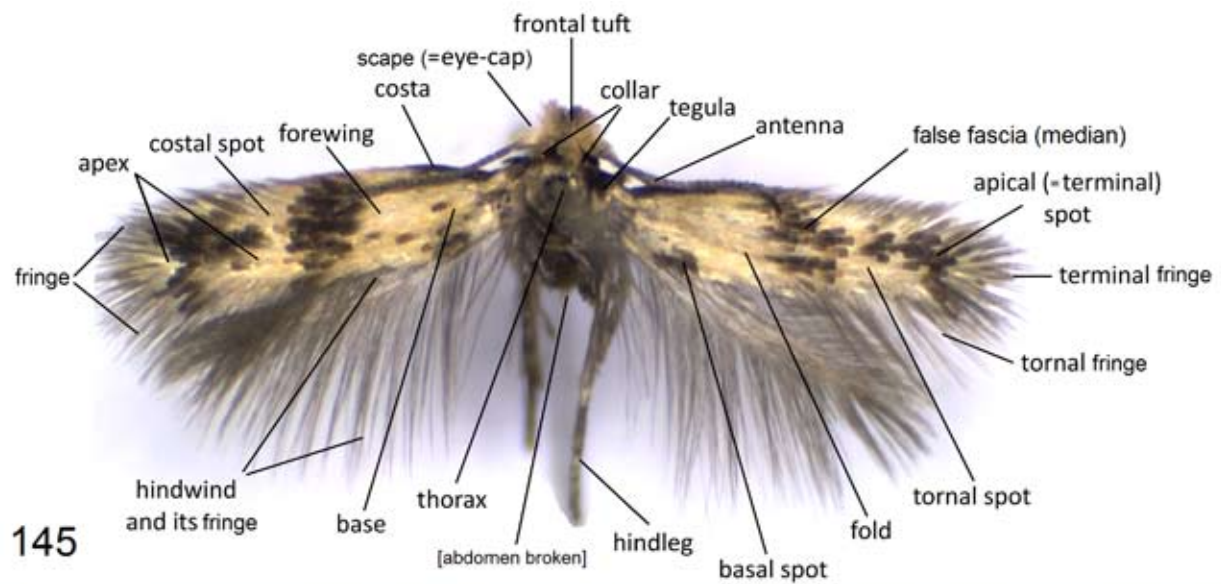
The morphology of the family Nepticulidae was more or less exhaustively characterised several times. For such detailed morphological (as well as biological) characterizations, we recommend monographic reviews by Scoble (1983), van Nieukerken (1986), Johansson *et al.* (1990), Puplesis (1994), Puplesis & Robinson (2000), and Puplesis & Diškus (2003). Some characterization of this morphologically peculiar lepidopteran family can be also found in some other reviews, notably by Wilkinson & Scoble (1979), Stonis *et al.* (2016, 2017), van Nieukerken *et al.* (2016), etc. Moreover, some new, interesting and important morphological data, especially as regards the Neotropical fauna, were revealed and published recently in various papers (see the chapter “Recommended Literature”).

We launched the first-ever electronic Nepticulidae species identification tool (<https://www.nepticulidaespecies.info>), and nine of ten sections of this tool are dedicated to morphology: one section is about adult forewing pattern and eight other about various structures of the male genitalia. Therefore, for better orientation and navigation, it is recommended to study the current pictorial morphology guide (Figs 145–186). This guide omits such characters like the adult’s head scaling, wing venation, morphology of the female genitalia, as well various other morphological characters, because they were purposely unincorporated into the launched identification tool (see the Chapter above).

References

- Johansson, R., Nielsen, E.S., Nieukerken, E.J. van & Gustafsson, B. (1990) The Nepticulidae and Opostegidae (Lepidoptera) of north west Europe. *Fauna Entomologica Scandinavica*, 23 (1/2), 1–739.
- Nieukerken, E.J. van (1986) Systematics and phylogeny of Holarctic genera of Nepticulidae (Lepidoptera, Heteroneura: Monotrysia). *Zoologische Verhandelingen*, 236 (1), 1–93.
- Nieukerken, E.J. van, Doorendeerd, C., Nishida, K. & Snyers, C. (2016) New taxa, including three new genera show uniqueness of Neotropical Nepticulidae (Lepidoptera). *ZooKeys*, 628, 1–63.
<https://doi.org/10.3897/zookeys.628.9805>
- Puplesis, R. (1994) *The Nepticulidae of Eastern Europe and Asia: western, central and eastern parts*. Backhuys Publishers, Leiden, 291 pp., 840 figs.
- Puplesis, R. & Diškus, A. (2003) *The Nepticuloidea & Tischerioidea (Lepidoptera) — a global review, with strategic regional revisions*. Lututė Publishers, Kaunas, 512 pp.
- Puplesis, R. & Robinson, G.S. (2000) A review of the Central and South American Nepticulidae (Lepidoptera) with special reference to Belize. *Bulletin of the Natural History Museum, London, Entomology*, 69 (1), 3–114.
- Scoble, M.J. (1983) A revised cladistic classification of the Nepticulidae (Lepidoptera) with descriptions of new taxa mainly from South Africa. *Transvaal Museum Monograph*, 2 (1), 1–105.
https://hdl.handle.net/10520/AJA090799001_84
- Stonis, J.R., Diškus, A., Dobrynina, V., Remeikis, A. & Buchner, P. (2022) *A guide to leaf mines of the Lithuanian Nepticulidae* (Introducing an electronic identification tool). Nature Research Centre, Vilnius, 122 pp.
<https://doi.org/10.35513/2022.Nepticulidae>
- Stonis, J.R., Diškus, A., Remeikis, A., Gerulaitis, V. & Karsholt, O. (2016) Leaf-mining Nepticulidae (Lepidoptera)

- from record high altitudes: documenting an entire new fauna in the Andean páramo and puna. Monograph. *Zootaxa*, 4181 (1), 1–94. <http://doi.org/10.11646/zootaxa.4181.1.1>
- Stonis, J.R., Diškus, A., Remeikis, A., Karsholt, O. & Cumbicus Torres, N. (2017) Illustrated review of the leaf-mining Nepticulidae (Lepidoptera) of the central Andes (Peru and Bolivia). *Zootaxa*, 4257 (1), 1–70. <https://doi.org/10.11646/zootaxa.4257.1.1>
- Stonis, J.R., Diškus, A., Remeikis, A. & Solis, M.A. (2018) A Gondwanan concept of *Simplimorpha* Scoble (*sensu lato*): a step toward clarity in the generic diagnostics of global Nepticulidae (Lepidoptera). *Zootaxa*, 4521 (2), 151–182. <https://doi.org/10.11646/zootaxa.4521.2.1>
- Wilkinson, C. & Scoble, M.J. (1979) The Nepticulidae (Lepidoptera) of Canada. *Memoirs of the Entomological Society of Canada*, 111, 1–129, pls 10. <https://doi.org/10.4039/entm111107fv>



Figures 145–152. Adult morphology (after Stonis *et al.*, 2016; 2018; 2022 and courtesy of Peter Buchner, Austria: Figs 146, 147, 150).

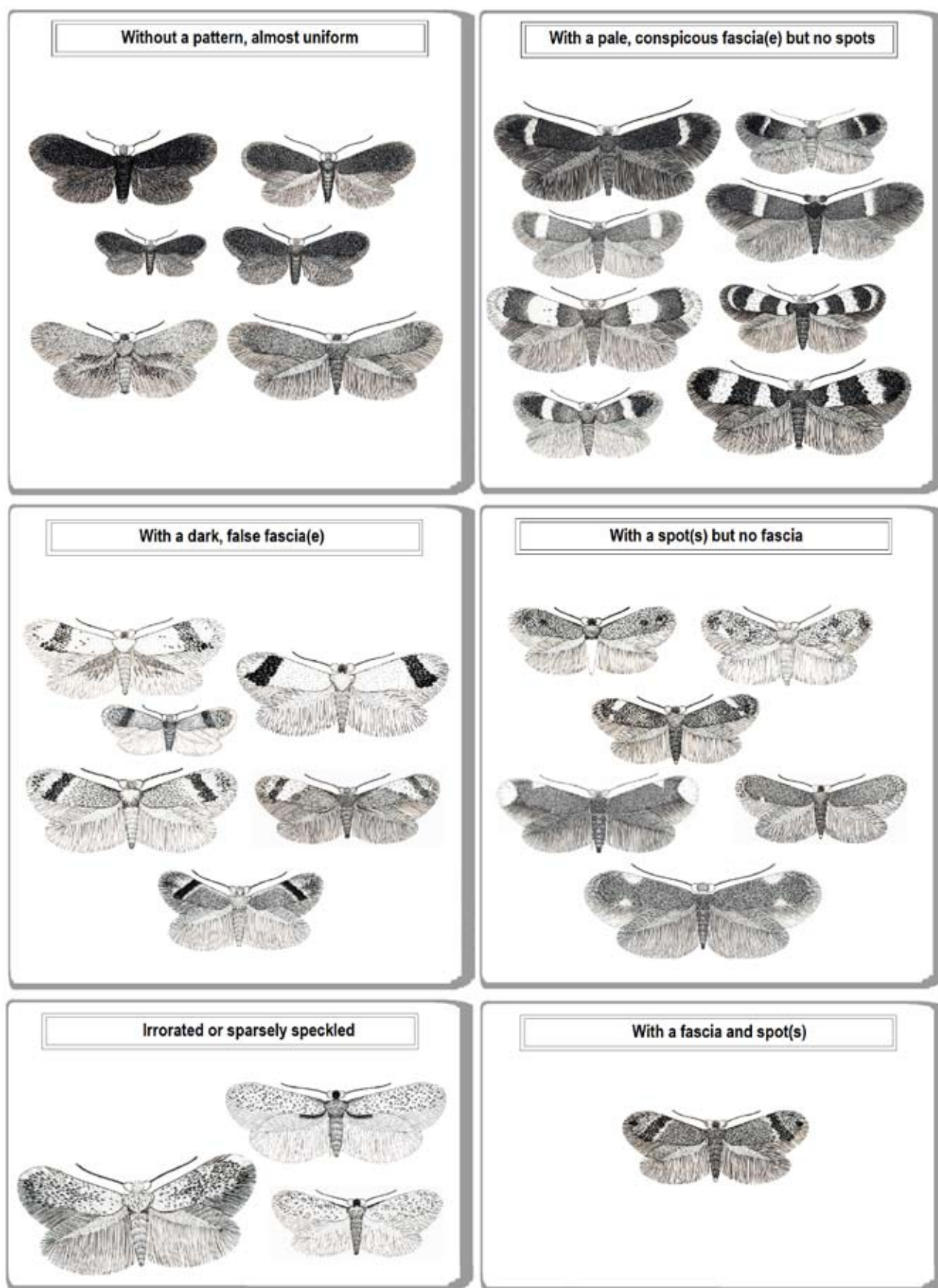
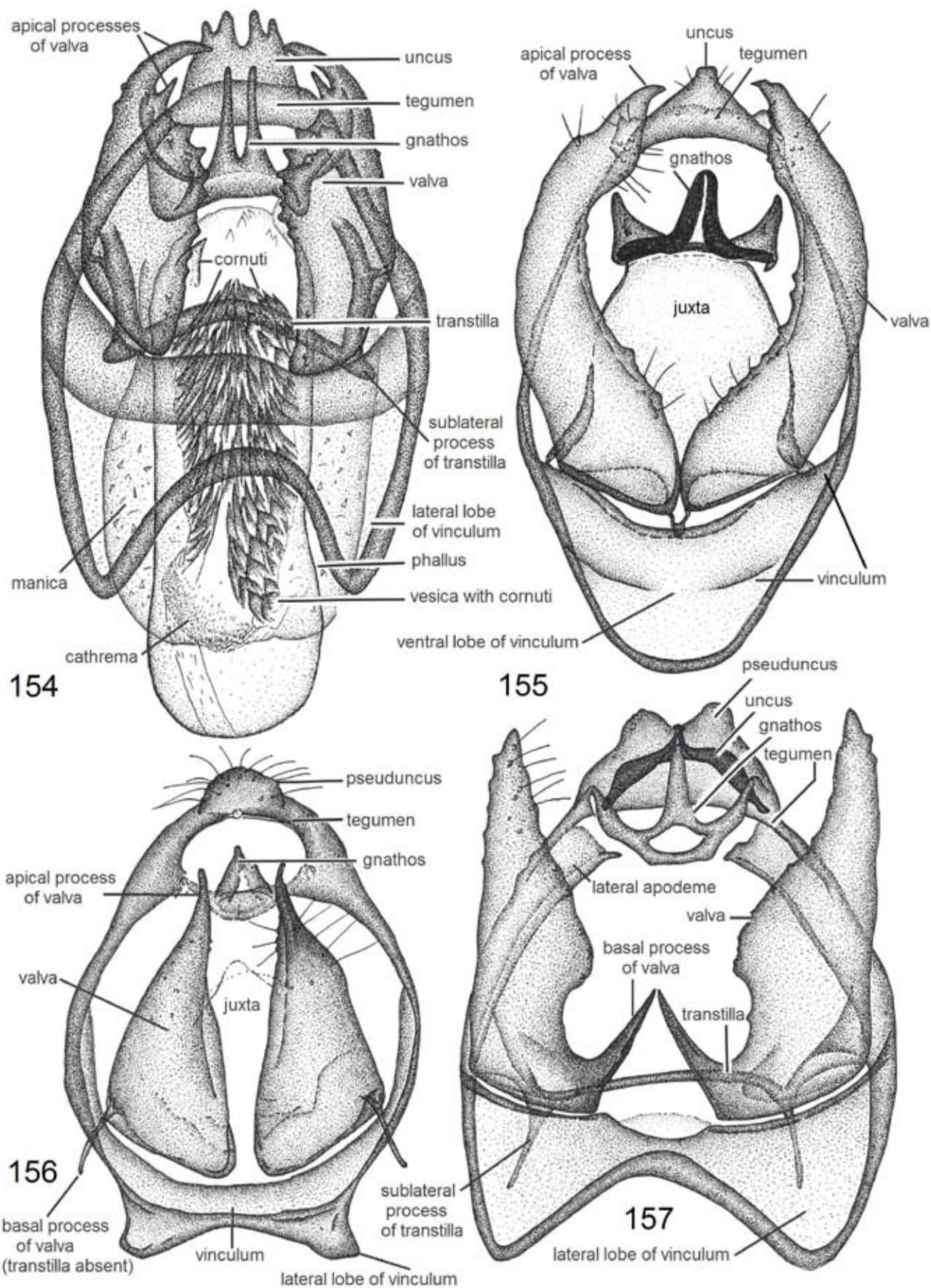
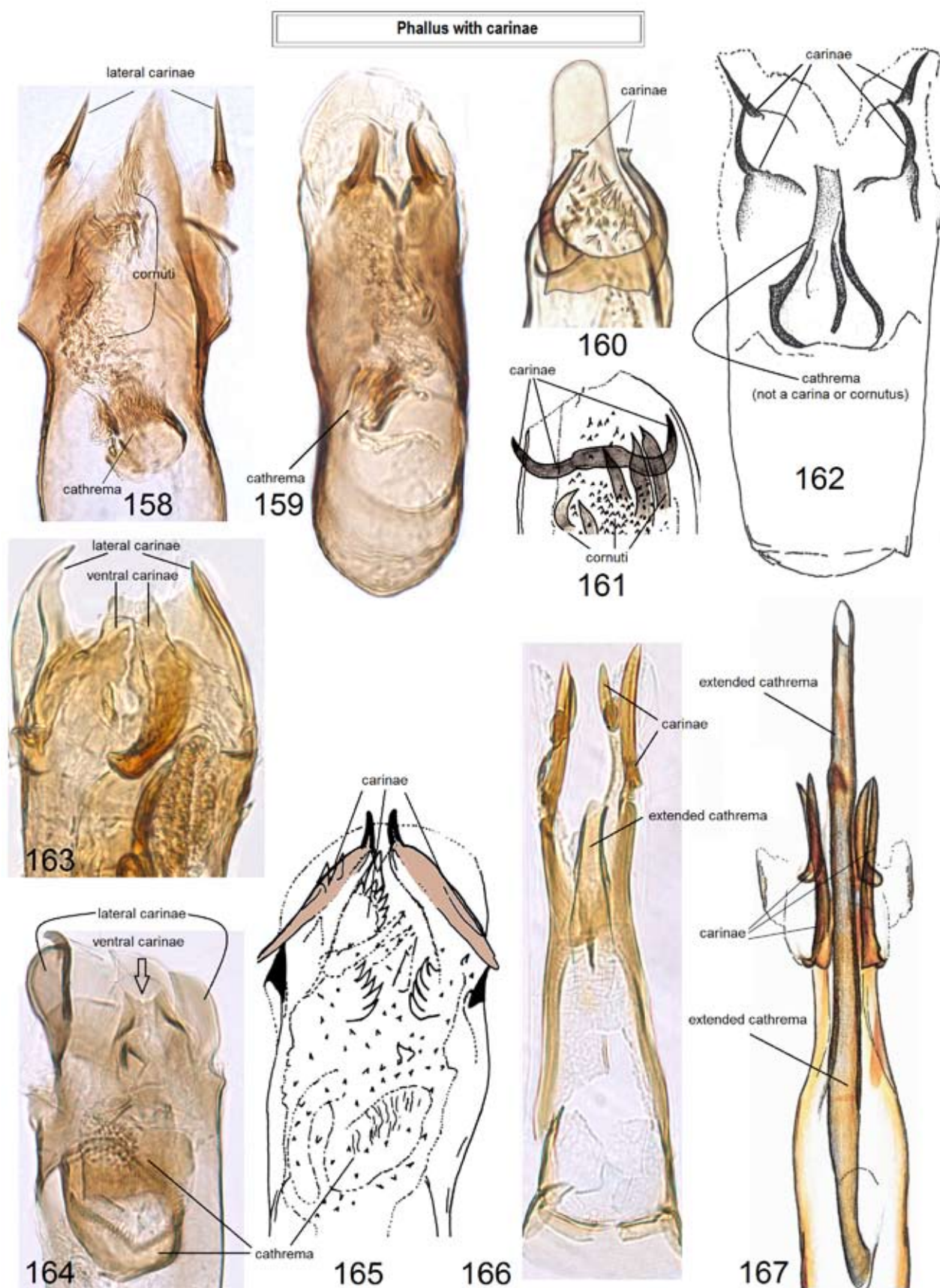


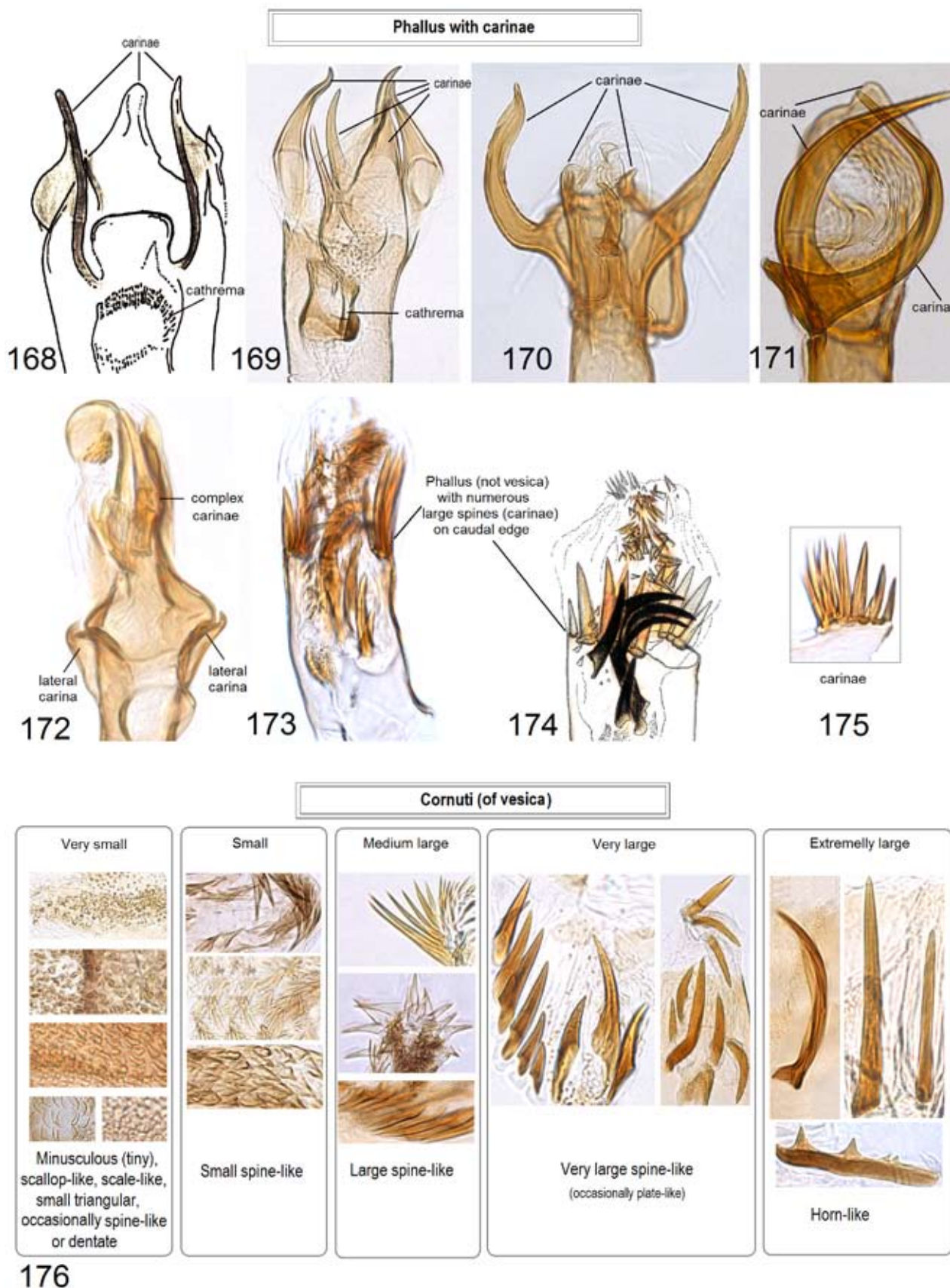
Figure 153. The main types of the forewing pattern of Nepticulidae.



Figures 154–157. Morphology of the male genitalia of Nepticulidae (after Puplesis & Diškus, 2003, modified).



Figures 158–167. Examples of the phallus with carinae.



Figures 168–176. Phallus of Nepticulidae: 168–175 – phallus with strongly developed carinae; 176 – variety of cornuti on vesica.

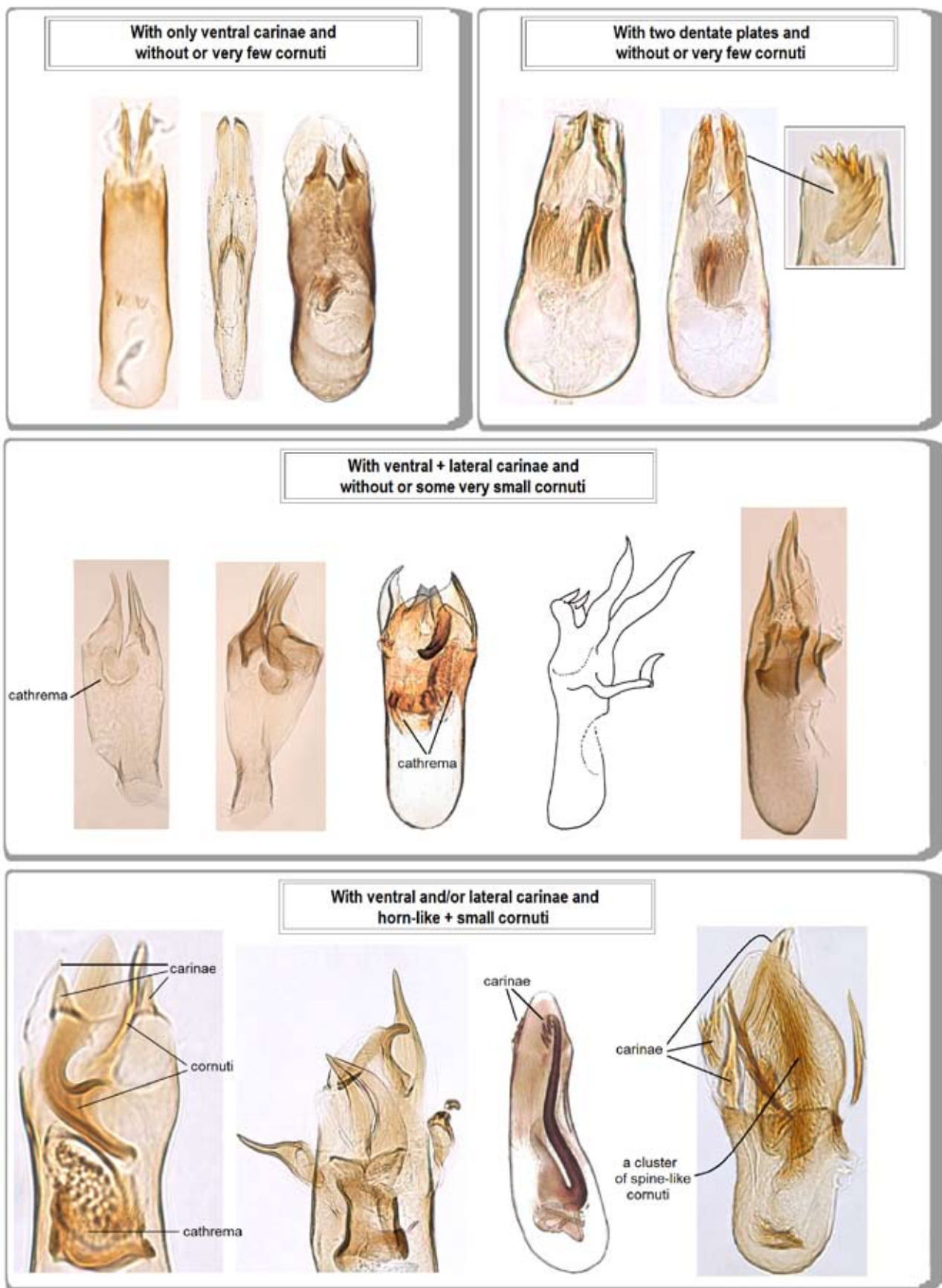


Figure 177. The main morphological varieties of the phallus possessing carinae.

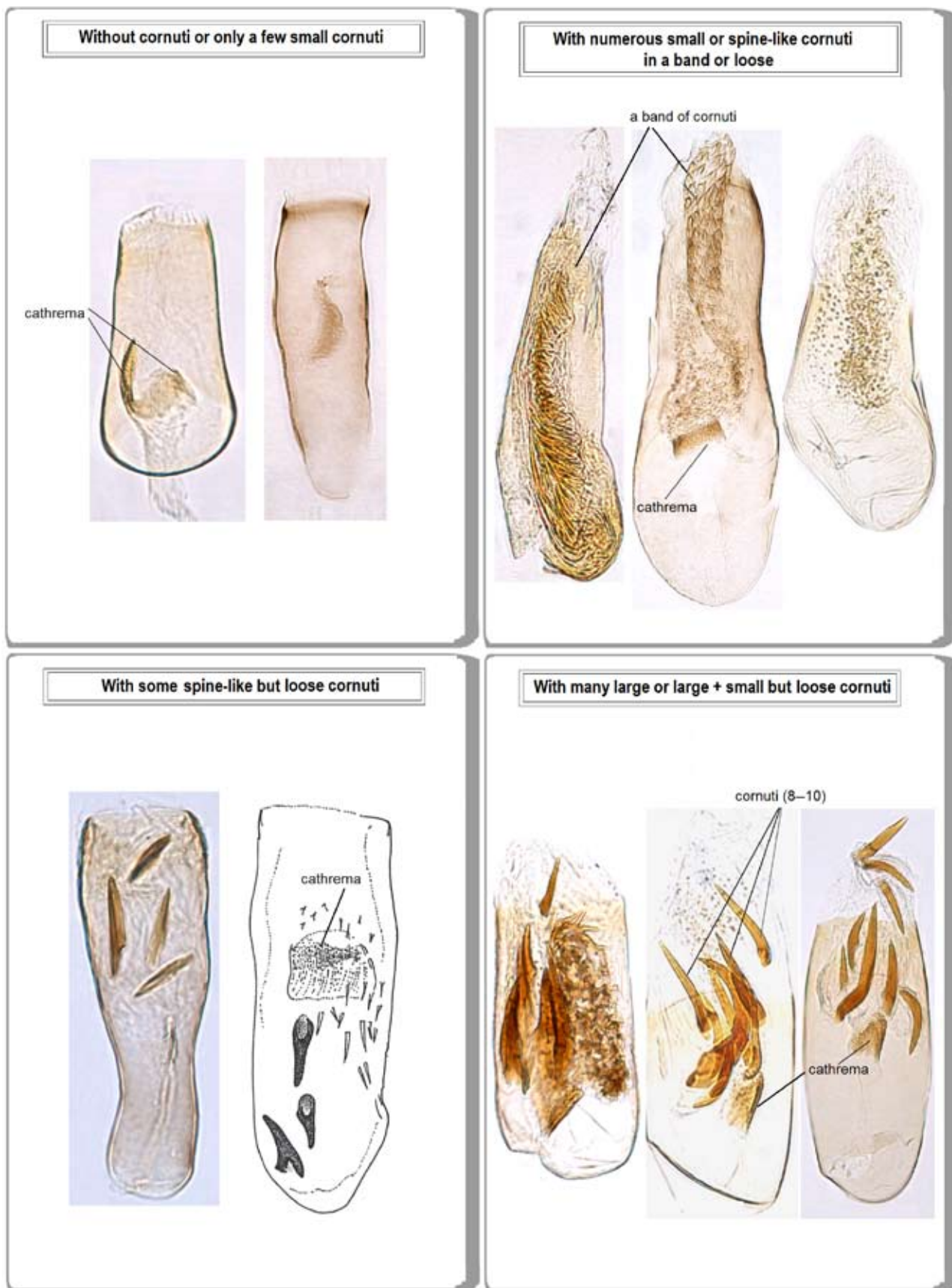


Figure 178. Main morphological types of the phallus without carinae.

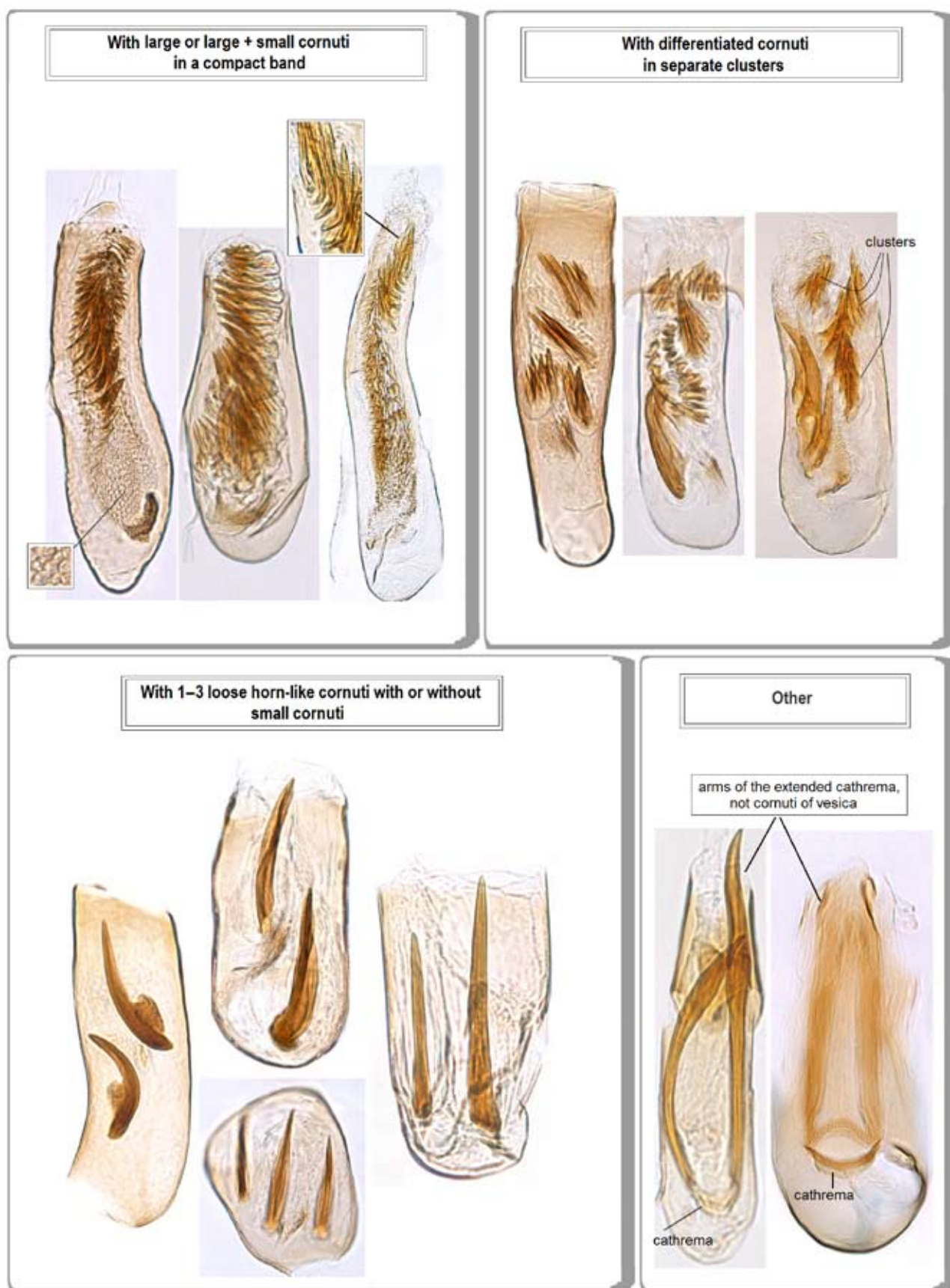


Figure 179. Main morphological types of the phallus without carinae.

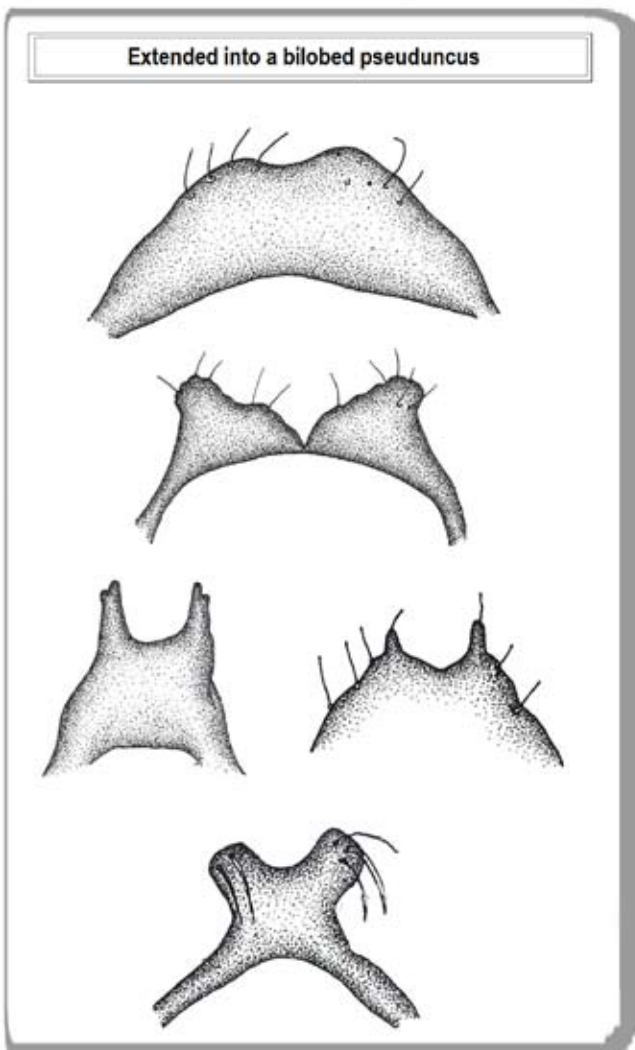
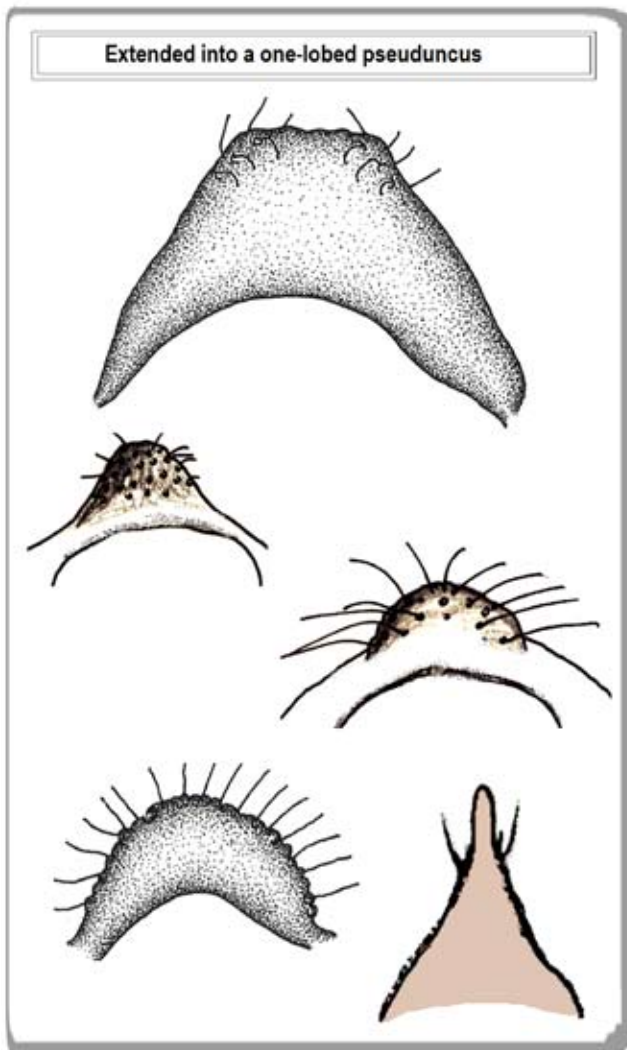
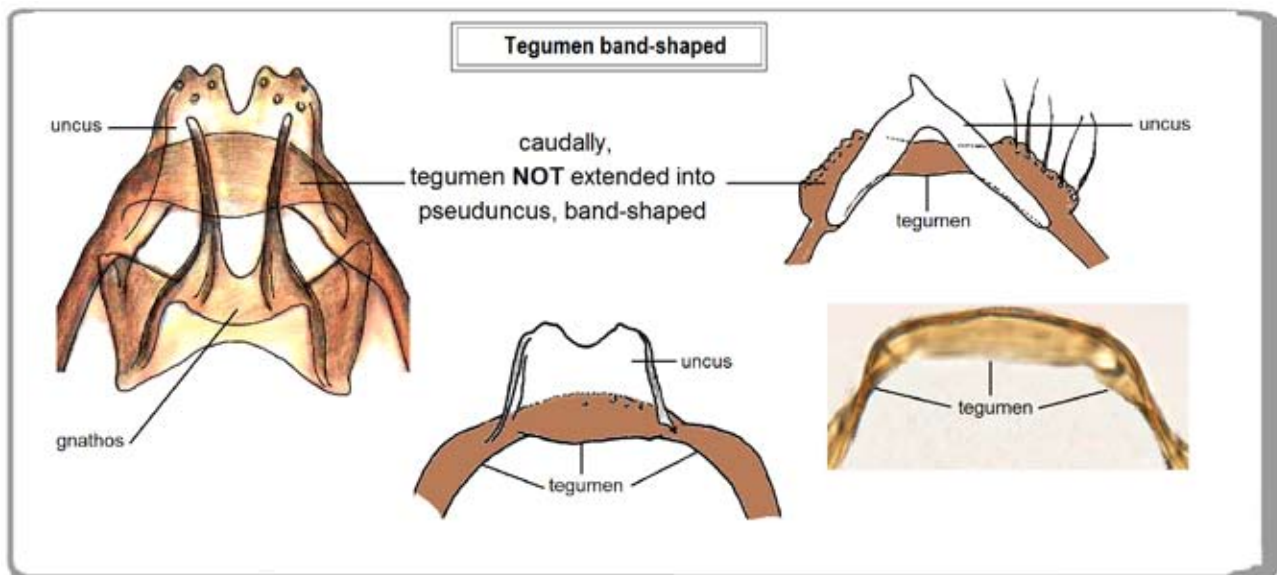


Figure 180. Tegumen of Nepticulidae: without pseuduncus and extended into a pseuduncus.

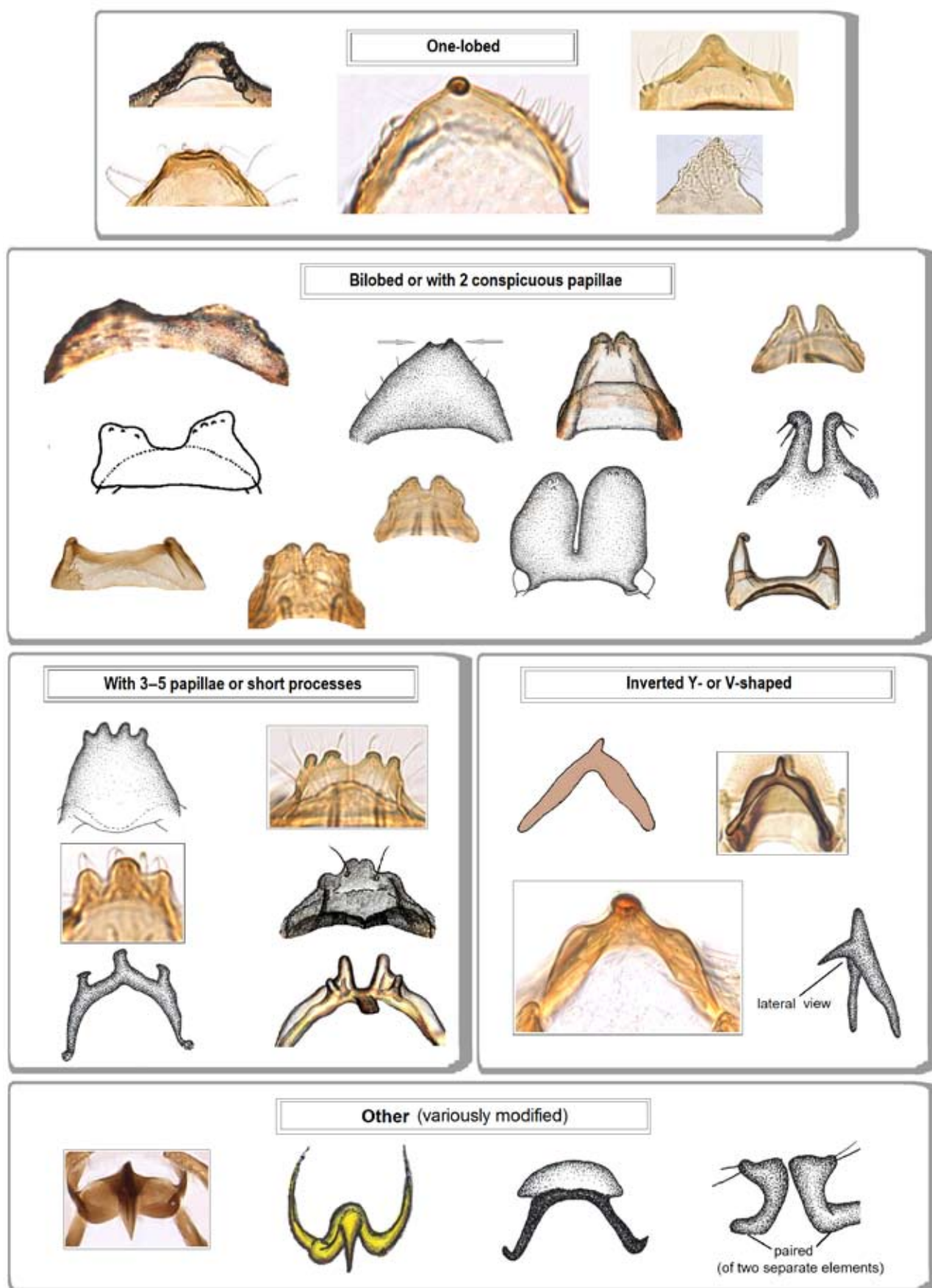


Figure 181. Main morphological types of the uncus of Nepticulidae.

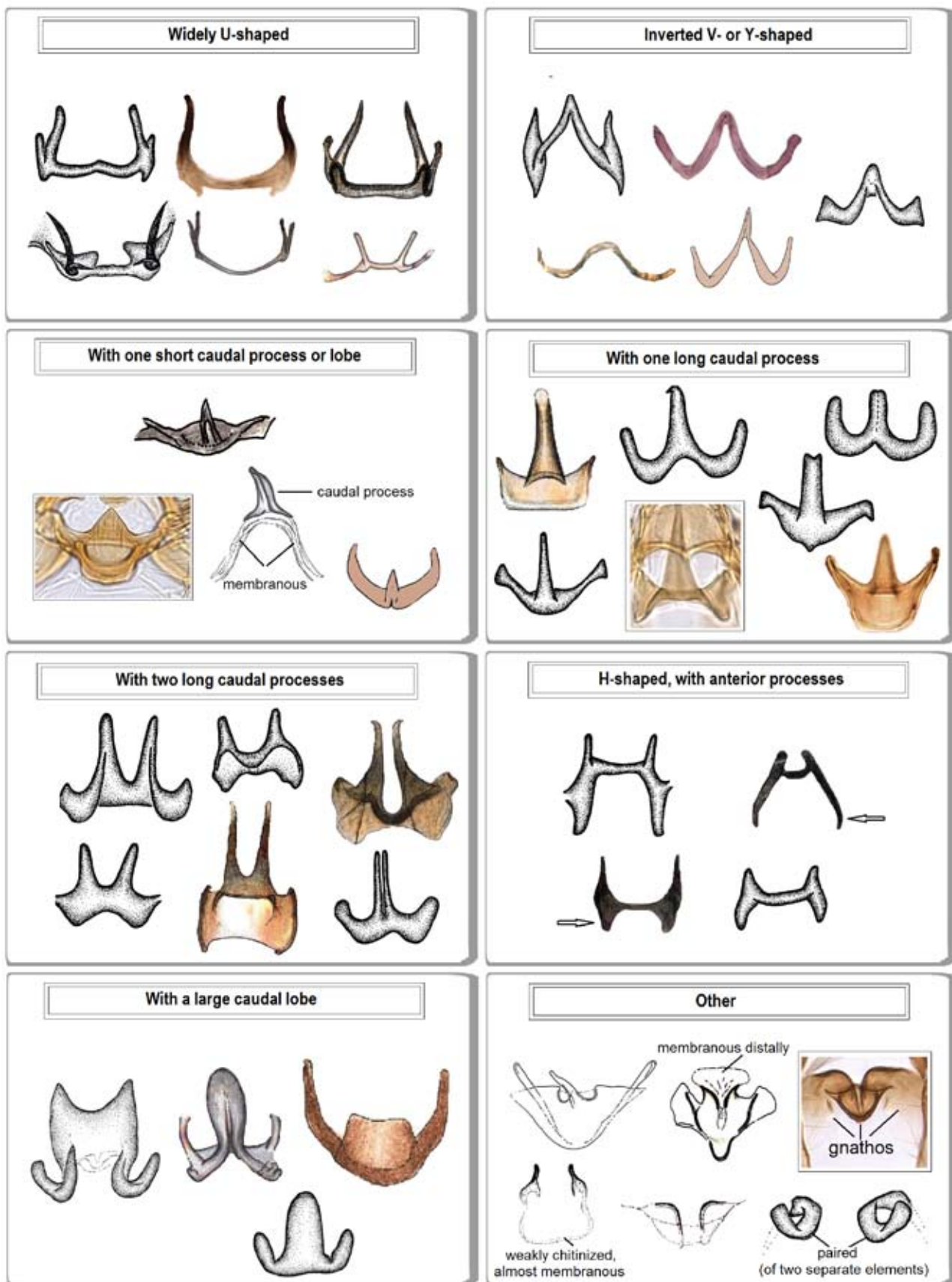


Figure 182. Main morphological types of the gnathos of Neptculidae.

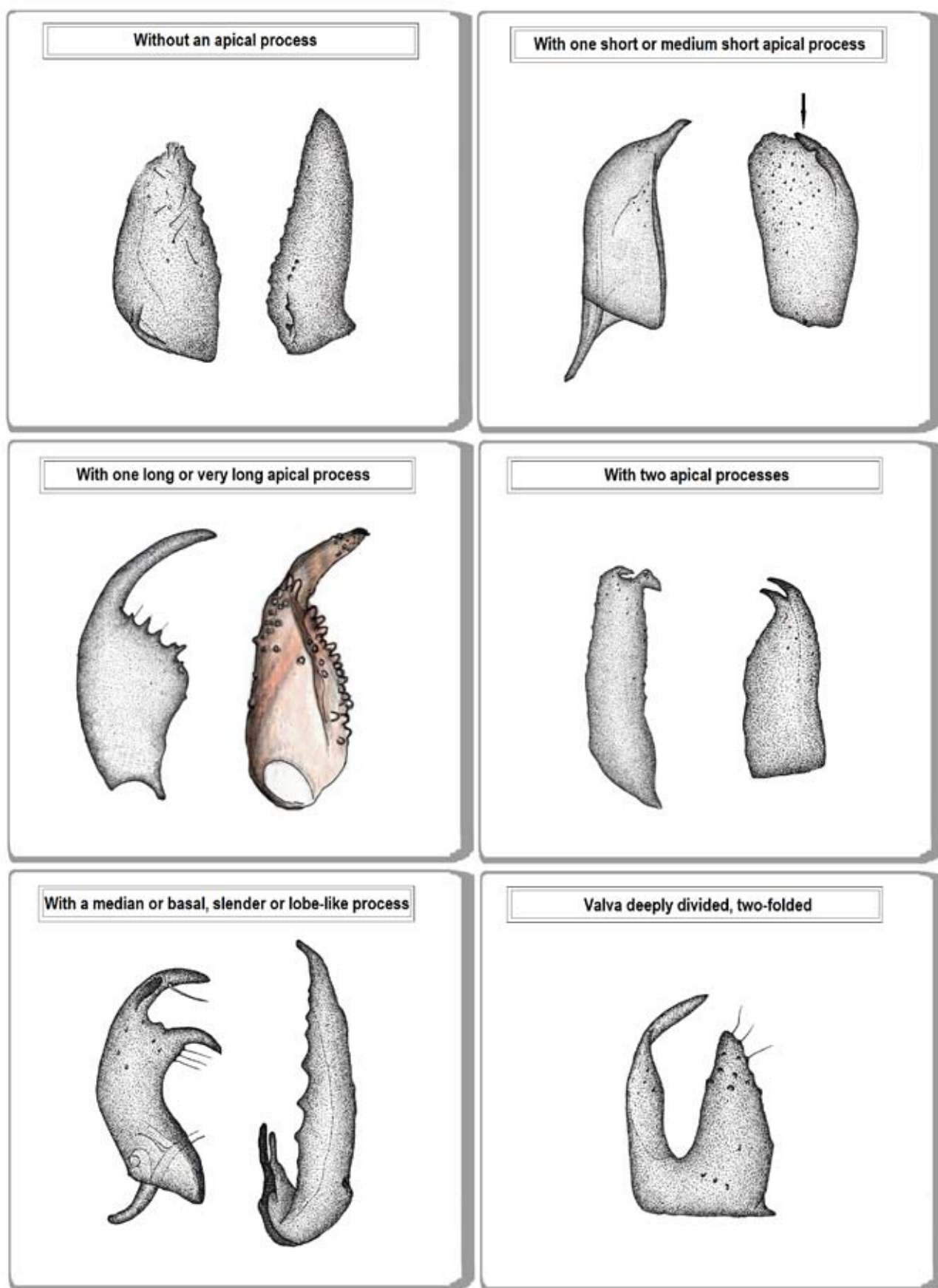
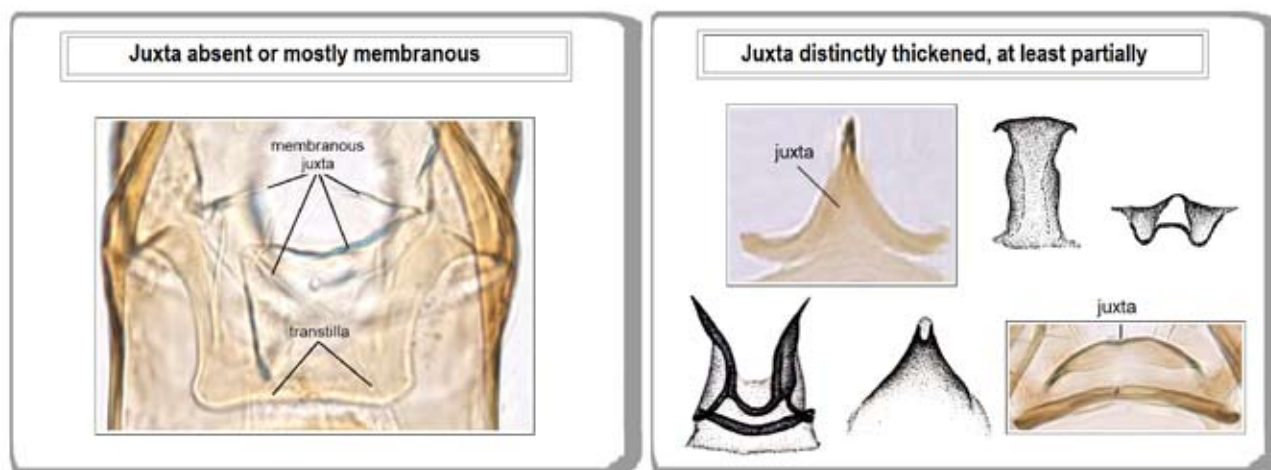
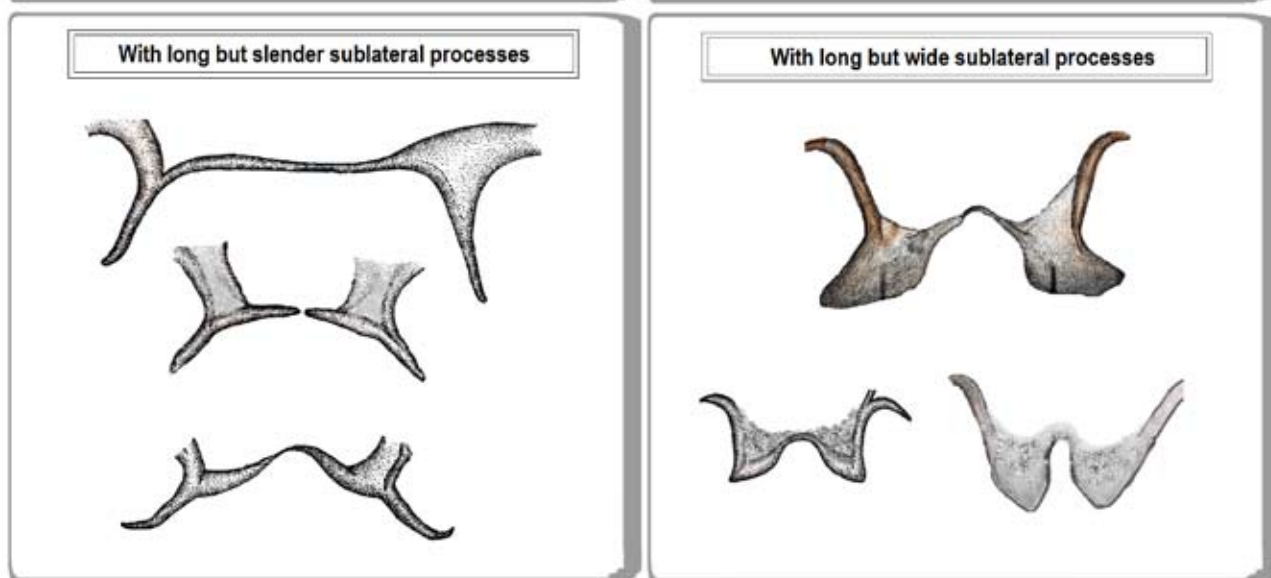
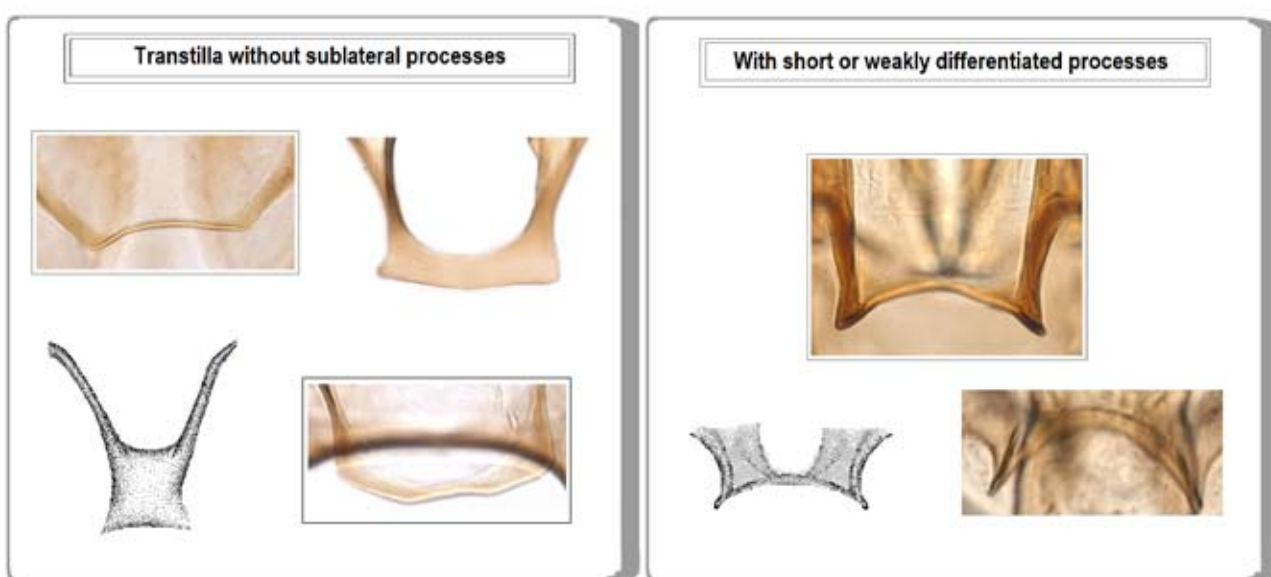


Figure 183. Valva of Nepticulidae.



184



185

Figures 184, 185. Juxta and transtilla of Nepticulidae: 184 – juxta; 185 – transtilla.

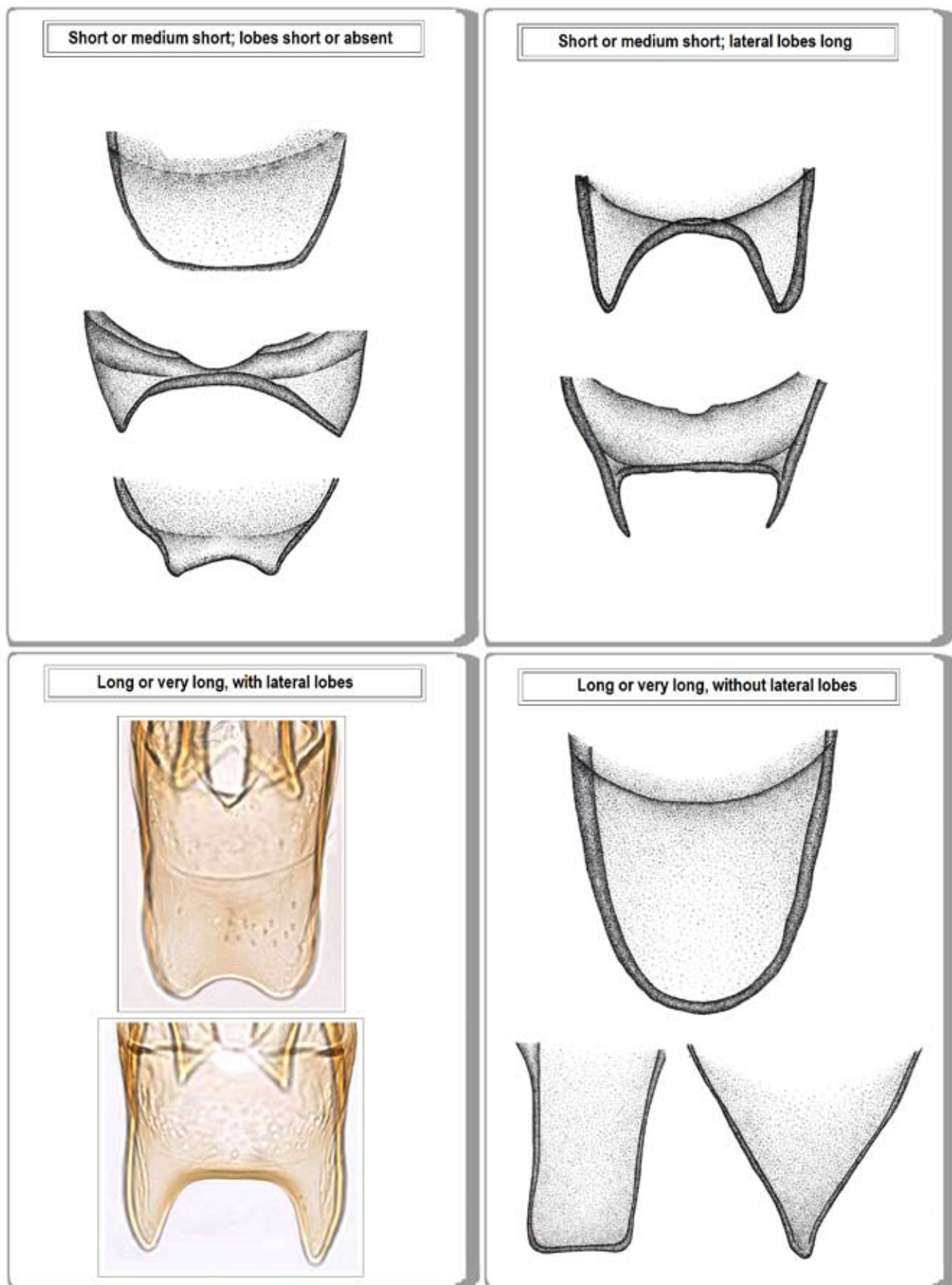


Figure 186. Vinculum of Nepticulidae.

PROVIDING NAMES FOR THE PREVIOUSLY DOCUMENTED BUT HITHERTO UNNAMED SPECIES

(by A. Diškus, A. Remeikis, J. R. Stonis)

Cite as: Diškus, A., Remeikis, A. & Stonis, J.R. (2022) Providing names for the previously documented but hitherto unnamed species. *In:* Stonis, J.R., Remeikis, A. & Diškus, A. *Neotropical Nepticulidae: a pictorial monograph introducing an electronic identification tool*. Vilnius, Nature Research Centre, 97–100 pp.

Previously, there were some species documented (Puplesis & Robinson, 2000; Stonis *et al.*, 2013, 2016) but left unnamed, i.e., with numbers instead of their names. As regards both morphology and biology, these species appear to be too important to be omitted in the first electronic Nepticulidae species identification tool available at www.nepticulidaespecies.info. Therefore, to have names available for the launched electronic tool, we name the following four distinctive species: *Stigmella quercilobatae* Diškus & Stonis, sp. nov. from Guatemala; *S. pauta* Diškus & Stonis, sp. nov.; *S. pallatangai* Diškus & Stonis, sp. nov. from Ecuador, and *Ectoedemia multicristata* Remeikis, sp. nov. from Belize. Except for *S. quercilobatae*, the other three named species are known from male singletons.

Stigmella quercilobatae Diškus & Stonis, sp. nov.
Stigmella species 515, *in* Stonis *et al.*, 2013: 21–22.

Type material. Holotype: ♂, Guatemala, Panajachel, 14°45'06"N, 91°09'43"W, elevation ca. 1657 m, montane forest, larva on *Quercus* sp., 22.ii.2012, ex pupa iii.2012, field card no. 5108, LT-GT Scientific Expedition, genitalia slide no. AD515. Paratype: 1 ♀, same label data as holotype, genitalia slide no. AD517 (both, the holotype and paratype, from adults in a pupal skin, no pinned specimens are available) (ZMUC).

Diagnosis. It belongs to the *quercipulchella* group and differs from other species of the group by the distinctly long and slender apical process of valva, the small pointed process on the inner lobe of the valva, relatively very long and slender anterior processes of the gnathos; from the most similar *S. guatemalensis* Diškus & Stonis, it differs by the presence of slender sublateral processes of transtilla, slender apical process of valva and the medially bent phallus, as well as by the distally strongly widened gallery of the leaf mine, the thin line of frass, and the pale yellow larva (larva of *S. guatemalensis* is deep green, with a dark green intestine).

Male (known from adult in pupal skin). Head: palpi cream; frontal tuft orange; collar and scape cream; antenna grey. Thorax and tegulae dark grey. Forewing fuscous with distinct purple and green and blue iridescence; fascia of forewing median, white, silvery shiny.

Female. Similar to male.

Male genitalia (Fig. 288). Capsule about 245 µm long, 150 µm wide. Uncus with two distinctive lobes. Gnathos H-shaped, with two caudal processes and longer anterior processes. Valva about 150 µm long, with long but distinctly slender apical process and a tiny but pointed process on the inner lobe; transtilla with short and slender sublateral processes. Vinculum very short, with short and slender lateral lobes. Phallus about 260 µm long, 95 µm wide, bent medially; vesica with a compact band of tiny and medium large spine-like cornuti and with an apical group of larger spine-like cornuti; manica small, indistinctive.

Female genitalia (illustrated in Stonis *et al.*, 2013: figs 89, 90). Anterior and posterior apophyses almost equally long. Vestibulum without sclerites. Accessory sac heavily folded and coiled, very long (about 250 µm); ductus spermathecae with three coils. Corpus bursae membranous, weakly developed (lost in the paratype slide no. AD517).

Bionomics. Host plant is *Quercus* sp. (section Lobatae). Larvae mine leaves in February. Larva pale yellow, with a pale brown intestine. The leaf mine as a false blotch: contorted gallery widens in the distal half; frass black, accumulated in a thin line. Cocoon ochre-brown. Adults emerged in March.

Distribution. This species occurs in Guatemala (Panajachel) in the mixed montane forests at the elevation about 1660 m.

Etymology. The species is named after the host plant genus and its section: *Quercus* L., section Lobatae.

Stigmella pauta Diškus & Stonis, sp. nov.

Stigmella species 764, in Stonis *et al.*, 2016: 93–94.

Type material. Holotype: ♂, Ecuador, Chimborazo Province, ca. 30 km NE Pallatanga, 1°52'41"S, 78°54'11"W, at 3325–3400 m, mining larva on *Polylepis pauta* Hieron. (Rosaceae), 24.i.2005, field card 4829, leg. A. Diškus & J. R. Stonis, genitalia slide no. AD764 (ZMUC).

Diagnosis. The combination of the membranous phallus with a small group of spine-like cornuti, unique shape of widely lobated uncus, extremely very short ventral plate of the vinculum with tiny lateral lobes, membranous transtilla, and large lobated central plate of the gnathos makes the species unique and distinguishes *S. pauta* from all other *Stigmella* species; the host plant *Polylepis pauta* Hieron. (Rosaceae) and the combined leaf mine also make this species distinctive.

Male. External characters remain unknown because the species is described from dissected, completely developed adult in pupal skin.

Female. Unknown.

Male genitalia (Fig. 336). Capsule about 250 µm long, 235 µm wide. Uncus wide, divided into two wide lobes. Gnathos with two long and slender caudal processes; central plate of the gnathos wide, sinuous anteriorly. Valva about 205 µm long, 65–75 µm wide, without an apical process; in the permanent slide of the holotype no. AD764, it is far too difficult to see either the valva is simple or widely bilobed (deeply divided); in contradiction to J. R. Stonis and his colleague A. Remeikis, Arūnas Diškus (who made the dissection of this species) stated that the valva of *S. pauta* is simple, one-lobed. Transtilla membranous, without sublateral processes. Juxta membranous, inconspicuous. Vinculum with extremely very short ventral plate and tiny lateral lobes. Phallus about 175 µm long, 125 µm wide, almost membranous; vesica with a cluster of medium large spine-like cornuti.

Bionomics. Host plant is *Polylepis pauta* Hieron. (Rosaceae). Larvae mine in leaves in January. The leaf mine is combined: gallery abruptly widens to a large blotch (also see Remarks). Exit slit on upper side of the leaf. Cocoon pale beige-yellow, outside of the mine. Otherwise, biology is unknown.

Distribution. The species is known from a single locality in the Equatorial Andes (Pallatanga canyon in Chimborazo Province, Ecuador) from the montane moist mixed forest habitat with some *Polylepis pauta*.

Etymology. The species is named after the host plant species *Polylepis pauta* Hieron. (Rosaceae).

Remarks. There are certain doubts about the exact morphology of the described leaf mine of this species. Following the methods described in the section above, samples of leaf mines should be collected very carefully, otherwise samples might easily be mixed up if two different species mine at the same host plant at the same time and produce closely similar (or variable) leaf mines. According to Stonis *et al.*, 2016, during the field research, there were instances of rearing adults of two different species from the same sample as in the case of *Stigmella pauta* sp. nov. and *S. pallatangai* sp. nov. (described below). Therefore, now it is impossible to describe precisely and attribute correctly the very similar leaf mines to two different species reared from this mixed sample.

Stigmella pallatangai Diškus & Stonis, sp. nov.

Stigmella species 763, in Stonis *et al.*, 2016: 90–91, 94.

Type material. Holotype: ♂, Ecuador, Chimborazo Province, ca. 30 km NE Pallatanga, 1°52'41"S, 78°54'11"W, at 3325–3400 m, 8 mining larvae on *Polylepis pauta* Hieron. (Rosaceae), 24.i.2005, field card 4829, leg. A. Diškus & J. R. Stonis, genitalia slide no. AD763 (ZMUC) (also one mining larva on *Polylepis pauta* from the same locality, 21.ii.2007, field card 4881, leg. A. Diškus; adult has not developed).

Diagnosis. The combination of the unique set of five large, stout spine-like cornuti on the vesica, unique shape of uncus, very short lateral lobes of vinculum, and two apical processes of valva distinguishes *S. pallatangai* sp. nov. from all other *Stigmella* species, including *S. pauta* sp. nov. (described above). The host plant *Polylepis pauta* Hieron. (Rosaceae) and the combined leaf mine shared with *S. pauta* also make this species distinctive among other *Stigmella* species.

Male. External characters remain unknown because the species is described from dissected, completely developed adult in pupal skin.

Female. Unknown.

Male genitalia (Fig. 335). Capsule about 260 µm long, 180 µm wide. Uncus with very short caudal lobes or papillae. Gnathos with two relatively short caudal processes and wide central plate. Valva about 150 µm long, 80 µm wide, with two apical processes; transtilla with tiny sublateral processes. Juxta membranous (indistinctive). Vinculum with very small and blunt lateral lobes. Phallus about 180 µm long, 95 µm wide; vesica with the unique set of five strongly thickened, horn-like cornuti and numerous indistinctive, tiny spine-like cornuti.

Bionomics. Host plant is *Polylepis pauta* Hieron. (Rosaceae). Larvae mine in leaves in January and February. The leaf mine is combined: gallery abruptly widens to a large blotch (also see Remarks). Exit slit on upper side of the leaf. Cocoon pale beige-yellow, outside of the mine. Otherwise, biology is unknown.

Distribution. The species is known from a single locality in the Equatorial Andes (Pallatanga canyon in Chimborazo Province, Ecuador) from the montane moist mixed forest habitat with *Polylepis pauta*.

Remarks. There are certain doubts about the precise morphology of the leaf mine of this species (see Remarks provided for *Stigmella pauta* sp. nov.).

Ectoedemia (Zimmermannia) multicristata Remeikis, sp. nov.

Ectoedemia species 29105, in Puplesis & Robinson, 2000: 41–42.

Type material. Holotype: ♂, Belize, Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3–16. iv.1998 (leg. R. Puplesis & S. R. Hill), genitalia slide no. 29105 (NHMUK).

Diagnosis. This species belongs to the subgenus *Zimmermannia* Hering of the genus *Ectoedemia* and resembles to *Ectoedemia bosquella* (Chambers) and *E. obrutella* (Zeller) (= *E. reneella* Wilkinson), both are known from the United States, including Florida. However, the Belizean *E. multicristata* sp. nov. differs from *E. bosquella* and *E. obrutella* by the presence of distinctive lateral carinae in the male genitalia.

Male (Fig. 349). Forewing length about 3.2 mm; wingspan about 7.1 mm. Head: palpi cream; frontal tuft very large, brown-black; collar almost black, comprised of piliform scales; scape cream, large; antenna brown-grey, flagellum about 56 segments. Thorax and tegulae greyish yellow, with dark brown and grey-black scales especially abundant anteriorly on tegula. Forewing grey-yellow, irregularly speckled with blackish brown scales; fringe greyish yellow distally, grey tornally; fringe line weakly developed. Underside of forewing brown with some green and blue iridescence. Hindwing relatively wide but narrowed apically, cream or greyish cream (depending from the angle of view); hair-pencil well-developed, cream and surrounded with tiny grey-black scales; fringe greyish cream. Legs yellowish cream to ochreous cream, with many black scales on upper side. Scaling and colour of abdomen unknown.

Female. Unknown.

Male genitalia (see “Illustrated Species Review”, Fig. 349). Capsule about 490 µm long. Uncus absent. Pseuduncus unusually short, truncated, with distinctive latero-dorsal papillae. Gnathos inverted V-shaped; lateral arms of gnathos long, well-chitinized. Valva about 377 µm long, relatively slender, gradually narrowed towards apex, slightly curved inwards, with a short but wide papillated median lobe dorsally. Transtilla with long and slender transverse bar and long, slender sublateral processes. Ventral plate of vinculum short but with distinctive median excavation and wide lateral lobes. Phallus about 550 µm long, with two very small but pointed lateral carinae, two large ventral carinae possessing spine-like apices, and 3–4 comb-like plates each bearing five or six spines; vesica with numerous tiny loose cornuti and a least a couple of medium large spine-like cornuti apically.

Biology. Adults collected in April. Otherwise, biology is unknown. It is expected that larvae of this new species are bark miners.

Distribution. Belize (Chiquibul Forest Reserve). *Ectoedemia* (*Zimmermannia*) *multicristata* is the first species of the subgenus *Zimmermannia* reported from the rainforest of the Neotropical region.

Etymology. The species name is derived from Ancient Greek *multi* (some, several) and Latin *cristatus* (plumed, tufted) in reference to the plumed, dentate carinae of the phallus in the male genitalia.

References

- Puplesis, R. & Robinson, G.S. (2000) A review of the Central and South American Nepticulidae (Lepidoptera) with special reference to Belize. *Bulletin of the Natural History Museum, London, Entomology*, 69 (1), 3–114.
- Stonis, J.R., Diškus, A., Remeikis, A. & Karsholt, O. (2016) Do leaf-mining Nepticulidae occur in the natural but so threatened Andean *Polylepis* forests? *Biologija*, 62 (2), 83–97. <http://dx.doi.org/10.6001/biologija.v62i2.3334>
- Stonis, J.R., Diškus, A., Remeikis, A. & Schuster, J. (2013) First discovery of *Quercus* feeding Nepticulidae (Lepidoptera) in Central America. *Zootaxa*, 3737 (1), 1–23. <https://doi.org/10.11646/zootaxa.3737.1.1>

CHECKLIST OF NEPTICULIDAE SPECIES FROM THE NEOTROPICS AND ADJACENT AREAS

(by A. Diškus, J. R. Stonis)

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Genus *Simplimorpha* Scoble, 1983

Subgenus *Myrtineptacula* Stonis & Diškus, 2018

Simplimorpha cercaria Diškus & Stonis, 2018

Simplimorpha (*Myrtineptacula*) *cercaria* Diškus & Stonis, in Stonis *et al.*, 2018c: 159–163.

Simplimorpha nielsenii Remeikis & Stonis, 2018

Simplimorpha (*Myrtineptacula*) *nielsenii* Remeikis & Stonis, in Stonis *et al.*, 2018c: 163–170.

Simplimorpha kailai Stonis & Diškus, 2018

Simplimorpha (*Myrtineptacula*) *kailai* Stonis & Diškus, in Stonis *et al.*, 2018c: 170–173.

Simplimorpha sapphireella Remeikis & Stonis, 2018

Simplimorpha (*Myrtineptacula*) *sapphireella* Remeikis & Stonis, in Stonis *et al.*, 2018c: 173–174.

Genus *Johanssoniella* Koçak, 1981

Johanssoniella hilli (Puplesis & Robinson, 2000)

Enteucha hilli Puplesis & Robinson, 2000: 19–20.

Johanssoniella contracolora (Puplesis & Robinson, 2000)

Enteucha contracolora Puplesis & Robinson, 2000: 20.

Johanssoniella acuta (Puplesis & Diškus, 2002)

Enteucha acuta Puplesis & Diškus, in Puplesis *et al.*, 2002: 21–22.

Species of uncertain placement in *Johanssoniella*

Johanssoniella terricula (Puplesis & Robinson, 2000)

Enteucha terricula Puplesis & Robinson, 2000: 20–21.

Johanssoniella bina Remeikis & Stonis, 2018

Johanssoniella bina Remeikis & Stonis, in Stonis *et al.*, 2018: 117–118.

Genus *Brachinepticula* Stonis & Diškus, 2018

Brachinepticula plurilobata Diškus & Stonis, 2018

Brachinepticula plurilobata Diškus & Stonis, in Stonis *et al.*, 2018b: 106–111.

Brachinepticula elongata Remeikis & Stonis, 2018

Brachinepticula elongata Remeikis & Stonis, in Stonis *et al.*, 2018b: 104–106.

Genus *Enteucha* Meyrick, 1915

Enteucha cyanochlora Meyrick, 1915

Enteucha cyanochlora Meyrick, 1915: 241.

Enteucha gilvafascia (Davis, 1978)

Artaversala gilvafascia Davis, 1978: 221–223.

Enteucha snaddoni Puplesis & Robinson, 2000

Enteucha snaddoni Puplesis & Robinson, 2000: 21–22.

Genus *Manoneura* Davis, 1979

Manoneura basidactyla (Davis, 1978)

Oligoneura basidactyla Davis, 1978: 218–219.

Manoneura tritaria Puplesis & Robinson, 2000

Manoneura tritaria Puplesis & Robinson, 2000: 23.

Manoneura forcipis Remeikis & Stonis, 2017

Manoneura forcipis Remeikis & Stonis, in Stonis *et al.*, 2017a: 51–52, 58.

Genus *Ozadelpha* van Nieukerken, 2016

Ozadelpha ovata (Puplesis & Robinson, 2000)

Stigmella ovata Puplesis & Robinson, 2000: 39.

Ozadelpha rionegrella Remeikis & Dobrynina, 2021

Ozadelpha rionegrella Remeikis & Dobrynina, 2021: 284–286.

Ozadelpha conostegiae van Nieukerken & Nishida, 2016

Ozadelpha conostegiae van Nieukerken & Nishida, in van Nieukerken *et al.*, 2016: 28–35.

Ozadelpha guajavae (Puplesis & Diškus, 2002)

Enteucha guajavae Puplesis & Diškus, in Puplesis *et al.*, 2002: 22–23.

Ozadelpha nigella Diškus & Stonis, 2019

Ozadelpha nigella Diškus & Stonis, in Stonis *et al.*, 2019a: 224–229.

Genus *Stigmella* Schrank, 1802

The *maya* group

Stigmella maya Remeikis & Stonis, 2013

Stigmella maya Remeikis & Stonis, in Stonis *et al.*, 2013c: 224–226.

Stigmella condaliafoliella (Busck, 1900)

Nepticula condaliafoliella Busck, 1900: 238.

Stigmella gossypii (Forbes & Leonard, 1930)

Nepticula gossypii Forbes & Leonard, 1930: 149.

Stigmella schinivora van Nieukerken, 2016

Stigmella schinivora van Nieukerken in van Nieukerken *et al.*, 2016: 15–19.

The *tiliella* group

Stigmella kimae Puplesis & Robinson, 2000

Stigmella kimae Puplesis & Robinson, 2000: 35–36.

The *barbata* group

Stigmella barbata Puplesis & Robinson, 2000

Stigmella barbata Puplesis & Robinson, 2000: 37–38.

Stigmella austroamericana Puplesis & Diškus, 2002

Stigmella austroamericana Puplesis & Diškus, in Puplesis *et al.*, 2002: 25–26.

Stigmella plumosetaeella Newton & Wilkinson, 1982

Stigmella plumosetaeella Newton & Wilkinson, 1982: 455–456.

The *purpurimaculae* group

Stigmella purpurimaculae Remeikis & Stonis, 2014

Stigmella purpurimaculae Remeikis & Stonis, Stonis *et al.*, 2014: 323–324.

Stigmella cana Remeikis & Stonis, 2014

Stigmella cana Remeikis & Stonis, in Stonis *et al.*, 2014: 324–325.

Stigmella truncata Remeikis & Stonis, 2014

Stigmella truncata Remeikis & Stonis, in Stonis *et al.*, 2014: 326–327.

Stigmella sceptra Remeikis & Stonis, 2014

Stigmella sceptra Remeikis & Stonis, in Stonis *et al.*, 2014: 327–328.

Stigmella concreta Remeikis & Stonis, 2014

Stigmella concreta Remeikis & Stonis, in Stonis *et al.*, 2014: 328.

Stigmella pseudoconcreta Remeikis & Stonis, 2014

Stigmella pseudoconcreta Remeikis & Stonis, in Stonis *et al.*, 2014: 329.

Stigmella quadrata Remeikis & Stonis, 2014

Stigmella quadrata Remeikis & Stonis, in Stonis *et al.*, 2014: 329–330.

The *intronia* group

Stigmella semilactea Remeikis & Stonis, 2014

Stigmella semilactea Remeikis & Stonis, Stonis *et al.*, 2014: 330–331.

Stigmella costaricensis van Nieukerken & Nishida, 2016

Stigmella costaricensis van Nieukerken & Nishida, in van Nieukerken *et al.*, 2016: 19–21.

Stigmella intronia van Nieukerken & Nishida, 2016

Stigmella intronia van Nieukerken & Nishida, in van Nieukerken *et al.*, 2016: 20–21.

The *eurydesma* group

Stigmella eurydesma (Meyrick, 1915)

Nepticula eurydesma Meyrick, 1915: 255.

Stigmella albilamina Puplesis & Robinson, 2000

Stigmella albilamina Puplesis & Robinson, 2000: 33–34.

Stigmella fuscilamina Puplesis & Robinson, 2000

Stigmella fuscilamina Puplesis & Robinson, 2000: 34.

The *salicis* group

Stigmella molinensis van Nieukerken & Snyers, 2016

Stigmella molinensis van Nieukerken & Snyers, in van Nieukerken *et al.*, 2016: 22–26.

The *rubeta* group

Stigmella rubeta Puplesis & Diškus, 2002

Stigmella rubeta Puplesis & Diškus, in Puplesis *et al.*, 2002: 24, 25.

Stigmella nubimontana Puplesis & Diškus, 2002

Stigmella nubimontana Puplesis & Diškus, in Puplesis *et al.*, 2002: 24.

The *lobata* group

Stigmella lobata Remeikis & Stonis, 2016

Stigmella lobata Remeikis & Stonis, in Stonis *et al.*, 2016d: 69, 73–75.

Stigmella decora Diškus & Stonis, 2017

Stigmella decora Diškus & Stonis, in Stonis *et al.*, 2017d: 8–11.

Stigmella unicaudata Remeikis & Stonis, 2017

Stigmella unicaudata Remeikis & Stonis, in Stonis *et al.*, 2017d: 12–14.

The *kristenseni* group

Stigmella kristenseni Diškus & Stonis, 2016

Stigmella kristenseni Diškus & Stonis, in Stonis *et al.*, 2016d: 69–72.

The *imperatoria* group

Stigmella imperatoria Puplesis & Robinson, 2000

Stigmella imperatoria Puplesis & Robinson, 2000: 30–31.

Stigmella rubiphagiella Diškus & Stonis, 2016

Stigmella rubiphagiella Diškus & Stonis, in Stonis *et al.*, 2016b: 254–256.

Stigmella polylepiella Diškus & Stonis, 2016

Stigmella polylepiella Diškus & Stonis, in Stonis *et al.*, 2016e: 86–90.

Satellite species unplaced in the *imperatoria* group

Stigmella ampla Diškus & Stonis, 2016

Stigmella ampla Diškus & Stonis, in Stonis *et al.*, 2016d: 54–55, 57–58.

Stigmella altiplanica Diškus & Stonis, 2016

Stigmella altiplanica Diškus & Stonis, in Stonis *et al.*, 2016d: 39.

Stigmella racemifera Šimkevičiūtė & Stonis, 2009

Stigmella racemifera Šimkevičiūtė & Stonis, in Šimkevičiūtė *et al.*, 2009: 270–272.

Stigmella angusta Diškus & Stonis, 2016

Stigmella angusta Diškus & Stonis, in Stonis *et al.*, 2016d: 61–62.

The *circinata* group

Stigmella circinata Diškus & Stonis, 2016

Stigmella circinata Diškus & Stonis, in Stonis *et al.*, 2016b: 251–254.

The *bipartita* group

Stigmella bipartita Diškus & Stonis, 2016

Stigmella bipartita Diškus & Stonis, in Stonis *et al.*, 2016c: 107–110.

Stigmella sanmartini Remeikis & Stonis, 2017

Stigmella sanmartini Remeikis & Stonis, in Stonis *et al.*, 2017d: 12, 15–17.

Stigmella aeneola Diškus & Stonis, 2018

Stigmella aeneola Diškus & Stonis, in Stonis *et al.*, 2018a: 866, 869–872.

Stigmella bracteata Diškus & Stonis, 2018

Stigmella bracteata Diškus & Stonis, in Stonis *et al.*, 2018a: 874–876.

Stigmella violea Diškus & Stonis, 2018

Stigmella violea Diškus & Stonis, in Stonis *et al.*, 2018a: 872, 873, 875.

Stigmella serpentina Diškus & Stonis, 2015

Stigmella serpentina Diškus & Stonis, in Stonis *et al.*, 2015: 576–580.

Stigmella pangorica Diškus & Stonis, 2015

Stigmella pangorica Diškus & Stonis, in Stonis *et al.*, 2015: 580–582.

Stigmella tripartita Diškus & Stonis, 2016

Stigmella tripartita Diškus & Stonis, in Stonis *et al.*, 2016c: 110–111.

Satellite species unplaced in the *bipartita* group

Stigmella paramica Diškus & Stonis, 2016

Stigmella paramica Diškus & Stonis, in Stonis *et al.*, 2016d: 22–25.

Stigmella spatiosa Diškus & Stonis, 2018

Stigmella spatiosa Diškus & Stonis, in Stonis *et al.*, 2018a: 878, 881–882, 884–885.

Stigmella hamata Puplesis & Robinson, 2000

Stigmella hamata Puplesis & Robinson, 2000: 30.

The *schoorli* group

Stigmella schoorli Puplesis & Robinson, 2000

Stigmella schoorli Puplesis & Robinson, 2000: 29–30.

Stigmella alticosma Remeikis & Stonis, 2016

Stigmella alticosma Remeikis & Stonis, in Stonis *et al.*, 2016d: 63–64.

Stigmella paracosma Remeikis & Stonis, 2017

Stigmella paracosma Remeikis & Stonis, in Stonis *et al.*, 2017a: 12, 14, 19.

Stigmella epicosma (Meyrick, 1915)

Nepticula epicosma Meyrick, 1915: 255.

The *expressa* group

Stigmella expressa Remeikis & Stonis, 2017

Stigmella expressa Remeikis & Stonis, in Stonis *et al.*, 2017a: 21–22.

Stigmella pseudorobusta Remeikis & Stonis, 2016

Stigmella pseudorobusta Remeikis & Stonis, in Stonis *et al.*, 2016d: 41–44.

Stigmella lachemillae Diškus & Stonis, 2016

Stigmella lachemillae Diškus & Stonis, in Stonis *et al.*, 2016d: 27–28.

Stigmella robusta Remeikis & Stonis, 2016

Stigmella robusta Remeikis & Stonis, in Stonis *et al.*, 2016d: 41.

Stigmella evanida Diškus & Stonis, 2016

Stigmella evanida Diškus & Stonis, in Stonis *et al.*, 2016d: 58–59, 61.

Stigmella acalyphae Diškus & Stonis, 2017

Stigmella acalyphae Diškus & Stonis, in Stonis *et al.*, 2017a: 24–25.

Stigmella lepida Diškus & Stonis, 2017

Stigmella lepida Diškus & Stonis, in Stonis *et al.*, 2017a: 26–27.

The *magnispinella* group

Stigmella magnispinella Remeikis & Stonis, 2016

Stigmella magnispinella Remeikis & Stonis, in Stonis *et al.*, 2016f: 571–572.

Stigmella olekarsholti Remeikis, Diškus & Stonis, 2016

Stigmella olekarsholti Remeikis, Diškus & Stonis, in Stonis *et al.*, 2016f: 569–570.

Stigmella varispinella Diškus & Stonis, 2016

Stigmella varispinella Diškus & Stonis, in Stonis *et al.*, 2016f: 565–569.

Stigmella dolia Remeikis & Stonis, 2016

Stigmella dolia Remeikis & Stonis, in Stonis *et al.*, 2016f: 572–574.

Stigmella patagonica Remeikis & Stonis, 2016

Stigmella patagonica Remeikis & Stonis, in Stonis *et al.*, 2016f: 574–575.

The *pseudodigitata* group

Stigmella pseudodigitata Remeikis & Stonis, 2014

Stigmella pseudodigitata Remeikis & Stonis, in Stonis *et al.*, 2014: 332.

Stigmella azurella Diškus & Stonis, 2017

Stigmella azurella Diškus & Stonis, in Stonis *et al.*, 2017a: 48–50.

The *nivea* group

Stigmella nivea Remeikis & Stonis, 2016

Stigmella nivea Remeikis & Stonis, in Stonis *et al.*, 2016d: 63, 65.

Stigmella olyritis (Meyrick, 1915)

Nepticula olyritis Meyrick, 1915: 256.

Stigmella ageratinae Diškus & Stonis, 2016

Stigmella ageratinae Diškus & Stonis, in Stonis *et al.*, 2016d: 75–79.

Stigmella apicibrunella Diškus & Stonis, 2017

Stigmella apicibrunella Diškus & Stonis, in Stonis *et al.*, 2017d: 3–8.

Stigmella cuprata (Meyrick, 1915)

Nepticula cuprata Meyrick, 1915: 255.

Stigmella eiffeli Diškus & Stonis, 2017

Stigmella eiffeli Diškus & Stonis, in Stonis *et al.*, 2017a: 41–42.

Stigmella inca Diškus & Stonis, 2017

Stigmella inca Diškus & Stonis, in Stonis *et al.*, 2017a: 39–41.

The *saginella* group

Stigmella crassifoliae Remeikis & Stonis, 2015

Stigmella crassifoliae Remeikis & Stonis, 2015: 410–411.

Stigmella nigriverticella (Chambers, 1875) [*partim*], in Stonis *et al.*, 2013b: 2–4.

Stigmella robleae Remeikis & Stonis, 2015

Stigmella robleae Remeikis & Stonis, 2015: 411–412.

Stigmella jaguari Remeikis & Stonis, 2013

Stigmella jaguari Remeikis & Stonis, in Stonis *et al.*, 2013b: 5–6.

Stigmella lauta Diškus & Stonis, 2013

Stigmella lauta Diškus & Stonis, in Stonis *et al.*, 2013b: 6–8.

Stigmella sublauta Remeikis & Stonis, 2013

Stigmella sublauta Remeikis & Stonis, in Stonis *et al.*, 2013b: 8.

Stigmella aurifasciata Diškus & Stonis, 2013

Stigmella aurifasciata Diškus & Stonis, in Stonis *et al.*, 2013b: 8–10.

The *quercipulchella* group

Stigmella guatemalensis Diškus & Stonis, 2013

Stigmella guatemalensis Diškus & Stonis, in Stonis *et al.*, 2013b: 10.

Stigmella quercilobatae Diškus & Stonis, sp. nov.

Stigmella species 515, in Stonis *et al.*, 2013b: 21–22.

The *procrastinella* group

Stigmella humboldti Remeikis & Stonis, 2015

Stigmella humboldti Remeikis & Stonis, 2015: 412–413.

The *incaica* group

Stigmella incaica Diškus & Stonis, 2021

Stigmella incaica Diškus & Stonis, in Stonis *et al.*, 2021b: 276–281.

Stigmella auripurpurata Diškus & Stonis, 2017

Stigmella auripurpurata Diškus & Stonis, in Stonis *et al.*, 2017b: 117–121.

Stigmella boehmeriphaga Diškus & Stonis, 2017

Stigmella boehmeriphaga Diškus & Stonis, in Stonis *et al.*, 2017b: 114–117.

Stigmella lata Diškus & Stonis, 2017

Stigmella lata Diškus & Stonis, in Stonis *et al.*, 2017b: 112–114.

Stigmella singularia Diškus & Stonis, 2017

Stigmella singularia Diškus & Stonis, in Stonis *et al.*, 2017b: 108–112.

Stigmella scutellariae Remeikis & Stonis, 2017

Stigmella scutellariae Remeikis & Stonis, in Stonis *et al.*, 2017c: 131–136.

Stigmella lamiacifoliae Remeikis & Stonis, 2017

Stigmella lamiacifoliae Remeikis & Stonis, in Stonis *et al.*, 2017c: 129–135.

Stigmella coronaria Diškus & Stonis, 2017

Stigmella coronaria Diškus & Stonis, in Stonis *et al.*, 2017a: 37, 44–45.

The *jungiae* group

Stigmella jungiae Diškus & Stonis, 2018

Stigmella jungiae Diškus & Stonis, in Stonis *et al.*, 2018a: 861–864.

Stigmella mustelina Remeikis & Stonis, 2016

Stigmella mustelina Remeikis & Stonis, in Stonis *et al.*, 2016d: 58, 60–61.

Stigmella misera Diškus & Stonis, 2017

Stigmella misera Diškus & Stonis, in Stonis *et al.*, 2017a: 31–33.

Stigmella patula Remeikis & Stonis, 2017

Stigmella patula Remeikis & Stonis, in Stonis *et al.*, 2017d: 17–19.

The *mentholica* group

Stigmella mentholica Diškus & Stonis, 2021

Stigmella mentholica Diškus & Stonis, in Stonis *et al.*, 2021a: 365–367, 371–372, 377.

Stigmella clinopodiella Diškus & Stonis, 2016

Stigmella clinopodiella Diškus & Stonis, in Stonis *et al.*, 2016d: 79–82.

Stigmella aromatica Diškus & Stonis, 2021

Stigmella aromatica Diškus & Stonis, in Stonis *et al.*, 2021a: 366, 368, 371, 373, 376–377.

Stigmella odora Diškus & Stonis, 2021

Stigmella odora Diškus & Stonis, in Stonis *et al.*, 2021a: 367, 374, 378.

Stigmella tomentosella Diškus & Stonis, 2021

Stigmella tomentosella Diškus & Stonis, in Stonis *et al.*, 2021a: 369, 371, 375, 378, 379.

The *marmorea* group

Stigmella marmorea Puplesis & Robinson, 2000

Stigmella marmorea Puplesis & Robinson, 2000: 26–27.

Stigmella peruanica Puplesis & Robinson, 2000

Stigmella peruanica Puplesis & Robinson, 2000: 27–28.

Stigmella altimontana Remeikis & Stonis, 2016

Stigmella altimontana Remeikis & Stonis, in Stonis *et al.*, 2016d: 51–53.

Stigmella auriargentata Remeikis & Stonis, 2016

Stigmella auriargentata Remeikis & Stonis, in Stonis *et al.*, 2016d: 44–45.

- Stigmella johannis*** (Zeller, 1877)
Nepticula johannis Zeller, 1877: 456–457.
- Stigmella andina*** (Meyrick, 1915)
Nepticula andina Meyrick, 1915: 255–256.
- Stigmella auripennata*** Diškus & Stonis, 2018
Stigmella auripennata Diškus & Stonis, in Stonis *et al.*, 2018a: 886, 889–892.
Stigmella species 610, in Stonis *et al.*, 2016: 111–115.
- Stigmella arequipica*** Remeikis & Stonis, 2017
Stigmella arequipica Remeikis & Stonis, in Stonis *et al.*, 2017a: 36, 43.
- Stigmella sinuosa*** Remeikis & Stonis, 2016
Stigmella sinuosa Remeikis & Stonis, in Stonis & Remeikis, 2016: 310–311.
- Stigmella mevia*** Remeikis & Stonis, 2016
Stigmella mevia Remeikis & Stonis, in Stonis & Remeikis, 2016: 311, 316.
- Stigmella hylomaga*** (Meyrick, 1931)
Nepticula hylomaga Meyrick, 1931: 415.
- Stigmella torosa*** Remeikis & Stonis, 2017
Stigmella torosa Remeikis & Stonis, in Stonis *et al.*, 2017d: 20, 23–24.
- Stigmella monstrata*** Remeikis & Stonis, 2017
Stigmella monstrata Remeikis & Stonis, in Stonis *et al.*, 2017d: 24–26.
- Stigmella calceolariae*** Diškus & Stonis, 2016
Stigmella calceolariae Diškus & Stonis, in Stonis *et al.*, 2016d: 33–36.
- Stigmella costalimai*** (Bourquin, 1962)
Nepticula costalimai Bourquin, 1962: 31–32.
- Stigmella latifoliae*** Remeikis, Diškus & Stonis, 2016
Stigmella latifoliae Remeikis, Diškus & Stonis, in Stonis *et al.*, 2016c: 115–119.
- Stigmella baccharicola*** Diškus & Stonis, 2016
Stigmella baccharicola Diškus & Stonis, in Stonis *et al.*, 2016c: 119–122.
- Stigmella confertae*** Diškus & Stonis, 2016
Stigmella confertae Diškus & Stonis, in Stonis *et al.*, 2016c: 124–126.
- Stigmella emarginatae*** Diškus & Stonis, 2016
Stigmella emarginatae Diškus & Stonis, in Stonis *et al.*, 2016c: 104–107.

Stigmella guittonae (Bourquin, 1962)
Nepticula guittonae Bourquin, 1962: 32–34.

Stigmella podanthae Diškus & Stonis, 2016
Stigmella podanthae Diškus & Stonis, in Stonis *et al.*, 2016a: 120–121.

Stigmella rudis Puplesis & Robinson, 2000
Stigmella rudis Puplesis & Robinson, 2000: 26.

Stigmella gynoxyphaga Diškus & Stonis, 2016
Stigmella gynoxyphaga Diškus & Stonis, in Stonis *et al.*, 2016d: 28, 31–33.

Stigmella montanotropica Puplesis & Diškus, 2002
Stigmella montanotropica Puplesis & Diškus, in Puplesis *et al.*, 2002: 23.

Stigmella pandora Remeikis & Stonis, 2016
Stigmella pandora Remeikis & Stonis, in Stonis *et al.*, 2016d: 54–56.

Stigmella huahumi Remeikis & Stonis, 2017
Stigmella huahumi Remeikis & Stonis, in Stonis *et al.*, 2017d: 26–27.

Stigmella calceolarifoliae Diškus & Stonis, 2016
Stigmella calceolarifoliae Diškus & Stonis, in Stonis *et al.*, 2016d: 79, 84–85.

Stigmella venezuelica Remeikis & Stonis, 2017
Stigmella venezuelica Remeikis & Stonis, in Stonis *et al.*, 2017d: 26, 28–29.

Stigmella pallatangai Diškus & Stonis, sp. nov.
Stigmella species 763, in Stonis *et al.*, 2016e: 90–91, 94.

Non-grouped species

Stigmella pauta Diškus & Stonis, sp. nov.
Stigmella species 764, in Stonis *et al.*, 2016e: 93–94.

Stigmella pruinosa Puplesis & Robinson, 2000
Stigmella pruinosa Puplesis & Robinson, 2000: 38–39.

Stigmella virginica Remeikis & Stonis, 2017
Stigmella virginica Remeikis & Stonis, in Stonis *et al.*, 2017d: 29–30.

Stigmella sparsella Diškus & Stonis, 2017
Stigmella sparsella Diškus & Stonis, in Stonis *et al.*, 2017a: 19, 54–55.

Stigmella brutea Remeikis & Stonis, 2014

Stigmella brutea Remeikis & Stonis, in Stonis *et al.*, 2014: 331–332.

Stigmella lilliputica Remeikis & Stonis, 2017

Stigmella lilliputica Remeikis & Stonis, in Stonis & Remeikis, 2017: 231–235.

Stigmella mimosae Diškus & Stonis, 2018

Stigmella mimosae Diškus & Stonis, in Stonis *et al.*, 2018d: 849, 851–853.

Stigmella rigida Diškus & Stonis, 2016

Stigmella rigida Diškus & Stonis, in Stonis *et al.*, 2016d: 36–39.

Stigmella gallicola van Nieukerken & Nishida, 2016

Stigmella gallicola van Nieukerken & Nishida, in van Nieukerken *et al.*, 2016: 7–14.

Stigmella foreroi Stonis & Vargas, 2019

Stigmella foreroi Stonis & Vargas, in Stonis *et al.*, 2019: 48–55.

Genus *Ectoedemia* Busck, 1907

Subgenus *Zimmermannia* Hering, 1940

Ectoedemia obrutella (Zeller, 1873)

Trifurcula obrutella Zeller, 1873: 316, 317.

Ectoedemia piperella Wilkinson & Newton, 1981: 77–78.

Ectoedemia reneella Wilkinson, 1981: 104–105.

Ectoedemia bosquella (Chambers, 1878)

Nepticula bosquella Chambers, 1878: 106.

Ectoedemia castaneae Busck, 1913: 103.

Ectoedemia heinrichi Busck, 1914: 149.

Ectoedemia helenella Wilkinson, 1981: 105–107.

Ectoedemia mesoloba Davis, 1978

Ectoedemia mesoloba Davis, 1978: 209–212.

Ectoedemia coruscella Wilkinson, 1981: 99–100.

Ectoedemia multicristata Remeikis sp. nov.

Ectoedemia species 29105 Puplesis & Robinson, 2000: 41–42.

Subgenus *Ectoedemia* Busck, 1907

The *angulifasciella* group

Ectoedemia morae Diškus & Stonis, 2016

Ectoedemia (Ectoedemia) morae Diškus & Stonis, in Stonis *et al.*, 2016b: 256, 258–260.

The *fuscivittata* group

Ectoedemia fuscivittata Puplesis & Robinson, 2000

Ectoedemia fuscivittata Puplesis & Robinson, 2000: 42.

A species of uncertain placement in *Ectoedemia*

Ectoedemia bulbosa Remeikis & Stonis, 2018

Ectoedemia bulbosa Remeikis & Stonis, 2018: 459–461.

Genus *Hesperolyra* van Nieukerken, 2016

Hesperolyra diskusi (Puplesis & Robinson, 2000)

Fomoria diskusi Puplesis & Robinson, 2000: 43.

Hesperolyra molybditis (Zeller, 1877)

Nepticula molybditis Zeller, 1877: 455, 456.

Hesperolyra repanda (Puplesis & Diškus, 2002)

Fomoria repanda Puplesis & Diškus, in Puplesis *et al.*, 2002: 26–27.

Hesperolyra saopaulensis van Nieukerken, 2016

Hesperolyra saopaulensis van Nieukerken, in van Nieukerken *et al.*, 2016: 52–55.

Hesperolyra robinsoni Stonis, 2017

Hesperolyra robinsoni Stonis, in Stonis *et al.*, 2017d: 34, 36.

Fomoria species 29122, in Puplesis & Robinson, 2000: 44–45.

Hesperolyra guajavifoliae Stonis & Vargas, 2019

Hesperolyra guajavifoliae Stonis & Vargas, in Stonis *et al.*, 2019b: 92–100.

Genus *Fomoria* Beirne, 1945

Species of uncertain placement in *Fomoria*

Fomoria tabulosa Puplesis & Diškus, 2002

Fomoria tabulosa Puplesis & Diškus, in Puplesis *et al.*, 2002: 27.

Fomoria cornijuxtata Remeikis & Stonis, 2018

Fomoria cornijuxtata Remeikis & Stonis, in Stonis & Remeikis, 2018: 462–463.

Genus *Acalyptris* Meyrick, 1921

The *murex* group

Acalyptris murex Diškus & Stonis, 2017

Acalyptris murex Diškus & Stonis, in Stonis *et al.*, 2017a: 58–60.

Acalyptris minimus Diškus & Stonis, 2018

Acalyptris minimus Diškus & Stonis, in Stonis *et al.*, 2018d: 844–849.

Acalyptris marmor Stonis & Diškus, 2020

Acalyptris marmor Stonis & Diškus, in Stonis *et al.*, 2020: 207, 210–211.

Acalyptris barbudo Stonis & Remeikis, 2020

Acalyptris barbudo Stonis & Remeikis, in Stonis *et al.*, 2020: 210, 212.

Satellite species unplaced in the *murex* group

Acalyptris hispidus Puplesis & Robinson, 2000

Acalyptris hispidus Puplesis & Robinson, 2000: 48.

Acalyptris jareki Stonis & Diškus, 2020

Acalyptris jareki Stonis & Diškus, in Stonis *et al.*, 2020: 213–214.

Acalyptris species 29135, in Puplesis & Robinson, 2000: 53–54.

Acalyptris novenarius Puplesis & Robinson, 2000

Acalyptris novenarius Puplesis & Robinson, 2000: 48–49.

Acalyptris caribbicus Diškus & Stonis, 2013

Acalyptris caribbicus Diškus & Stonis, in Stonis *et al.*, 2013a: 106–109.

The *trifidus* group

Acalyptris trifidus Puplesis & Robinson, 2000

Acalyptris trifidus Puplesis & Robinson, 2000: 50–51.

Acalyptris species 29140, in Puplesis & Robinson, 2000: 55–56.

Acalyptris laxibasis Puplesis & Robinson, 2000

Acalyptris laxibasis Puplesis & Robinson, 2000: 52–53.

Acalyptris rotundus Puplesis & Diškus, 2002

Acalyptris rotundus Puplesis & Diškus, in Puplesis *et al.*, 2002: 31–32.

Acalyptris hilli Stonis & Diškus, 2020

Acalyptris hilli Stonis & Diškus, in Stonis *et al.*, 2020: 217–219.

Acalyptris amazonius Puplesis & Diškus, 2002

Acalyptris amazonius Puplesis & Diškus, in Puplesis *et al.*, 2002: 32–33.

Acalyptris hyacinthum Stonis & Vargas, 2020

Acalyptris hyacinthum Stonis & Vargas, in Stonis *et al.*, 2020: 217, 219–220.

Acalyptris mortalis Diškus & Stonis, 2020

Acalyptris mortalis Diškus & Stonis, in Stonis *et al.*, 2020: 220–225.

Acalyptris miranda (Diškus & Stonis, 2017)

Fomoria miranda Diškus & Stonis, in Stonis *et al.*, 2017d: 31, 33–35.

The *bifidus* group

Acalyptris lascuevella Puplesis & Robinson, 2000

Acalyptris lascuevella Puplesis & Robinson, 2000: 49–50.

Acalyptris bifidus Puplesis & Robinson, 2000

Acalyptris bifidus Puplesis & Robinson, 2000: 50.

Acalyptris yucatani Remeikis & Stonis, 2013

Acalyptris yucatani Remeikis & Stonis, in Stonis *et al.*, 2013c: 227–229.

Acalyptris argentosa (Puplesis & Robinson, 2000)

Glaucolepis argentosa Puplesis & Robinson, 2000: 57.

The *peteni* group

Acalyptris tenuijuxtus (Davis, 1978)

Microcalyptris tenuijuxtus Davis, 1978: 216–217.

Acalyptris unicornis Puplesis & Robinson, 2000

Acalyptris unicornis Puplesis & Robinson, 2000: 51–52.

Acalyptris peteni Diškus & Stonis, 2013

Acalyptris peteni Diškus & Stonis, in Stonis *et al.*, 2013a: 102, 104–106.

Acalyptris trigonijuxtus Remeikis & Stonis, 2015

Acalyptris trigonijuxtus Remeikis & Stonis, in Stonis & Remeikis, 2015: 83–84.

Acalyptris dominicanus Remeikis & Stonis, 2015

Acalyptris dominicanus Remeikis & Stonis, in Stonis & Remeikis, 2015: 85–86.

The *statuarius* group

Acalyptris bicornutus (Davis, 1978)

Microcalyptris bicornutus Davis, 1978: 212–214.

Acalyptris statuarius Diškus & Stonis, 2013

Acalyptris statuarius Diškus & Stonis, in Stonis *et al.*, 2013a: 109–111.

Acalyptris nigrisignum Remeikis & Stonis, 2015

Acalyptris nigrisignum Remeikis & Stonis, in Stonis & Remeikis, 2015: 81–83.

The *scirpi* group

Acalyptris bipinnatellus (Wilkinson, 1979)

Microcalyptris bipinnatellus Wilkinson, 1979: 75–77.

Acalyptris postalatratus (Wilkinson, 1979)

Microcalyptris postalatratus Wilkinson, 1979: 77–78.

Satellite species unplaced in the *scirpi* group

Acalyptris solaris Remeikis & Stonis, 2018

Acalyptris solaris Remeikis & Stonis, in Stonis & Remeikis, 2018: 462–465.

The *fortis* group

Acalyptris fortis Puplesis & Robinson, 2000

Acalyptris fortis Puplesis & Robinson, 2000: 47–48.

Acalyptris martinheringi Puplesis & Robinson, 2000

Acalyptris martinheringi Puplesis & Robinson, 2000: 46–47.

Acalyptris basihastatus Puplesis & Diškus, 2002

Acalyptris basihastatus Puplesis & Diškus, in Puplesis *et al.*, 2002: 29–30.

Acalyptris pseudohastatus Puplesis & Diškus, 2002

Acalyptris pseudohastatus Puplesis & Diškus, in Puplesis *et al.*, 2002: 30.

Acalyptris articulosus Puplesis & Diškus, 2002

Acalyptris articulosus Puplesis & Diškus, in Puplesis *et al.*, 2002: 30–31.

Acalyptris platygnathos Puplesis & Robinson, 2000

Acalyptris platygnathos Puplesis & Robinson, 2000: 54–55.

Acalyptris basicornis Remeikis & Stonis, 2013

Acalyptris basicornis Remeikis & Stonis, in Stonis *et al.*, 2013a: 102–103.

Acalyptris extremus Stonis & Diškus, 2020

Acalyptris extremus Stonis & Diškus, in Stonis *et al.*, 2020: 234, 237–239.

The *bovicorneus* group

Acalyptris bovicorneus Puplesis & Robinson, 2000

Acalyptris bovicorneus Puplesis & Robinson, 2000: 45–46.

Acalyptris terrificus Šimkevičiūtė & Stonis, 2009

Acalyptris terrificus Šimkevičiūtė & Stonis, in Šimkevičiūtė *et al.*, 2009: 275.

Acalyptris species AG015, in Šimkevičiūtė *et al.*, 2009: 275–276.

Acalyptris janzeni van Nieukerken & Nishida, 2016

Acalyptris janzeni van Nieukerken & Nishida, 2016, in van Nieukerken *et al.*, 2016: 55–58.

The *latipennata* group

Acalyptris latipennata (Puplesis & Robinson, 2000)

Fomoria latipennata Puplesis & Robinson, 2000: 45.

Acalyptris dividua Puplesis & Robinson, 2000

Acalyptris dividua Puplesis & Robinson, 2000: 54.

Acalyptris paravidua Šimkevičiūtė & Stonis, 2009

Acalyptris paravidua Šimkevičiūtė & Stonis, in Šimkevičiūtė *et al.*, 2009: 272–274.

Acalyptris ecuadoriana Puplesis & Diškus, 2002

Acalyptris ecuadoriana Puplesis & Diškus, in Puplesis *et al.*, 2002: 27–28.

Acalyptris onorei Puplesis & Diškus, 2002

Acalyptris onorei Puplesis & Diškus, in Puplesis *et al.*, 2002: 28–29.

Acalyptris amazonensis Stonis & Diškus, 2018

Acalyptris amazonensis Stonis & Diškus, 2018: 192–198.

Acalyptris insolentis Puplesis & Diškus, 2002

Acalyptris insolentis Puplesis & Diškus, in Puplesis *et al.*, 2002: 33.

A species of uncertain placement in *Acalyptris*

Acalyptris distaleus (Wilkinson, 1979)

Microcalyptris distaleus Wilkinson, 1979: 78–81.

Genus *Glaucolepis* Braun, 1917

The *flagellata* group

Glaucolepis flagellata Remeikis & Stonis, 2017

Glaucolepis flagellata Remeikis & Stonis, in Stonis *et al.*, 2017e: 495–500.

Glaucolepis pseudoflagellata Remeikis & Stonis, 2017

Glaucolepis pseudoflagellata Remeikis & Stonis, in Stonis *et al.*, 2017e: 496–501.

Glaucolepis gielisorum (Nieukerken, 2016)

Neotrifurcula gielisorum Nieukerken, in Nieukerken *et al.*, 2016: 38–39.

A non-grouped species

Glaucolepis aerifica (Meyrick, 1915)

Nepticula aerifica Meyrick, 1915: 255.

References

- Beirne, B.P. (1945) The male genitalia of the British Stigmellidae (Nepticulidae) (Lep.). *Proceedings of the Royal Irish Academy, (B)*, 50 (9), 191–218. <https://www.jstor.org/stable/20490833>
- Bourquin, F. (1962) Microlepidopteros nuevos con sus biologias. *Revista de la Sociedad Entomologica Argentina*, 23, 31–46. <https://www.biotaxa.org/RSEA/issue/view/4667>
- Busck, A. (1900) New species of moths of the superfamily Tineina from Florida. *Proceedings of the United States National Museum*, 23 (1208), 225–254. <https://doi.org/10.5479/si.00963801.23-1208.225>
- Busck, A. (1907) New American Tineina. *Proceedings of the Entomological Society of Washington*, 8 (3/4): 86–99. <http://biodiversitylibrary.org/page/2345065>
- Chambers, V.T. (1878) Art. III. – Descriptions of new Tineina from Texas, and others from more Northern localities. *Bulletin of the United States Geological and Geographical Survey of the Territories*, 4 (1), 79–106. <https://biostor.org/reference/133741>
- Davis, D.R. (1978) New leaf-mining moths of the family Nepticulidae from Florida. *The Florida Entomologist*, 61 (4), 209–224. <https://doi.org/10.2307/3494210>
- Davis, D.R. (1979) *Manoneura*, a new name to replace the generic homonym *Oligoneura* Davis (Lepidoptera: Nepticulidae). *The Florida Entomologist*, 62 (3), 276. <https://doi.org/10.2307/3494067>
- Forbes, W.T.M. & Leonard, M.D. (1930) A new leaf-miner of cotton in Porto Rico (*Nepticula gossypii* n. sp.). *Journal of the Department of Agriculture, Porto Rico*, 14, 149–157.
- Hering, E.M. (1940) *Zimmermannia liebwerdella* (Zimmermann). Ein Nachwort. *Mitteilungen aus dem Zoologischen Museum in Berlin*, 24 (2), 266. <https://doi.org/10.1002/mmzn.19390240205>
- Koçak, A.Ö. (1981) On the nomenclature of some genera of Lepidoptera. *Priamus*, 1 (3), 97–109.
- Meyrick, E. (1915) Descriptions of South American Micro-Lepidoptera. *The Transactions of the Entomological Society of London*, 48, 201–256. <https://doi.org/10.1111/j.1365-2311.1915.tb02527.x>
- Meyrick, E. (1921) Exotic Microlepidoptera 2 (13), 385–416. <https://www.biodiversitylibrary.org/page/9808623>
- Meyrick, E. (1931) Micro-Lepidoptera from South Chile and Argentina. *Anales del Museo Nacional de Historia Natural, Buenos Aires*, 36, 377–415.
- Newton, P.J. & Wilkinson, C. (1982) A taxonomic revision of the North American species of *Stigmella* (Lepidoptera: Nepticulidae). *Systematic Entomology*, 7 (4), 367–463. <https://doi.org/10.1111/j.1365-3113.1982.tb00455.x>
- Nieukerken, E.J. van, Doorenweerd, C., Nishida, K. & Snyers, C. (2016) New taxa, including three new genera show uniqueness of Neotropical Nepticulidae (Lepidoptera). *ZooKeys*, 628, 1–63. <https://doi.org/10.3897/zookeys.628.9805>

- Puplesis, R., Diškus, A. & Robinson, G.S. (2002) New Neotropical Nepticulidae (Lepidoptera) from the western Amazonian rainforest and the Andes of Ecuador. *Bulletin of the Natural History Museum, London* (Entomology), 71 (1), 19–58. <https://doi.org/10.1017/S0968045402000020>
- Puplesis, R. & Robinson, G.S. (2000) A review of the Central and South American Nepticulidae (Lepidoptera) with special reference to Belize. *Bulletin of the Natural History Museum, London*, Entomology, 69 (1), 3–114.
- Remeikis, A. & Dobrynina, V. (2021) Differentiation of the Andean *Ozadelpha ovata* and *O. rionegrella* sp. nov. (Lepidoptera, Nepticulidae) based on characters of the male genitalia. *Zootaxa*, 5016 (2), 283–288. <https://doi.org/10.11646/zootaxa.5016.2.8>
- Remeikis, A. & Stonis, J.R. (2015) First discovery of *Quercus*-feeding Nepticulidae (Lepidoptera) in South America, with description of new species and designation of the *S. nigriverticella* complex in the *S. saginella* group. *Zootaxa*, 4057 (3), 409–429. <https://doi.org/10.11646/zootaxa.4057.3.7>
- Schrank, F. von Paula (1802) Durchgedachte Geschichte der in Baiern einheimischen und zahmen Thiere. *Fauna Boica*, 2 (2). J.W. Krüll, Ingolstadt, 412 pp. <https://doi.org/10.5962/bhl.title.44923>
- Scoble, M.J. (1983) A revised cladistic classification of the Nepticulidae (Lepidoptera) with descriptions of new taxa mainly from South Africa. *Transvaal Museum Monograph*, 2 (1), 1–105. https://hdl.handle.net/10520/AJA090799001_84
- Stonis, J.R. & Diškus, A. (2018) *Acalyptris amazonensis* sp. nov.: documentation of another leaf-mining species supplementing the unique but disputable *A. latipennata* group (Lepidoptera: Nepticulidae). *Biologija*, 64 (3), 191–202. <https://doi.org/10.6001/biologija.v64i3.3824>
- Stonis, J.R., Diškus, A., Fernández-Alonso, J.L., Remeikis, A. & Solis, M.A. (2021a) New leaf-mining Nepticulidae (Lepidoptera): potential pests of aromatic Lamiaceae plants from equatorial Andes. *Zootaxa*, 4926 (3), 363–383. <https://doi.org/10.11646/zootaxa.4926.3.3>
- Stonis, J.R., Diškus, A., Katinas, L. & Solis, M.A. (2018a) Asteraceae: host to the greatest diversity of leafmining Nepticulidae (Lepidoptera) in South America? *Proceedings of the Entomological Society of Washington*, 120 (4), 856–902. <https://doi.org/10.4289/0013-8797.120.4.856>
- Stonis, J.R., Diškus, A. & Remeikis, A. (2015) The first description of the leaf-mining Nepticulidae (Lepidoptera) feeding on the South American plant genus *Liabum*, Asteraceae. *Zootaxa*, 4040 (5), 576–582. <https://doi.org/10.11646/zootaxa.4040.5.6>
- Stonis, J.R., Diškus, A., Remeikis, A. & Cumbicus Torres, N. (2016a) First description of leaf-mining Nepticulidae and Tischeriidae (Insecta, Lepidoptera) feeding on the Chilean endemic plant genus *Podanthus* Lag. (Asteraceae). *Zootaxa*, 4061 (2), 119–130. <http://doi.org/10.11646/zootaxa.4061.2.2>
- Stonis, J.R., Diškus, A., Remeikis, A. & Cumbicus Torres, N. (2016b) Rosaceae-feeding Nepticulidae (Lepidoptera) of South America: some taxonomic and trophic diversity revealed. *Biologija*, 62 (4), 250–267. <https://doi.org/10.6001/biologija.v62i4.3412>
- Stonis, J.R., Diškus, A., Remeikis, A., Davis, D.R., Solis, M.A. & Cumbicus Torres, N. (2016c) The first record of *Baccharis* L. (Asteraceae) as a host-plant genus for Nepticulidae (Lepidoptera), with description of new *Stigmella* species from South America. *Zootaxa*, 4136 (1), 101–128. <http://doi.org/10.11646/zootaxa.4136.1.4>
- Stonis, J.R., Diškus, A., Remeikis, A., Gerulaitis, V. & Karsholt, O. (2016d) Leaf-mining Nepticulidae (Lepidoptera) from record high altitudes: documenting an entire new fauna in the Andean páramo and puna. Monograph. *Zootaxa*, 4181 (1), 1–94. <https://doi.org/10.11646/zootaxa.4181.1.1>
- Stonis, J.R., Diškus, A., Remeikis, A. & Karsholt, O. (2016e) Do leaf-mining Nepticulidae occur in the natural but so threatened Andean *Polylepis* forests? *Biologija*, 62 (2), 83–97. <http://dx.doi.org/10.6001/biologija.v62i2.3334>
- Stonis, J.R., Diškus, A., Remeikis, A., Karsholt, O. & Cumbicus Torres, N. (2017a) Illustrated review of the leaf-mining Nepticulidae of the central Andes (Peru and Bolivia). Monograph. *Zootaxa*, 4257 (1), 1–70. <https://doi.org/10.11646/zootaxa.4257.1.1>
- Stonis, J.R., Diškus, A., Remeikis, A. & Monroe, A.K. (2017b) The mystery of the tiny Urticaceae-feeders: documentation of the first leaf-mining Nepticulidae (Lepidoptera) species from equatorial America associated with *Phenax*, *Boehmeria* and *Pilea*. *Biologija*, 63 (2), 105–125. <https://doi.org/10.6001/biologija.v63i2.3523>
- Stonis, J.R., Diškus, A., Remeikis, A. & Nishida, K. (2019a) Discovery of a new species of *Ozadelpha* van Nieukerken sheds more light on the diagnostics of this controversial genus of Nepticulidae (Lepidoptera). *Biologija*, 65 (4), 223–235. <https://doi.org/10.6001/biologija.v65i4.4116>

- Stonis, J.R., Diškus, A., Remeikis, A., Noreika, R. & Schuster, J. (2013a) Four new leaf-mining *Acalypttris* species from Guatemala and Belize, with new data on bionomics of *Stigmella pruinosa* (Lepidoptera: Nepticulidae). *Zootaxa*, 3737 (2), 101–117. <https://doi.org/10.11646/zootaxa.3737.2.1>
- Stonis, J.R., Diškus, A., Remeikis, A. & Schuster, J. (2013b) First discovery of *Quercus* feeding Nepticulidae (Lepidoptera) in Central America. *Zootaxa*, 3737 (1), 1–23. <https://doi.org/10.11646/zootaxa.3737.1.1>
- Stonis, J.R., Diškus, A., Remeikis, A. & Solis, M.A. (2018b) The American *Brachinepticula* gen. nov. and *Manoneura* Davis (Nepticulidae): a new generic concept based on a reinforced cathrema in the phallus. *Biologija*, 64 (2), 99–128. <https://doi.org/10.6001/biologija.v64i2.3735>
- Stonis, J.R., Diškus, A., Remeikis, A. & Solis, M.A. (2018c) A Gondwanan concept of *Simplimorpha* Scoble (*sensu lato*): a step toward clarity in the generic diagnostics of global Nepticulidae (Lepidoptera). *Zootaxa*, 4521 (2), 151–182. <https://doi.org/10.11646/zootaxa.4521.2.1>
- Stonis, J.R., Diškus, A., Remeikis, A., Vargas, S.A. & Solis, M.A. (2020) Diagnostics and updated catalogue of *Acalypttris* Meyrick, the second largest genus of Nepticulidae (Lepidoptera) in the Americas. *Zootaxa*, 4748 (2), 201–247. <https://doi.org/10.11646/zootaxa.4748.2.1>
- Stonis, J.R., Diškus, A. & Solis, M.A. (2018d) Two new Fabaceae-feeding Nepticulidae (Lepidoptera) from the Western Hemisphere, including a potential pest of the economically important *Centrolobium* Mart. ex Benth. *Proceedings of the Entomological Society of Washington*, 120 (4), 842–855. <https://doi.org/10.4289/0013-8797.120.4.842>
- Stonis, J.R. & Remeikis, A. (2015) The first records on the genus *Acalypttris* from the Caribbean (Lepidoptera: Nepticulidae). *Zootaxa*, 4057 (1), 79–90. <https://doi.org/10.11646/zootaxa.4057.1.4>
- Stonis, J.R. & Remeikis, A. (2016) Southern Andean *Stigmella sinuosa* complex (Lepidoptera, Nepticulidae): unraveling problematic taxonomy with a pictorial key of adults? *Zootaxa*, 4136 (2), 309–322. <https://doi.org/10.11646/zootaxa.4136.2.3>
- Stonis, J.R. & Remeikis, A. (2017) Anacardiaceae-feeding Nepticulidae in the Neotropics: description of *Stigmella lilliputica* sp. nov. from Argentina, a pest on Chilean peppertree *Schinus polygama*. *Biologija*, 63 (3), 230–237. <https://doi.org/10.6001/biologija.v63i3.3577>
- Stonis, J.R. & Remeikis, A. (2018) Odd species of Nepticulidae (Lepidoptera) from the American rainforest and southern Andes. *Zootaxa*, 4392 (3), 458–468. <https://doi.org/10.11646/zootaxa.4392.3.2>
- Stonis, J.R., Remeikis, A. & Davis, D.R. (2014) Ten new species from the Patagonian Andes (Argentina and Chile), mostly belonging to a newly designated *Stigmella purpurimaculae* group (Lepidoptera: Nepticulidae). *Zootaxa*, 3887 (3), 321–353. <https://doi.org/10.11646/zootaxa.3887.3.3>
- Stonis, J.R., Remeikis, A., Diškus, A., Baryshnikova, S. & Solis, M.A. (2021b) What are the smallest moths (Lepidoptera) in the world? *Zootaxa*, 4942 (2), 269–289. <https://doi.org/10.11646/zootaxa.4942.2.8>
- Stonis, J.R., Remeikis, A., Diškus, A., Forero, D. & Cumbicus Torres, N. (2017c) A report on Lamiaceae-feeding Nepticulidae (Lepidoptera) from South America. *Zootaxa*, 4338 (1), 128–140. <https://doi.org/10.11646/zootaxa.4338.1.6>
- Stonis, J.R., Remeikis, A., Diškus, A. & Gerulaitis, V. (2016f) The Ando-Patagonian *Stigmella magnispinella* group (Lepidoptera, Nepticulidae) with description of new species from Ecuador, Peru and Argentina. *Zootaxa*, 4200 (4), 561–579. <http://doi.org/10.11646/zootaxa.4200.4.7>
- Stonis, J.R., Remeikis, A., Diškus, A. & Megoran, N. (2017d) New species of leaf-mining Nepticulidae (Lepidoptera) from the Neotropical and Ando-Patagonian regions, with new data on host plants. *Zootaxa*, 4272 (1), 1–39. <https://doi.org/10.11646/zootaxa.4272.1.1>
- Stonis, J.R., Remeikis, A., Diškus, A. & Noreika, R. (2013c) New Nepticulidae species (Insecta: Lepidoptera) from the Yucatán Peninsula (SE Mexico). *Zootaxa*, 3609 (2), 223–230. <https://doi.org/10.11646/zootaxa.3609.2.8>
- Stonis, J.R., Remeikis, A., Diškus, A., Orlovskytė, S., Vargas, S.A. & Solis, M.A. (2019b) A new leafmining pest of guava: *Hesperolyra guajavifoliae* sp. nov., with comments on the diagnostics of the endemic Neotropical genus *Hesperolyra* van Nieukerken (Lepidoptera, Nepticulidae). *ZooKeys*, 900: 87–110. <https://doi.org/10.3897/zookeys.900.46332>
- Stonis, J.R., Remeikis, A., Diškus, A. & Solis, M.A. (2017e) The American species of the genus *Glaucolepis* Braun, 1917 (*Neotrifurcula* van Nieukerken, syn. nov.) (Lepidoptera: Nepticulidae). *Zootaxa*, 4338 (3), 489–506. <https://doi.org/10.11646/zootaxa.4338.3.5>

- Stonis, J.R., Remeikis, A. & Vargas, S.A. (2019c) Colombian Nepticuloidea and Tischerioidea: a small step out of obscurity. *Biologija*, 65 (2), 67–79. <https://doi.org/10.6001/biologija.v65i2.4023>
- Šimkevičiūtė, A., Stonis, J.R. & Diškus, A. (2009) Taxonomic checklist of Nepticulidae of Mexico, with the description of three new species from the Pacific Coast (Insecta, Lepidoptera). *Acta Zoologica Lituanica*, 19 (4), 268–277. <https://doi.org/10.2478/v10043-009-0037-0>
- Wilkinson, C. (1979) A taxonomic study of the micro-lepidopteran genera *Microcalyptris* Braun and *Fomoria* Beirne occurring in the United States of America (Lepidoptera, Nepticulidae). *Tijdschrift voor Entomologie*, 122 (4), 59–90. <http://biostor.org/reference/49894>
- Zeller, P.C. (1873) Beiträge zur Kenntniss der nordamericanischen Nachtfalter, besonders der Microlepidopteren. Zweite Abtheilung. *Verhandlungen (der Kaiserlich-Königlichen) Zoologisch – Botanischen Gesellschaft in Wien*, 23, 201–334. <https://biostor.org/reference/99971>
- Zeller, P.C. (1877) Exotische Microlepidoptera. II. *Horae Societatis Entomologicae Rossicae*, 13, 289–493. <http://biodiversitylibrary.org/page/12834243>

ILLUSTRATED SPECIES REVIEW

(by J. R. Stonis, A. Remeikis)

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Genus *Simplimorpha* Scoble

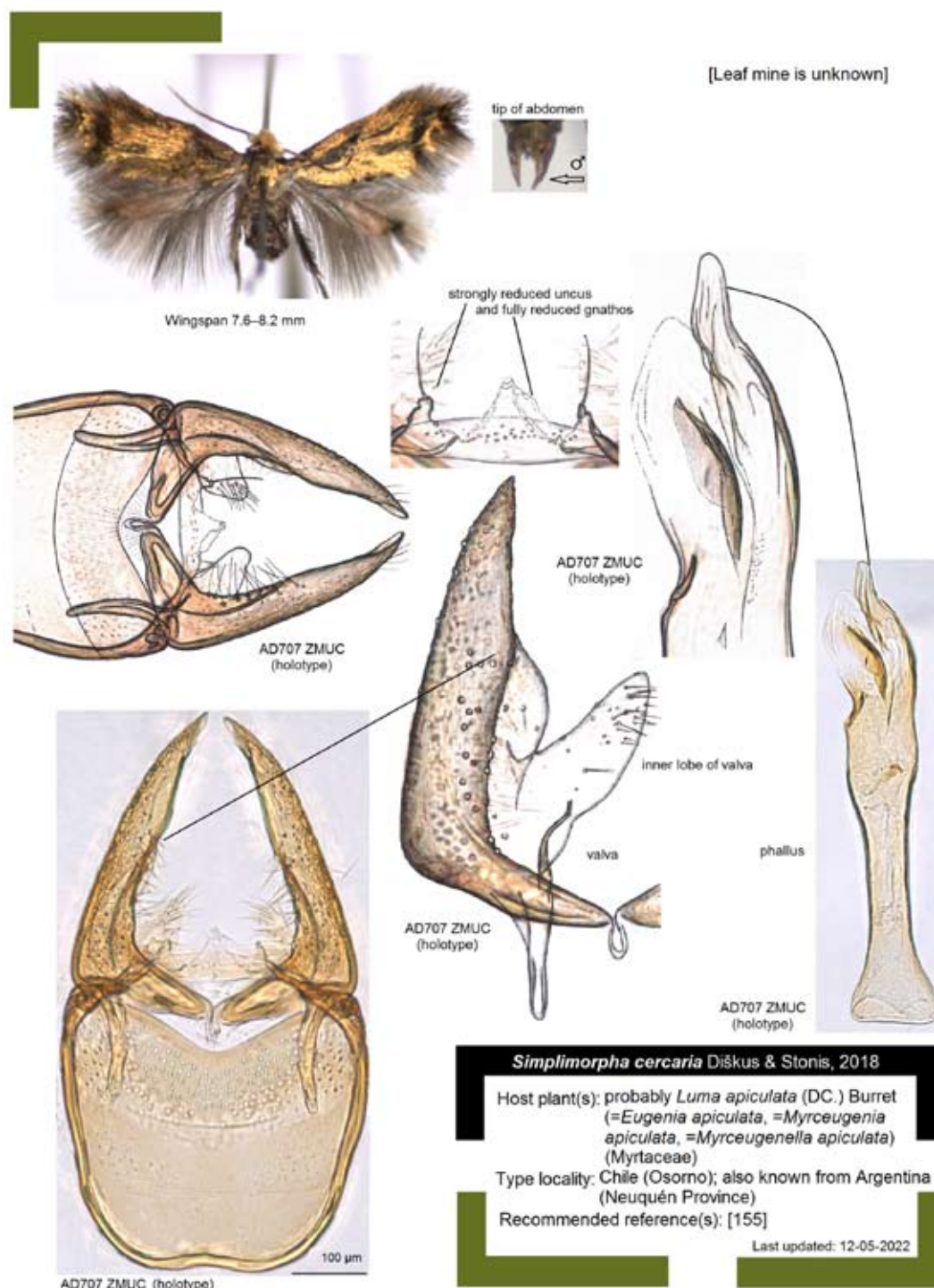


Figure 187. *Simplimorpha cercaria* Diškus & Stonis, described as a species of the subgenus *Myrtinepticula* Stonis & Diškus (see “A Gondwanan concept of *Simplimorpha* Scoble: a step toward clarity in the generic diagnostics of global Nepticulidae” by Stonis *et al.*, 2018).

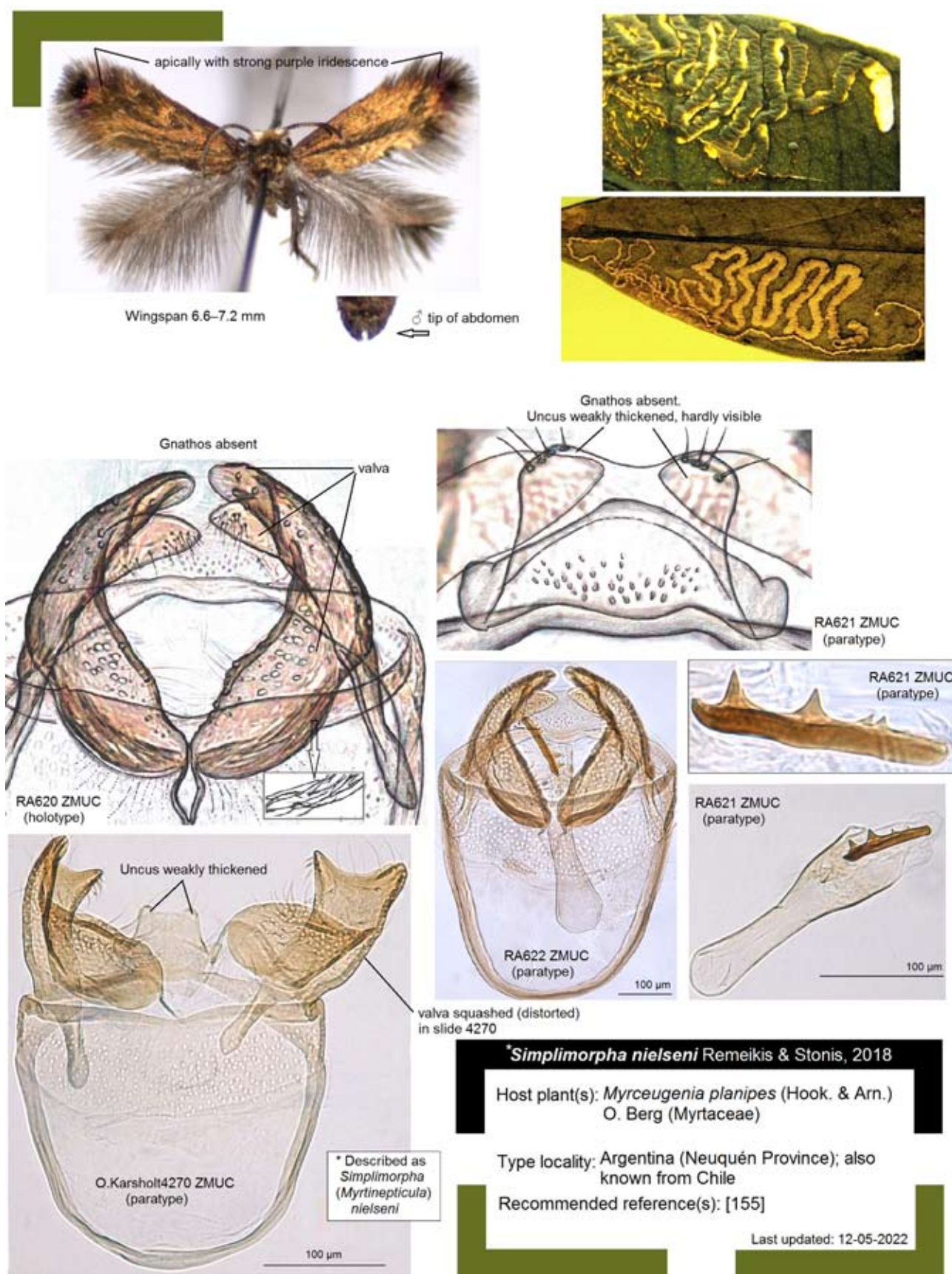


Figure 188. *Simplimorpha nielsen* Remeikis & Stonis, described as a species of the subgenus *Myrtinepticula* Stonis & Diškus (see “A Gondwanan concept of *Simplimorpha* Scoble: a step toward clarity in the generic diagnostics of global Nepticulidae” by Stonis *et al.*, 2018).

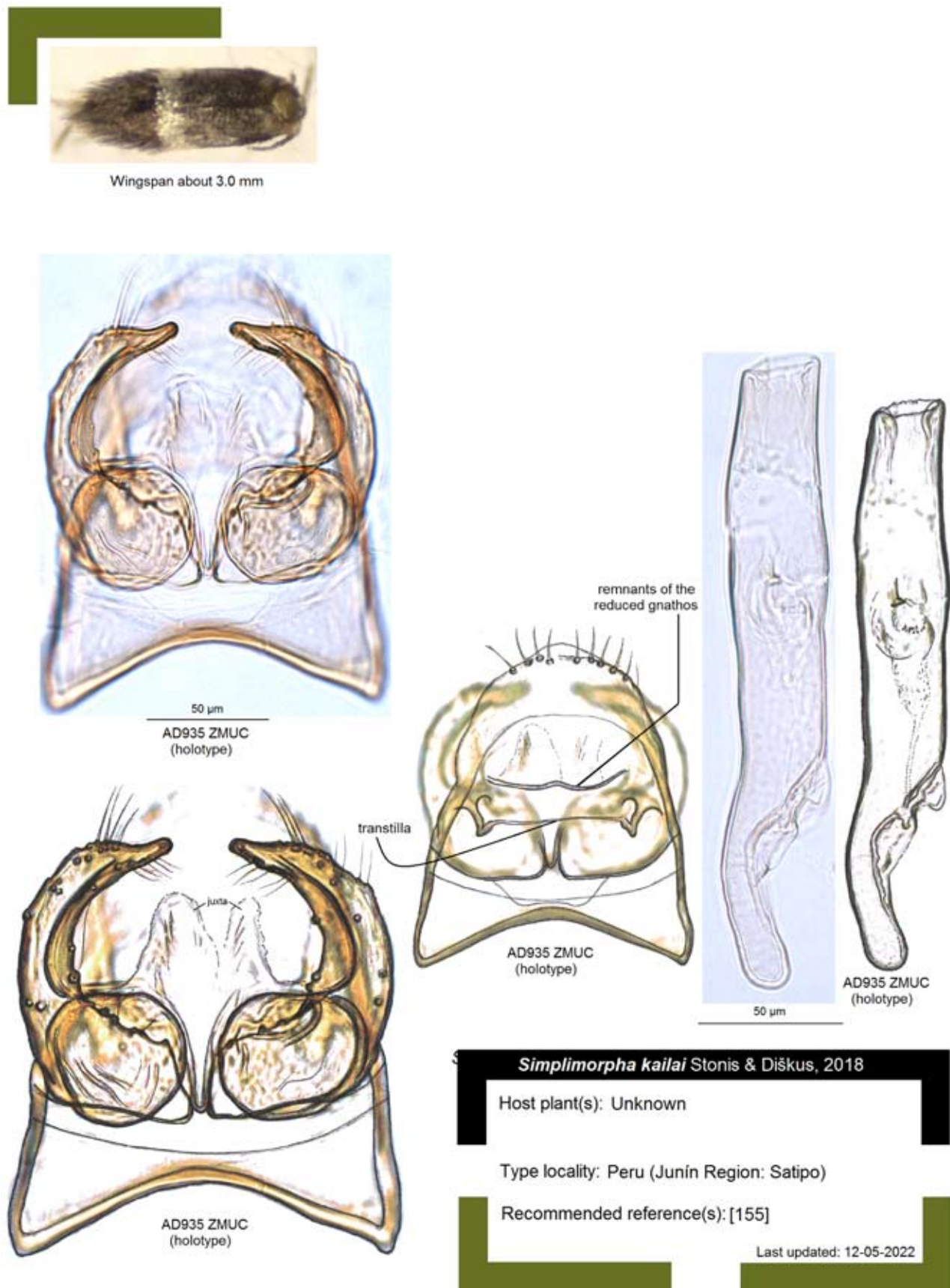


Figure 189. *Simplimorpha kailai* Stonis & Diškus, described as a species of the subgenus *Myrtinepticula* Stonis & Diškus (see “A Gondwanan concept of *Simplimorpha* Scoble: a step toward clarity in the generic diagnostics of global Nepticulidae” by Stonis *et al.*, 2018).



Male is unknown.
The species was described from a female only



****Simplimorpha sapphirella* Remeikis & Stonis, 2018**

Host plant(s): Unknown

Type locality: Chile (Cauquenes: Alto Tregualemu)

Recommended reference(s): [155]

Last updated: 12-05-2022

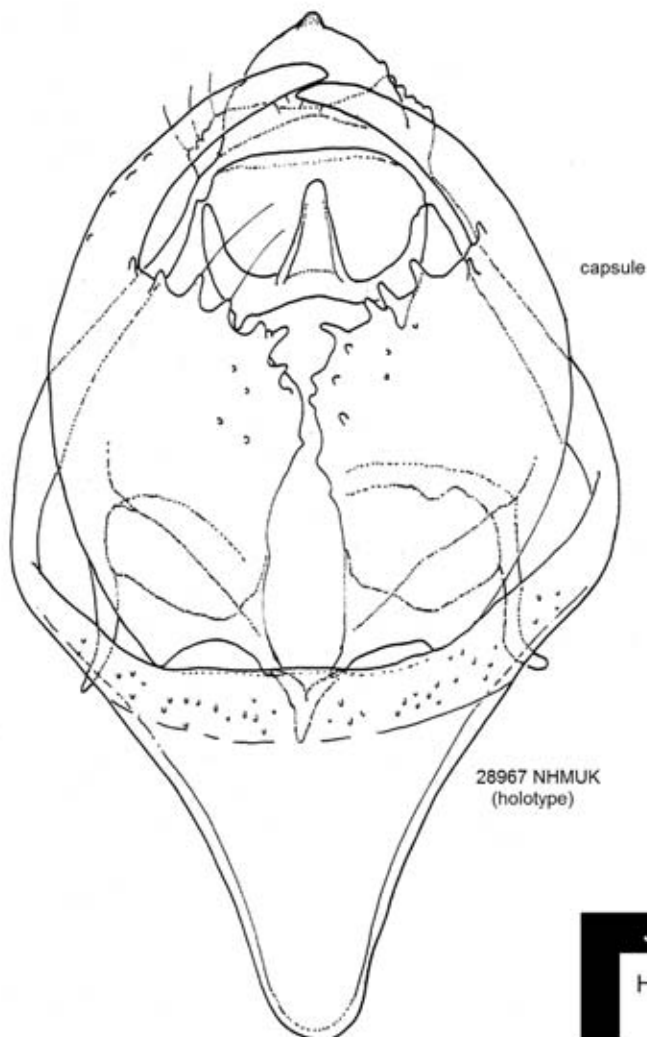
* This species was described as
Simplimorpha (Myrtinepticula) sapphirella

Figure 190. *Simplimorpha sapphirella* Remeikis & Stonis, described as a species of the subgenus *Myrtinepticula* Stonis & Diškus (see “A Gondwanan concept of *Simplimorpha* Scoble: a step toward clarity in the generic diagnostics of global Nepticulidae” by Stonis *et al.*, 2018).

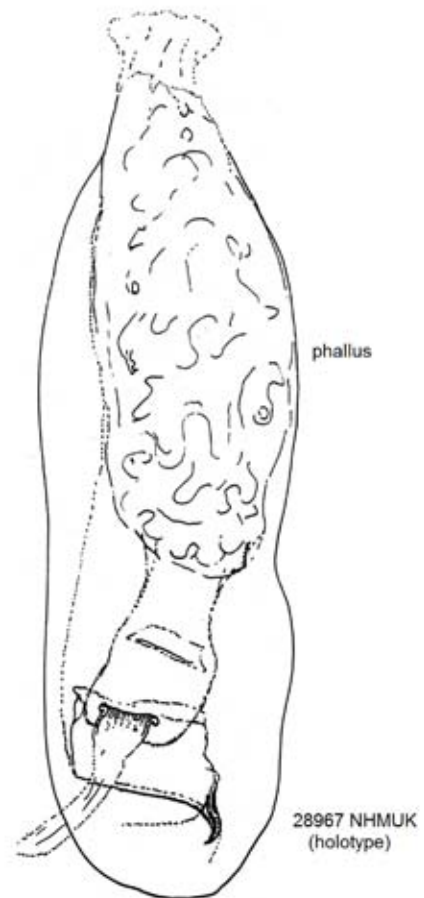
Genus *Johanssoniella* Koçak



Wingspan about 7.4 mm
(after Puplesis & Robinson, 2000)



28967 NHMUK
(holotype)



28967 NHMUK
(holotype)

***Johanssoniella hilli* (Puplesis & Robinson, 2000)**

Host plant(s): Unknown

Type locality: Belize (Chiquibul Forest Reserve)

Recommended reference(s): [71], [154]

Last updated: 10-05-2022

Figure 191. A species profile of *Johanssoniella hilli* (Puplesis & Robinson).

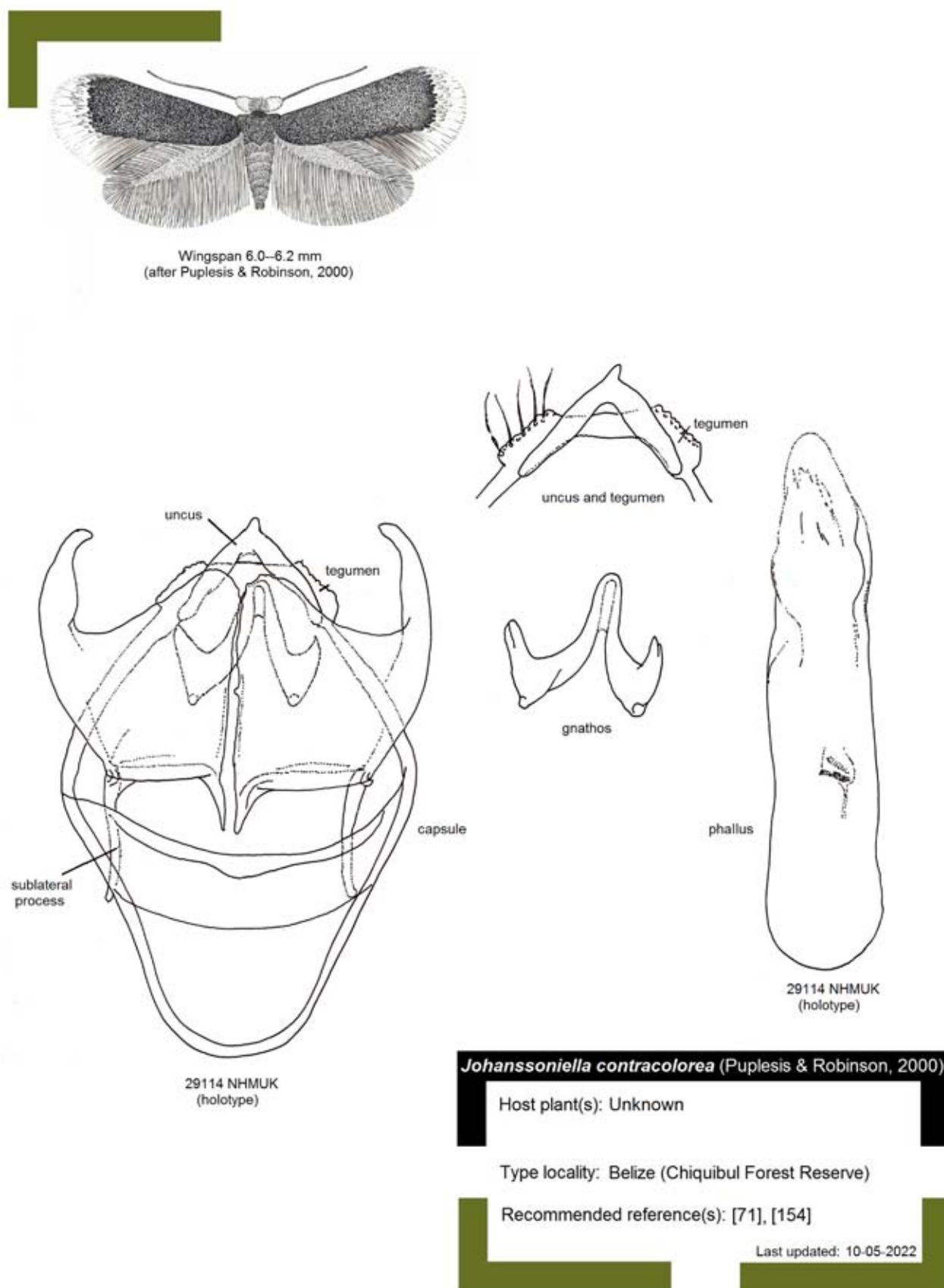


Figure 192. A species profile of *Johanssoniella contracolorea* (Puplesis & Robinson).

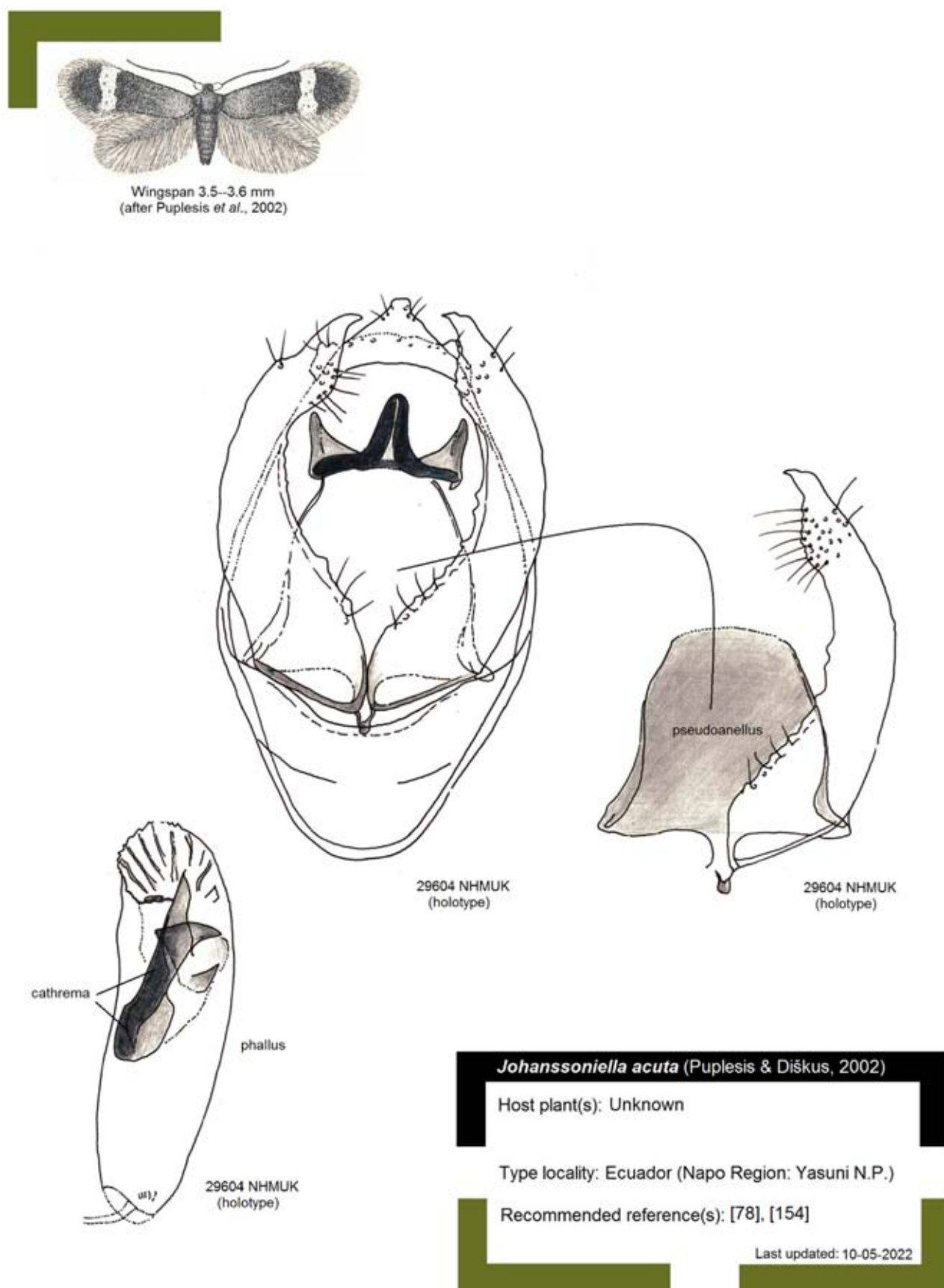


Figure 193. A species profile of *Johanssoniella acuta* (Puplesis & Diškus).

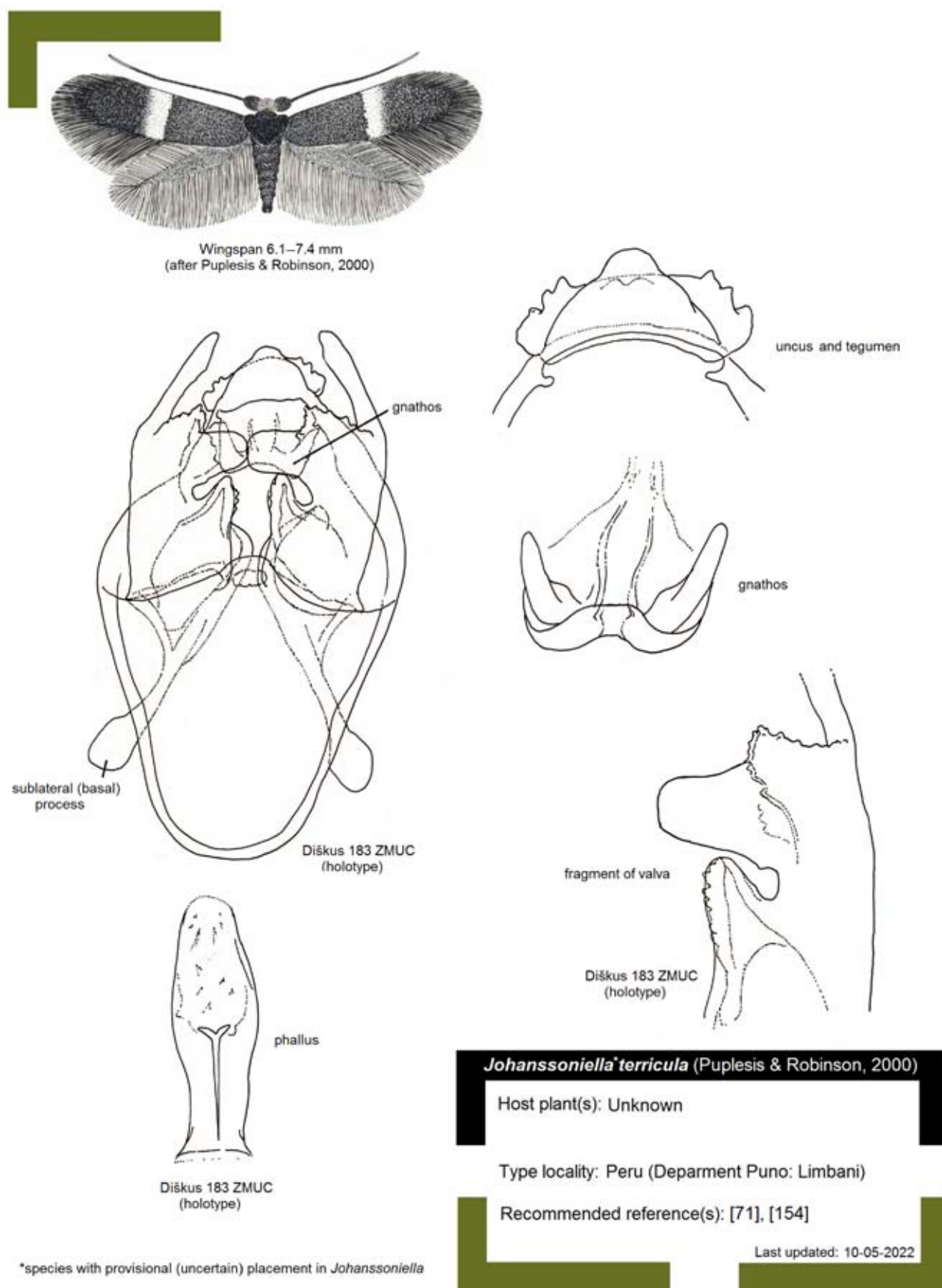


Figure 194. A species profile of *Johanssoniella terricola* (Puplesis & Robinson).

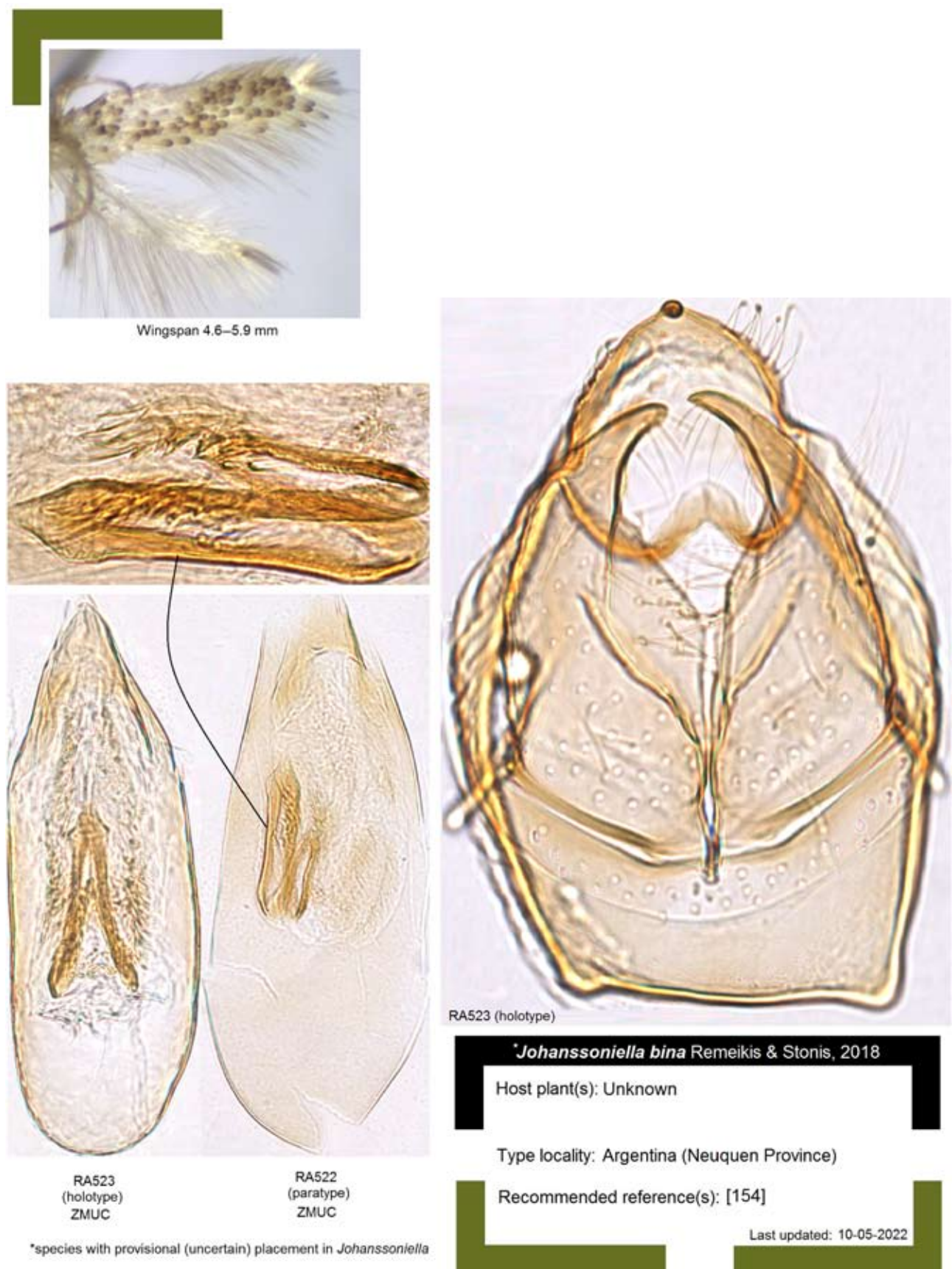


Figure 195. *Johanssoniella bina* Remeikis & Stonis, a species of uncertain placement in *Johanssoniella*.

Genus *Brachinepticula* Stonis & Diškus

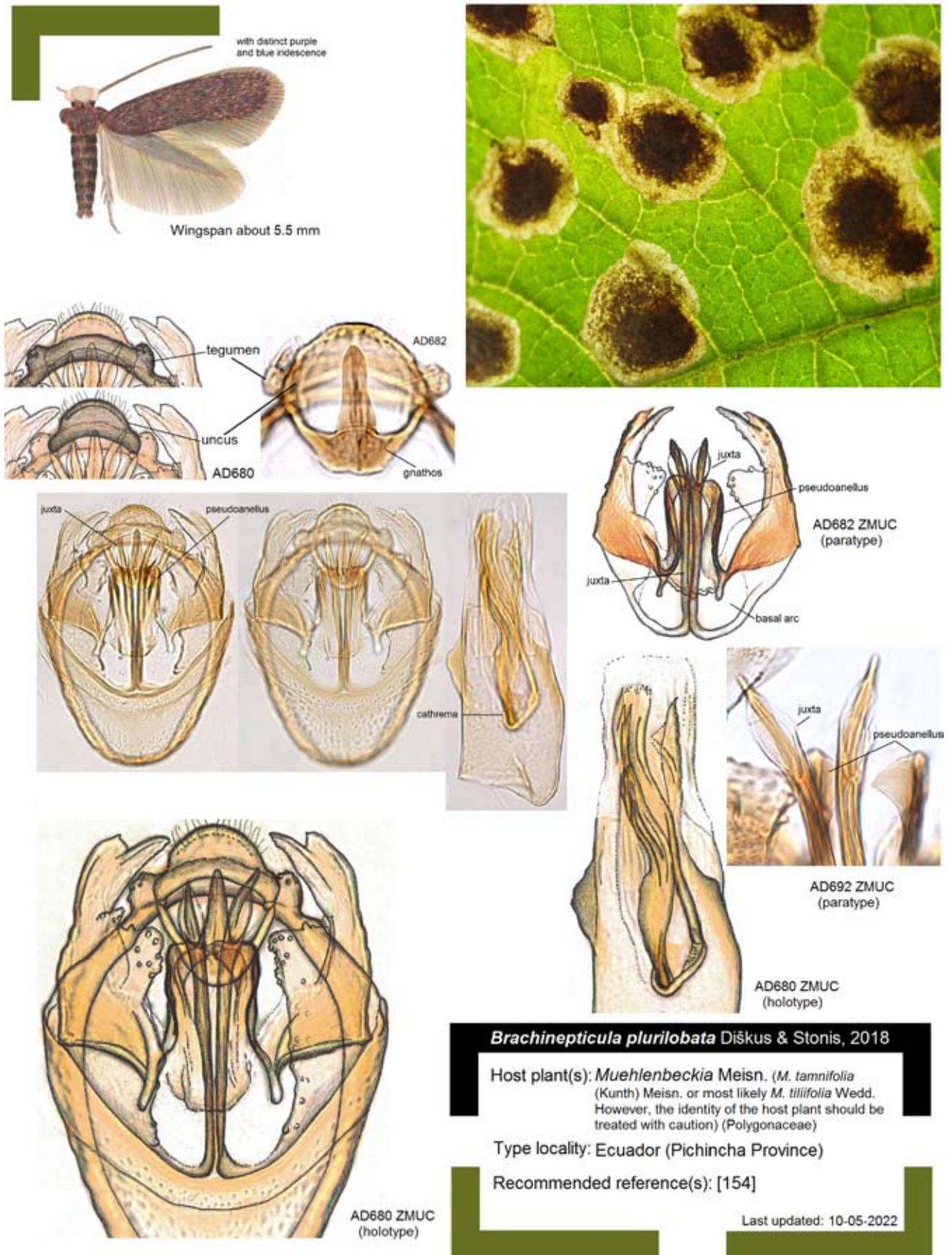


Figure 196. A species profile of *Brachinepticula plurilobata* Diškus & Stonis.

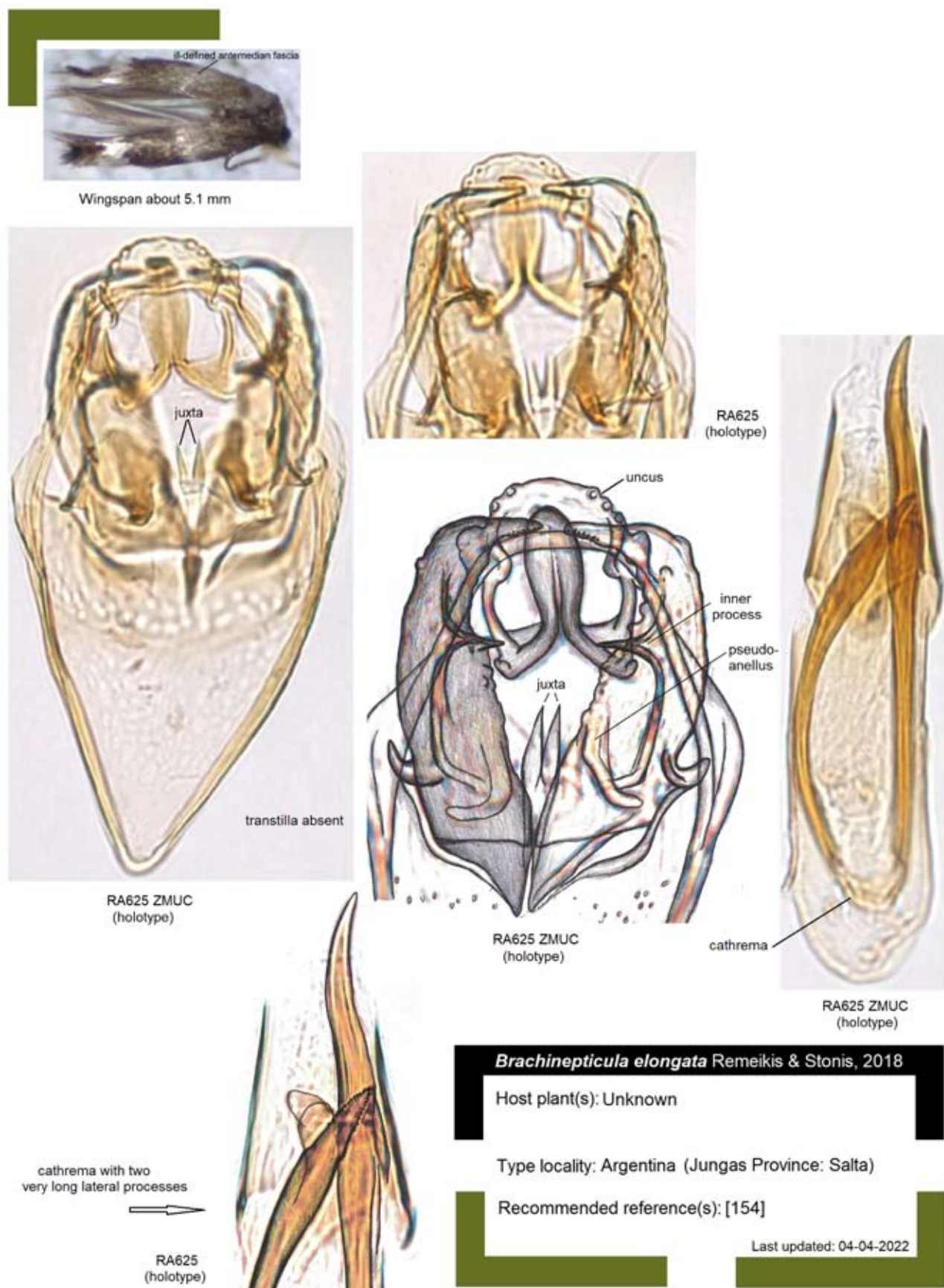
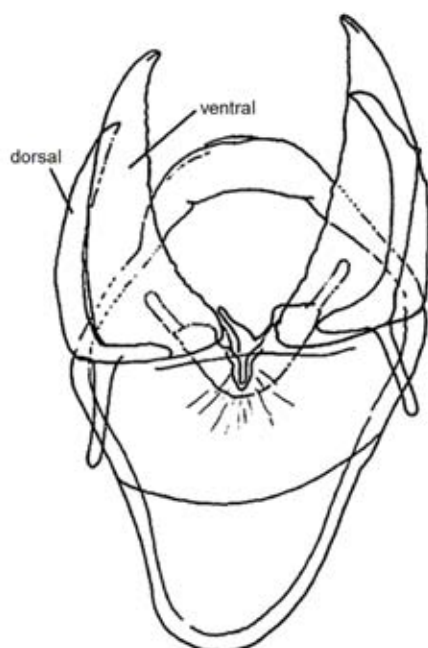


Figure 197. A species profile of *Brachinepticula elongata* Remeikis & Stonis.

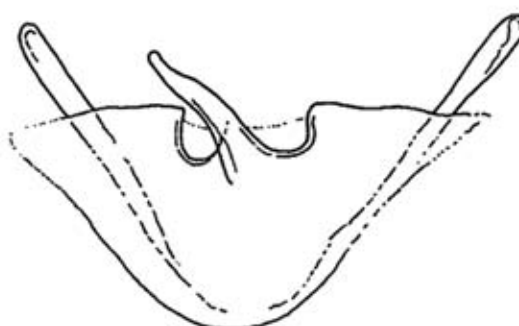
Genus *Enteucha* Meyrick



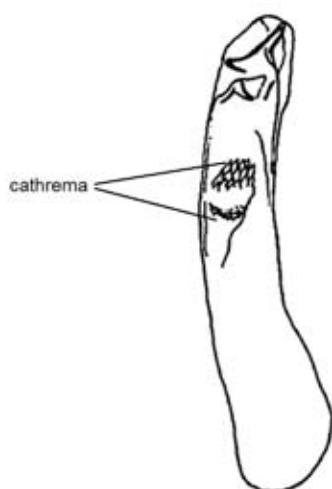
Wingspan about 6.0 mm
(after Puplesis & Robinson, 2000)



capsule: holotype, 19273 NHMUK
(after Puplesis & Robinson, 2000)



gnathos: holotype, 19273 NHMUK
(after Puplesis & Robinson, 2000)



phallus: holotype, 19273 NHMUK
(after Puplesis & Robinson, 2000)

Enteucha cyanochlora Meyrick, 1915

Host plant(s): Unknown
(probably Polygonaceae)

Type locality: South America: Guyana (Bartica)

Recommended reference(s): [37], [71], [154]

Last updated: 10-05-2022

Figure 198. A species profile of *Enteucha cyanochlora* Meyrick.

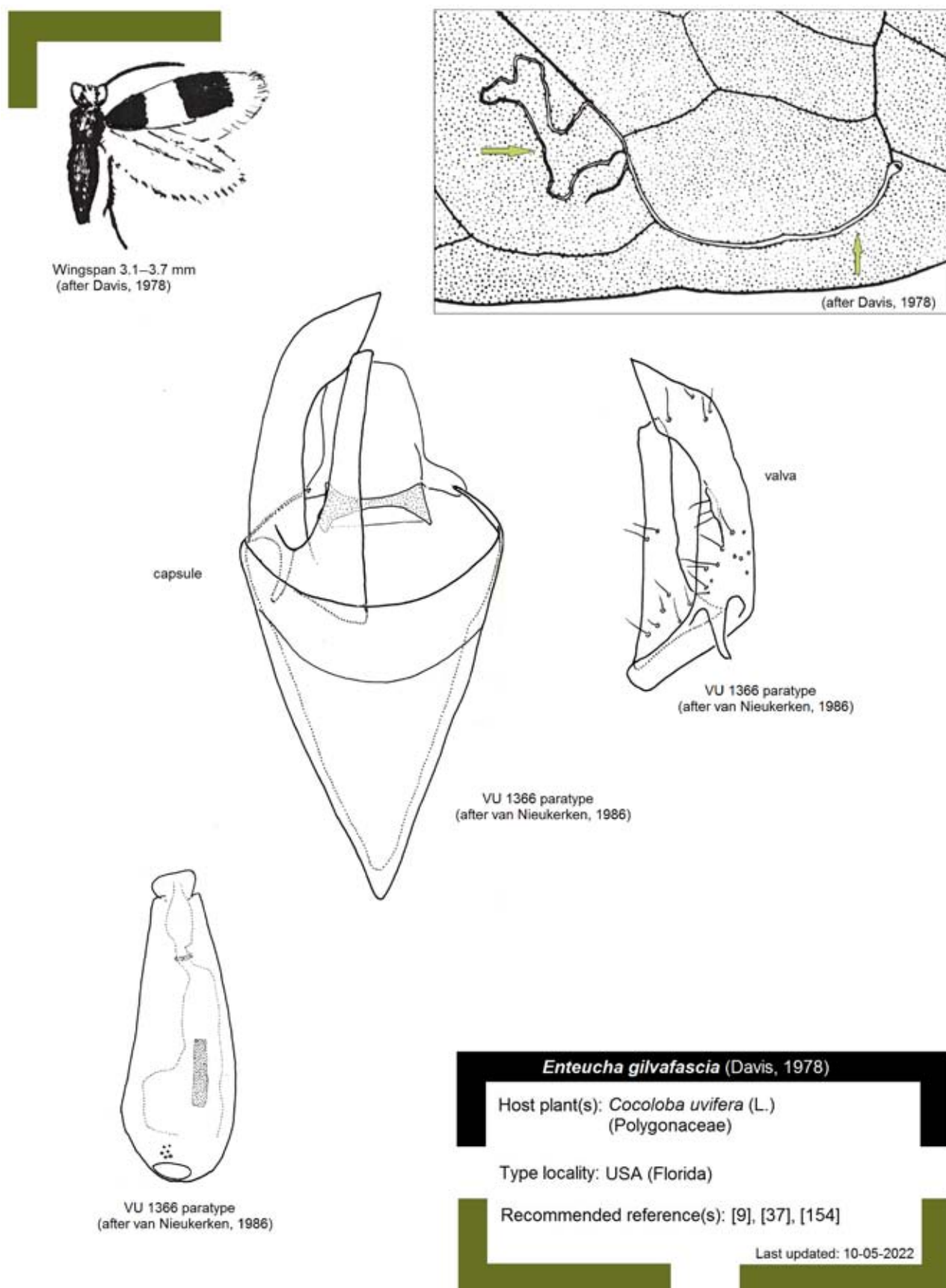


Figure 199. A species profile of *Enteucha gilvafascia* (Davis).

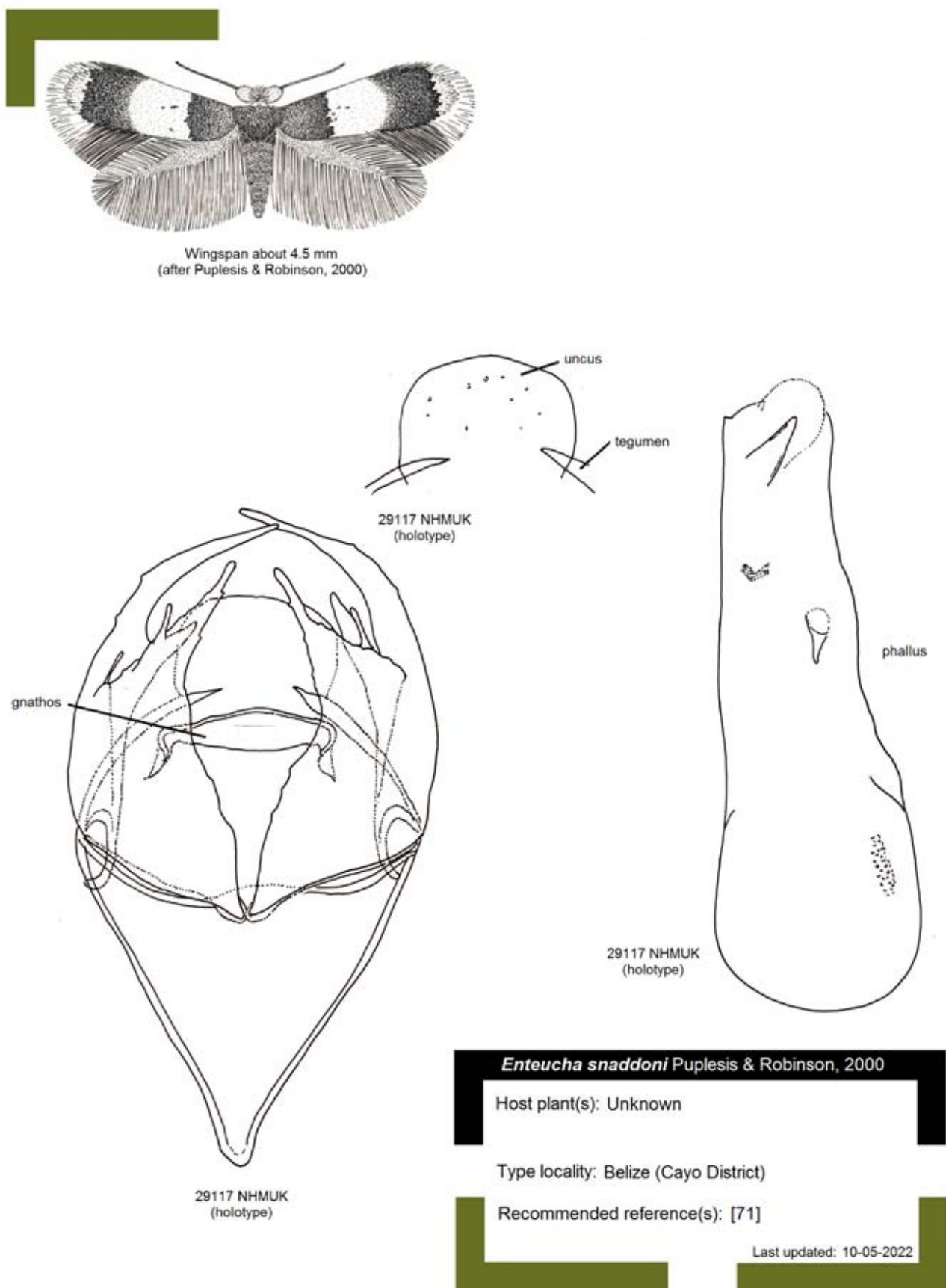


Figure 200. A species profile of *Enteucha snaddonii* Puplesis & Robinson.

Genus *Manoneura* Davis

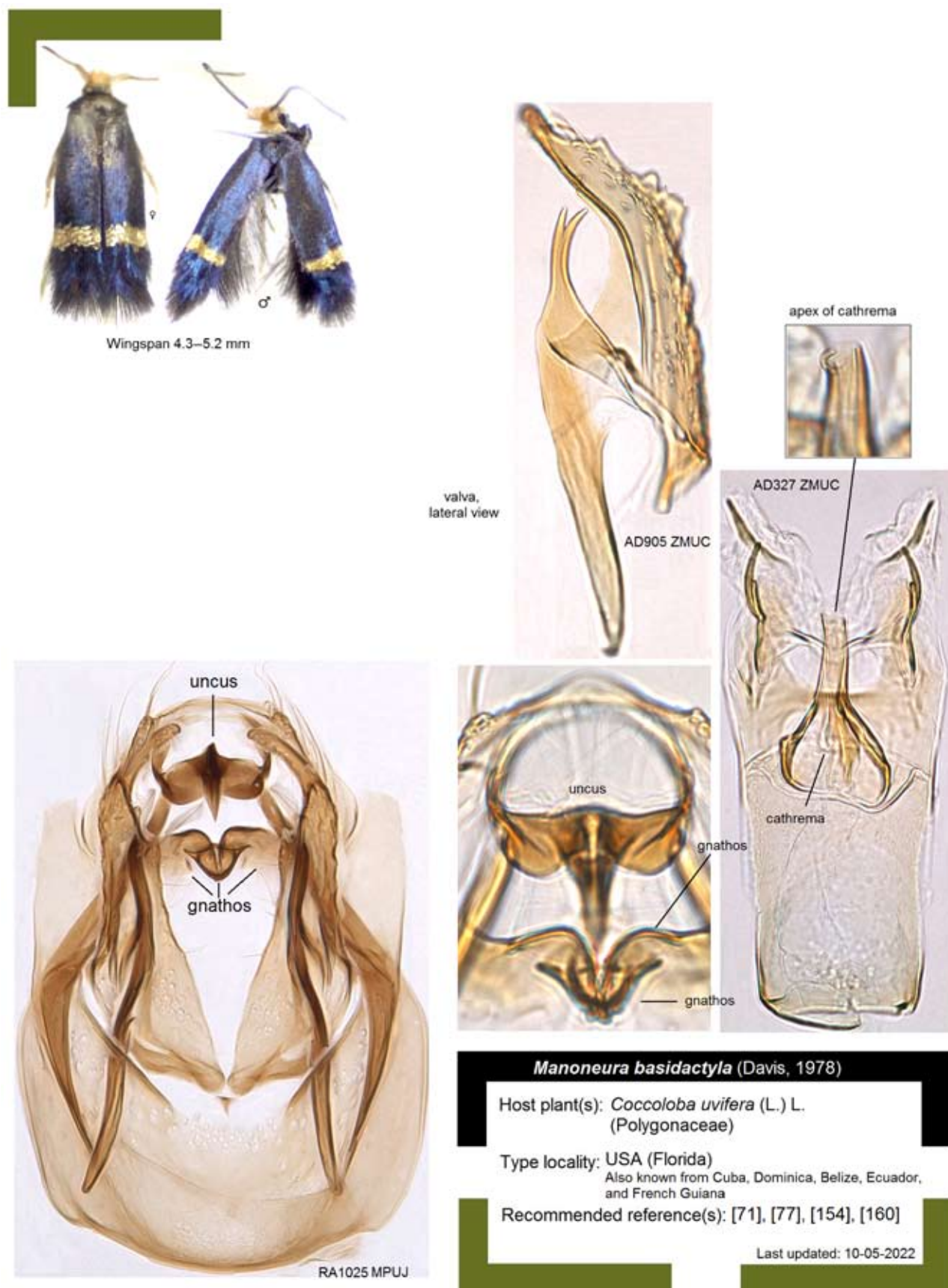


Figure 201. A species profile of *Manoneura basidactyla* (Davis).

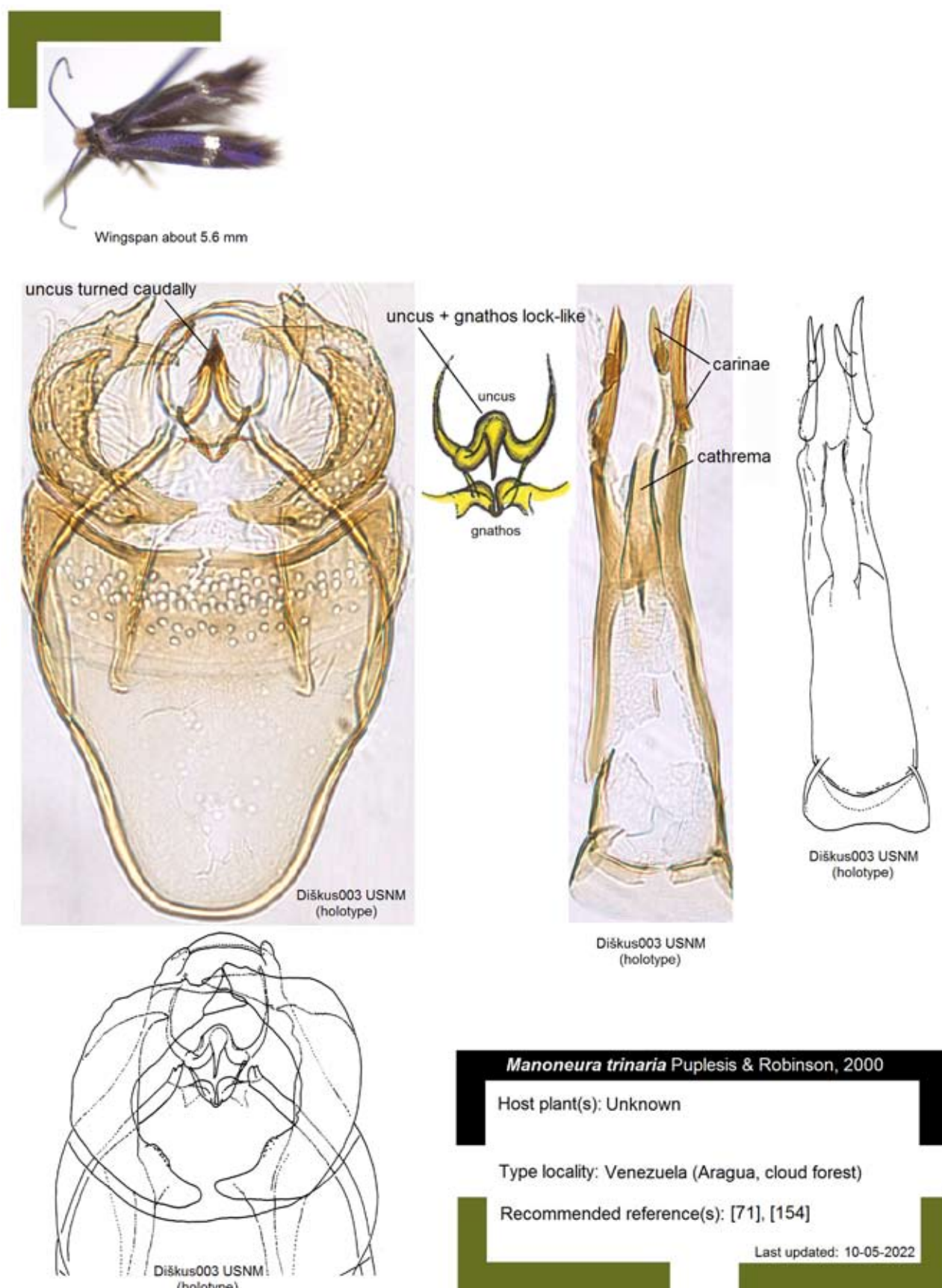
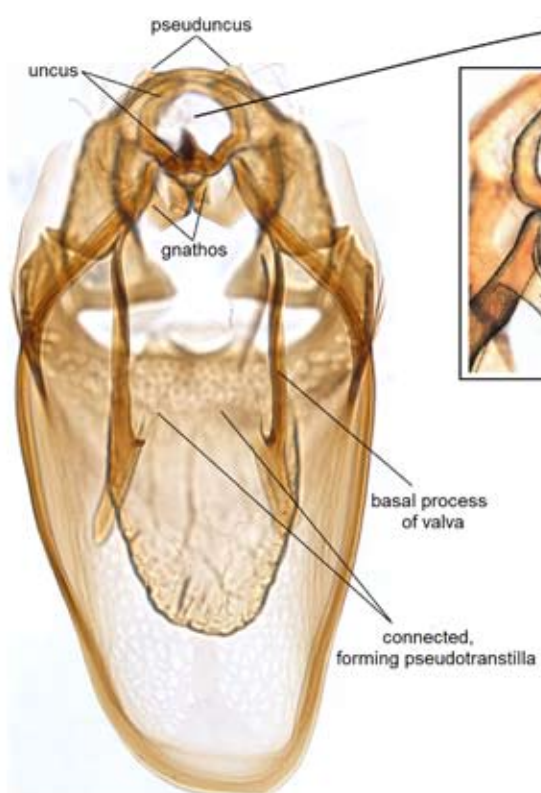


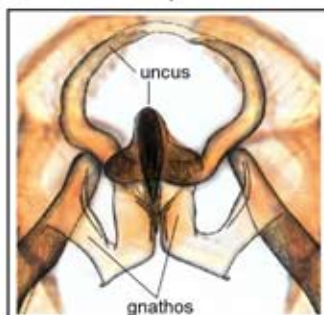
Figure 202. A species profile of *Manoneura trinararia* Puplesis & Robinson.



Wingspan about 5.9 mm



RA552 ZMUC
(holotype)



RA552 ZMUC
(holotype)



RA552 ZMUC
(holotype)

***Manoneura forcipis* Remeikis & Stonis, 2017**

Host plant(s): Unknown

Type locality: Peru (Dept. Apurimac)

Recommended reference(s): [151]

Last updated: 13-09-2021

Figure 203. A species profile of *Manoneura forcipis* Remeikis & Stonis.

Genus *Ozadelpha* van Nieuwerkerken

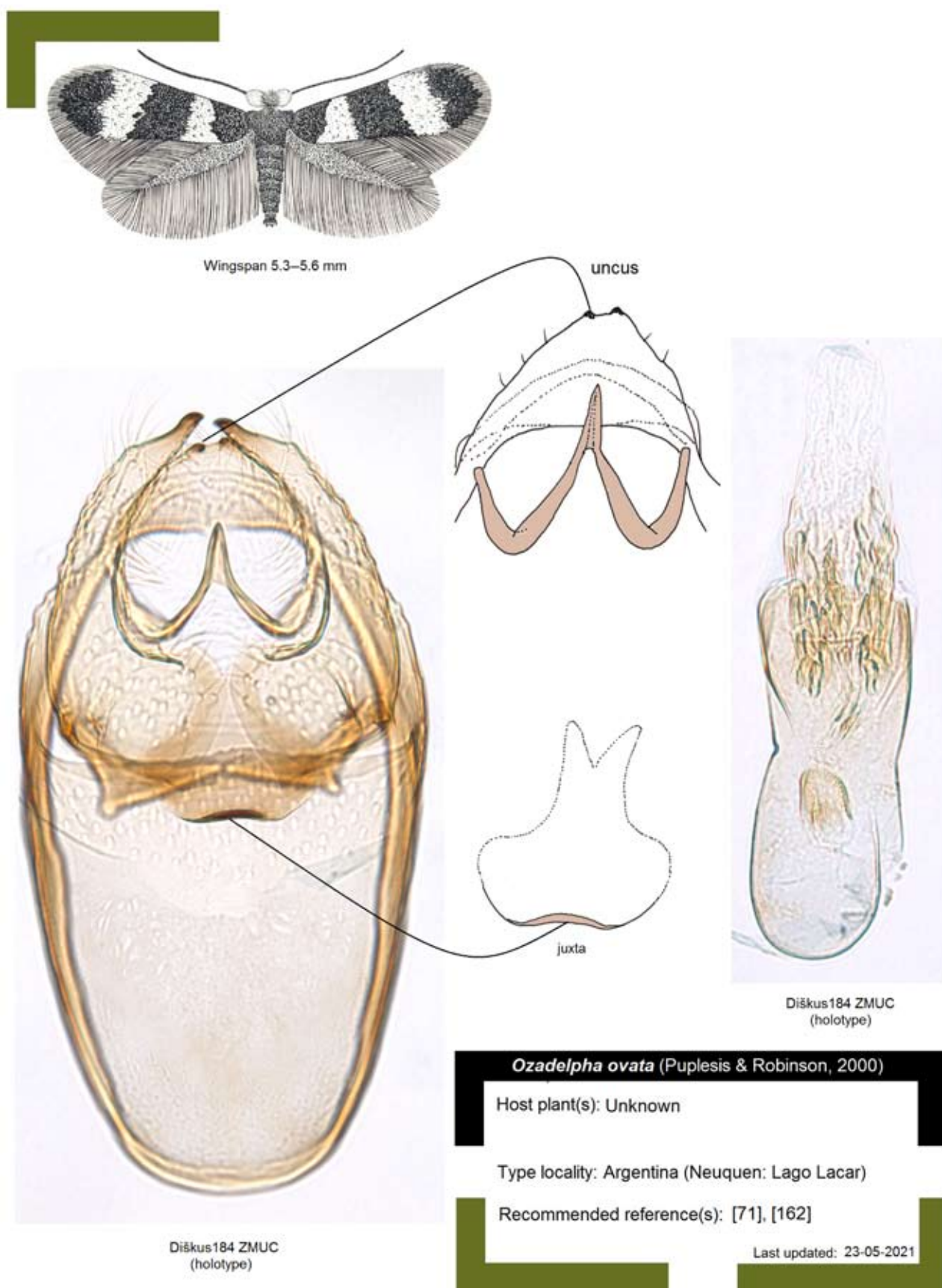


Figure 204. A species profile of *Ozadelpha ovata* (Puplesis & Robinson).



***Ozadelpha rionegrella* Remeikis & Dobrynina, 2021**

Host plant(s): Unknown

Type locality: Argentina (Rio Negro: Lago Nahuel Huapi)

Recommended reference(s): [170]

Last updated: 23-05-2021

Figure 205. A species profile of *Ozadelpha rionegrella* Remeikis & Dobrynina.

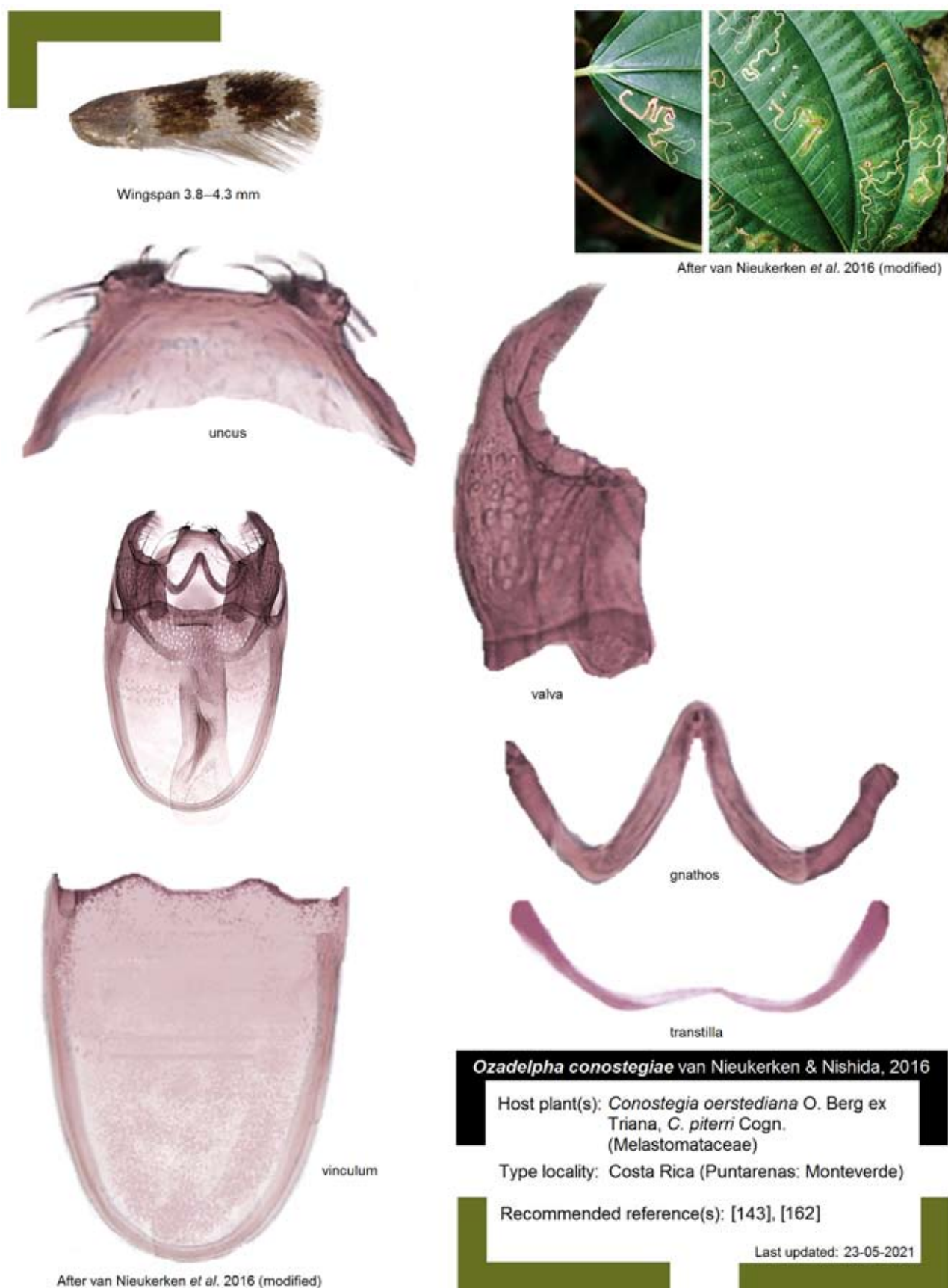


Figure 206. A species profile of *Ozadelpha conostegiae* van Nieukerken & Nishida.

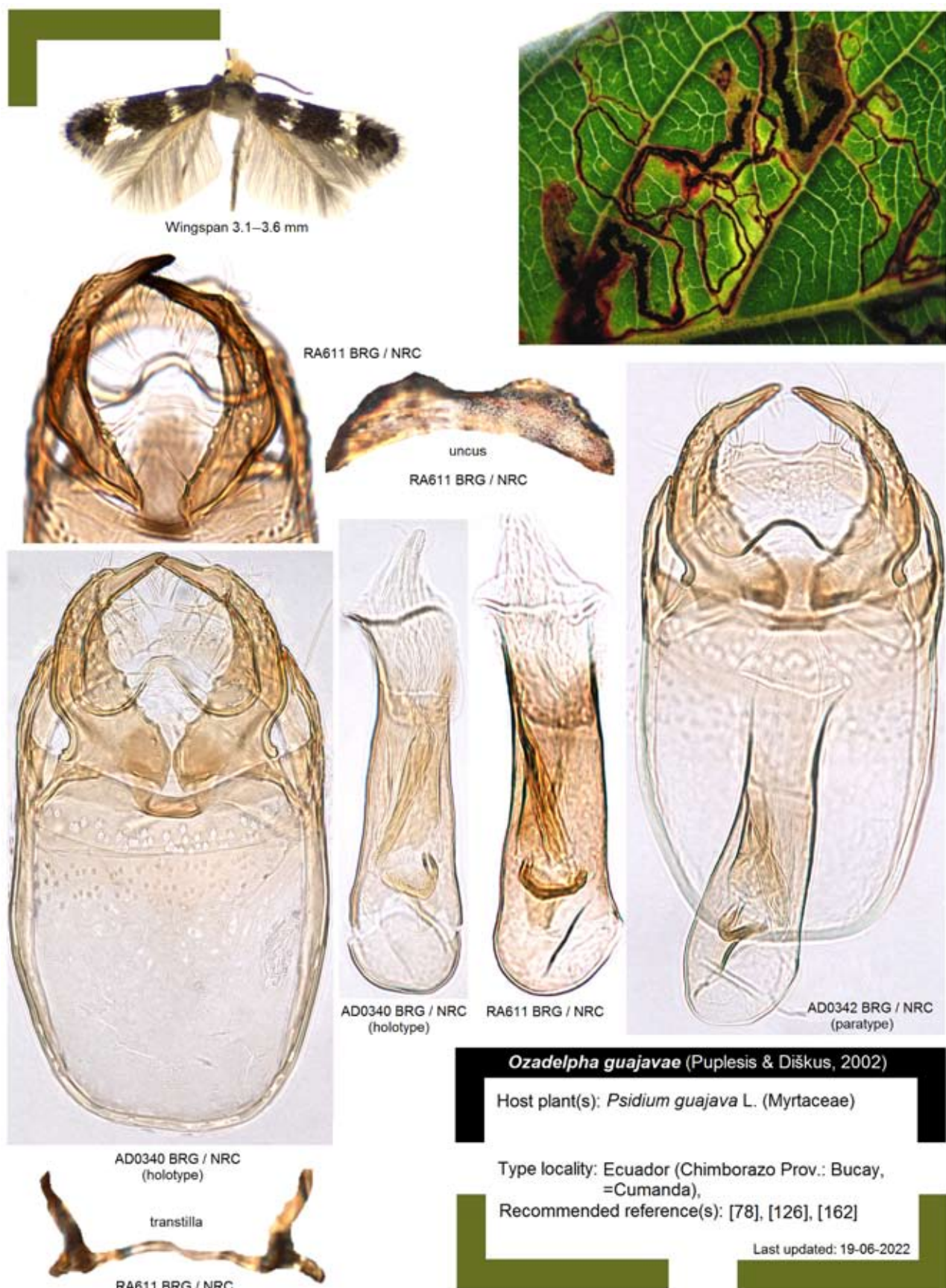


Figure 207. A species profile of *Ozadelpha guajavae* (Puplesis & Diškus).

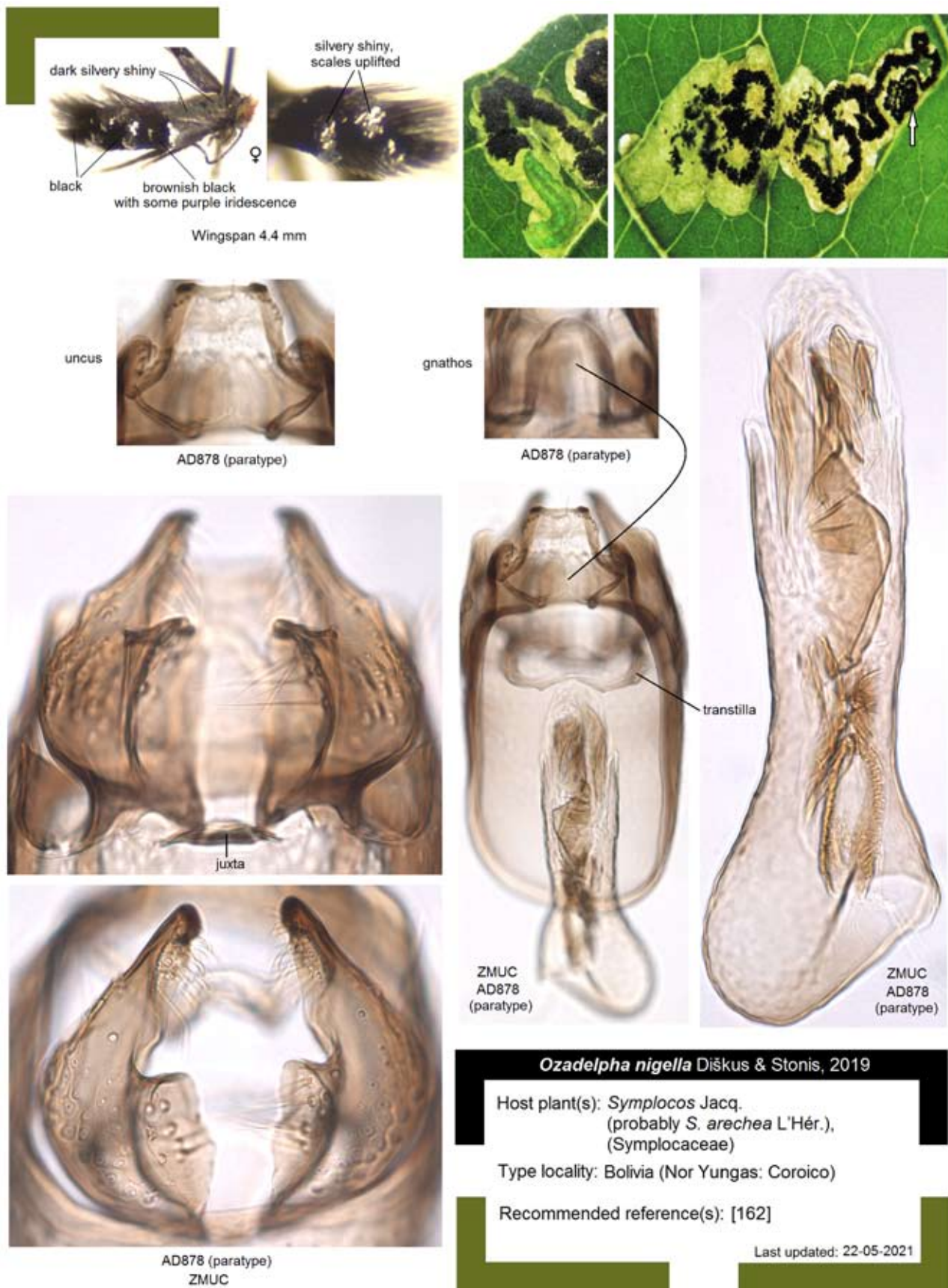


Figure 208. A species profile of *Ozadelpha nigella* Diškus & Stonis, 2019

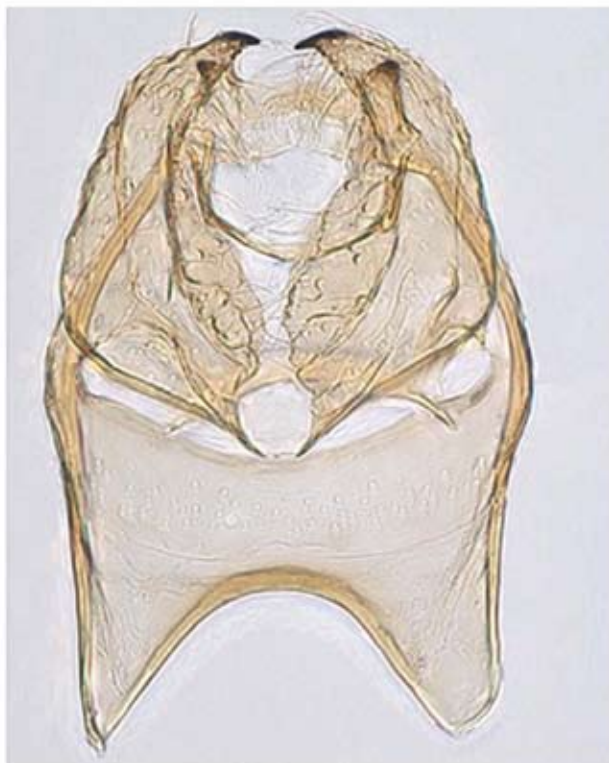
Genus *Stigmella* Schrank



Wingspan 2.8–3.3 mm



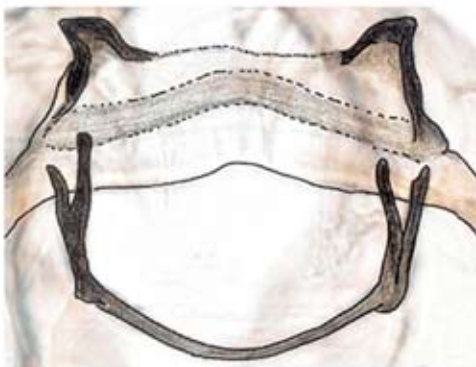
with black androconia



RA473 ZMUC
(holotype)



RA473 ZMUC
(holotype)



RA473 ZMUC
(holotype)

***Stigmella maya* Remeikis & Stonis, 2013**

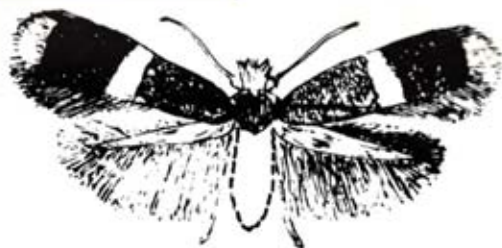
Host plant(s): *Karwinskia humboldtiana* (Schult.)
Zucc. (Rhamnaceae)

Type locality: Mexico (Yucatán, Tulum)

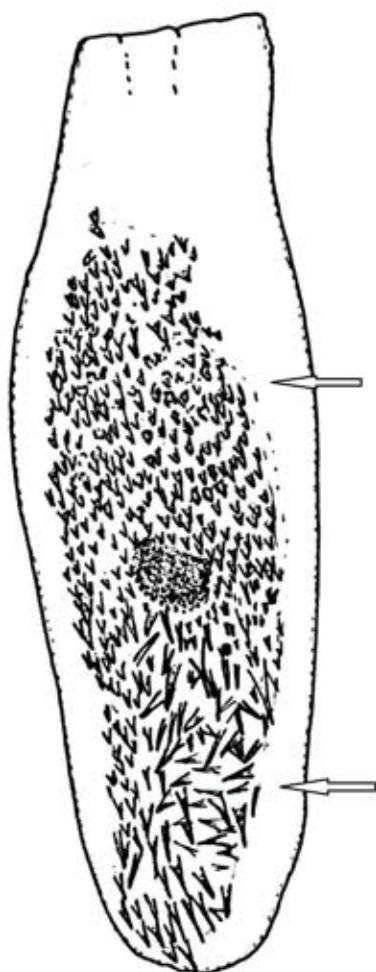
Recommended reference(s): [114], [167]

Last updated: 04-04-2022

Figure 209. *Stigmella maya* Remeikis & Stonis, a species attributed to the *S. maya* group.

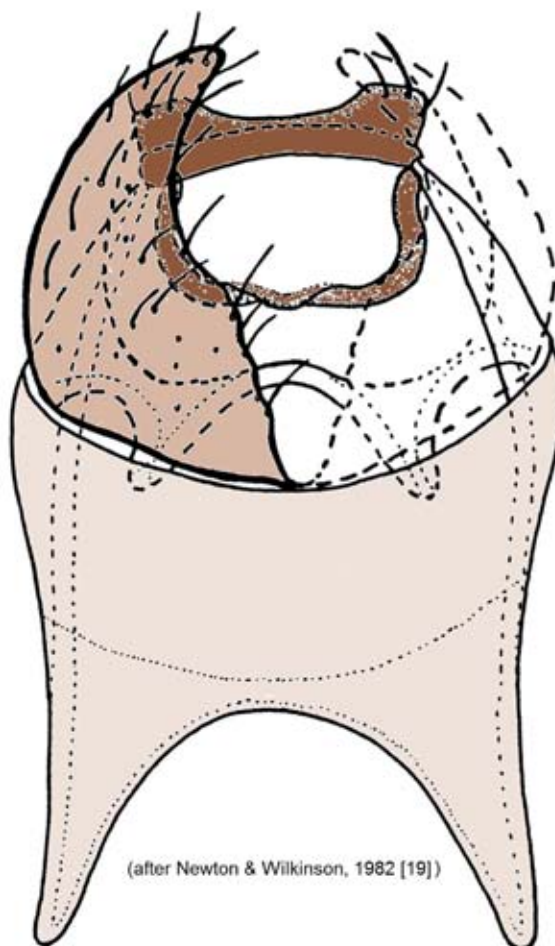


Wingspan about 3.1 mm
(after Newton & Wilkinson, 1982 [19])



(after Newton & Wilkinson, 1982 [19])

* = *Condalia ferrea* (Vahl) Griseb.



(after Newton & Wilkinson, 1982 [19])

***Stigmella condaliafoliella* (Busck, 1900)**

Host plant(s): * *Krugiodendron ferreum* (Vahl) Urb.
(Rhamnaceae)

Type locality: USA (Florida)

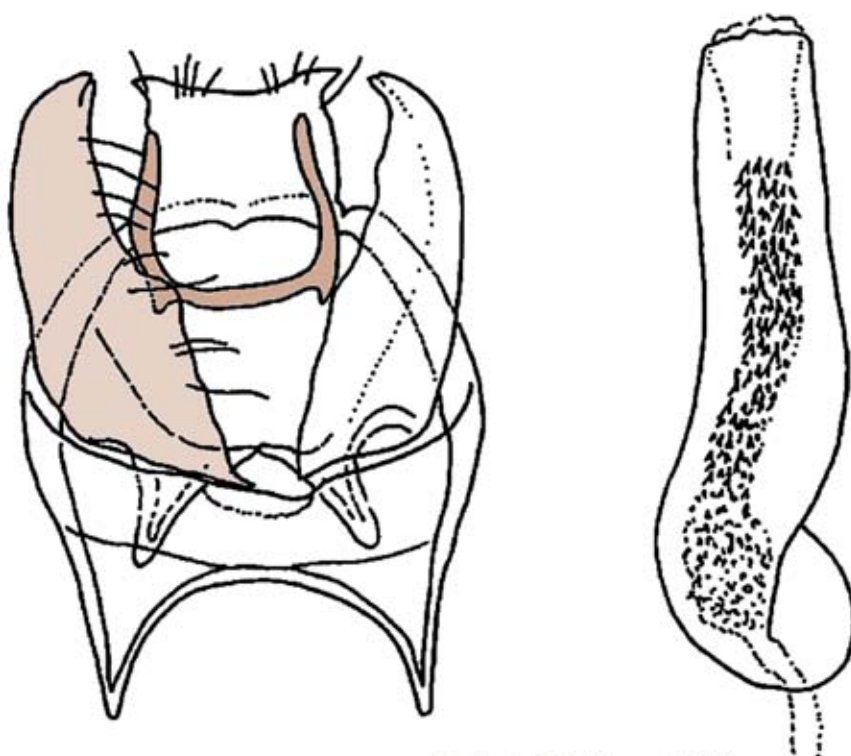
Recommended reference(s): [19]

Last updated: 19-05-2022

Figure 210. *Stigmella condaliafoliella* (Busck), a species attributed to the *S. maya* group.



Wingspan about 6.5 mm
(after Puplesis & Robinson, 2000)



(after Newton & Wilkinson, 1982 [19])

***Stigmella gossypii* (Forbes & Leonard, 1930)**

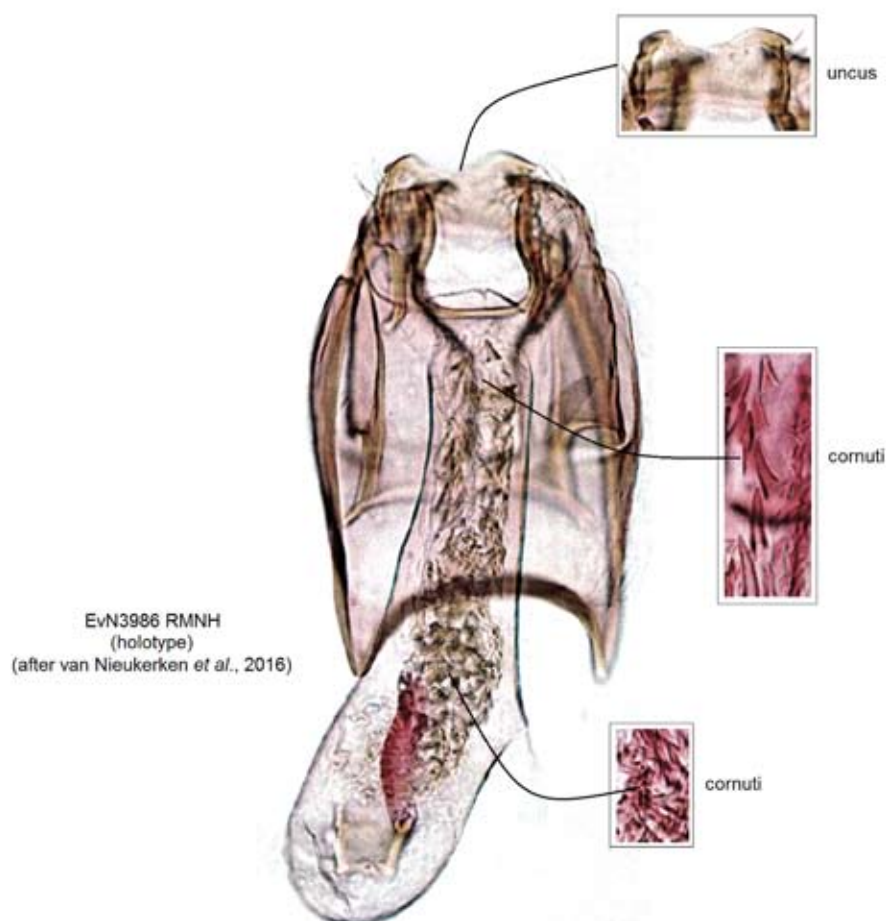
Host plant(s): *Gossypium barbadense* L.,
G. hirsutum L.
(Malvaceae)

Locality: Puerto Rico; USA (Florida)

Recommended reference(s): [19], [71]

Last updated: 11-05-2022

Figure 211. *Stigmella gossypii* (Forbes & Leonard), a species attributed to the *S. maya* group.



***Stigmella schinivora* van Nieukerken, 2016**

Host plant(s): *Schinus terebinthifolia* Raddi
(Anacardiaceae)

Type locality: Argentina (Cataras del Iguazú)

Recommended reference(s): [143]

Last updated: 18-05-2022

Figure 212. *Stigmella schinivora* van Nieukerken, a species attributed to the *S. maya* group.

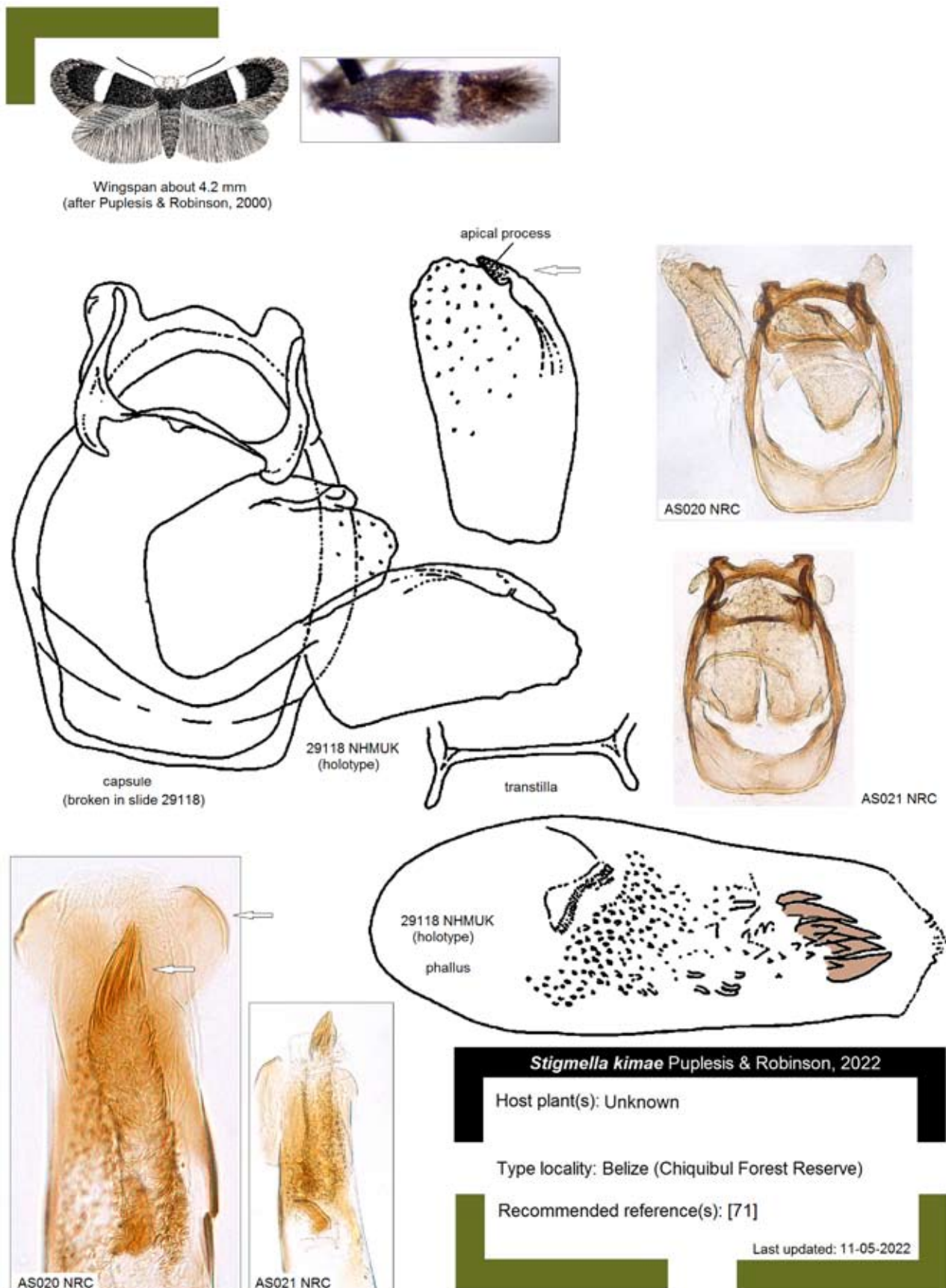


Figure 213. *Stigmella kimae* Puplesis & Robinson, a species attributed to the *S. tiliella* group.

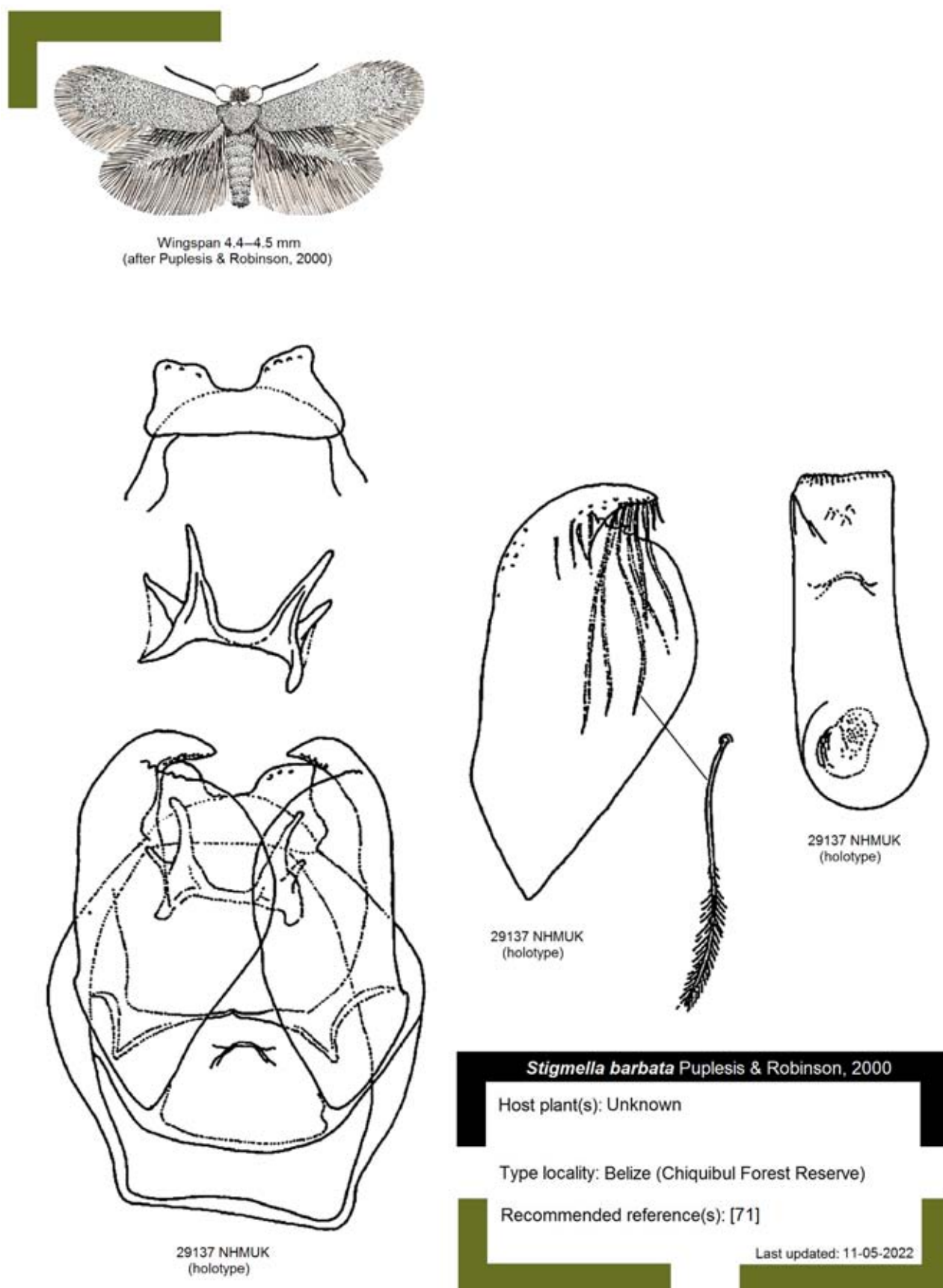


Figure 214. *Stigmella barbata* Puplesis & Robinson, a species attributed to the *S. barbata* group.

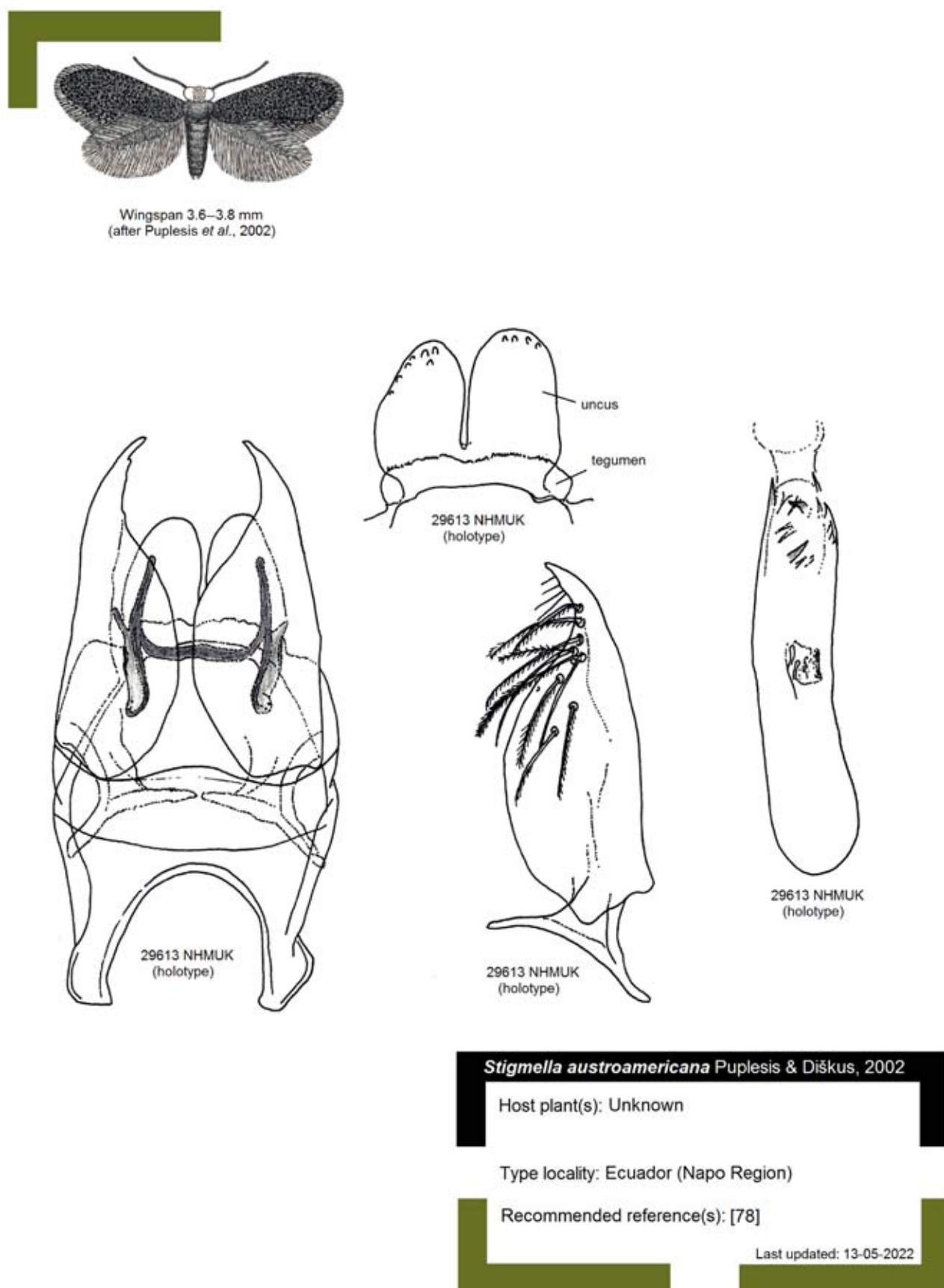
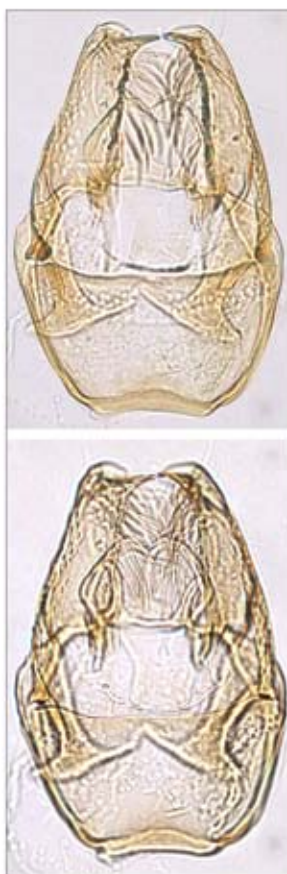
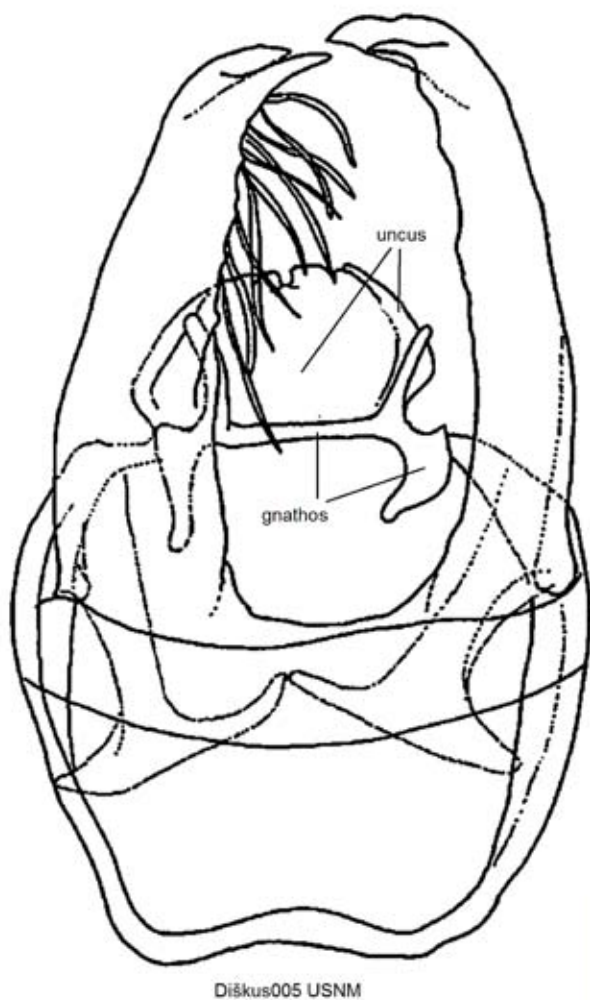


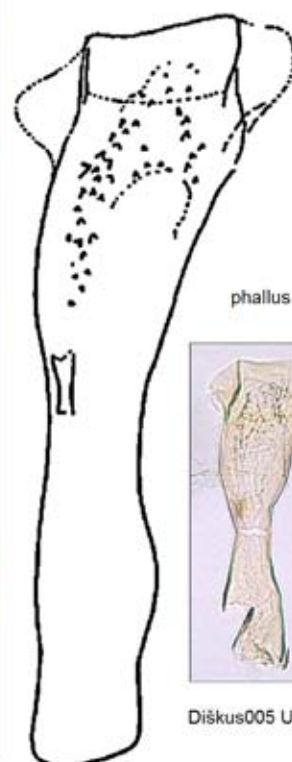
Figure 215. *Stigmella austroamericana* Puplesis & Diškus, a species attributed to the *S. barbata* group.



Wingspan 3.4–3.9 mm



Diškus005 USNM



phallus



Diškus005 USNM

***Stigmella plumosetaeella* Newton & Wilkinson, 1982**

Host plant(s): Unknown

Type locality: USA (Arizona); also known from Mexico

Recommended reference(s): [19], [71], [96]

Last updated: 11-05-2022

Figure 216. *Stigmella plumosetaeella* Newton & Wilkinson, a species attributed to the *S. barbata* group.

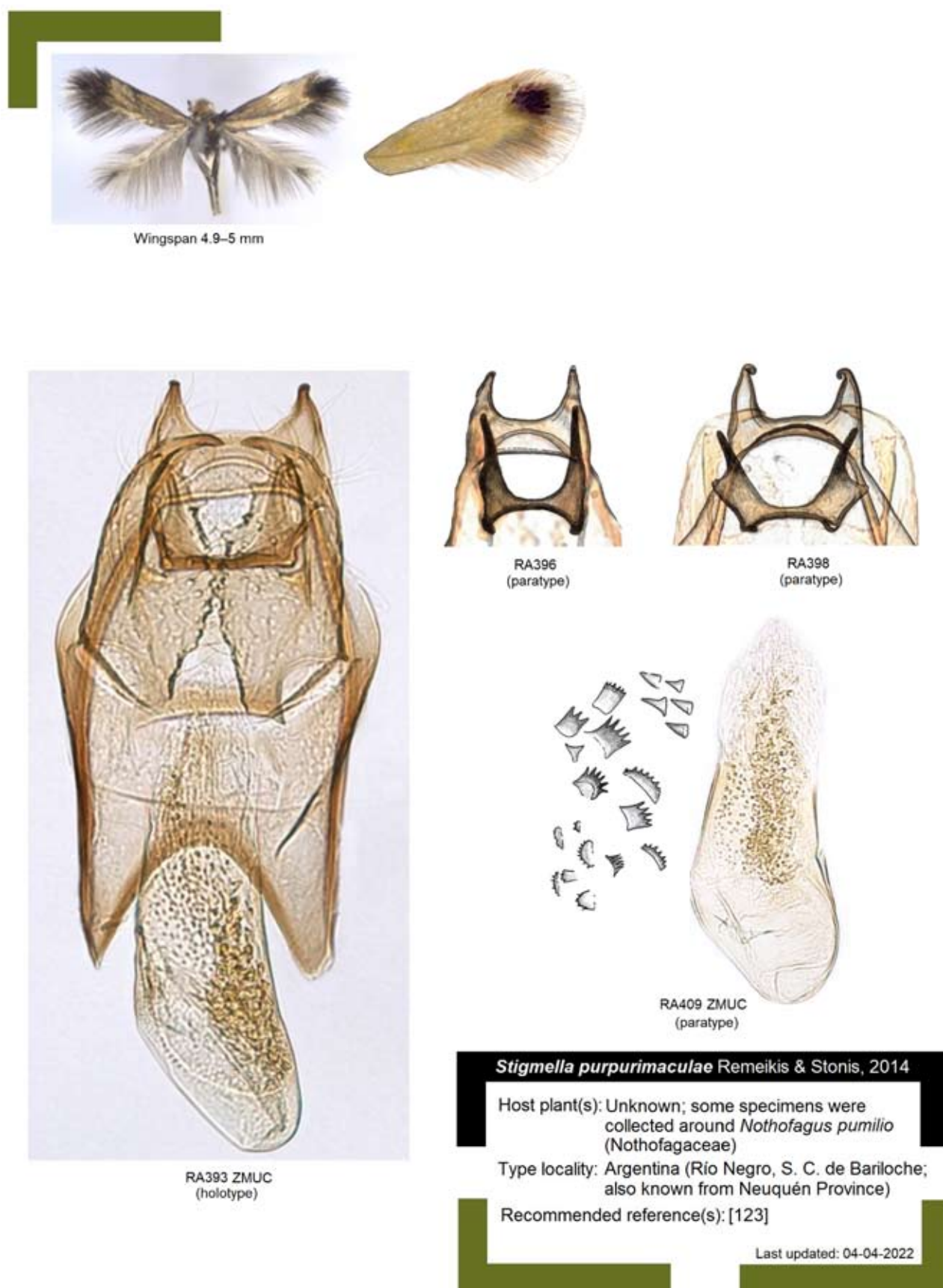


Figure 217. *Stigmella purpurimaculæ* Remeikis & Stonis, a species attributed to the *S. purpurimaculæ* group.

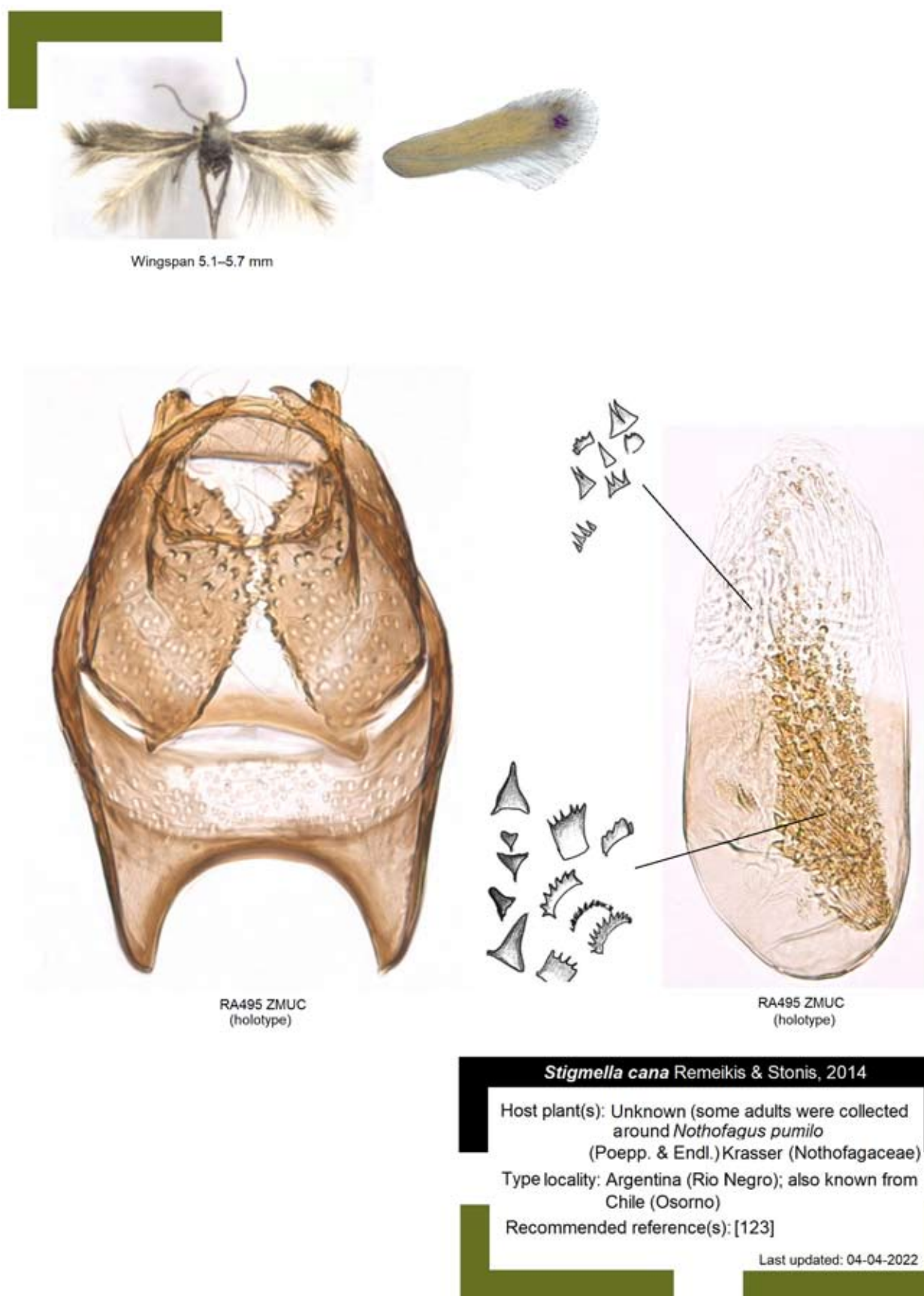


Figure 218. *Stigmella cana* Remeikis & Stonis, a species attributed to the *S. purpurimaculatae* group.

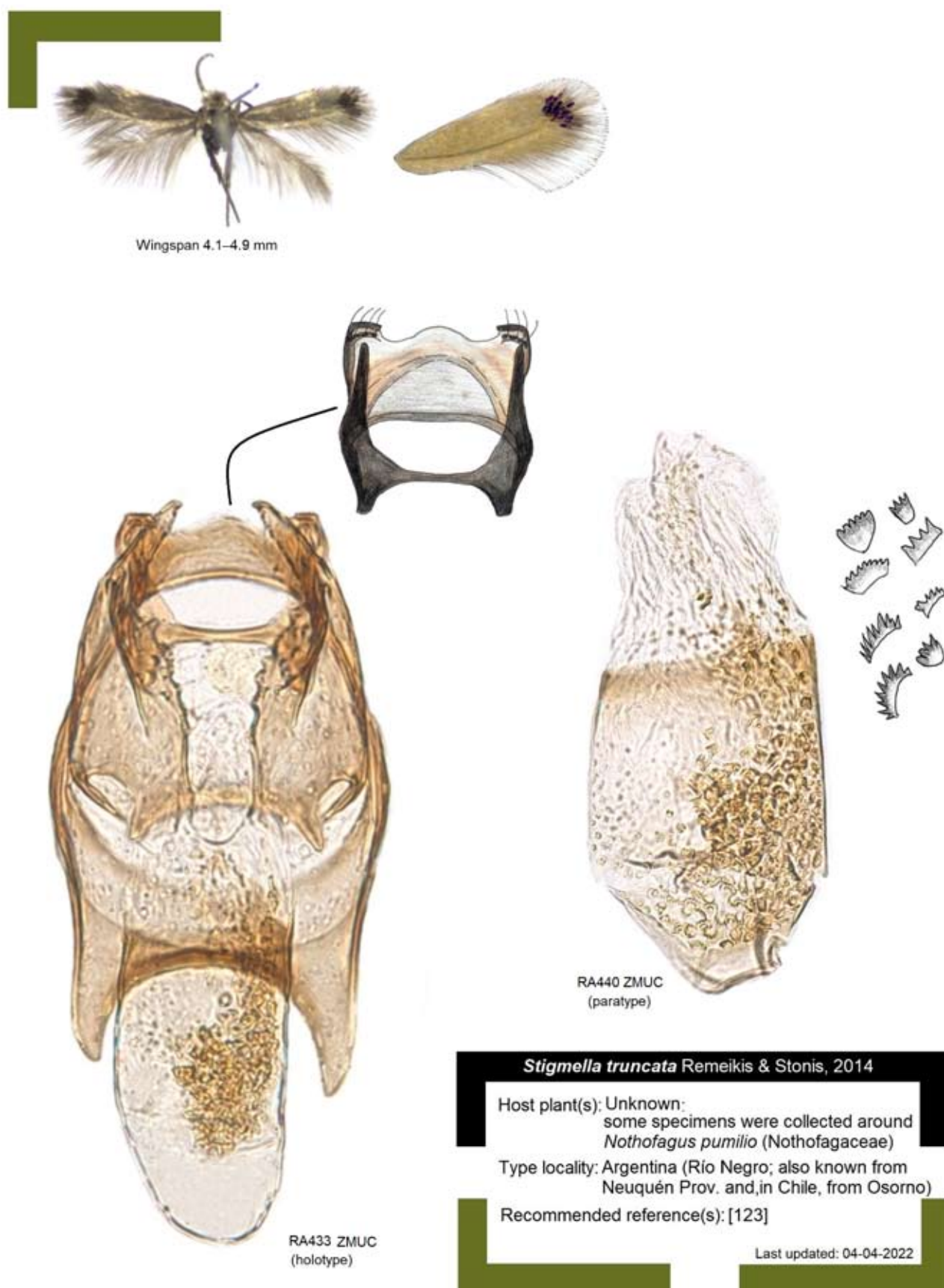


Figure 219. *Stigmella truncata* Remeikis & Stonis, a species attributed to the *S. purpurimaculata* group.

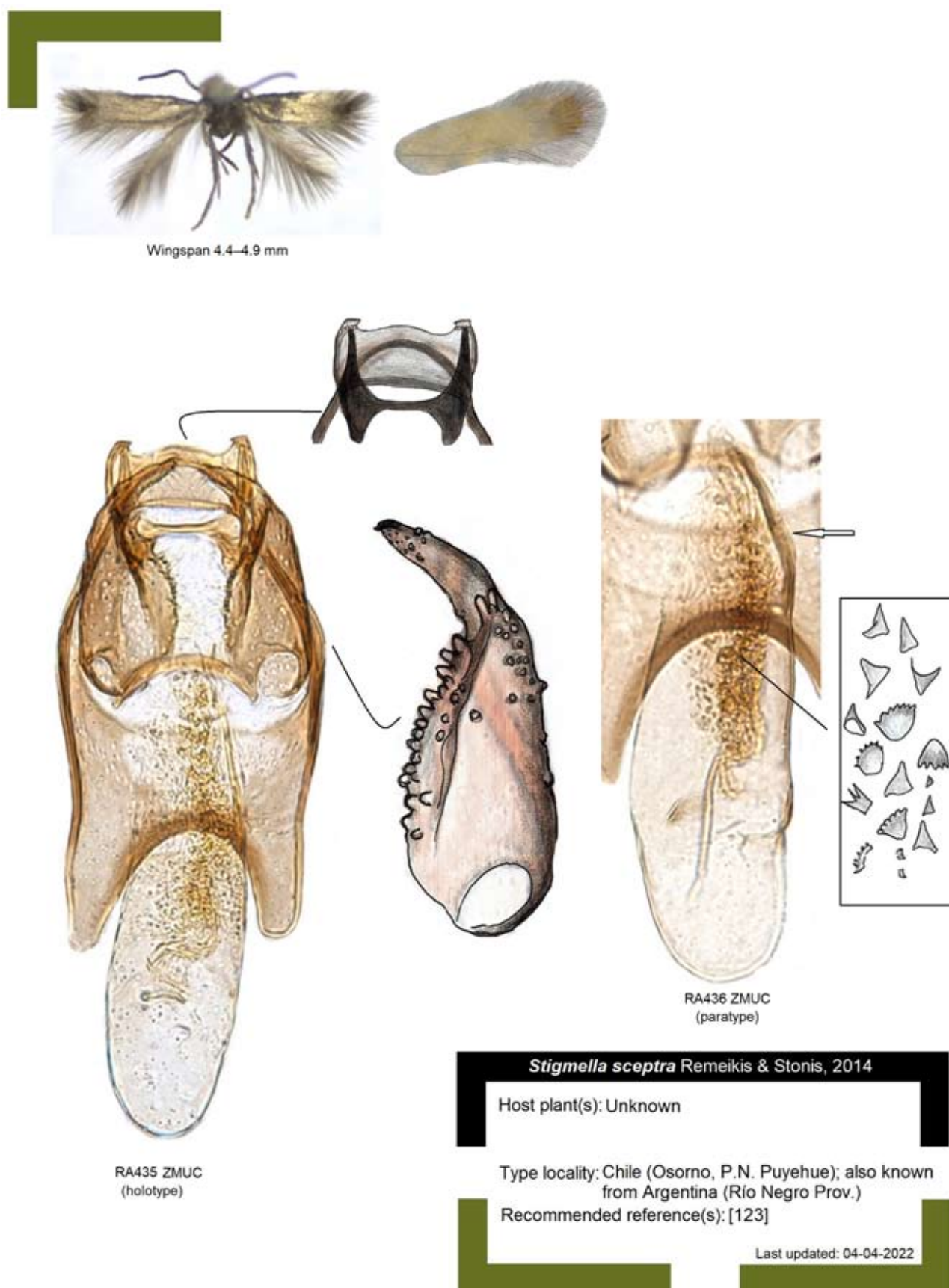


Figure 220. *Stigmella sceptrum* Remeikis & Stonis, a species attributed to the *S. purpurimaculata* group.

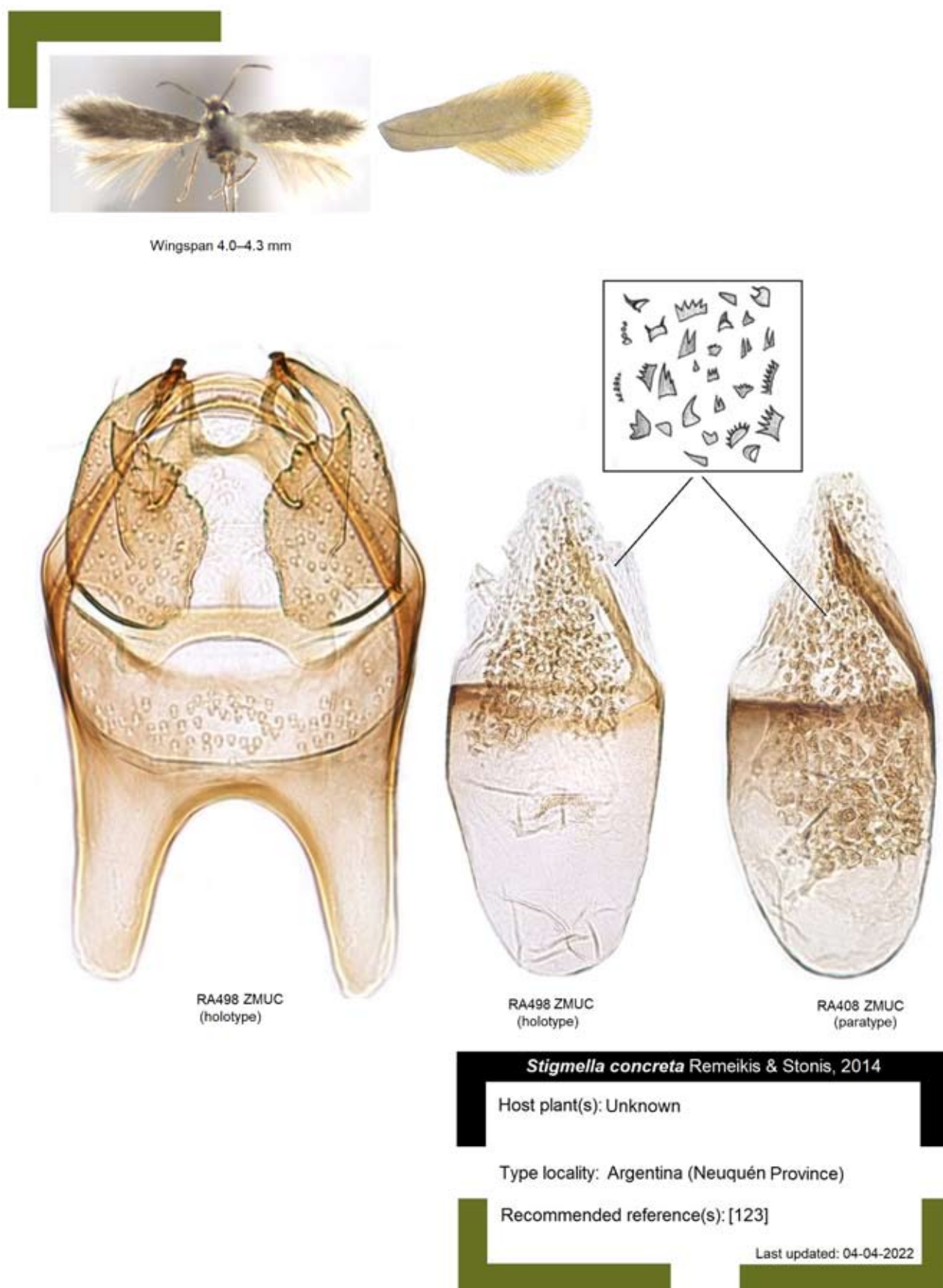


Figure 221. *Stigmella concreta* Remeikis & Stonis, a species attributed to the *S. purpurimaculæ* group.

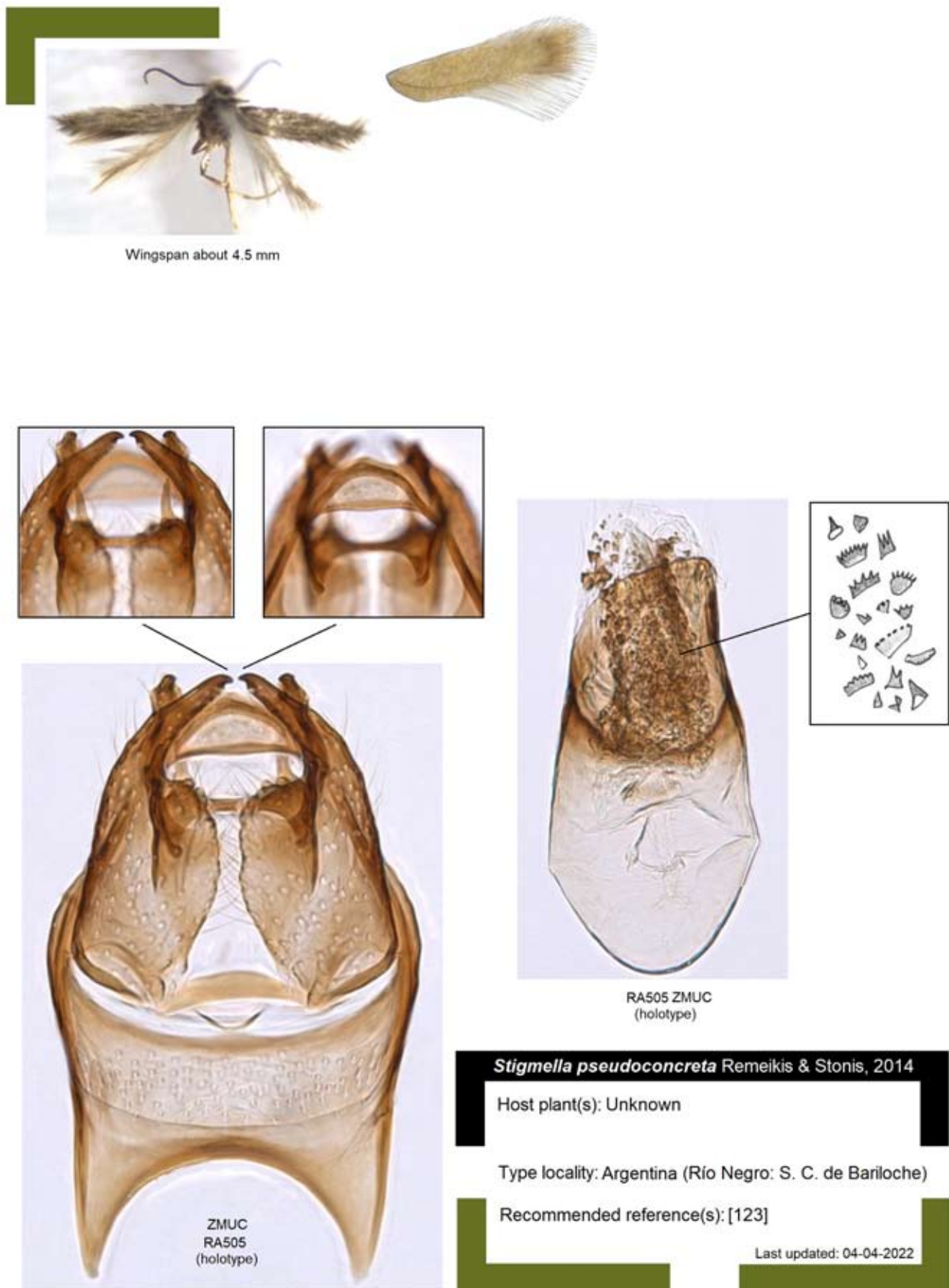


Figure 222. *Stigmella pseudoconcreta* Remeikis & Stonis, a species attributed to the *S. purpurimaculae* group.

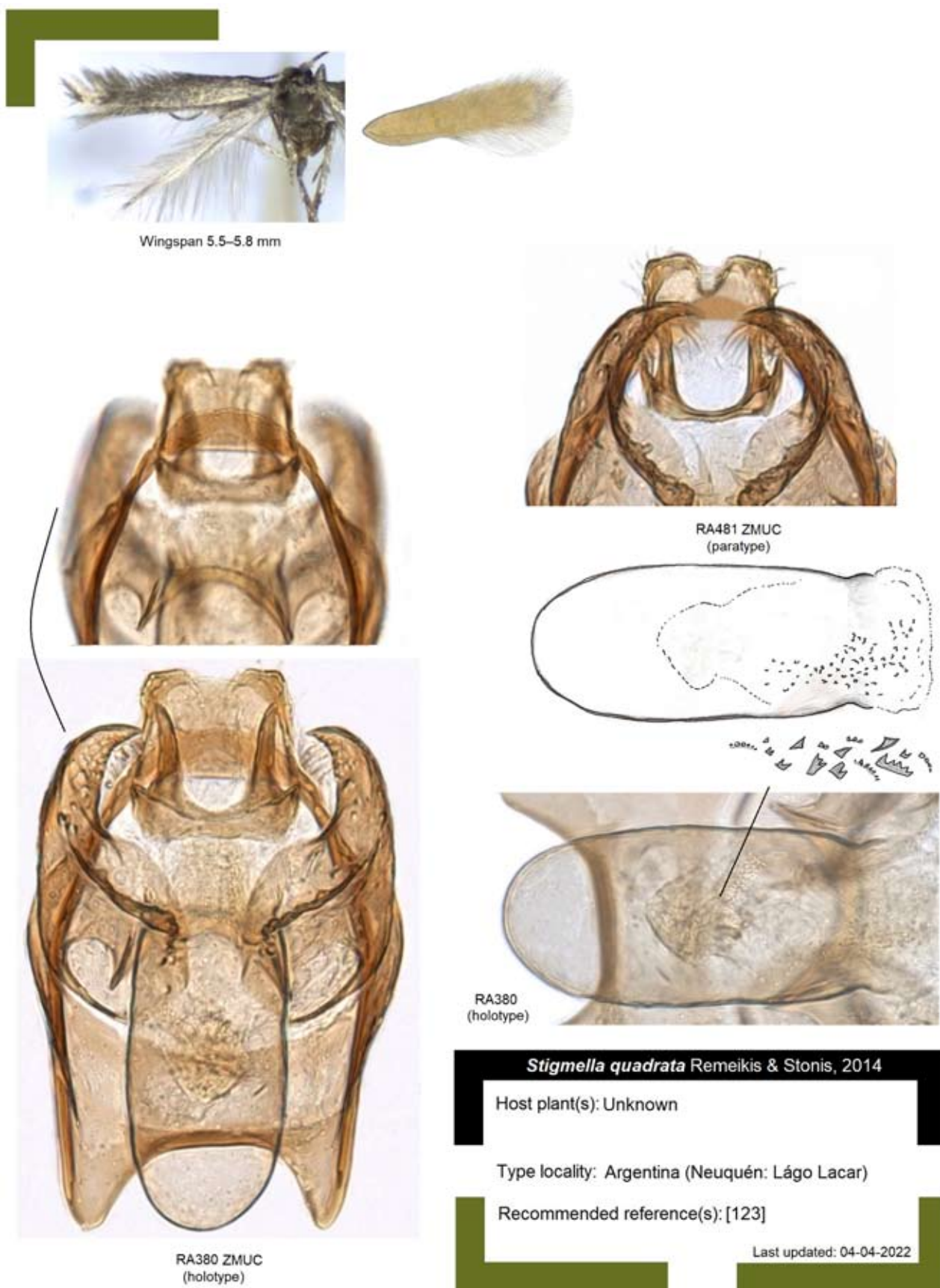


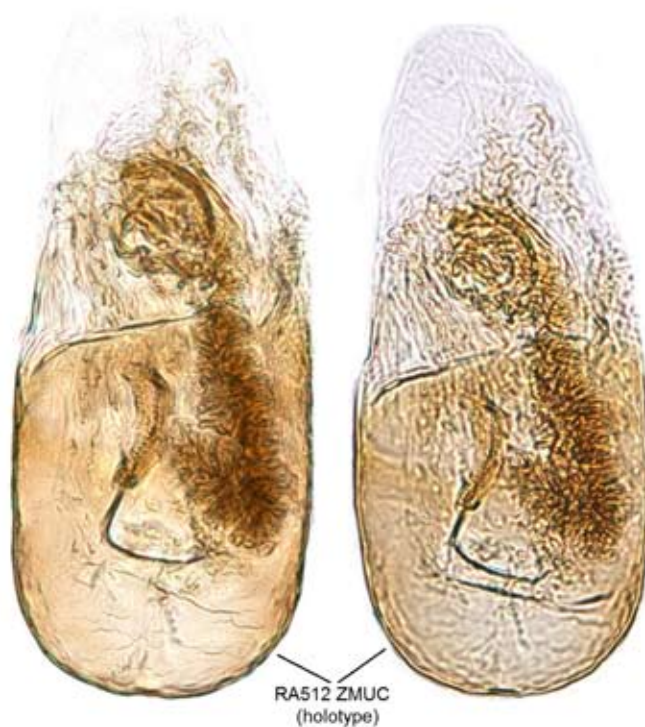
Figure 223. *Stigmella quadrata* Remeikis & Stonis, a species attributed to the *S. purpurimaculatae* group.



Wingspan 4.5–6.3 mm



milky-whitish scales (!)
on the dark brown forewing



***Stigmella semilactea* Remeikis & Stonis, 2014**

Host plant(s): Unknown; some specimens were collected around *Colletia spinosissima* and *Discaria serratifolia* (Rhamnaceae)

Type locality: Argentina (Neuquén Province; also known from Río Negro Province)

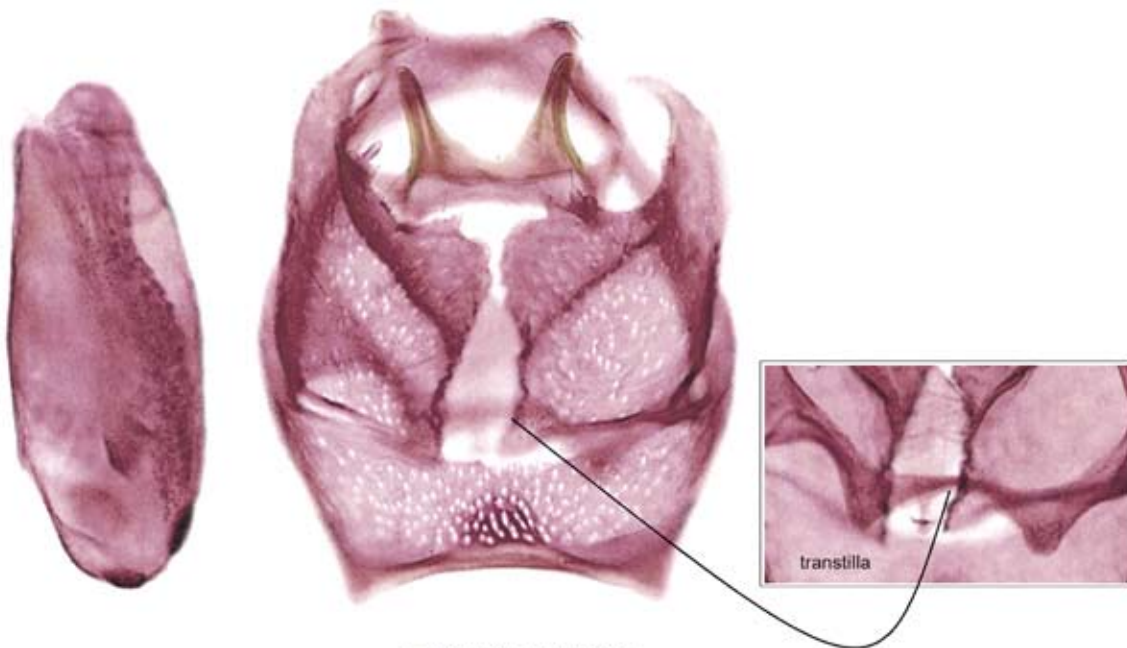
Recommended reference(s): [123]

Last updated: 04-04-2022

Figure 224. *Stigmella semilactea* Remeikis & Stonis, a species attributed to the *S. intronia* group.



Wingspan about 7.5 mm
(after van Nieukerken *et al.*, 2016)



EvN4037 RMNH.INS.24037
(after van Nieukerken *et al.*, 2016)

***Stigmella costaricensis* van Nieukerken & Nishida, 2016**

Host plant(s): Unknown

Type locality: Costa Rica (Parque National Chirripó)

Recommended reference(s): [143]

Last updated: 18-05-2022

Figure 225. *Stigmella costaricensis* van Nieukerken & Nishida, a species attributed to the *S. intronia* group.



Figure 226. *Stigmella intronia* van Nieukerken & Nishida, a species attributed to the *S. intronia* group.

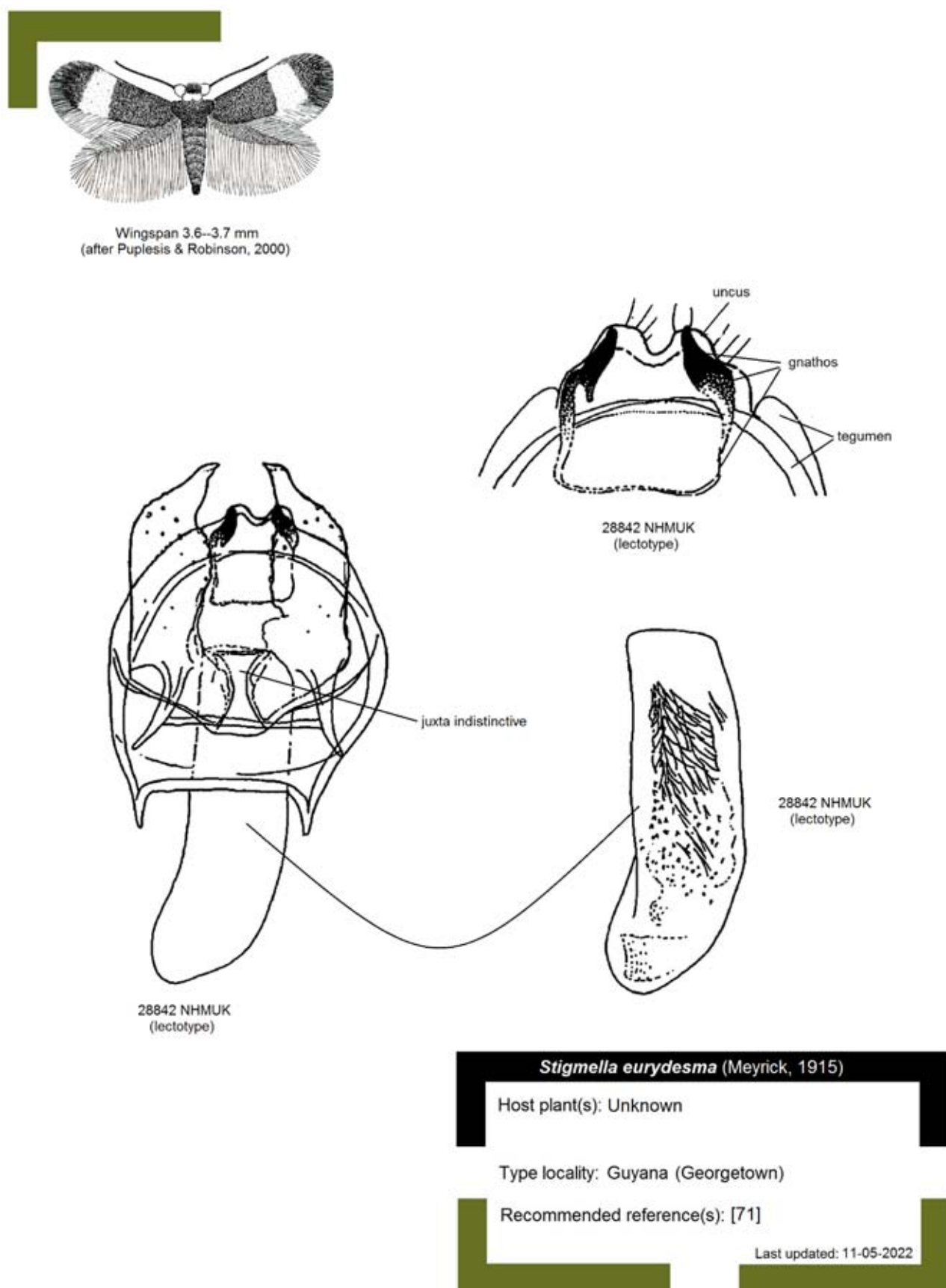


Figure 227. *Stigmella eurydesma* (Meyrick), a species attributed to the *S. eurydesma* group.

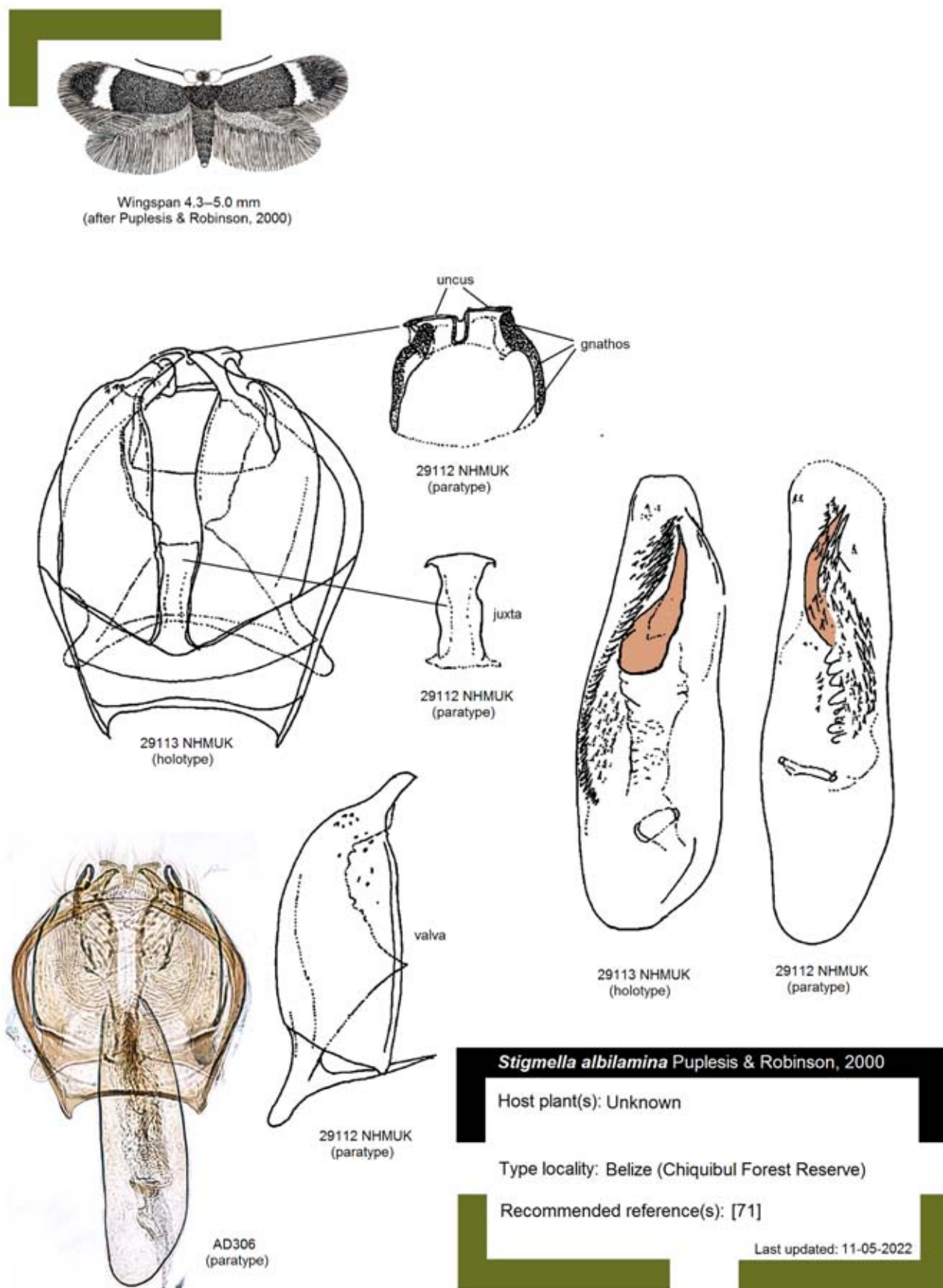


Figure 228. *Stigmella albilamina* Puplesis & Robinson, a species attributed to the *S. eurydesma* group.

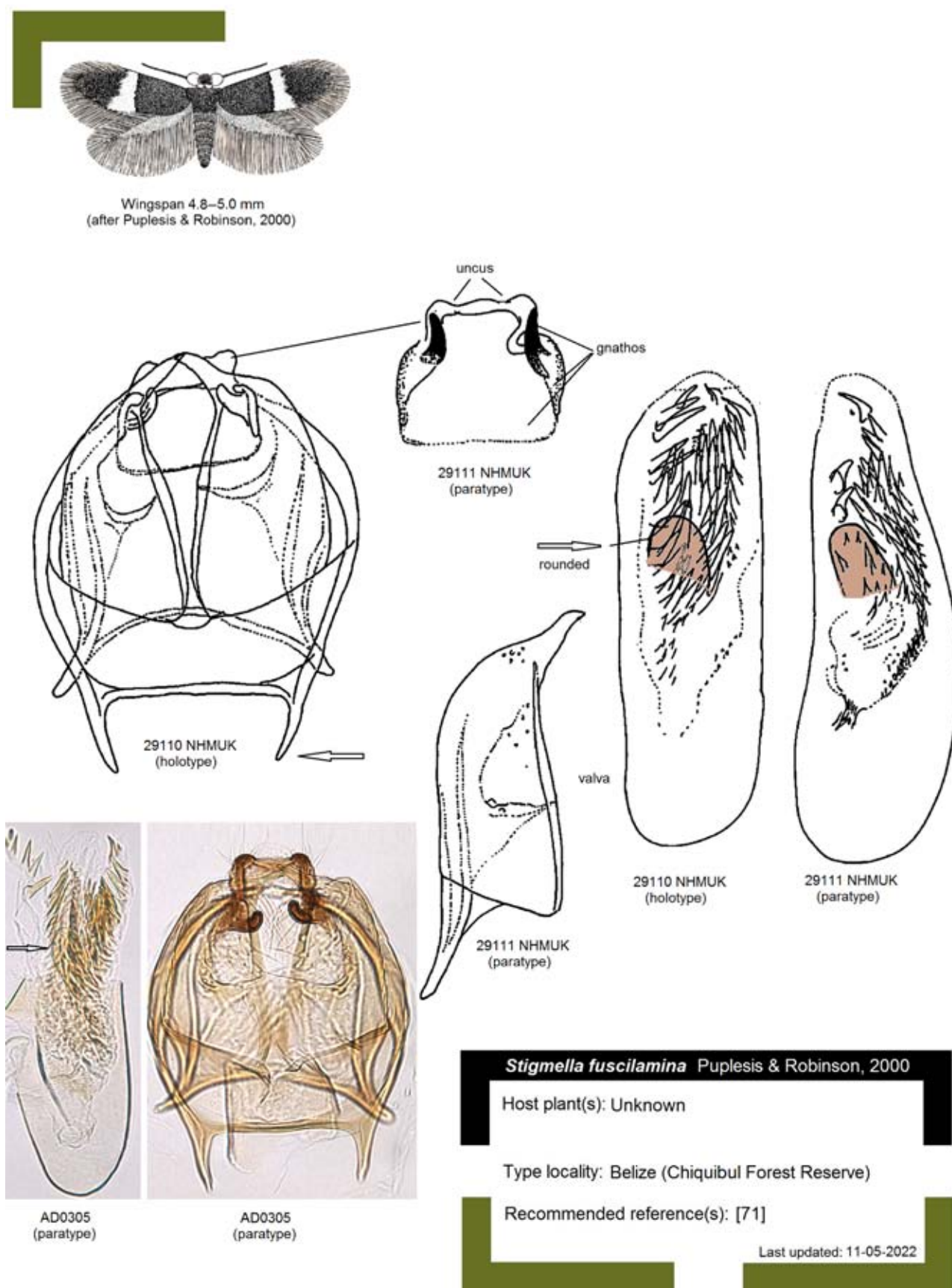


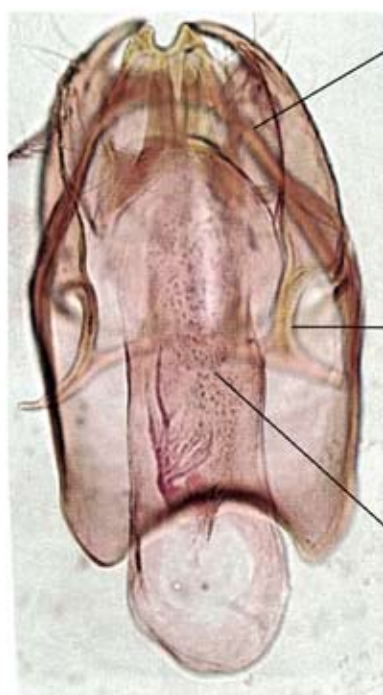
Figure 229. *Stigmella fuscilamina* Puplesis & Robinson, a species attributed to the *S. eurydesma* group.



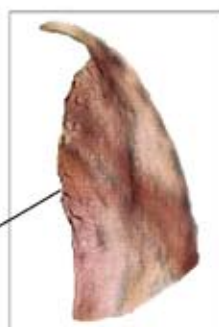
Wingspan 4.4–4.5 mm (♂)
(after van Nieukerken *et al.*, 2016)



(after van Nieukerken *et al.*, 2016)



(after van Nieukerken *et al.*, 2016)



valva



transtilla



cornuti

***Stigmella molinensis* van Nieukerken & Snyers, 2016**

Host plant(s): *Salix humboldtiana* Willd.
(Salicaceae)

Type locality: Peru (Lima)

Recommended reference(s): [143]

Last updated: 19-05-2022

Figure 230. *Stigmella molinensis* van Nieukerken & Snyers, a species attributed to the *S. salicis* group.

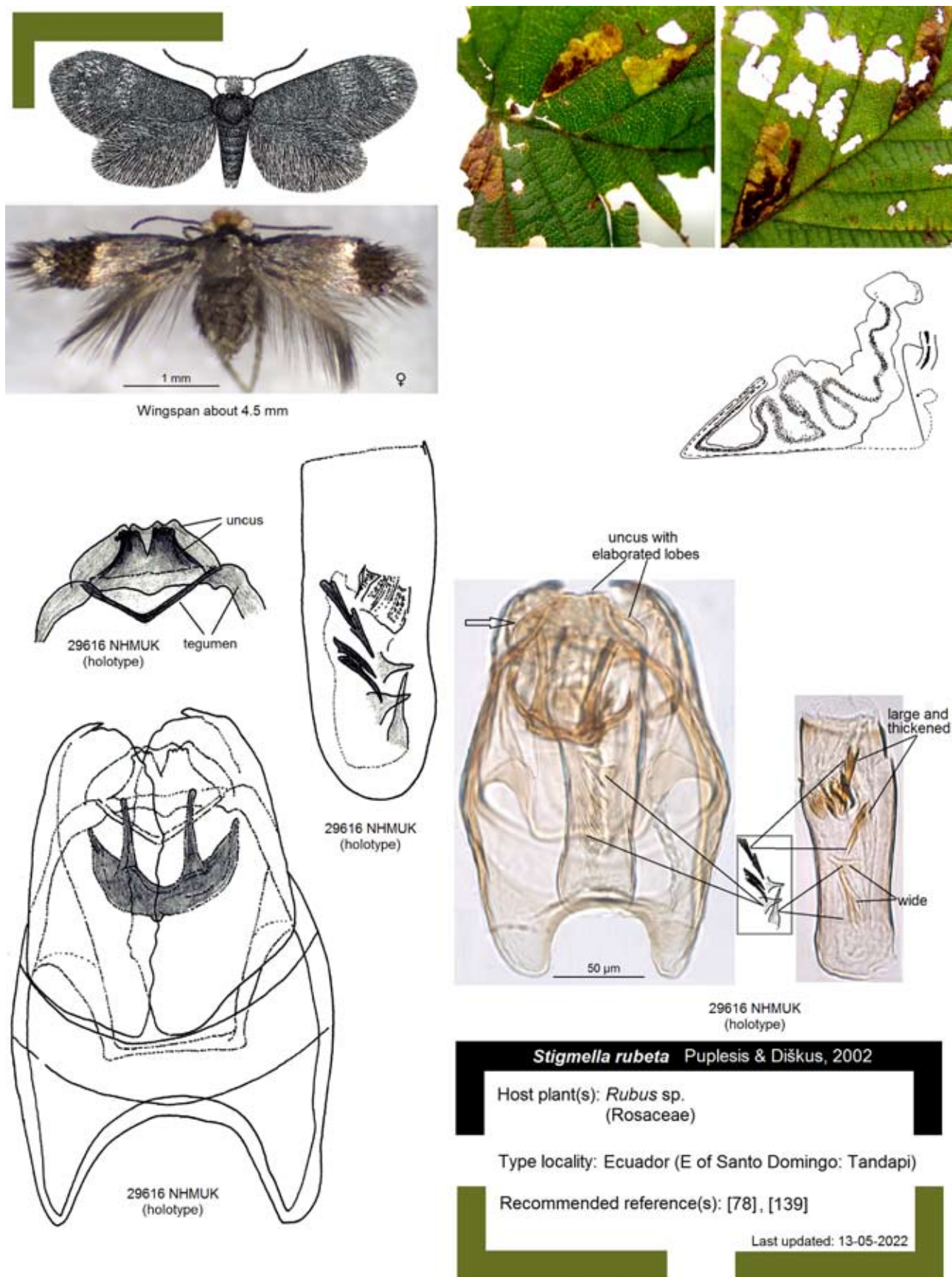


Figure 231. *Stigmella rubeta* Puplesis & Diškus, a species attributed to the *S. rubeta* group.

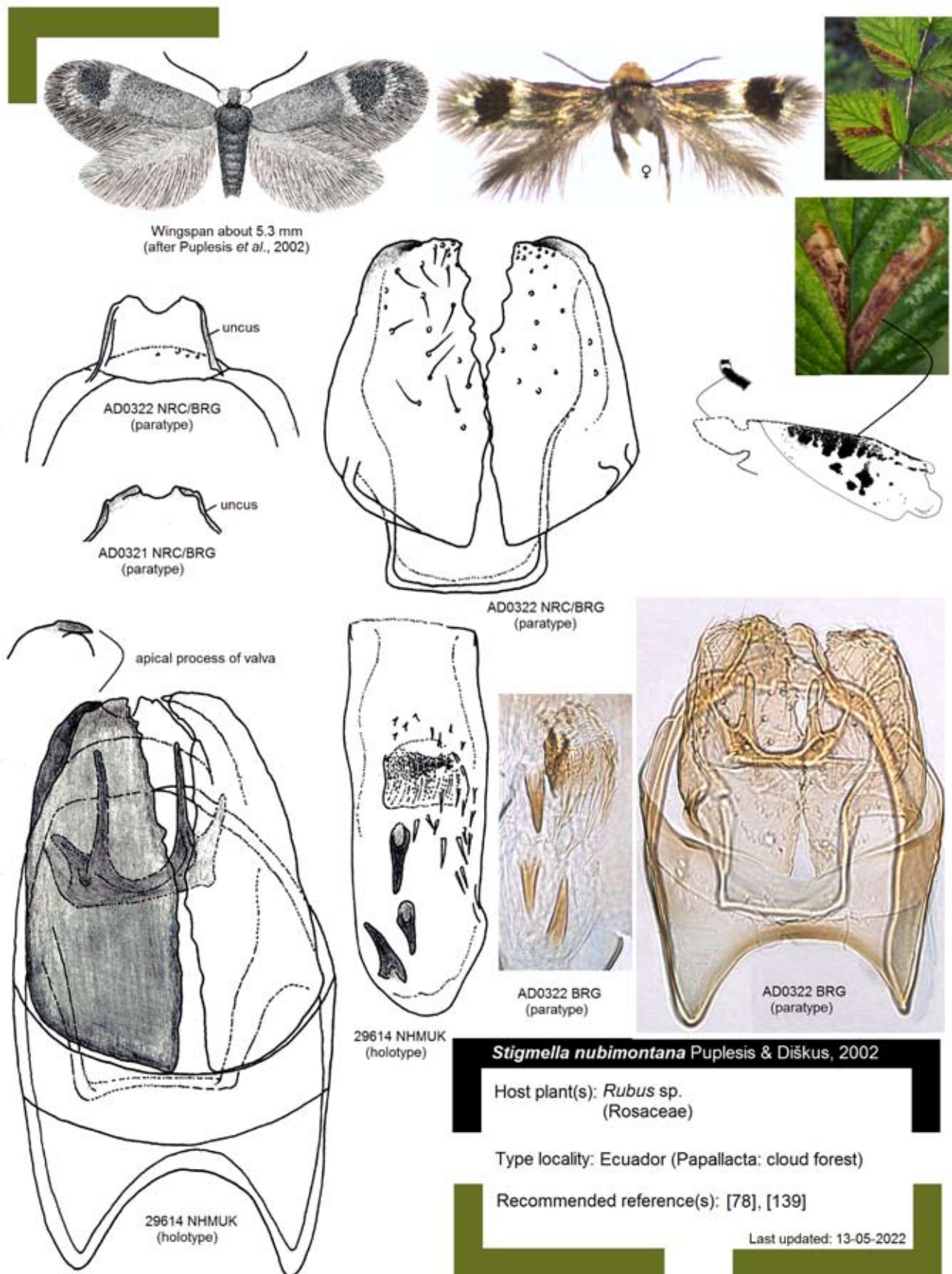


Figure 232. *Stigmella nubimontana* Puplesis & Diškus, a species attributed to the *S. rubeta* group.



Wingspan 7.1–7.6 mm



RA553 ZMUC
(holotype)



RA553 ZMUC
(holotype)



RA553 ZMUC
(holotype)

***Stigmella lobata* Remeikis & Stonis, 2016**

Host plant(s): Unknown

Type locality: Peru (Dept. Puno)

Recommended reference(s): [137], [151]

Last updated: 27-08-2021

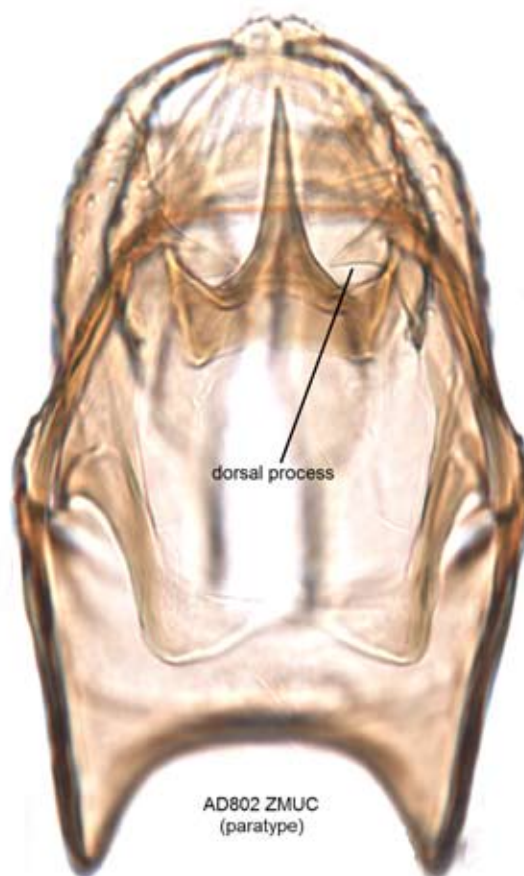
Figure 233. *Stigmella lobata* Remeikis & Stonis, a species attributed to the *S. lobata* group.



Wingspan 4.6 mm



AD802 ZMUC
(paratype)



AD802 ZMUC
(paratype)



AD802 ZMUC (paratype)

***Stigmella decora* Diškus & Stonis, 2017**

Host plant(s): *Rhynchotheca spinosa* Ruiz & Pav
(=*Rhynchotheca spinosa* var. *lobata*
R. Knuth) Geraniaceae/Vivianiaceae)

Type locality: Ecuador (Chimborazo, Pallatanga)

Recommended reference(s): [147]

Last updated: 21-05-2021

Figure 234. *Stigmella decora* Diškus & Stonis, a species attributed to the *S. lobata* group.

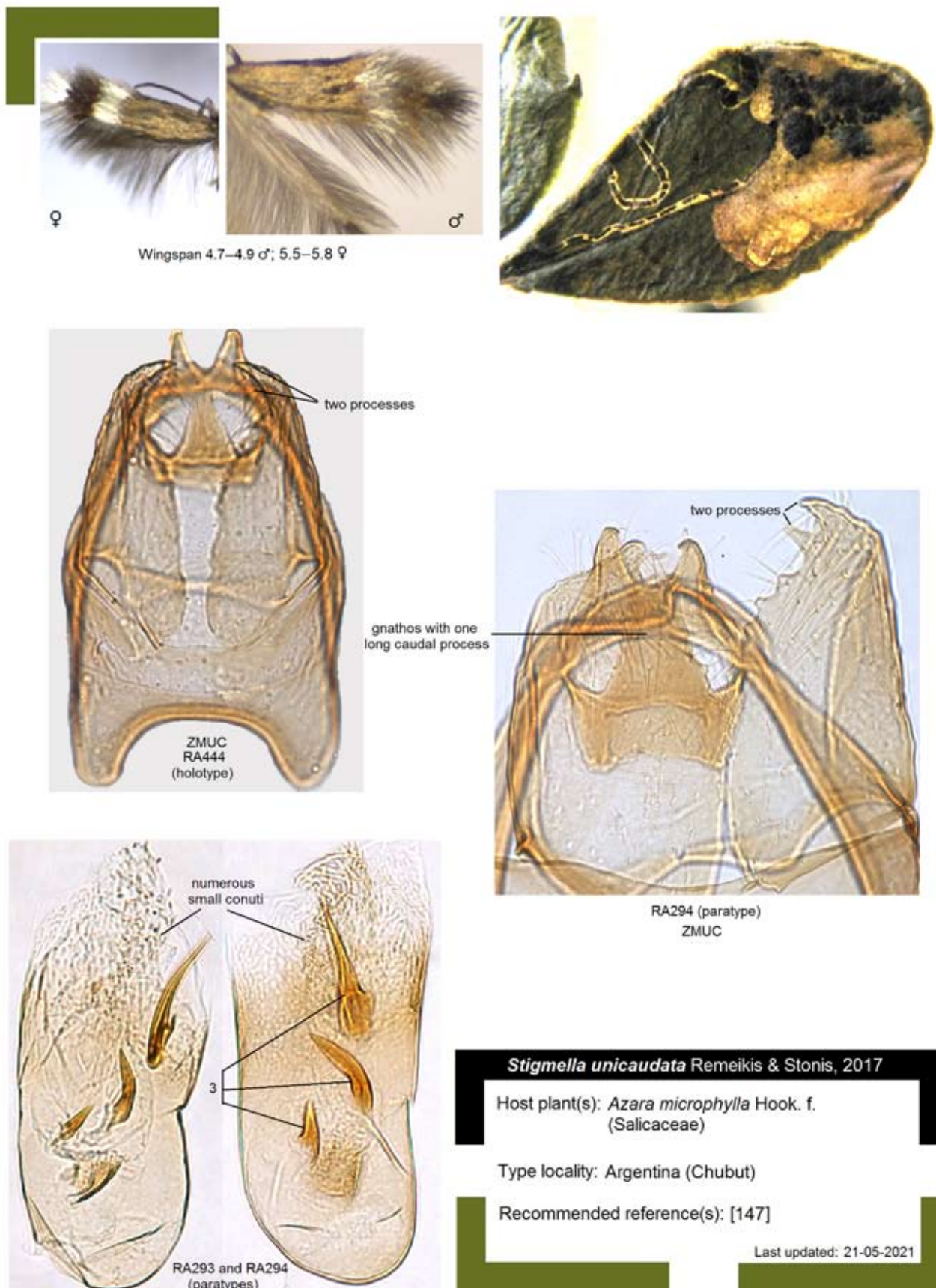


Figure 235. *Stigmella unicaudata* Remeikis & Stonis, a species attributed to the *S. lobata* group.



Wingspan 8.1–8.2 mm



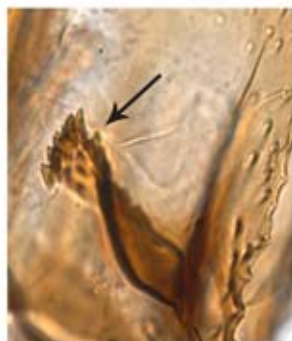
AD670 ZMUC
(holotype)



AD670 ZMUC
(holotype)



AD670 ZMUC
(holotype)



inner,
dentate lobe on valva

***Stigmella kristenseni* Diškus & Stonis, 2016**

Host plant(s): Unknown

Type locality: Peru (Dept. Lima)

Recommended reference(s): [137]

Last updated: 17-09-2021

Figure 236. *Stigmella kristenseni* Diškus & Stonis, a species attributed to the *S. kristenseni* group.



Wingspan 9.0–9.6 mm



Diškus195 ZMUC
(holotype)



Diškus195 ZMUC
(holotype)

***Stigmella imperatoria* Puplesis & Robinson, 2000**

Host plant(s): Unknown

Type locality: Peru (Dept. Ancash)

Recommended reference(s): [71], [137]

Last updated: 17-09-2021

Figure 237. *Stigmella imperatoria* Puplesis & Robinson, a species attributed to the *S. imperatoria* group.

Stigmella rubiphiella, as an exception, was described on the basis of the specific male genitalia and leaf mines. Details of male adult scaling remain unknown because the holotype was dissected from adult in a pupal skin and no pinned specimen was preserved (Stonis et al., 2016 [139]).

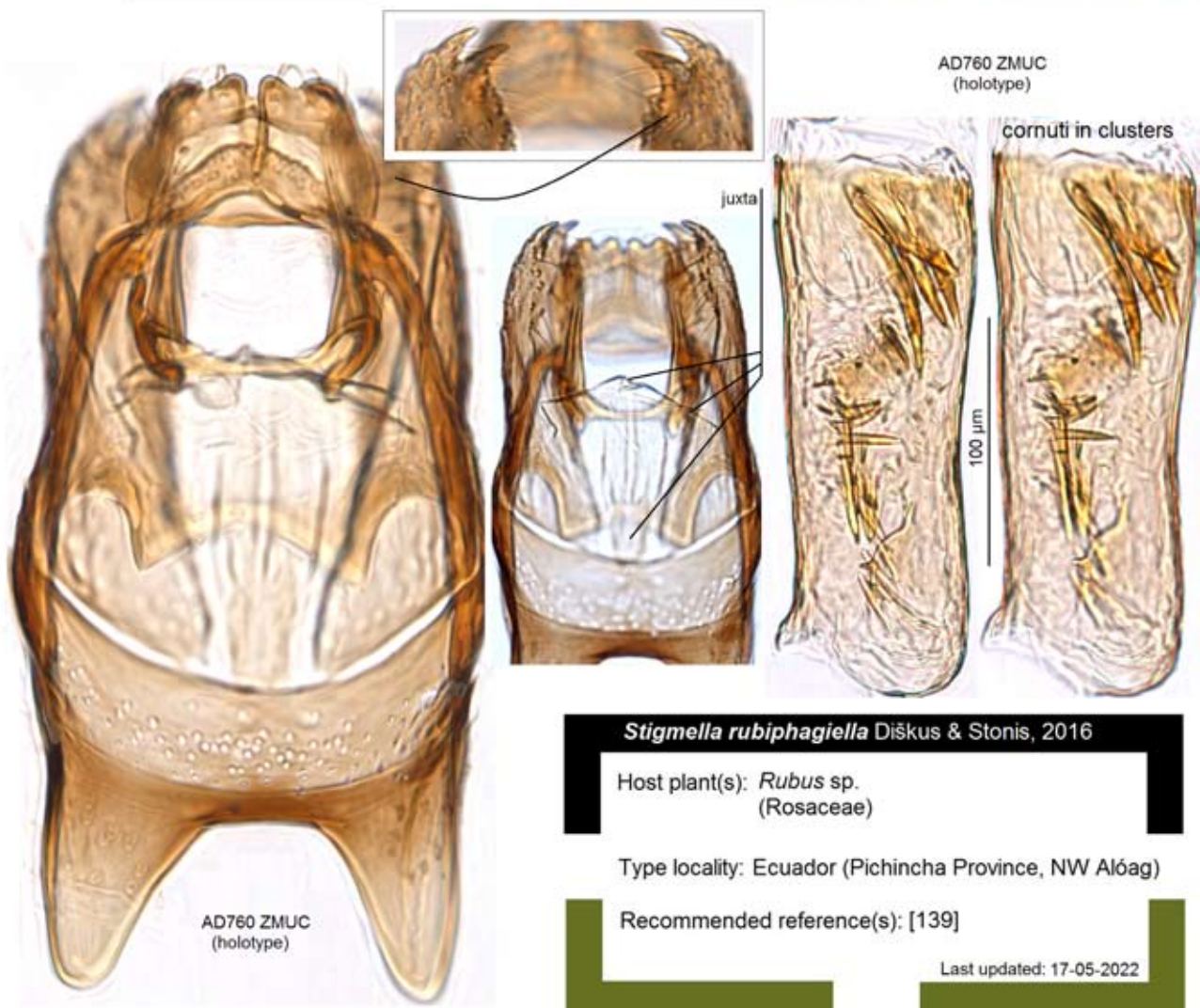
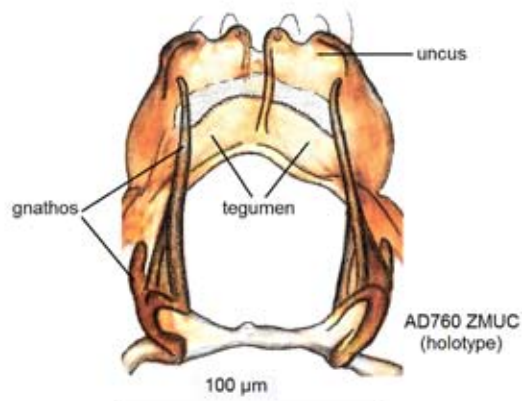


Figure 238. *Stigmella rubiphiella* Diškus & Stonis, a species attributed to the *S. imperatoria* group.

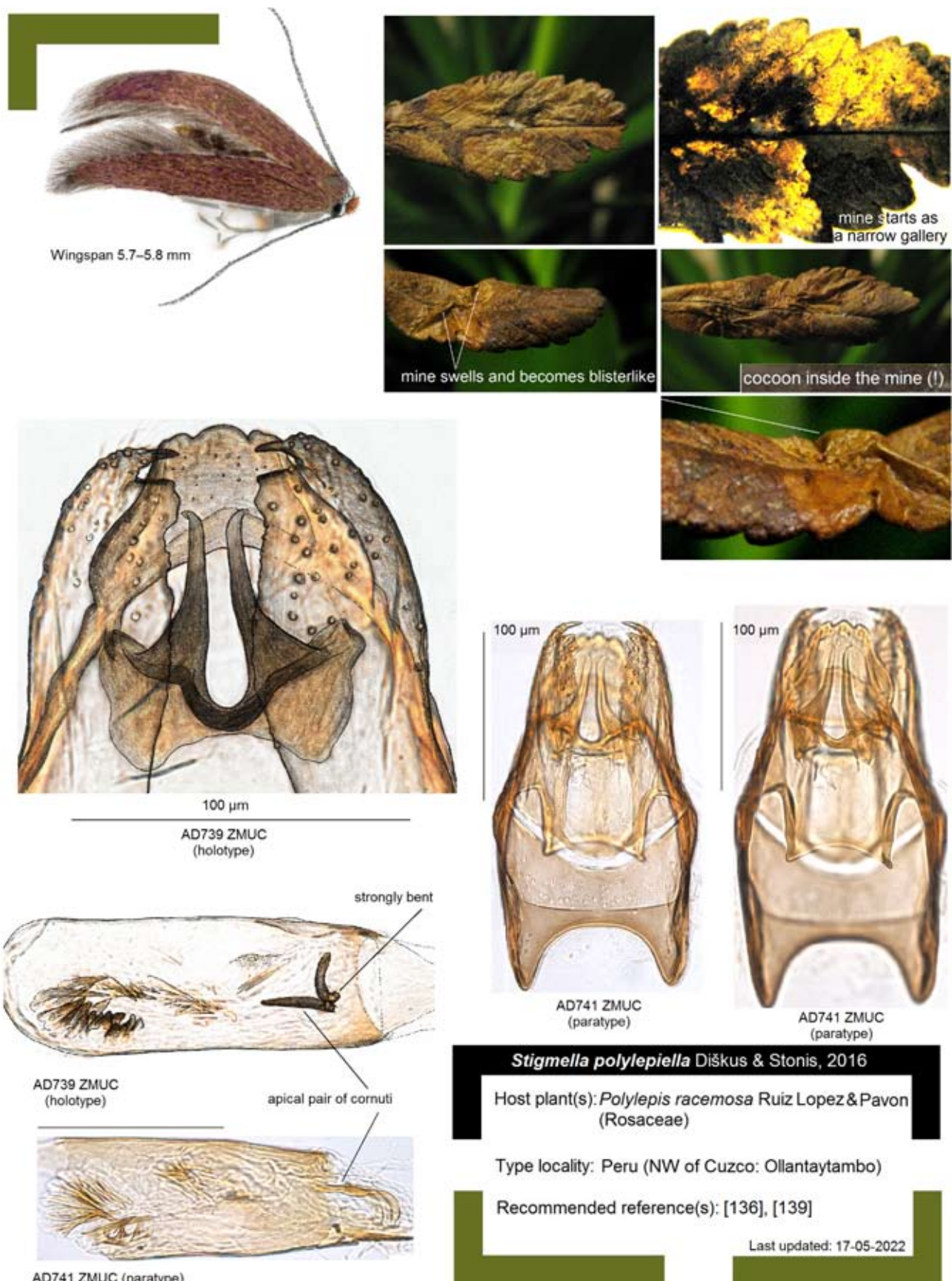


Figure 239. *Stigmella polylepiella* Diškus & Stonis, a species attributed to the *S. imperatoria* group.



Wingspan 10.8–10.9 mm



AD645
(holotype)



AD645 ZMUC
(holotype)



AD645 ZMUC
(holotype)

Stigmella ampla Diškus & Stonis, 2016

Host plant(s): Unknown

Type locality: Peru (Dept. Lima)

Recommended reference(s): [137]

Last updated: 17-09-2021

Figure 240. *Stigmella ampla* Diškus & Stonis, a satellite species resembling of the *imperatoria* group, but not attributed to it.



Wingspan 9.5–9.6 mm



AD647 ZMUC
(holotype)



AD647 ZMUC
(holotype)



AD647 ZMUC
(holotype)

***Stigmella altiplanica* Diškus & Stonis, 2016**

Host plant(s): Unknown

Type locality: Peru (Dept. Ancash)

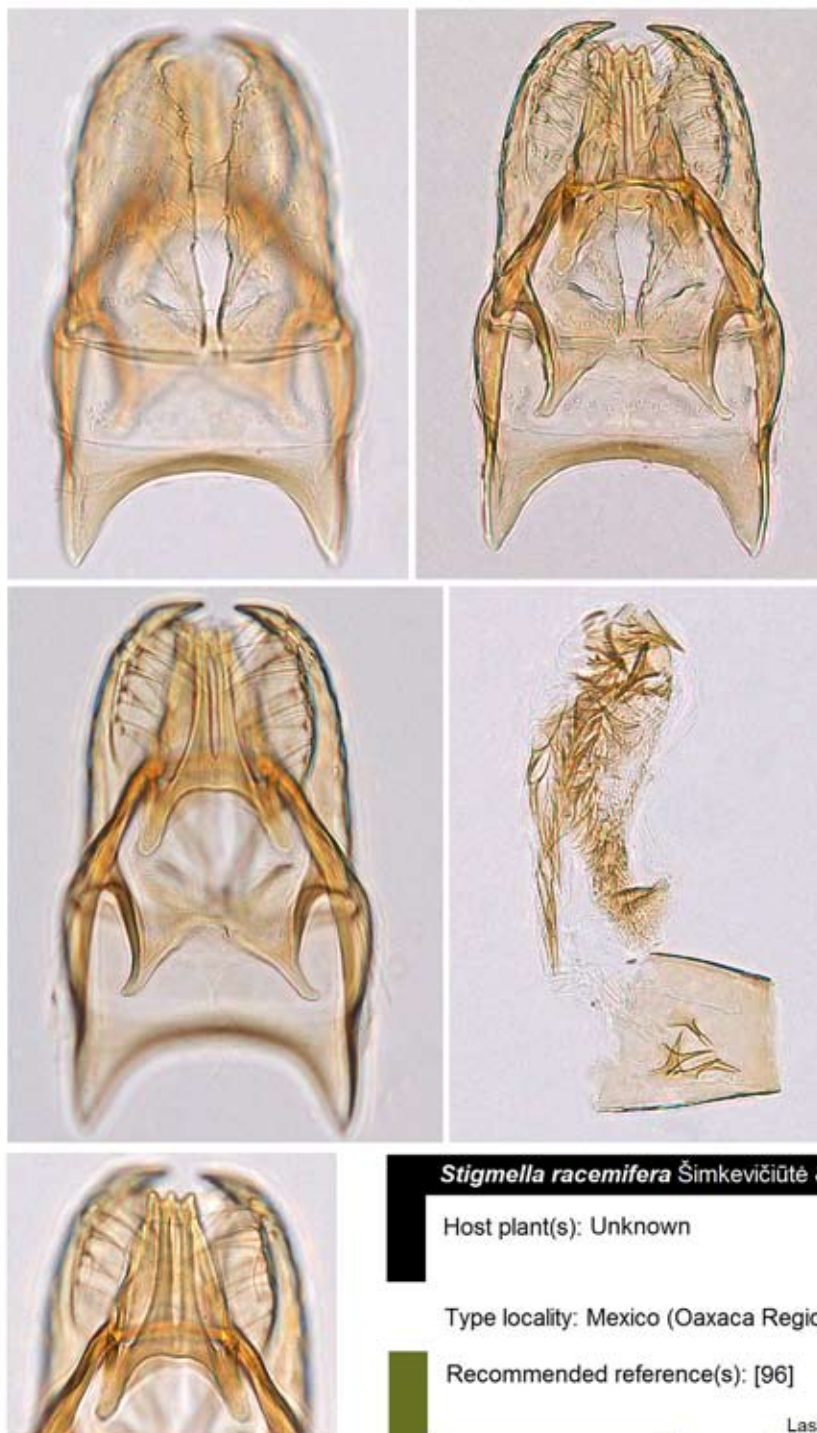
Recommended reference(s): [137]

Last updated: 17-09-2021

Figure 241. *Stigmella altiplanica* Diškus & Stonis, a satellite species resembling of the *imperatoria* group, but not attributed to it.



Wingspan about 3.2 mm
(after Šimkevičiūtė *et al.*, 2009)



***Stigmella racemifera* Šimkevičiūtė & Stonis, 2009**

Host plant(s): Unknown

Type locality: Mexico (Oaxaca Region: Pacific Coast)

Recommended reference(s): [96]

Last updated: 14-05-2022

Figure 242. *Stigmella racemifera* Šimkevičiūtė & Stonis, a satellite species resembling of the *imperatoria* group, but not attributed to it.



Wingspan 8.6 mm



AD633 ZMUC
(holotype)



AD633 ZMUC
(holotype)



AD633 ZMUC
(holotype)

***Stigmella angusta* Diškus & Stonis, 2016**

Host plant(s): Unknown

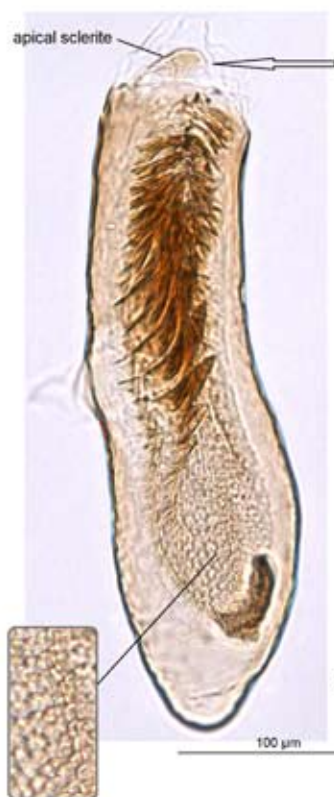
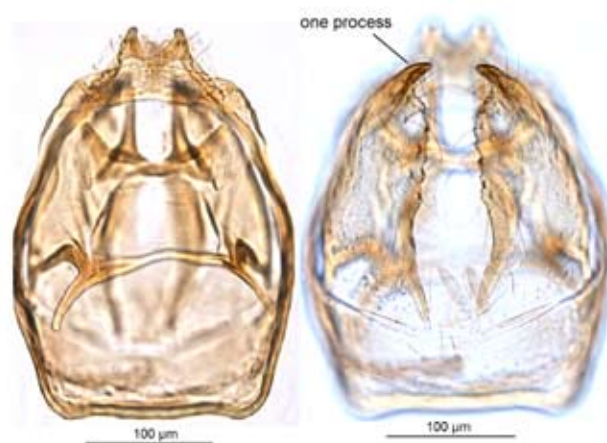
Type locality: Peru (Dept. Lima)

Recommended reference(s): [137]

Last updated: 17-09-2021

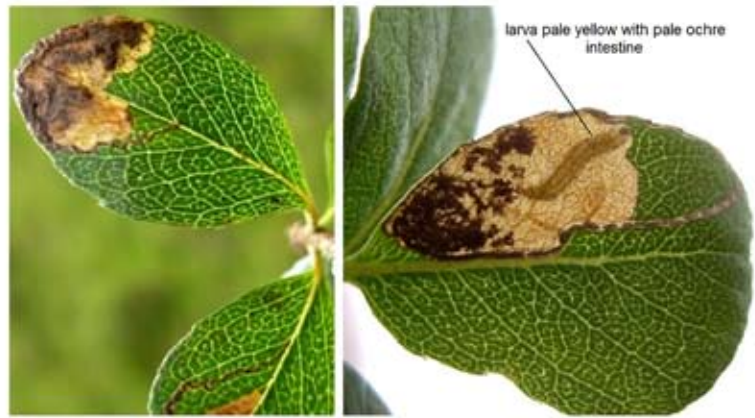
Figure 243. *Stigmella angusta* Diškus & Stonis, a satellite species resembling of the *imperatoria* group, but not attributed to it.

Stigmella circinata, as an exception, was described on the basis of the highly specific male and female genitalia and leaf mines. Details of male and female adult scaling remain unknown because all currently available type series specimens were dissected from adults in a pupal skin and no pinned specimens were preserved (Stonis *et al.*, 2016 [139]).



AD785 ZMUC
(holotype)

AD785 ZMUC
(holotype)



AD785 ZMUC
(holotype)

Stigmella circinata Diškus & Stonis, 2016

Host plant(s): *Hesperomeles obtusifolia* (Pers.) Lindl
(Rosaceae)

Type locality: Ecuador (Pichincha Province, NW Alóag)

Recommended reference(s): [139]

Last updated: 17-05-2022

Figure 244. *Stigmella circinata* Diškus & Stonis, a species attributed to the *S. circinata* group.

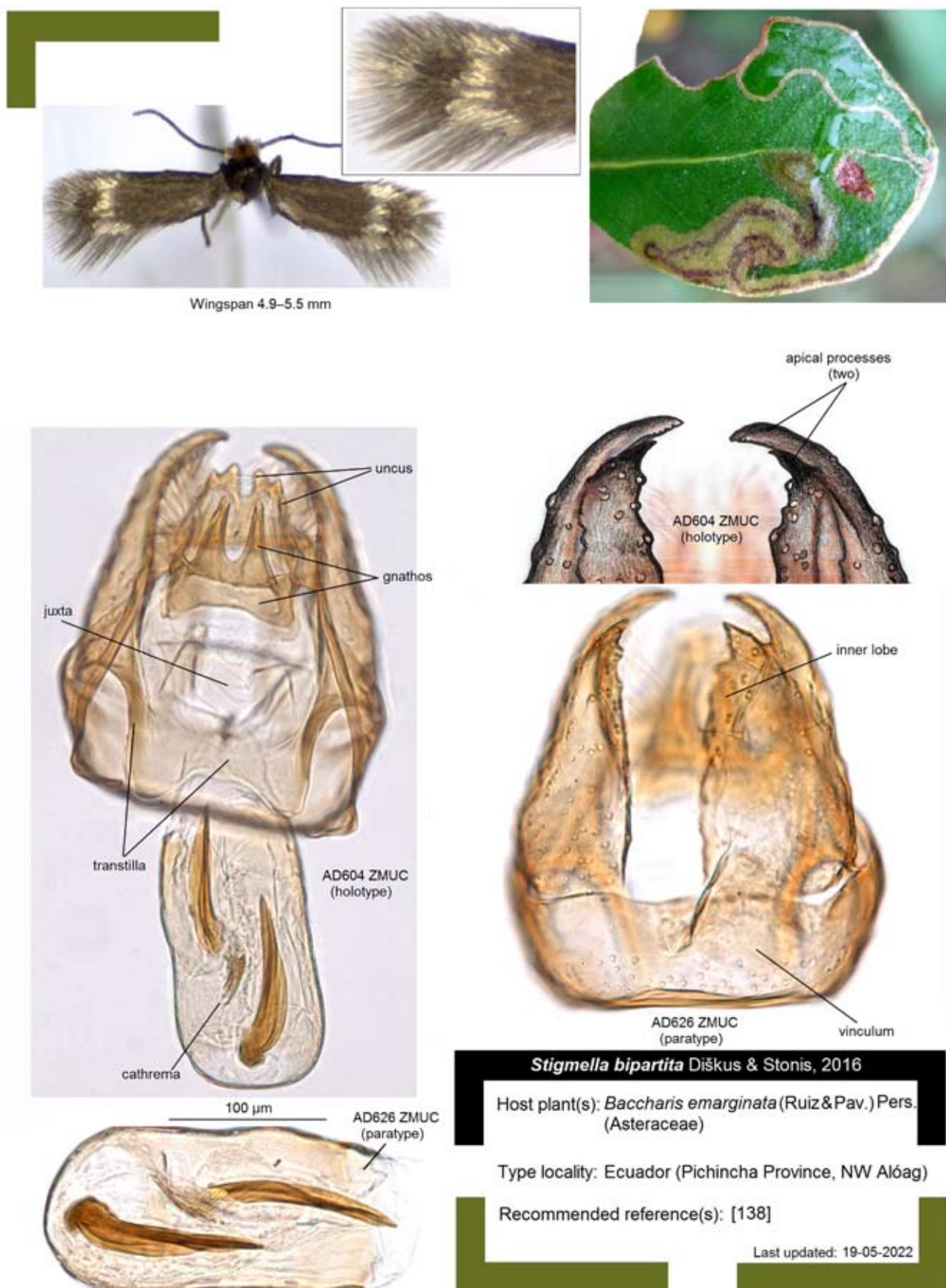


Figure 245. *Stigmella bipartita* Diškus & Stonis, a species attributed to the *S. bipartita* group.



Wingspan 6.7–7.1 mm



***Stigmella sanmartini* Remeikis & Stonis, 2017**

Host plant(s): *Mutisia decurrens* Cav. (Asteraceae)

Type locality: Argentina (Neuquen, San Martin)

Recommended reference(s): [146]

Last updated: 21-05-2021

Figure 246. *Stigmella sanmartini* Remeikis & Stonis, a species attributed to the *S. bipartita* group.

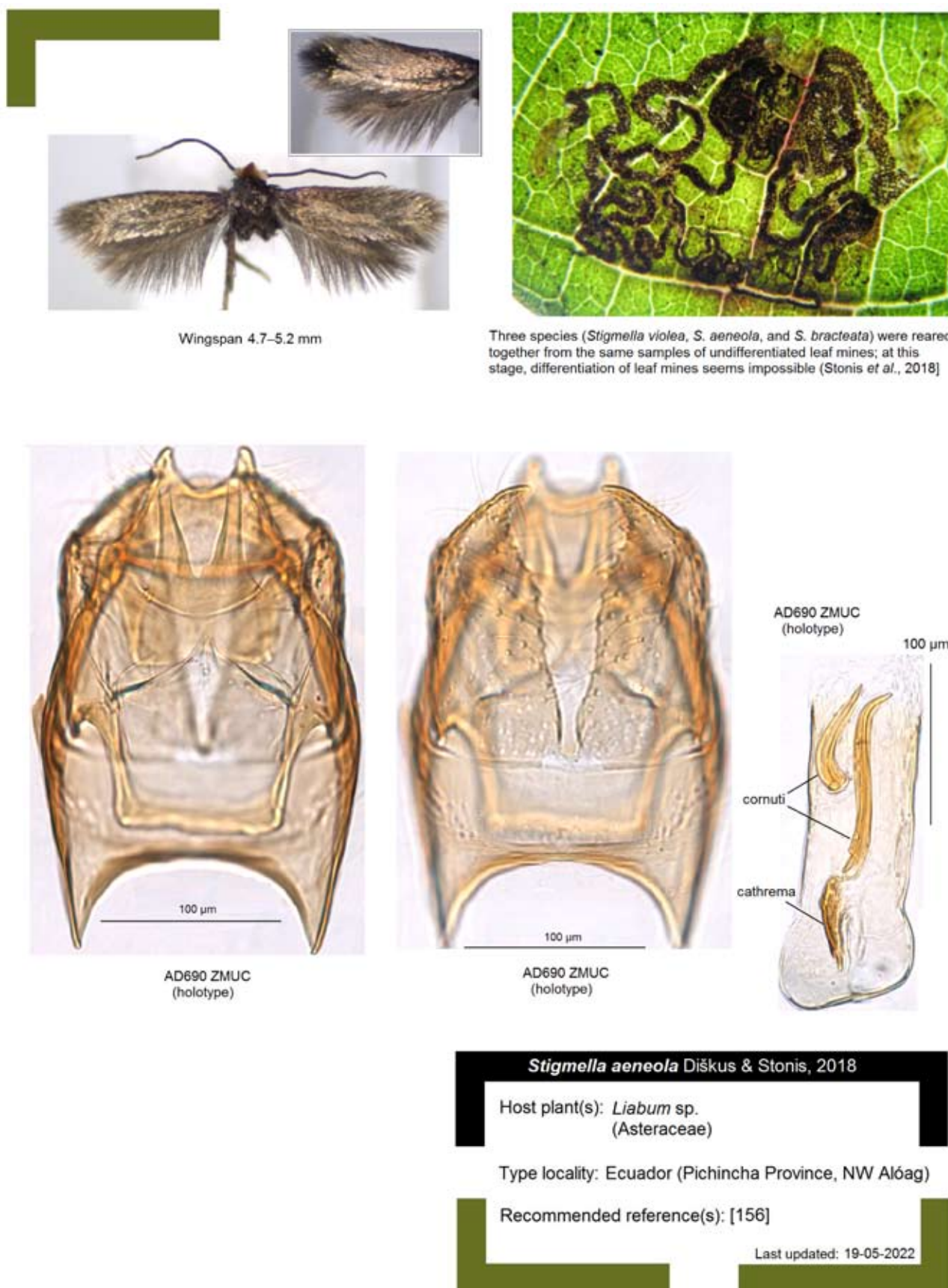
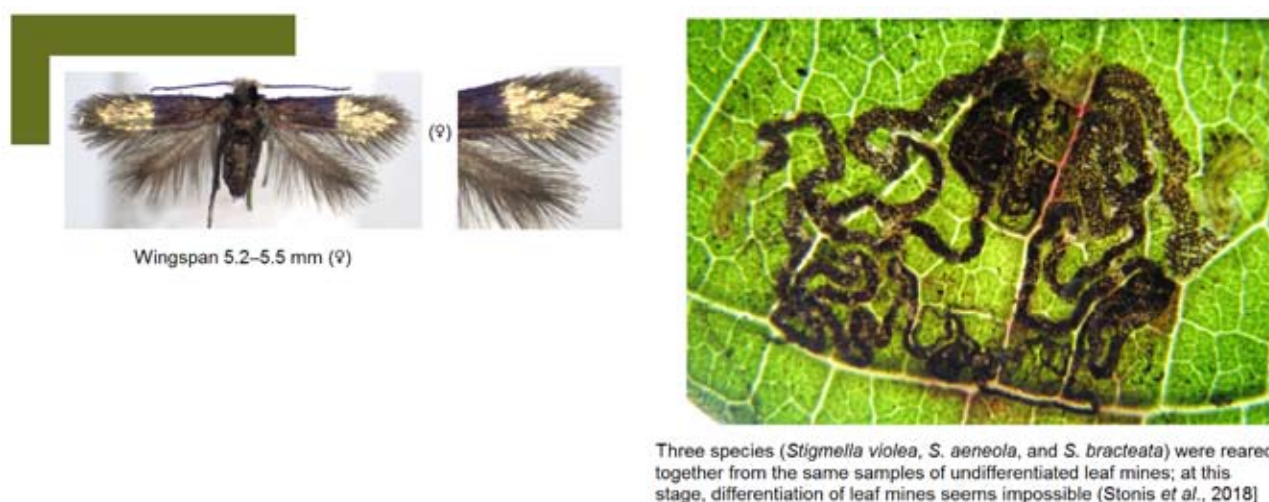


Figure 247. *Stigmella aeneola* Diškus & Stonis, a species attributed to the *S. bipartita* group.



Male is unknown.
The species was described from a female only

<i>Stigmella bracteata</i> Diškus & Stonis, 2018
Host plant(s): <i>Liabum</i> sp. (Asteraceae)
Type locality: Ecuador (Pichincha Province, NW Alóag)
Recommended reference(s): [156]
Last updated: 19-05-2022

Figure 248. *Stigmella bracteata* Diškus & Stonis, a species attributed to the *S. bipartita* group.



Wingspan 4.5–5.1 mm



Three species (*Stigmella violea*, *S. aeneola*, and *S. bracteata*) were reared together from the same samples of undifferentiated leaf mines; at this stage, differentiation of leaf mines seems impossible (Stonis *et al.*, 2018)



AD814 ZMUC
(holotype)

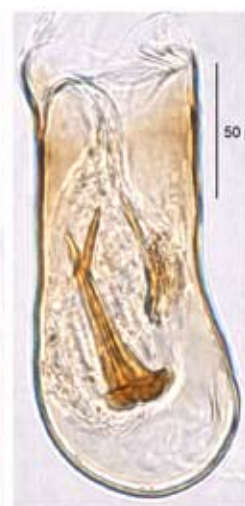


cornuti

cathrema



AD832 ZMUC
(paratype)



AD832 ZMUC
(paratype)



AD814 ZMUC
(holotype)

Stigmella violea Diškus & Stonis, 2018

Host plant(s): *Liabum* sp.
(Asteraceae)

Type locality: Ecuador (Pichincha Province, NW Alóag)

Recommended reference(s): [156]

Last updated: 19-05-2022

Figure 249. *Stigmella violea* Diškus & Stonis, a species attributed to the *S. bipartita* group.

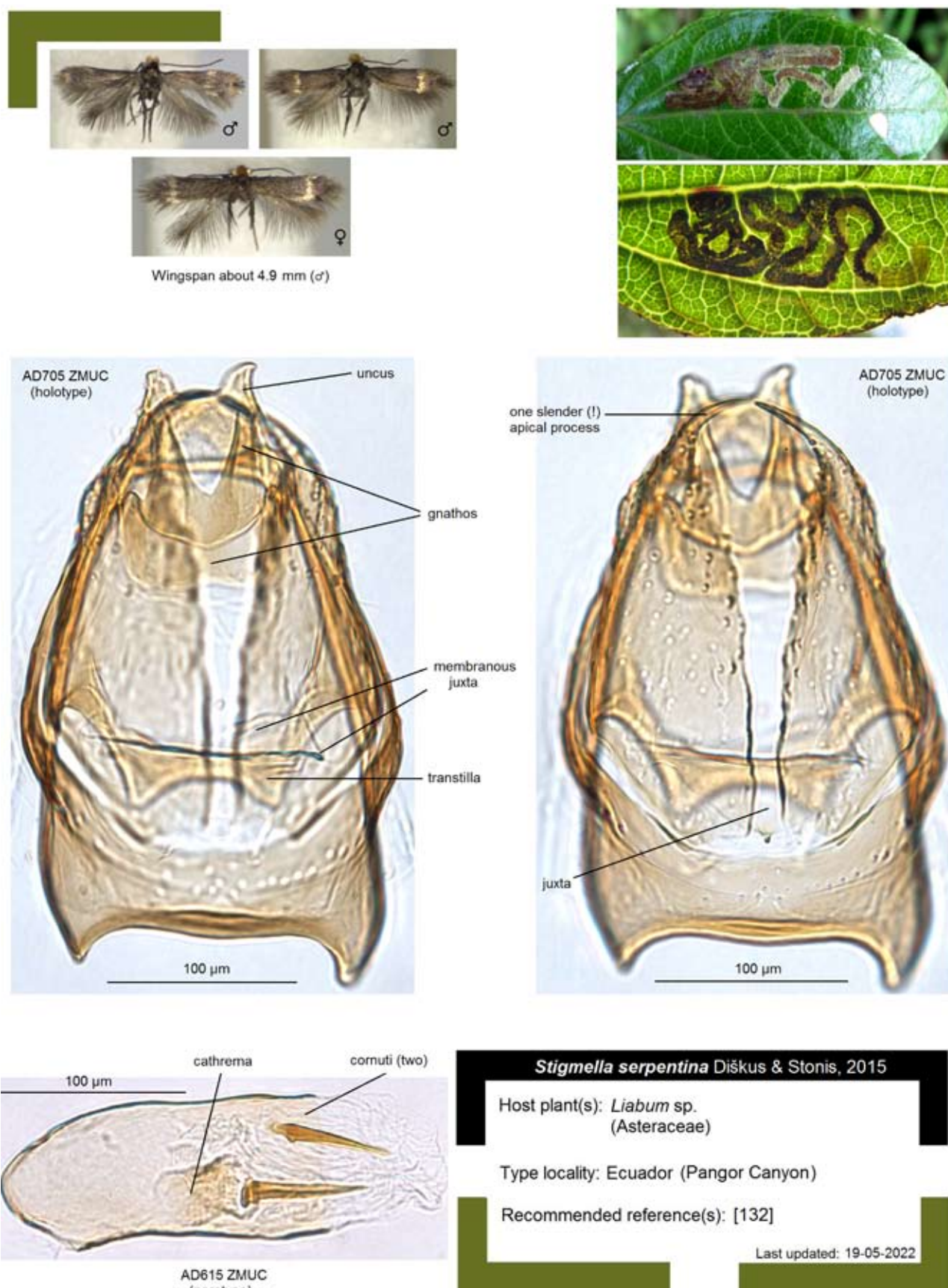


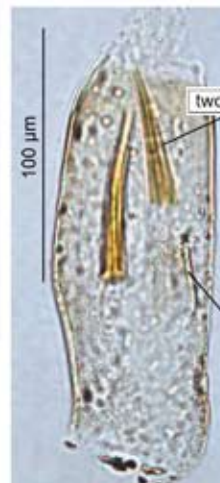
Figure 250. *Stigmella serpentina* Diškus & Stonis, a species attributed to the *S. bipartita* group.



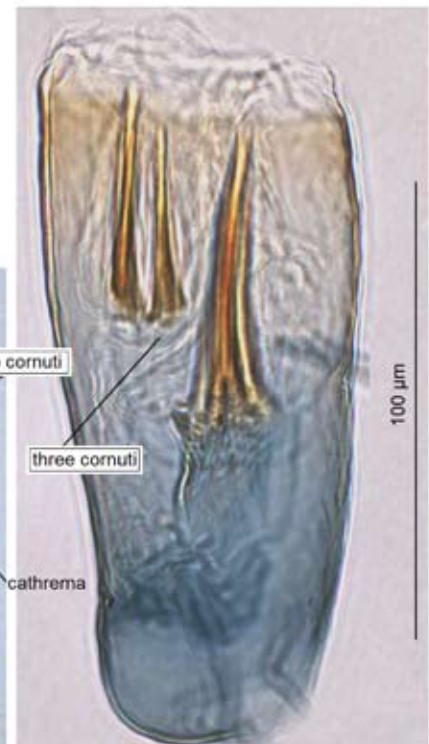
Wingspan 5.6–5.9 mm



Leaf mine similar to those of *S. serpentina* (not preserved or documented, as being initially confused with that species) (Stonis *et al.*, 2015)



AD616 ZMUC (holotype)



AD703 ZMUC (paratype)



AD616 ZMUC (holotype)

Stigmella pangorica Diškus & Stonis, 2015

Host plant(s): *Liabum* sp.
(Asteraceae)

Type locality: Ecuador (Pangor Canyon)

Recommended reference(s): [132]

Last updated: 19-05-2022

Figure 251. *Stigmella pangorica* Diškus & Stonis, a species attributed to the *S. bipartita* group.



Figure 252. *Stigmella tripartita* Diškus & Stonis, a species attributed to the *S. bipartita* group.

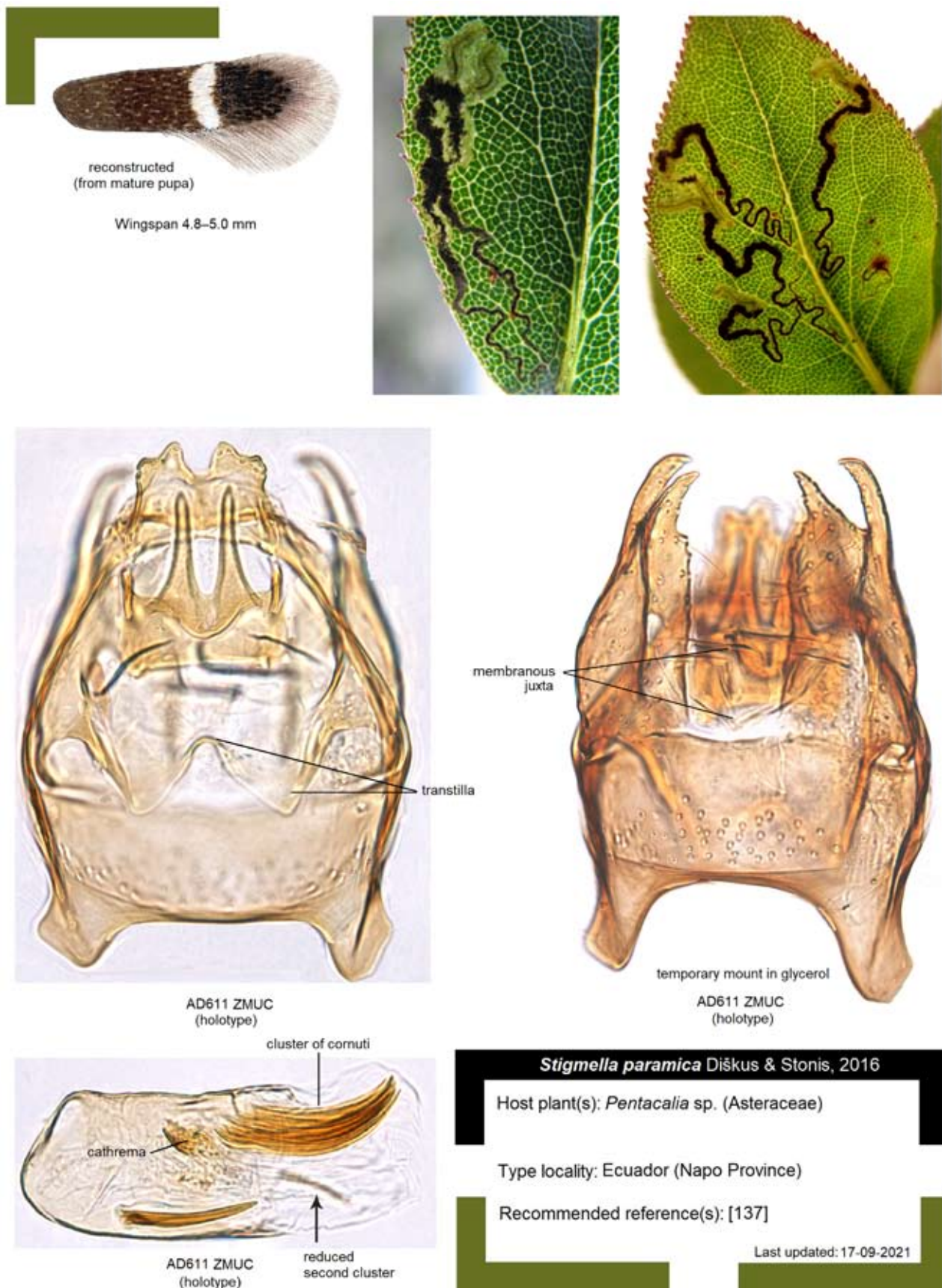


Figure 253. *Stigmella paramica* Diškus & Stonis, a satellite species resembling of the *bipartita* group, but not attributed to it.

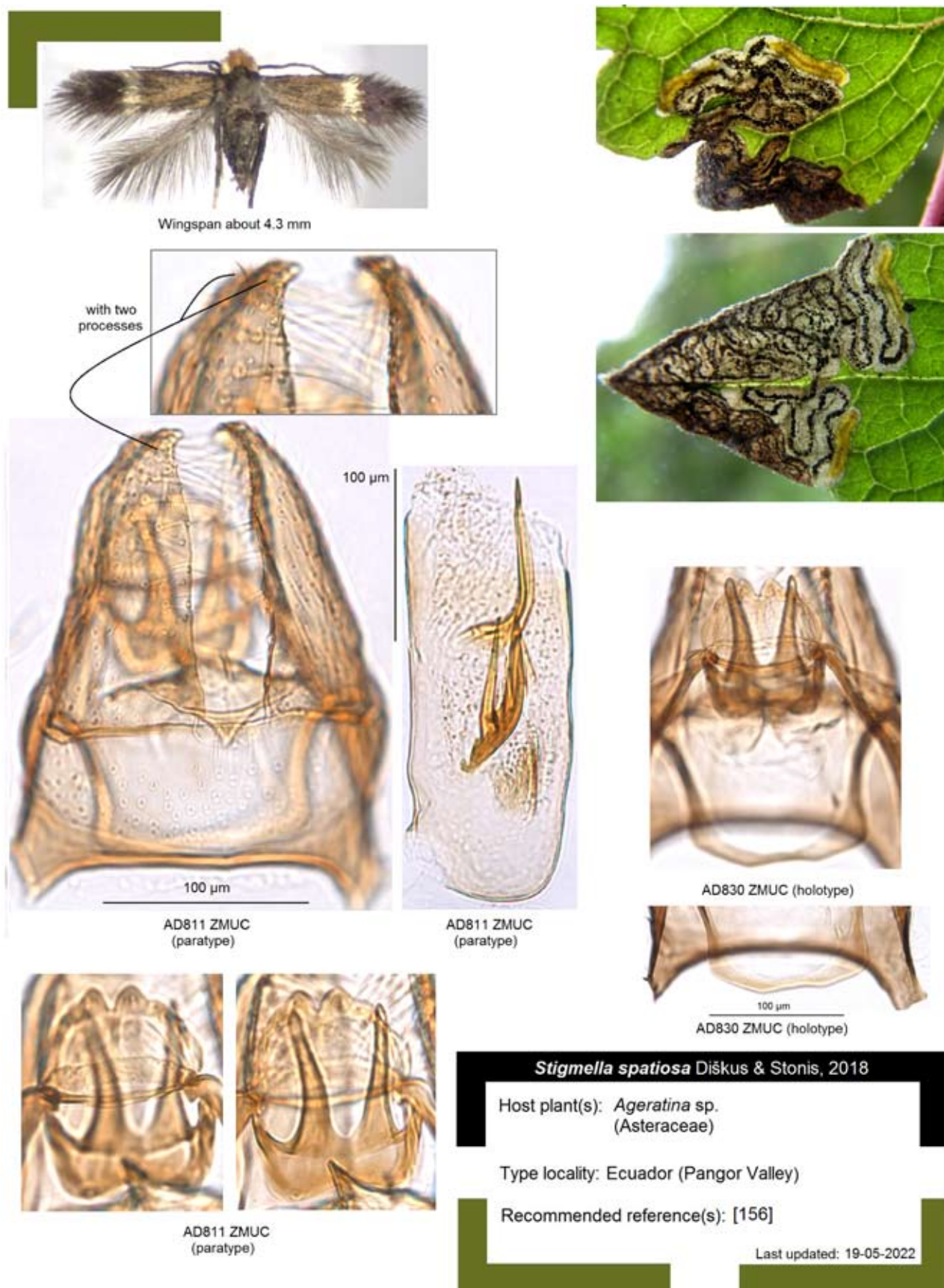


Figure 254. *Stigmella spatiosa* Diškus & Stonis, a satellite species resembling of the *bipartita* group, but not attributed to it.

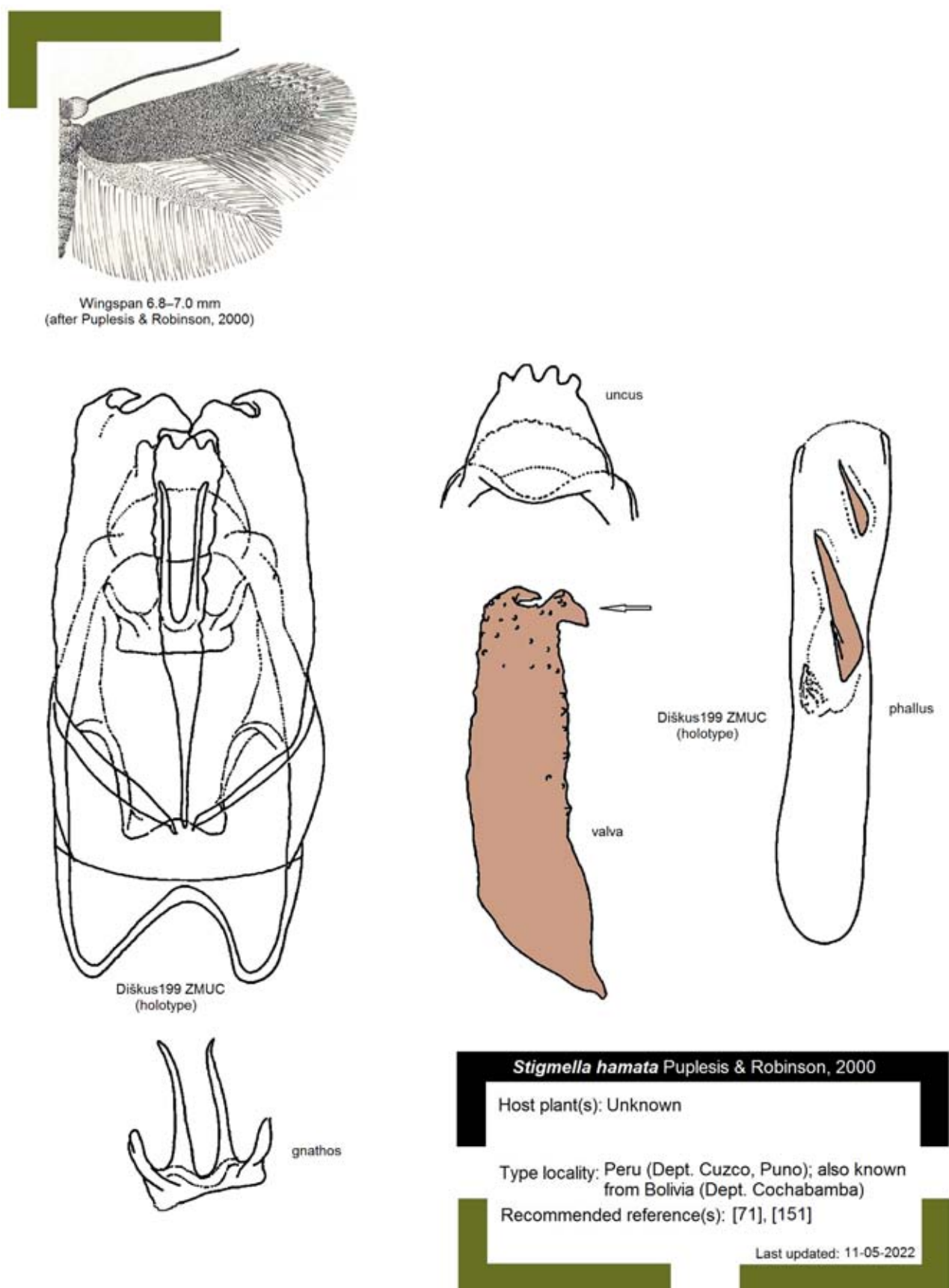
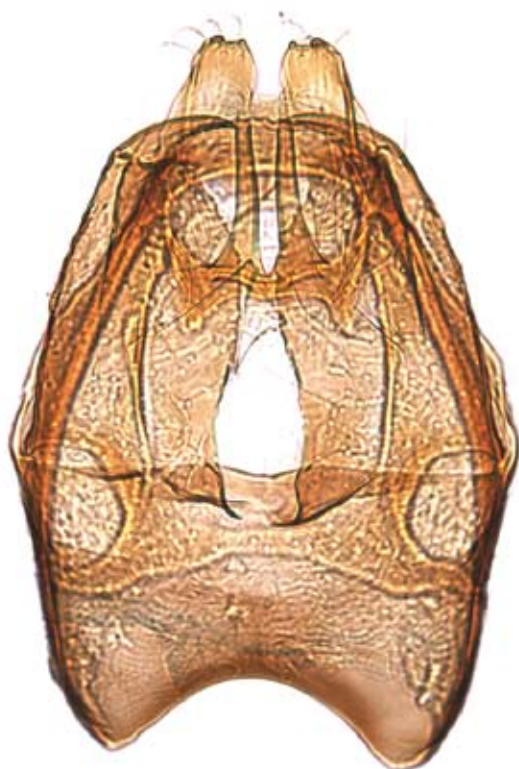


Figure 255. *Stigmella hamata* Puplesis & Robinson, a satellite species resembling of the *bipartita* group, but not attributed to it.



Wingspan 5.8–6.0 mm



Diiskus201 ZMUC
(paratype)



Diiskus200 ZMUC
(holotype)



Diiskus201 ZMUC
(paratype)

***Stigmella schoorli* Puplesis & Robinson, 2000**

Host plant(s): Unknown

Type locality: Peru (Dept. Ancash)

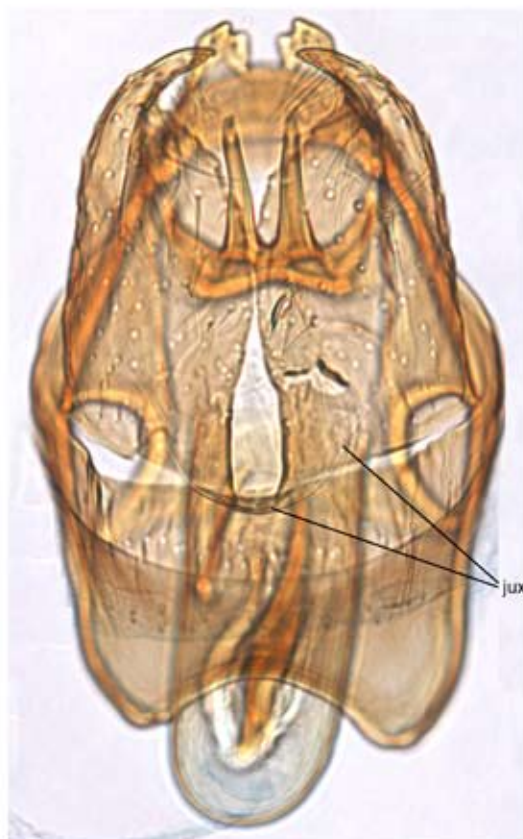
Recommended reference(s): [71], [137]

Last updated: 17-09-2021

Figure 256. *Stigmella schoorli* Puplesis & Robinson, a species attributed to the *S. schoorli* group.



Wingspan 5.0 mm



AD188 ZMUC
(holotype)



AD188 ZMUC
(holotype)

***Stigmella alticosma* Remeikis & Stonis, 2016**

Host plant(s): Unknown

Type locality: Peru (Dept. Lima)

Recommended reference(s): [137], [151]

Last updated: 26-08-2021

Figure 257. *Stigmella alticosma* Remeikis & Stonis, a species attributed to the *S. schoorli* group.

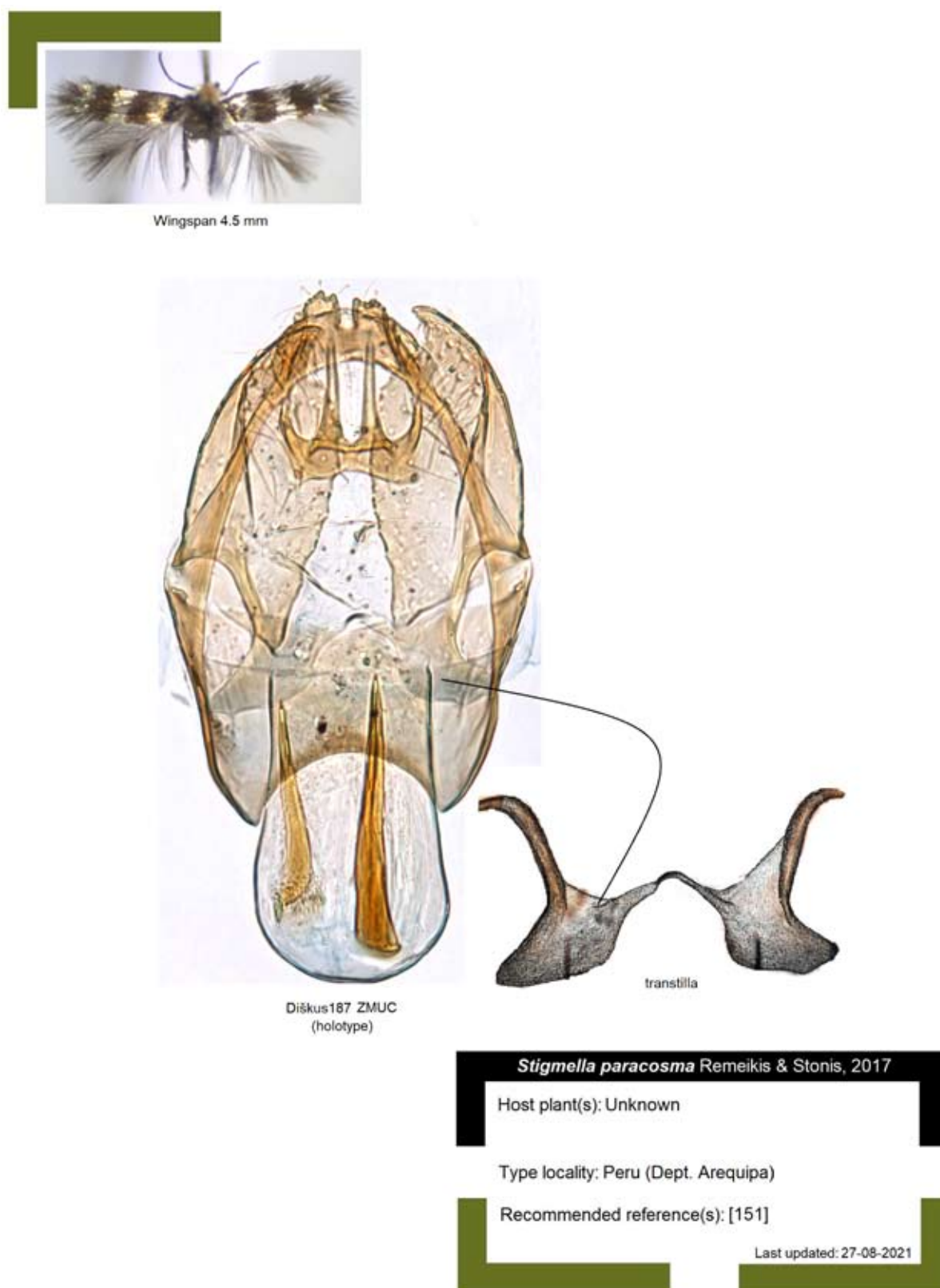


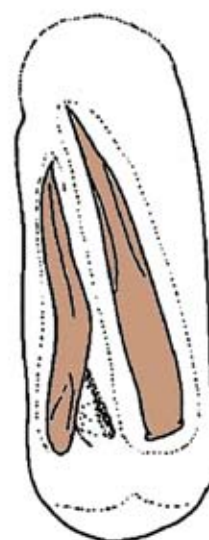
Figure 258. *Stigmella paracosma* Remeikis & Stonis, a species attributed to the *S. schoorli* group.



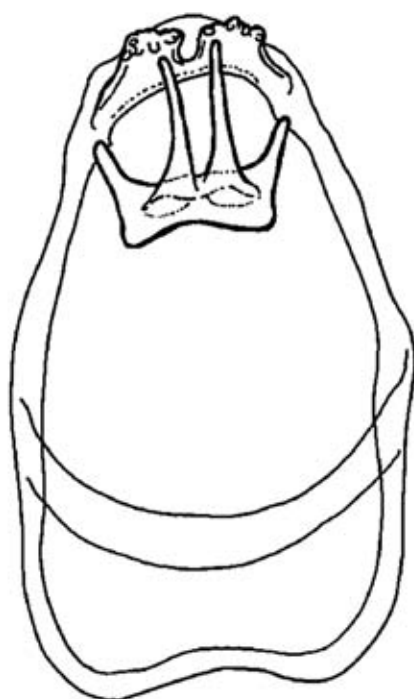
Wingspan 4.1–4.4 mm
(after Puplesis & Robinson, 2000)



28849 NHMUK
(lectotype)



28849 NHMUK
(lectotype)



28849 NHMUK
(lectotype)

* provided by Vargas, 2011 [95]

***Stigmella epicosma* (Meyrick, 1915)**

Host plant(s): **Trixis cacalioides* (Kunth) D.Don.
(Asteraceae)

Type locality: Peru (Lima)

Recommended reference(s): [71], [151], [156]

Last updated: 11-05-2022

Figure 259. *Stigmella epicosma* (Meyrick), a species attributed to the *S. schoorli* group.



Wingspan 6.5–6.7 mm



RA545 ZMUC
(holotype)



RA545 ZMUC
(holotype)



RA545 ZMUC
(holotype)

***Stigmella expressa* Remeikis & Stonis, 2017**

Host plant(s): Unknown

Type locality: Peru (Dept. Ayacucho)

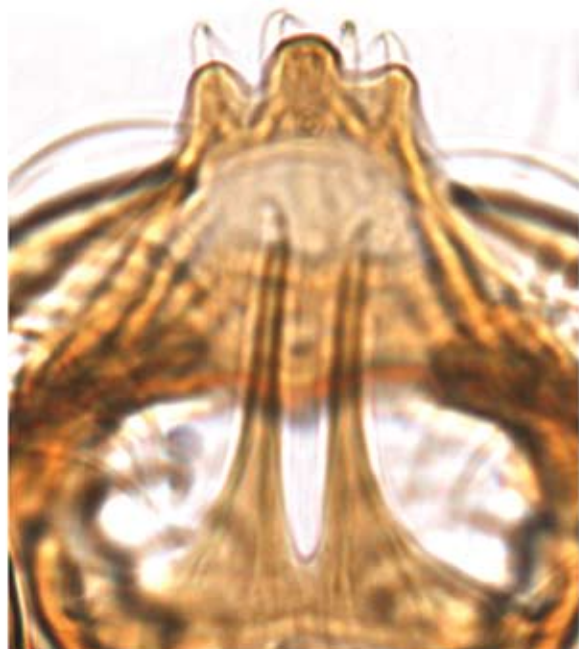
Recommended reference(s): [151]

Last updated: 27-08-2021

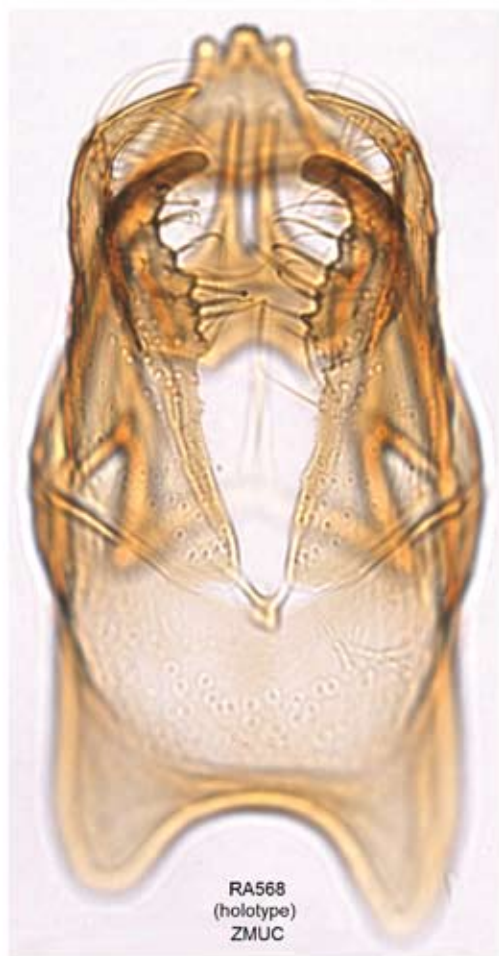
Figure 260. *Stigmella expressa* Remeikis & Stonis, a species attributed to the *S. expressa* group.



Wingspan 8.6–9.6 mm



RA568 ZMUC
(holotype)



RA568
(holotype)
ZMUC



RA568 ZMUC
(holotype)

***Stigmella pseudorobusta* Remeikis & Stonis, 2016**

Host plant(s): Unknown

Type locality: Peru (Dept. Ancash)

Recommended reference(s): [137], [151]

Last updated: 04-06-2021

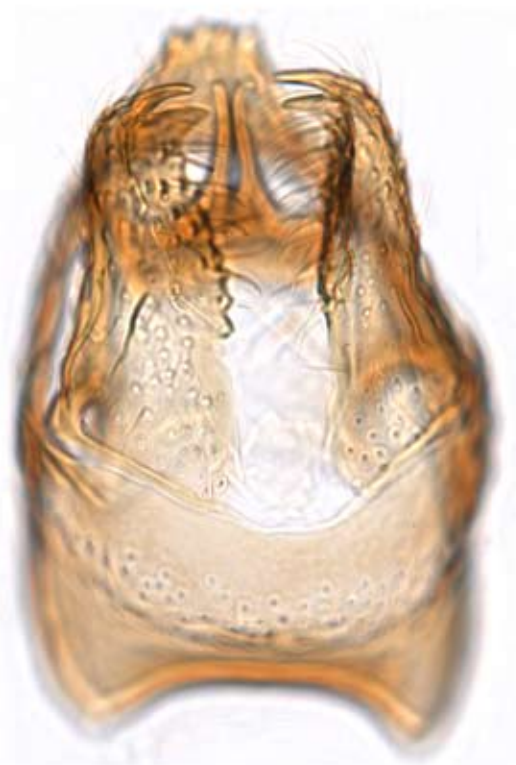
Figure 261. *Stigmella pseudorobusta* Remeikis & Stonis, a species attributed to the *S. expressa* group.



Wingspan 4.9–6.6 mm



Wingspan 4.7–5.0 mm



AD637 ZMUC
(holotype)



AD637 ZMUC
(holotype)



AD637 ZMUC
(holotype)

***Stigmella lachemillae* Diškus & Stonis, 2016**

Host plant(s): *Lachemilla orbiculata* (Ruiz & Pav.)
Rydb. (Rosaceae)

Type locality: Ecuador (Chimborazo Province)

Recommended reference(s): [137]

Last updated: 17-09-2021

Figure 262. *Stigmella lachemillae* Diškus & Stonis, a species attributed to the *S. expresa* group.



Wingspan 7.6–9.6 mm

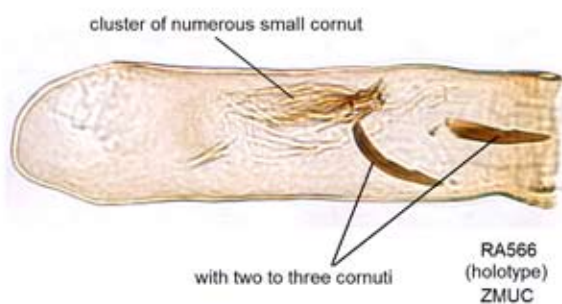


with two caudal processes

RA566
(holotype)
ZMUC



RA566
(holotype)
ZMUC



cluster of numerous small cornuti

with two to three cornuti

RA566
(holotype)
ZMUC

Stigmella robusta Remeikis & Stonis, 2016

Host plant(s): Unknown

Type locality: Peru (Dept. Ancash)

Recommended reference(s): [137], [151]

Last updated: 04-06-2021

Figure 263. *Stigmella robusta* Remeikis & Stonis, a species attributed to the *S. expressa* group.



Wingspan 6.4–6.5 mm



AD672 ZMUC
(holotype)



AD672 ZMUC
(holotype)



AD672 ZMUC
(holotype)

***Stigmella evanida* Diškus & Stonis, 2016**

Host plant(s): Unknown

Type locality: Peru (Dept. Lima)

Recommended reference(s): [137]

Last updated: 17-09-2021

Figure 264. *Stigmella evanida* Diškus & Stonis, a species attributed to the *S. expressa* group.

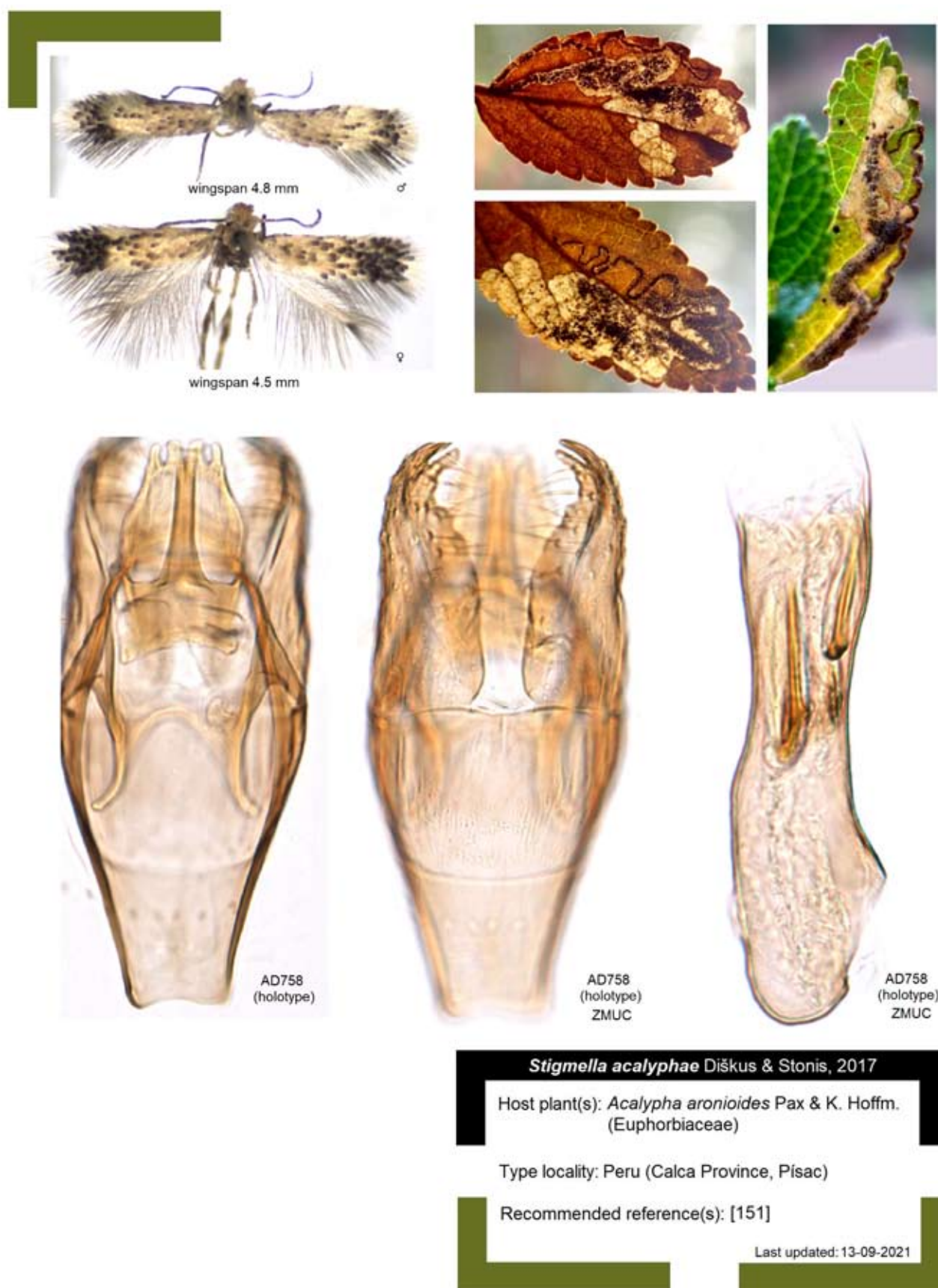


Figure 265. *Stigmella acalyphae* Diškus & Stonis, a species attributed to the *S. expressa* group.



Figure 266. *Stigmella lepida* Diškus & Stonis, a species attributed to the *S. expressa* group.



Wingspan 5.1–5.2 mm



RA544 ZMUC
(holotype)



RA544 ZMUC
(holotype)



RA544 ZMUC
(holotype)



RA544 ZMUC
(holotype)

***Stigmella magnispinella* Remeikis & Stonis, 2016**

Host plant(s): Unknown

Type locality: Andean Peru (Dept. Ayacucho and Ancash)

Recommended reference(s): [134]

Last updated: 04-04-2022

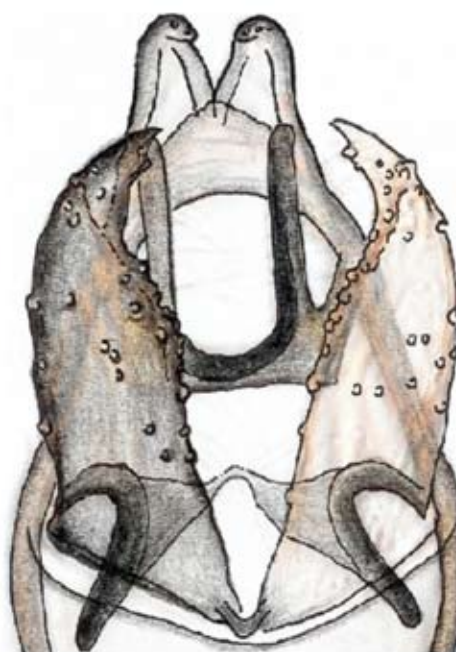
Figure 267. *Stigmella magnispinella* Remeikis & Stonis, a species attributed to the *S. magnispinella* group.



Wingspan 4.3–5.7 mm



RA543 ZMUC
(paratype)



RA560 ZMUC
(holotype)



RA543 ZMUC
(paratype)



RA543 ZMUC
(paratype)

***Stigmella olekarsholti* Remeikis & Stonis, 2016**

Host plant(s): Asteraceae plant (an unidentified species)

Type locality: Peru (Dept. Apurimac; also known from Cusco)

Recommended reference(s): [134]

Last updated: 04-04-2022

Figure 268. *Stigmella olekarsholti* Remeikis, Diškus & Stonis, a species attributed to the *S. magnispinella* group.

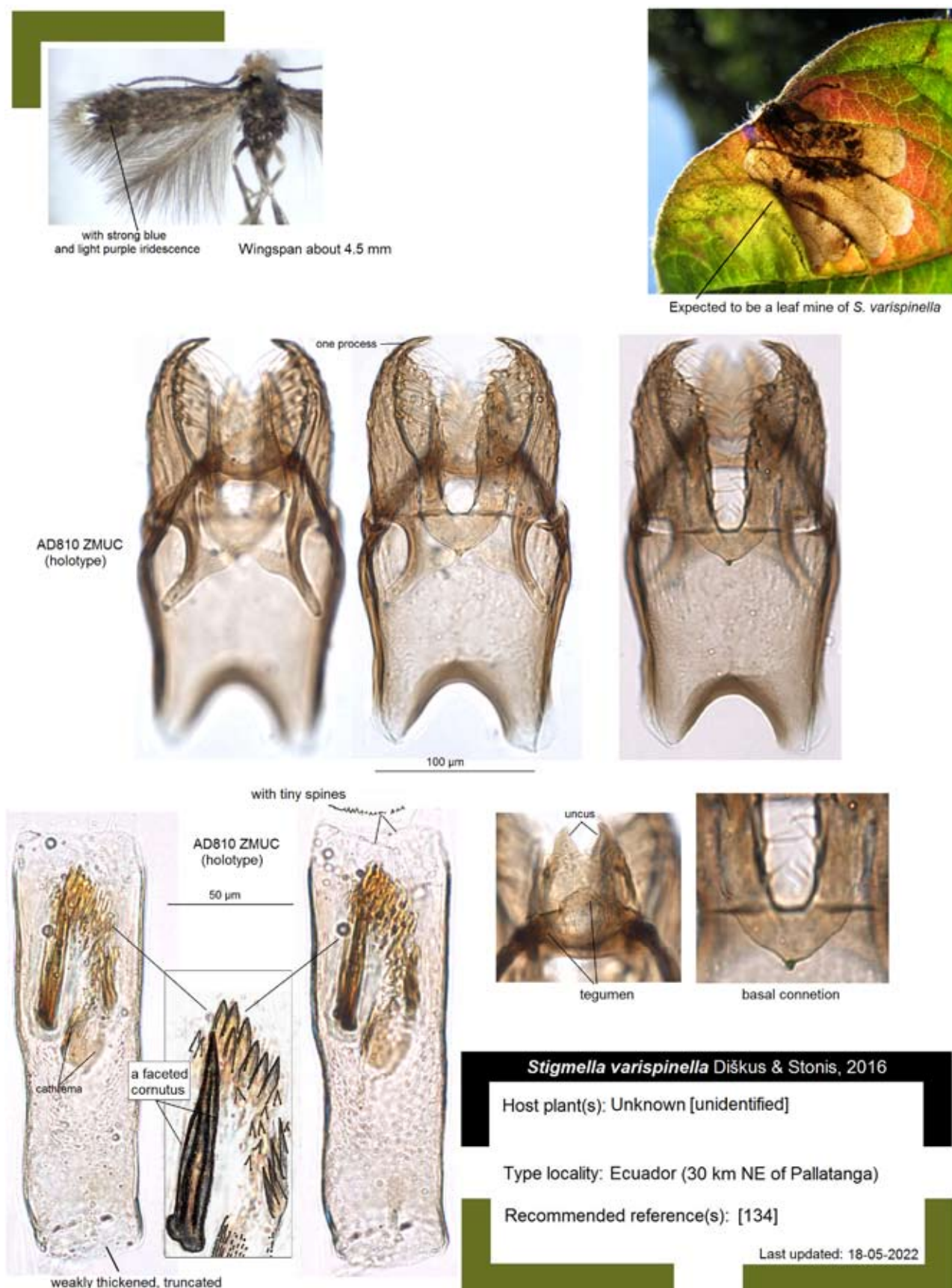


Figure 269. *Stigmella varispinella* Diškus & Stonis, a species attributed to the *S. magnispinella* group.



Wingspan about 6.5 mm



RA601
(holotype)
ZMUC



RA601
(holotype)
ZMUC



RA601 ZMUC
(holotype)



RA601 ZMUC
(holotype)

***Stigmella dolia* Remeikis & Stonis, 2016**

Host plant(s): Unknown

Type locality: Argentina (Neuquén Province)

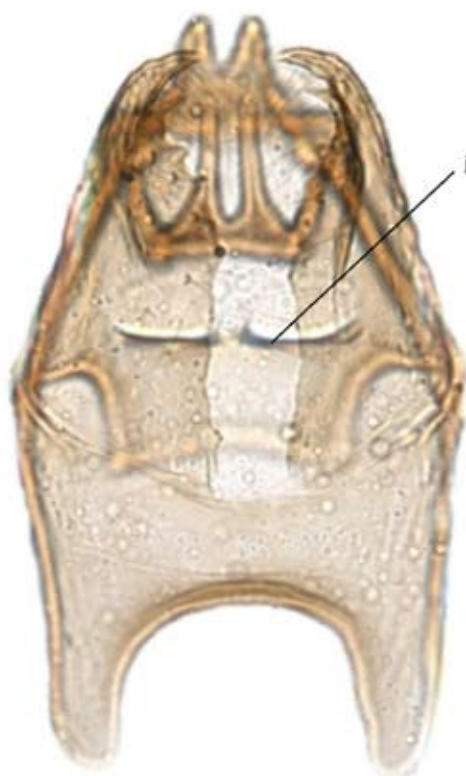
Recommended reference(s): [134]

Last updated: 04-04-2022

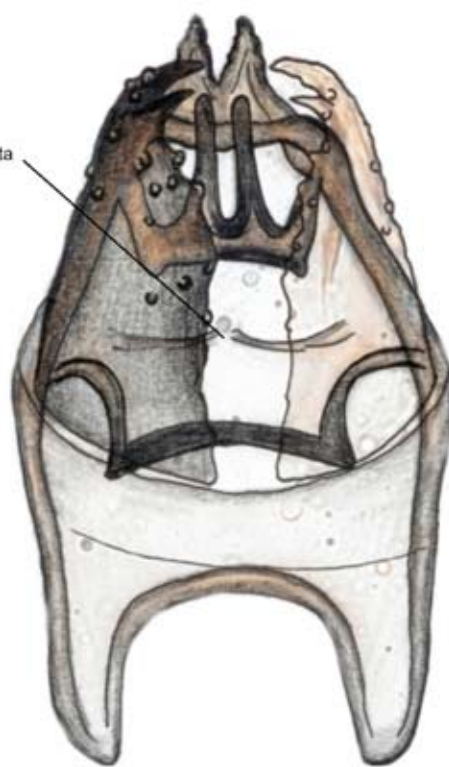
Figure 270. *Stigmella dolia* Remeikis & Stonis, a species attributed to the *S. magnispinella* group.



Wingspan 5.2–5.6 mm



RA348 ZMUC
(holotype)



RA348 ZMUC
(holotype)



RA348 ZMUC
(holotype)

***Stigmella patagonica* Remeikis & Stonis, 2016**

Host plant(s): Unknown;
caught on *Discaria serratifolia*
(Vent.) Benth. & Hook. f. ex Mast.
(Rhamnaceae)

Type locality: Argentina (Neuquén Province)

Recommended reference(s): [134]

Last updated: 04-04-2022

Figure 271. *Stigmella patagonica* Remeikis & Stonis, a species attributed to the *S. magnispinella* group.

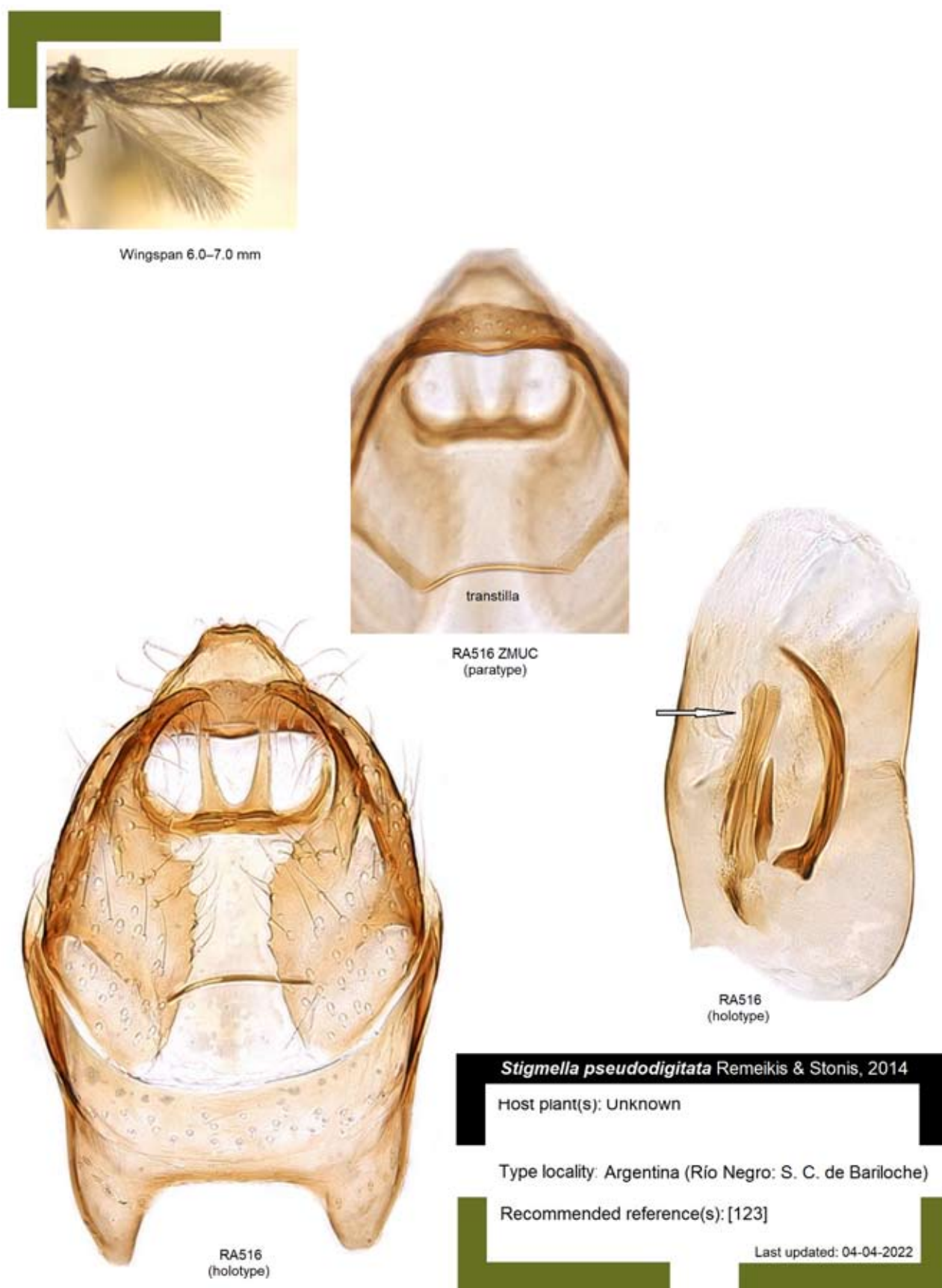
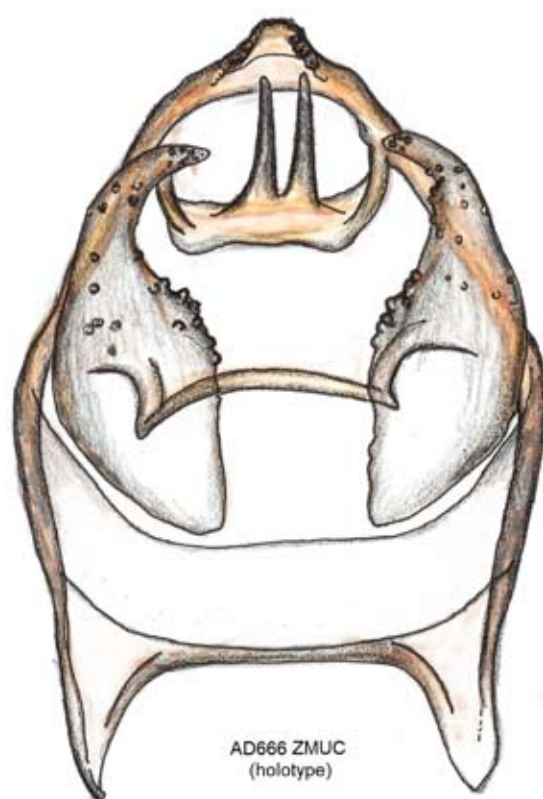


Figure 272. *Stigmella pseudodigitata* Remeikis & Stonis, a species attributed to the *S. pseudodigitata* group.



***Stigmella azurella* Diškus & Stonis, 2017**

Host plant(s): Unknown

Type locality: Bolivia (Nor Yungas Province)

Recommended reference(s): [151]

Last updated: 13-09-2021

Figure 273. *Stigmella azurella* Diškus & Stonis, a species attributed to the *S. pseudodigitata* group.

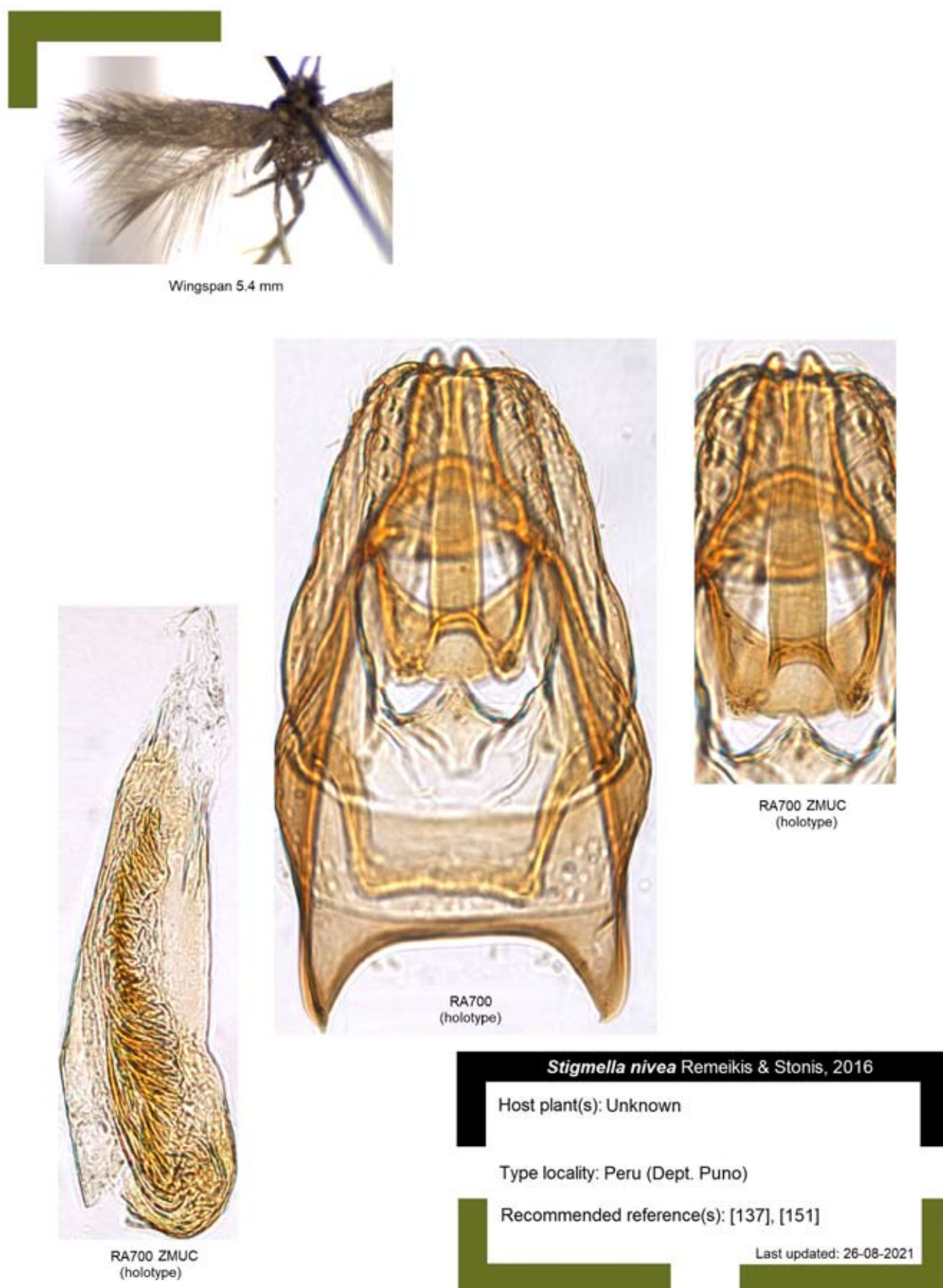


Figure 274. *Stigmella nivea* Remeikis & Stonis, a species attributed to the *S. nivea* group.

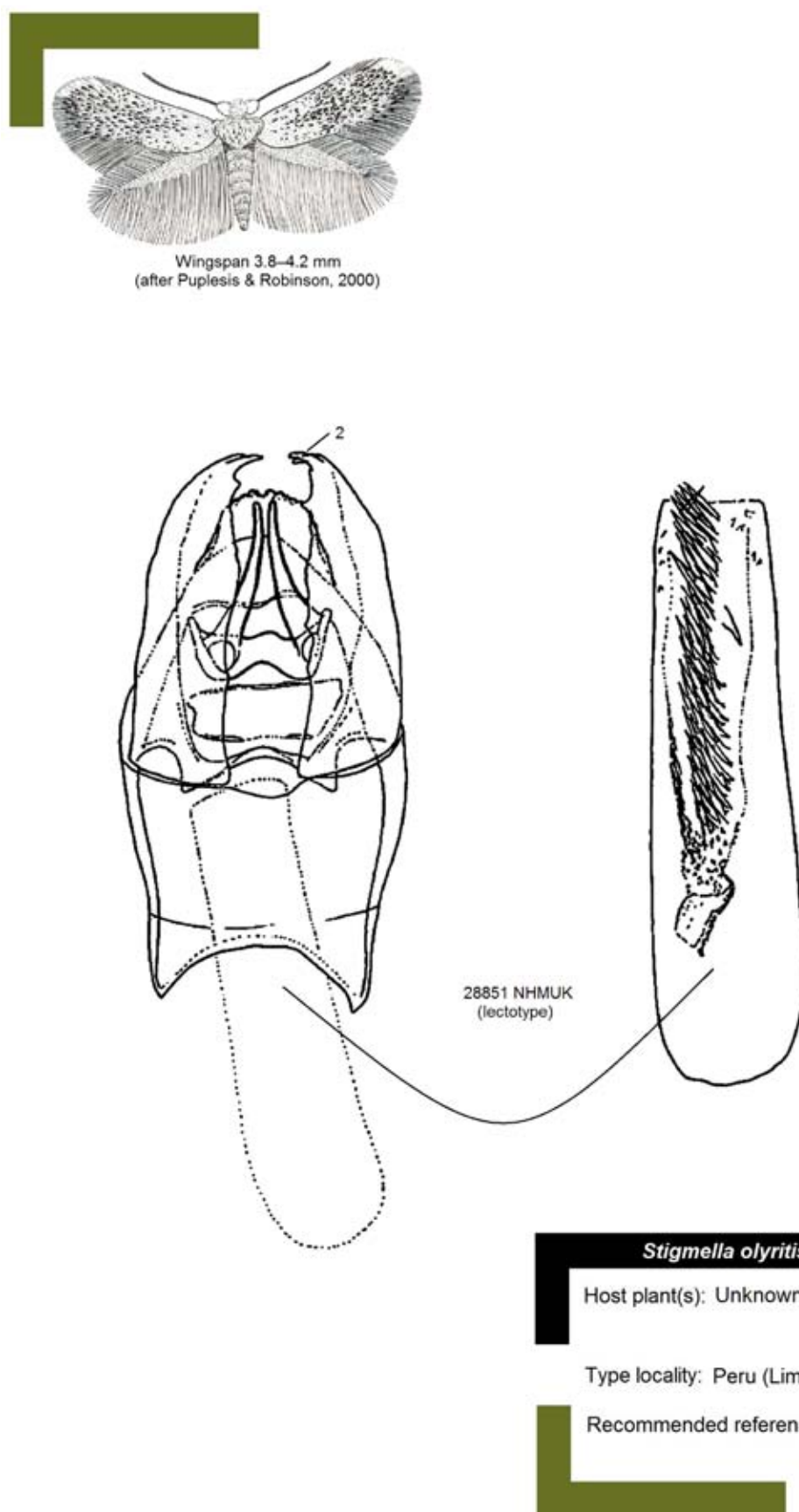


Figure 275. *Stigmella olyritis* (Meyrick), a species attributed to the *S. nivea* group.



Wingspan 5.5–5.6 mm



AD595 ZMUC
(paratype)



AD595 ZMUC
(paratype)



AD595 ZMUC
(paratype)

***Stigmella ageratinae* Diškus & Stonis, 2016**

Host plant(s): *Ageratina pentlandiana* (DC.) R.M.
King & H. Rob. (Asteraceae)

Type locality: Bolivia (Copacabana)

Recommended reference(s): [137]

Last updated: 17-09-2021

Figure 276. *Stigmella ageratinae* Diškus & Stonis, a species attributed to the *S. nivea* group.

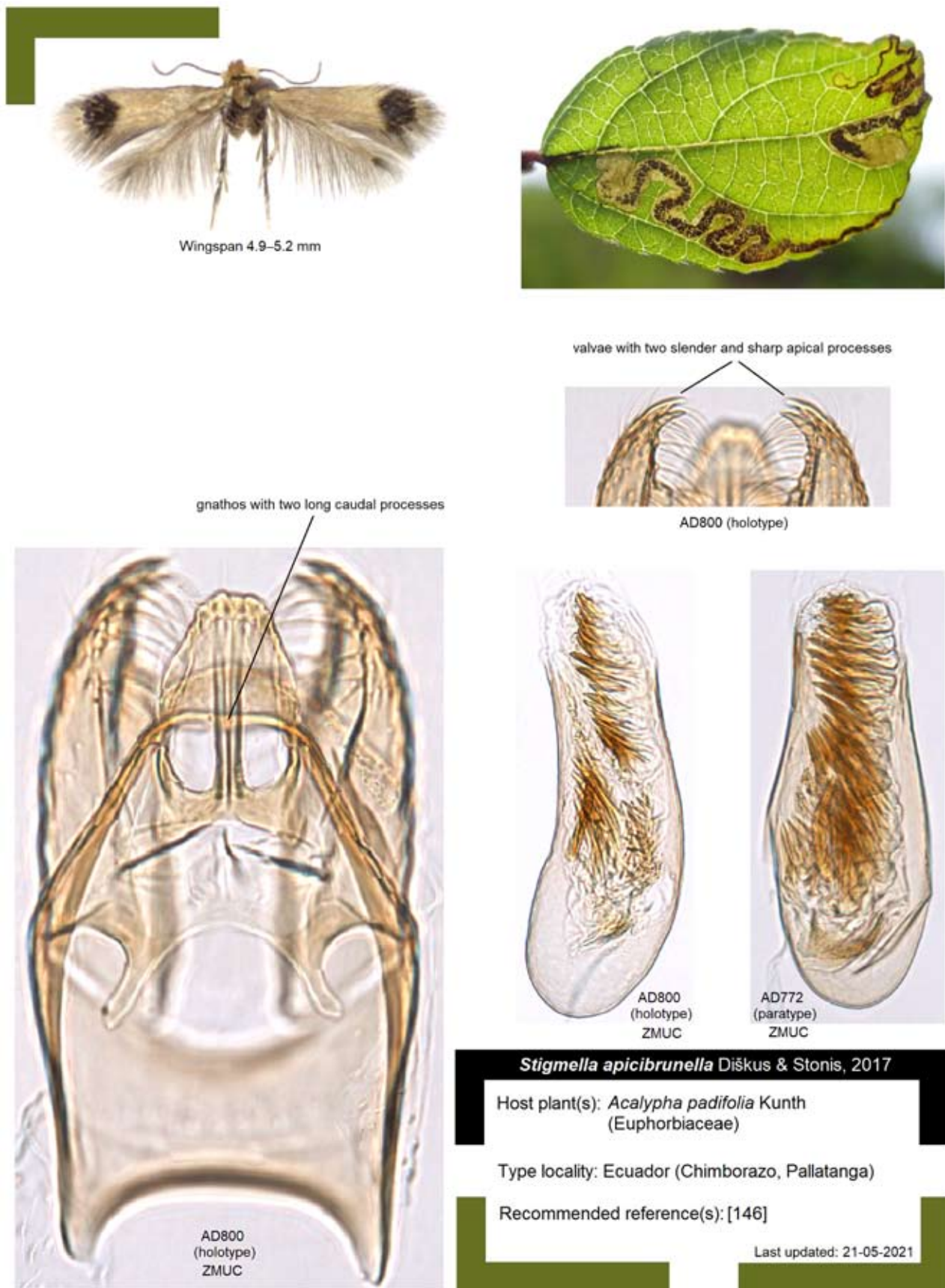


Figure 277. *Stigmella apicibrunella* Diškus & Stonis, a species attributed to the *S. nivea* group.

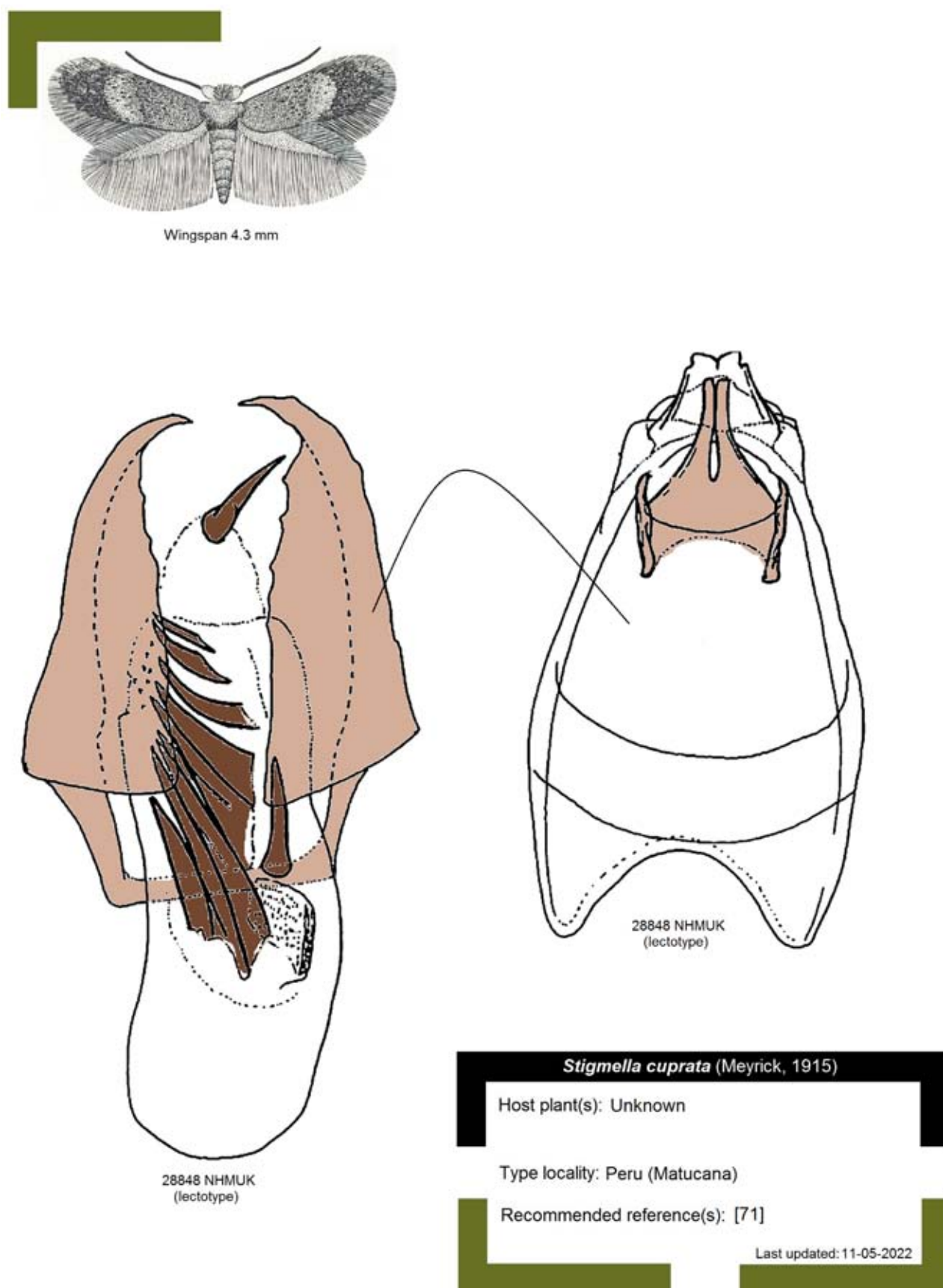
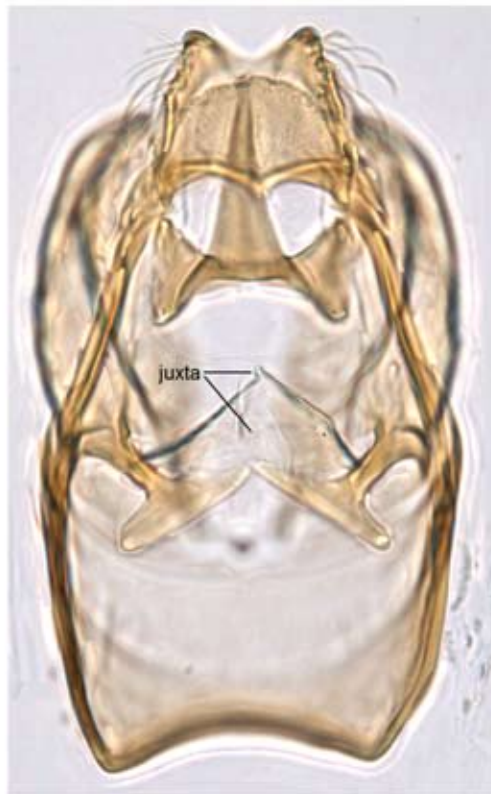


Figure 278. *Stigmella cuprata* (Meyrick), a species attributed to the *S. nivea* group.



Wingspan about 6.4 mm



AD668 ZMUC
(holotype)



AD668 ZMUC
(holotype)



AD668
(holotype)

***Stigmella eiffeli* Diškus & Stonis, 2017**

Host plant(s): Unknown

Type locality: Peru (Dept. Lima)

Recommended reference(s): [151]

Last updated: 13-09-2021

Figure 279. *Stigmella eiffeli* Diškus & Stonis, a species attributed to the *S. nivea* group.

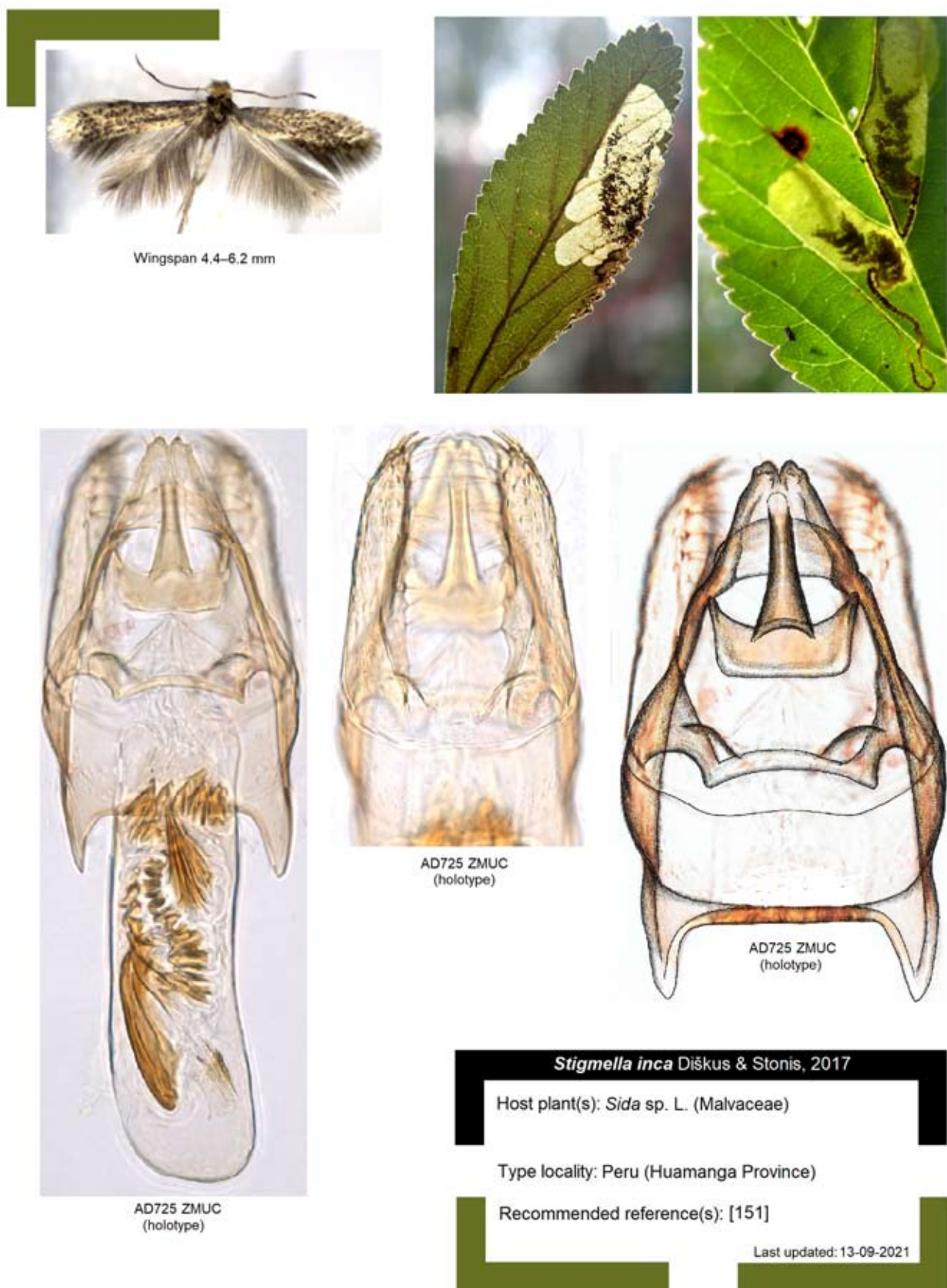


Figure 280. *Stigmella inca* Diškus & Stonis, a species attributed to the *S. nivea* group.

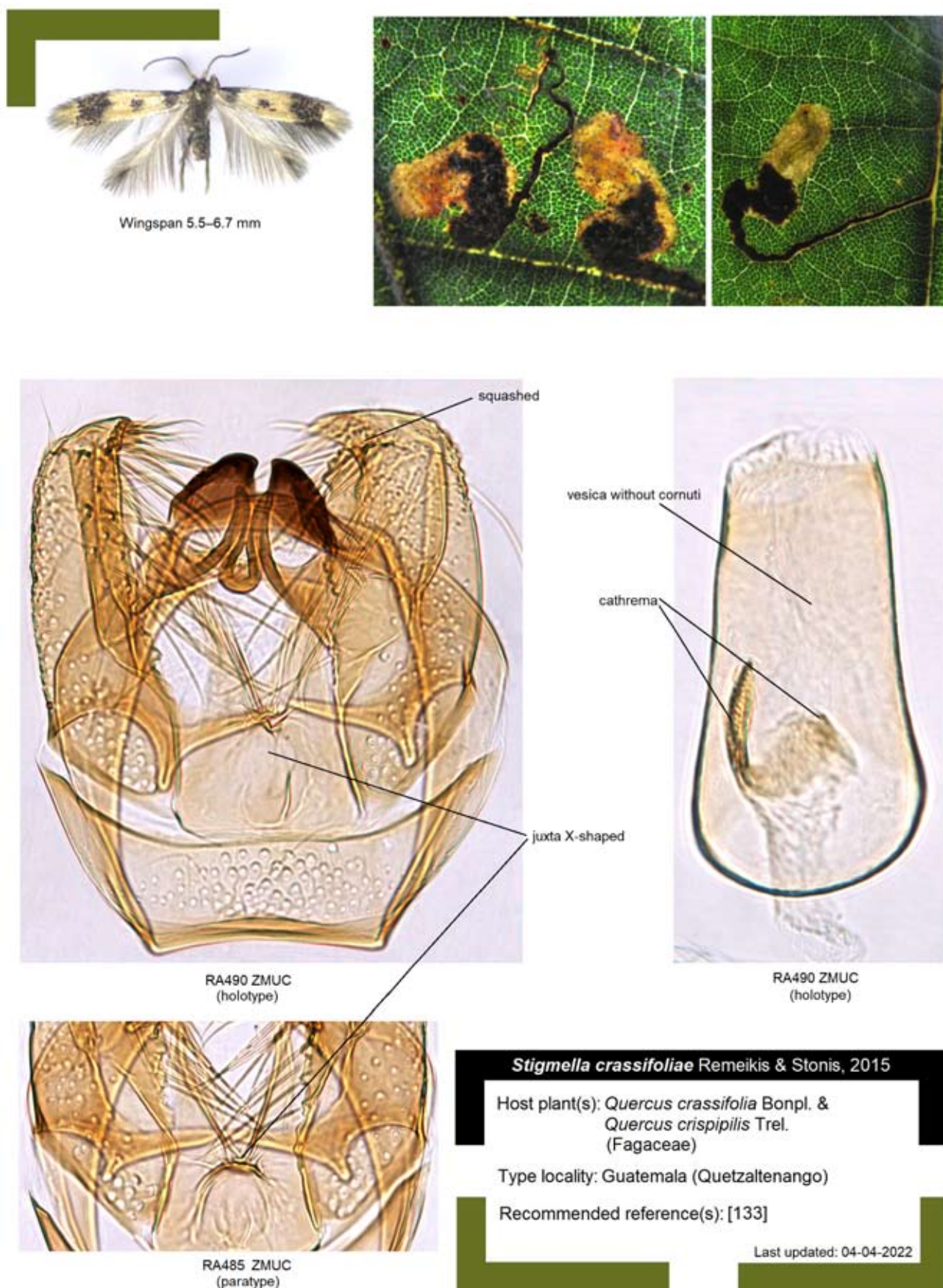


Figure 281. *Stigmella crassifoliae* Remeikis & Stonis, a species attributed to the *S. saginella* group.

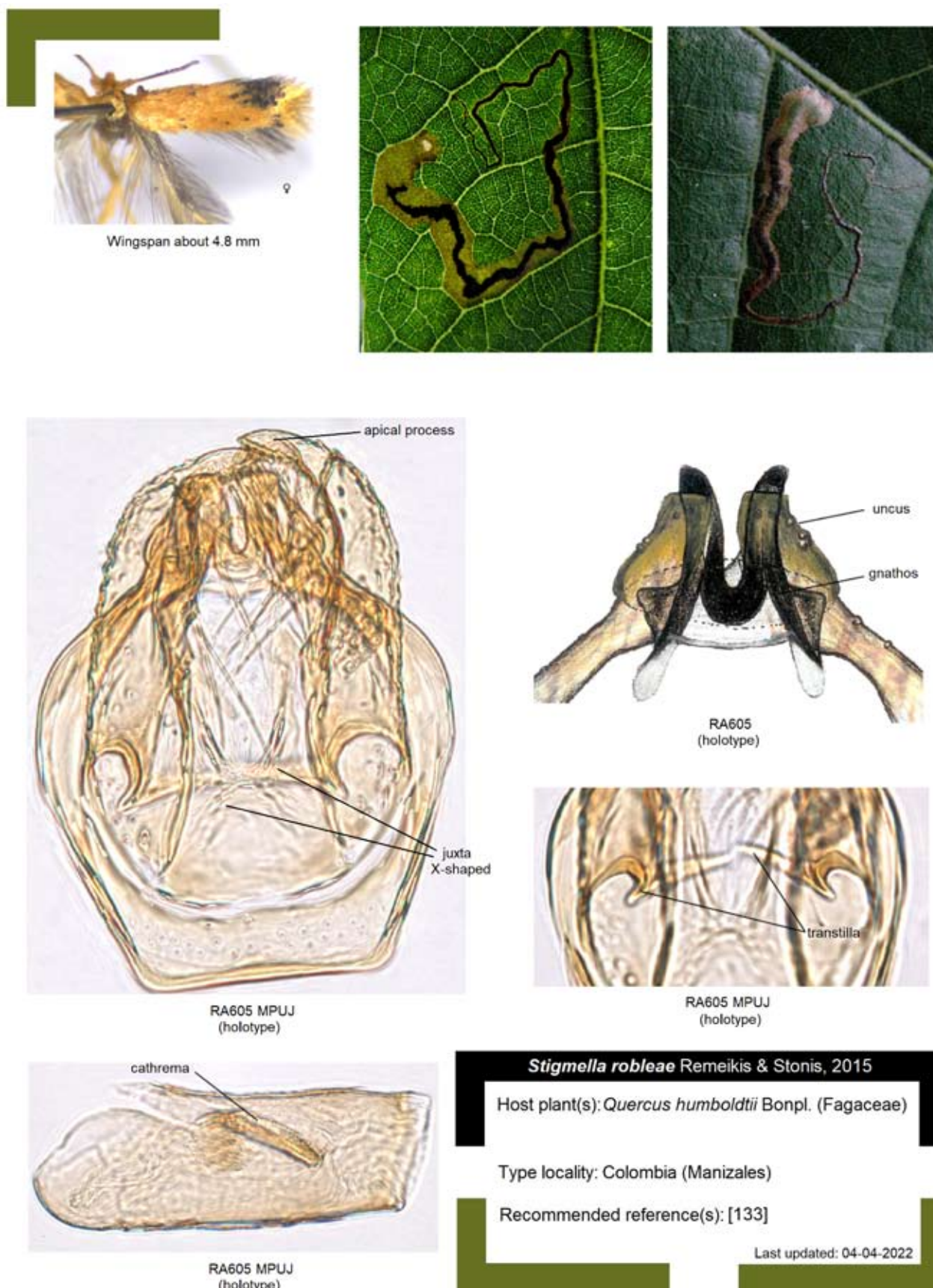
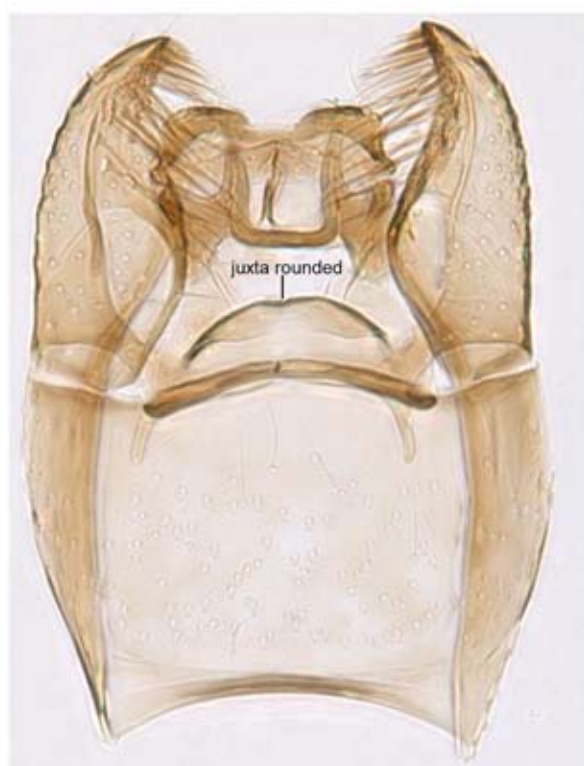
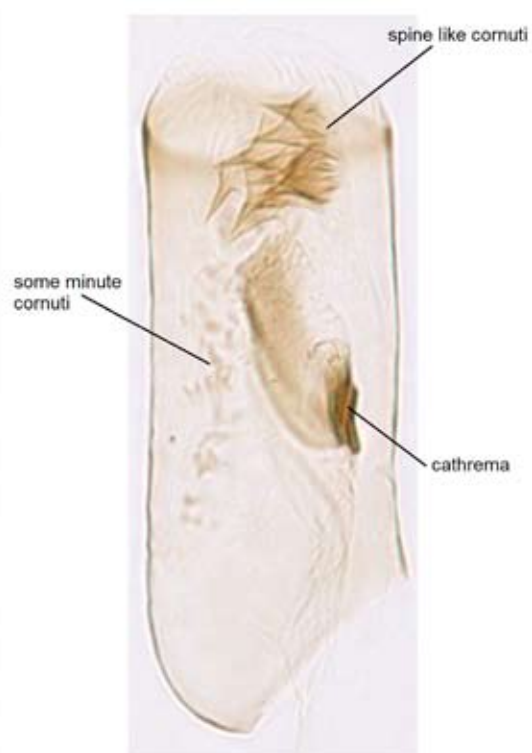


Figure 282. *Stigmella robleae* Remeikis & Stonis, a species attributed to the *S. saginella* group.



RA491 ZMUC
(holotype)



RA491 ZMUC
(holotype)

***Stigmella jaguari* Remeikis & Stonis, 2013**

Host plant(s): *Quercus crispipilis* Trel. (Fagaceae)

Type locality: Guatemala (Quetzaltenango)

Recommended reference(s): [116]

Last updated: 04-04-2022

Figure 283. *Stigmella jaguari* Remeikis & Stonis, a species attributed to the *S. saginella* group.

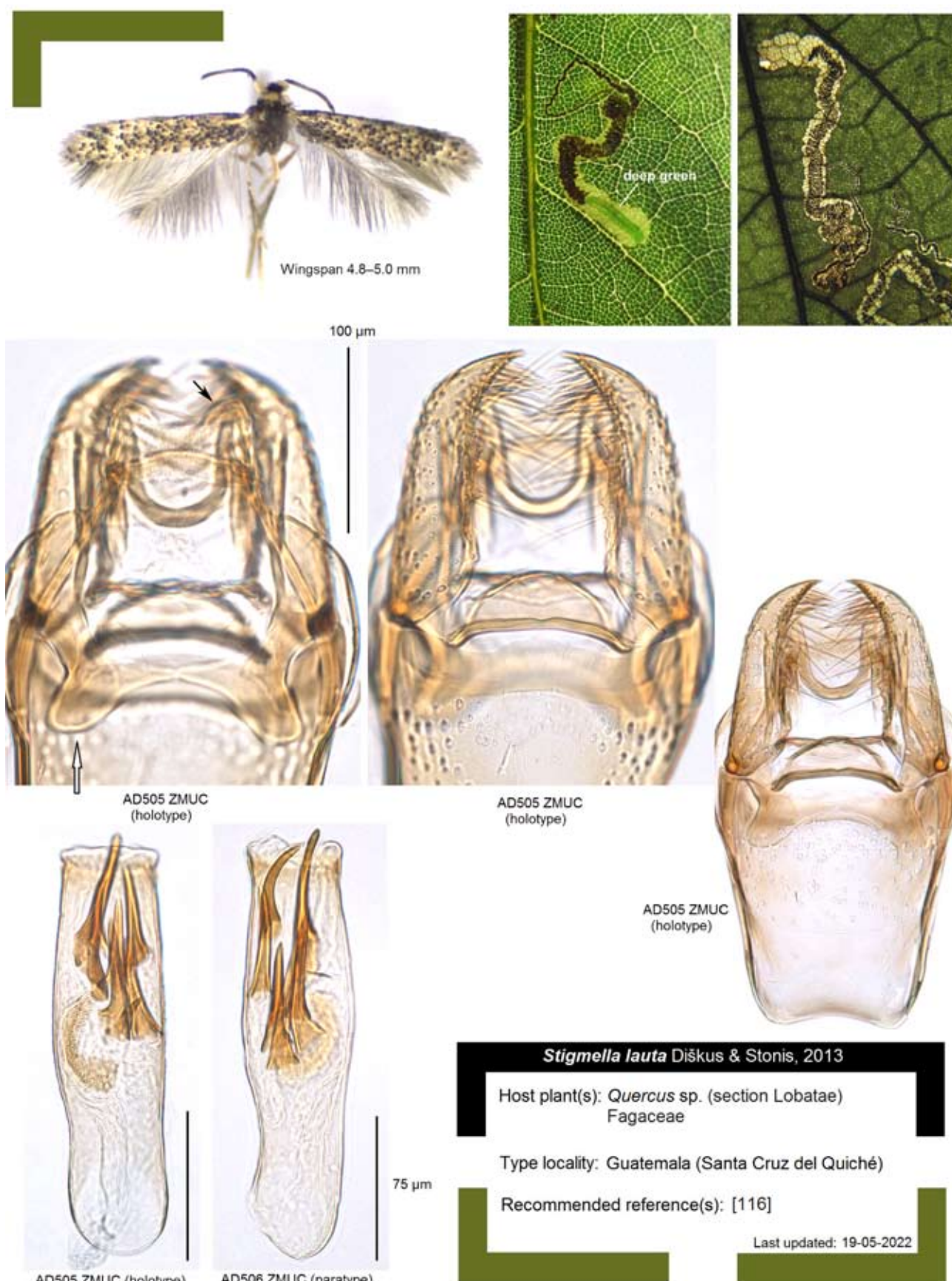


Figure 284. *Stigmella lauta* Diškus & Stonis, a species attributed to the *S. saginella* group.



Wingspan 5.0–5.2 mm



Male is unknown.
The species was described from a female only

***Stigmella sublauta* Remeikis & Stonis, 2013**

Host plant(s): *Quercus crassifolia* Humb. & Bonpl.
(Fagaceae)

Type locality: Guatemala (Quetzaltenango)

Recommended reference(s): [116]

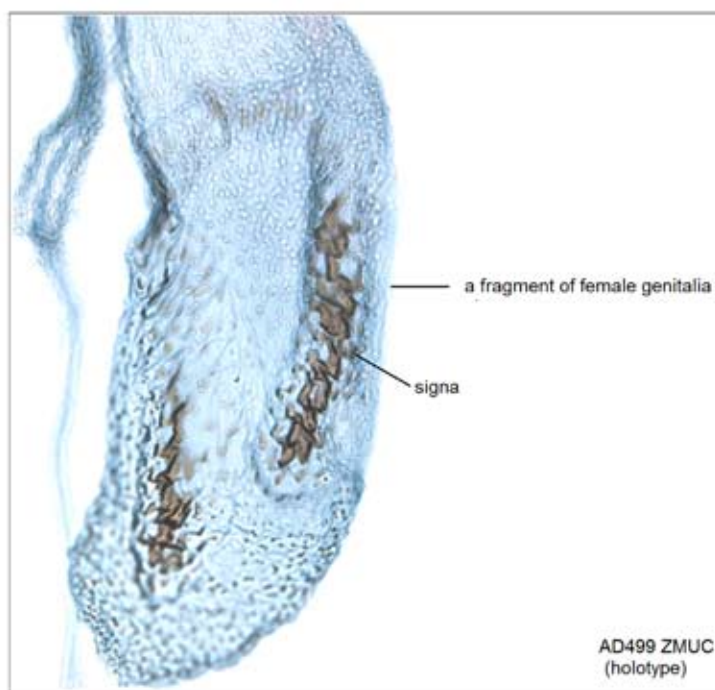
Last updated: 04-04-2022

Figure 285. *Stigmella sublauta* Remeikis & Stonis, a species attributed to the *S. saginella* group.



Wingspan about 5.0 mm

Male is unknown.
The species was described from a female only



***Stigmella aurifasciata* Diškus & Stonis, 2013**

Host plant(s): *Quercus* sp. (section Lobatae)
Fagaceae

Type locality: Guatemala (Panajachel)

Recommended reference(s): [116]

Last updated: 19-05-2022

Figure 286. *Stigmella aurifasciata* Diškus & Stonis, a species attributed to the *S. saginella* group.

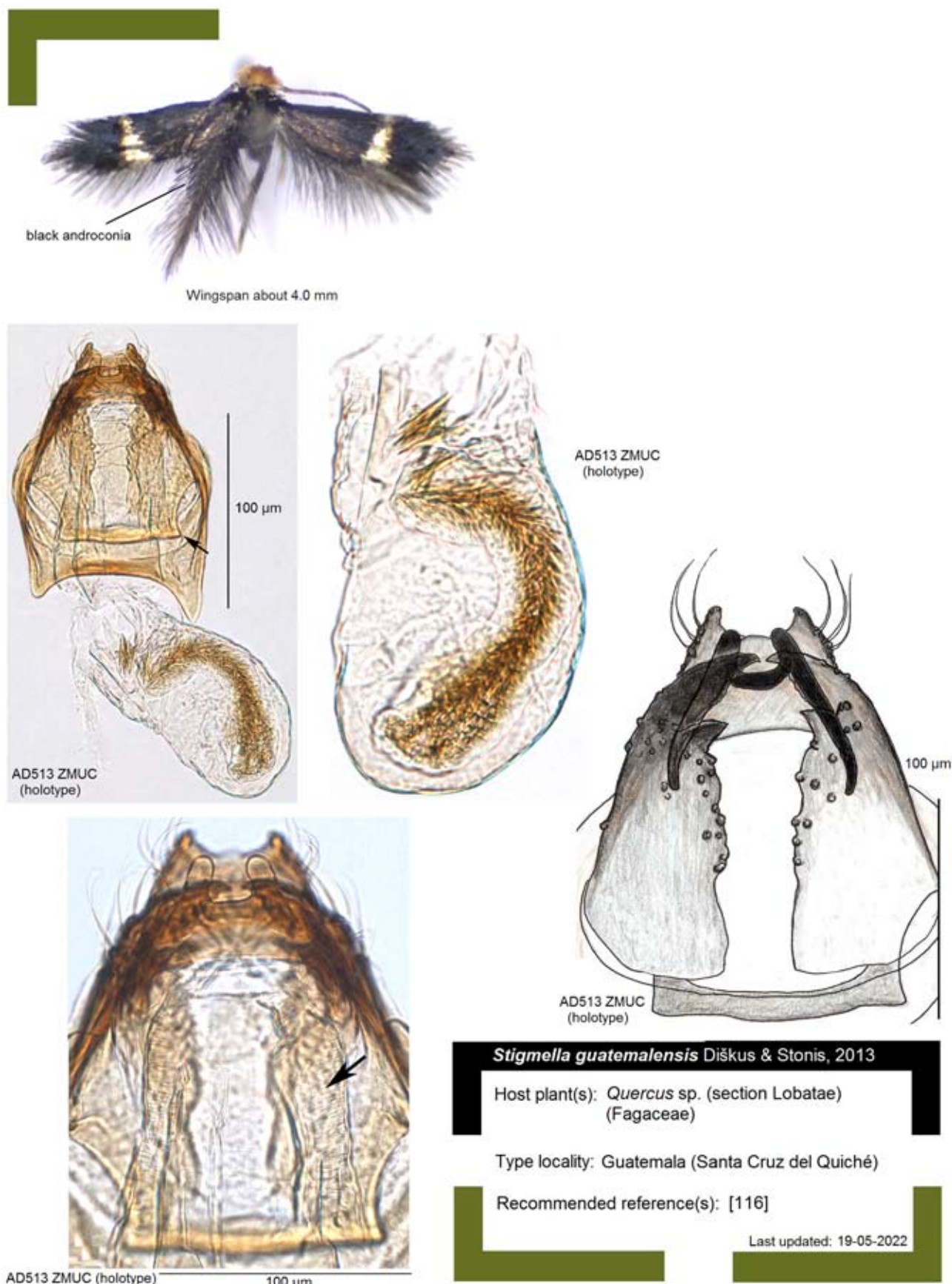


Figure 287. *Stigmella guatemalensis* Diškus & Stonis, a species attributed to the *S. quercipulchella* group.

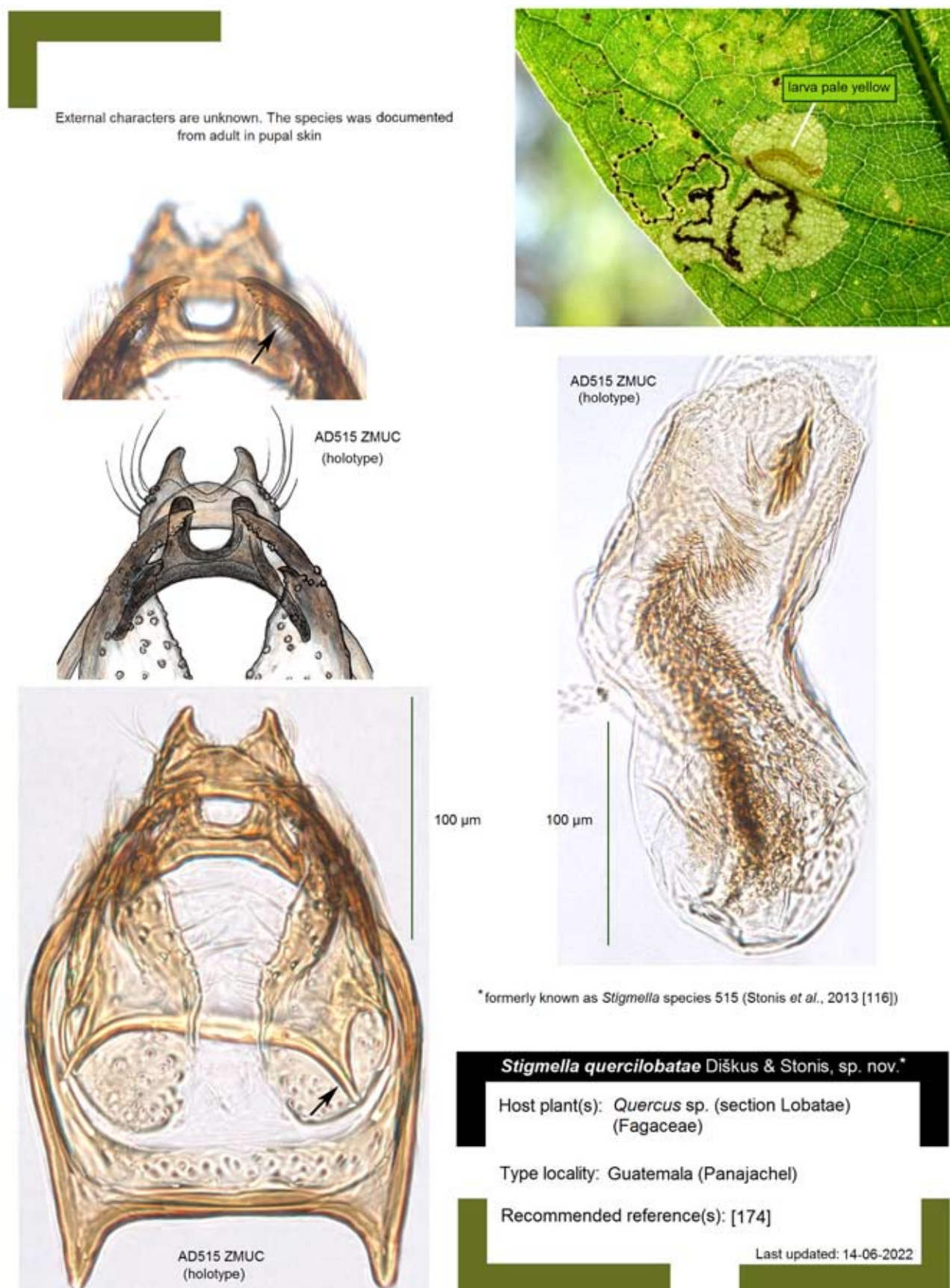
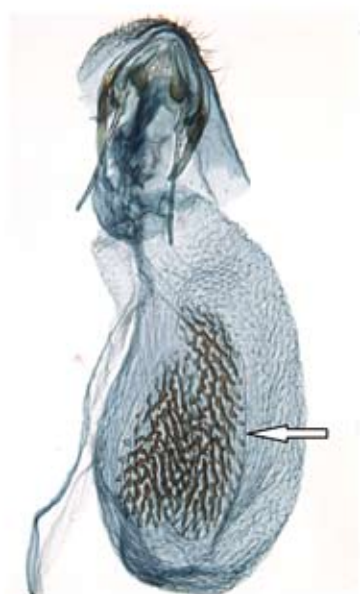


Figure 288. *Stigmella quercilobatae* Diškus & Stonis, a species attributed to the *S. quercipulchella* group.



Male is unknown.
The species was described from a female only



female genitalia, RA607 MPUJ (holotype)

***Stigmella humboldti* Remeikis & Stonis, 2015**

Host plant(s): *Quercus humboldtii* Bonpl. (Fagaceae)

Type locality: Colombia (Parque Chicaque)

Recommended reference(s): [133]

Last updated: 04-04-2022

Figure 289. *Stigmella humboldti* Remeikis & Stonis, a species attributed to the *S. procrastinella* group.

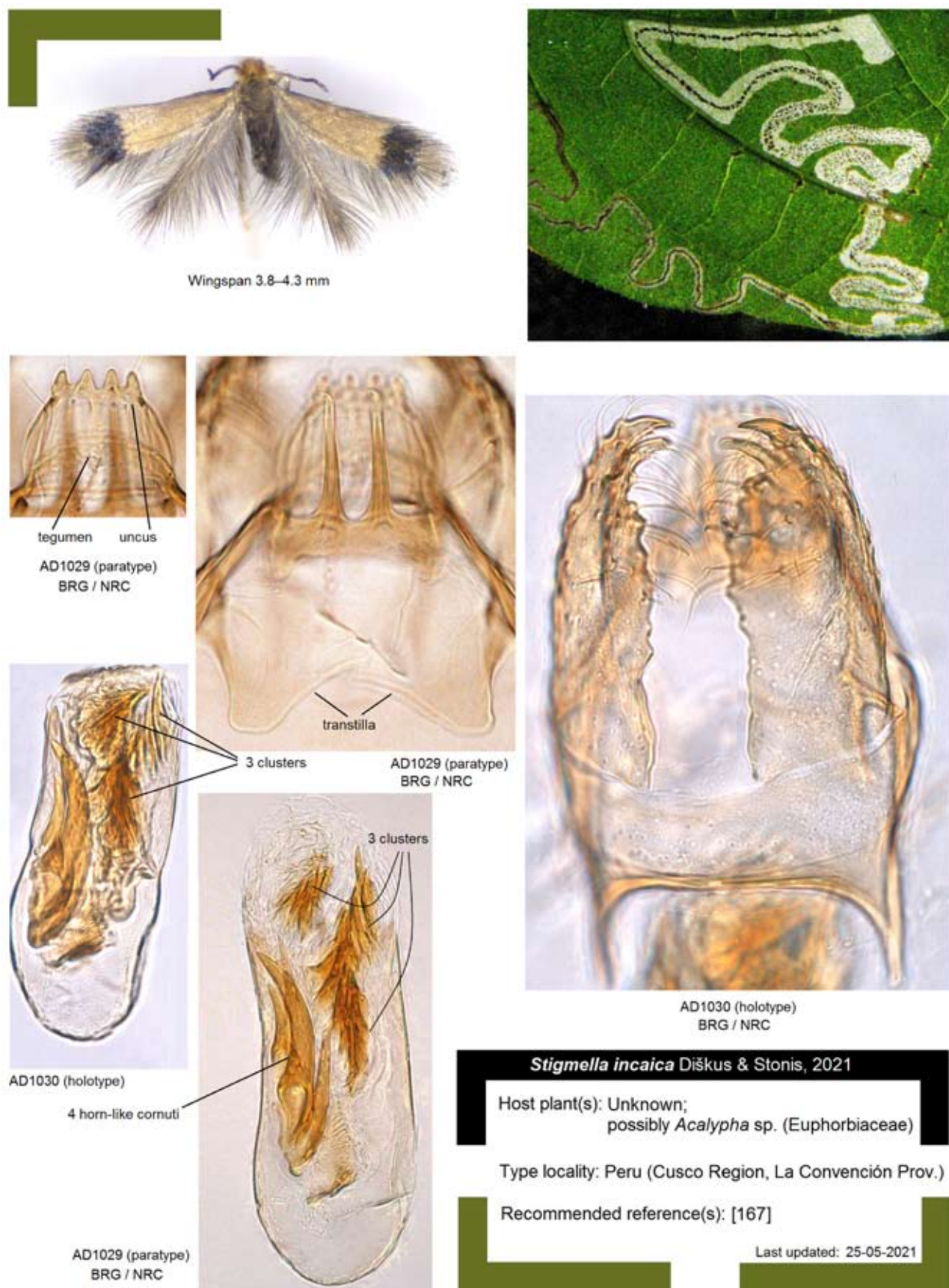


Figure 290. *Stigmella incaica* Diškus & Stonis, a species attributed to the *S. incaica* group.

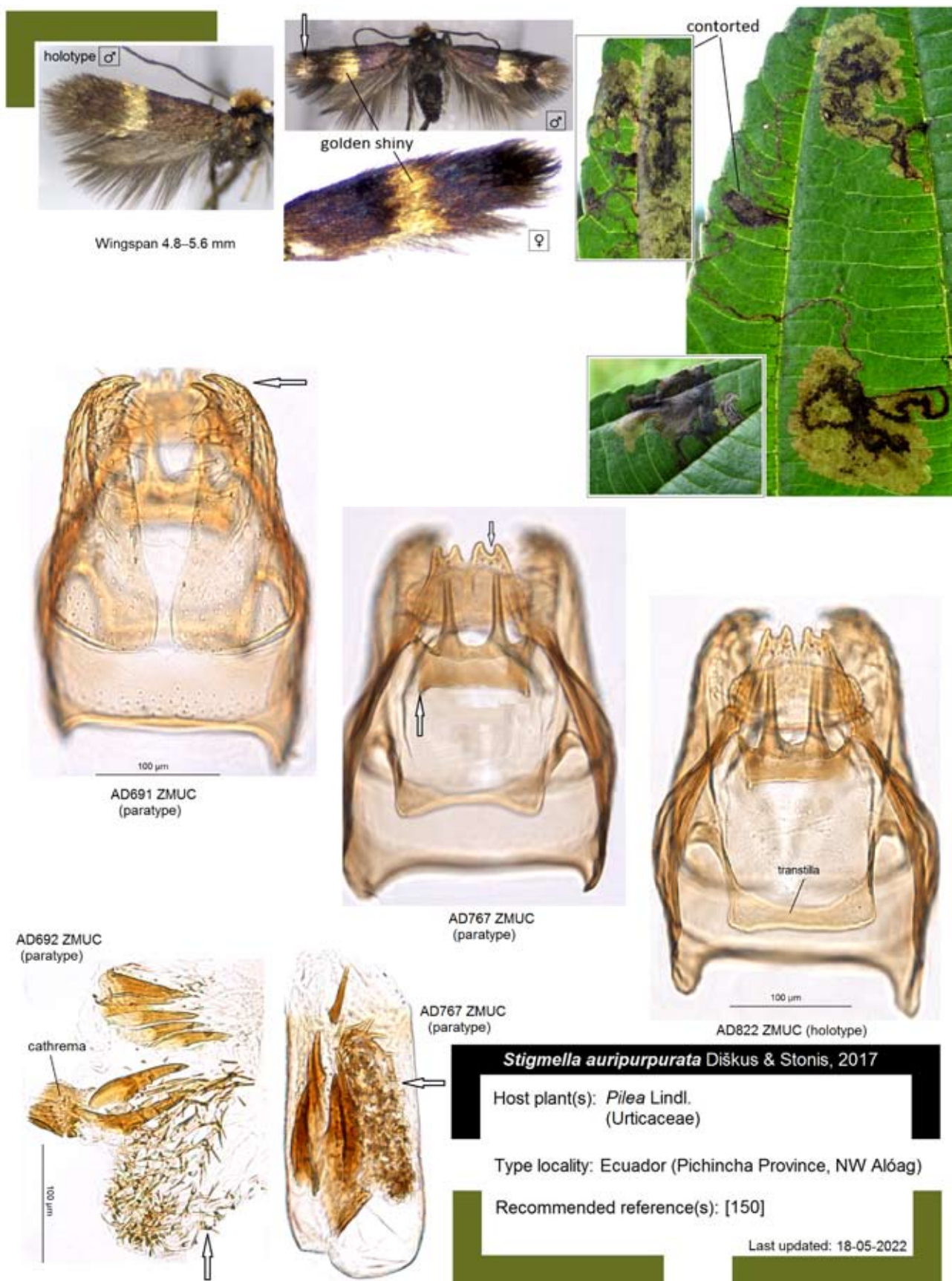


Figure 291. *Stigmella auripurpurata* Diškus & Stonis, a species attributed to the *S. incaica* group.

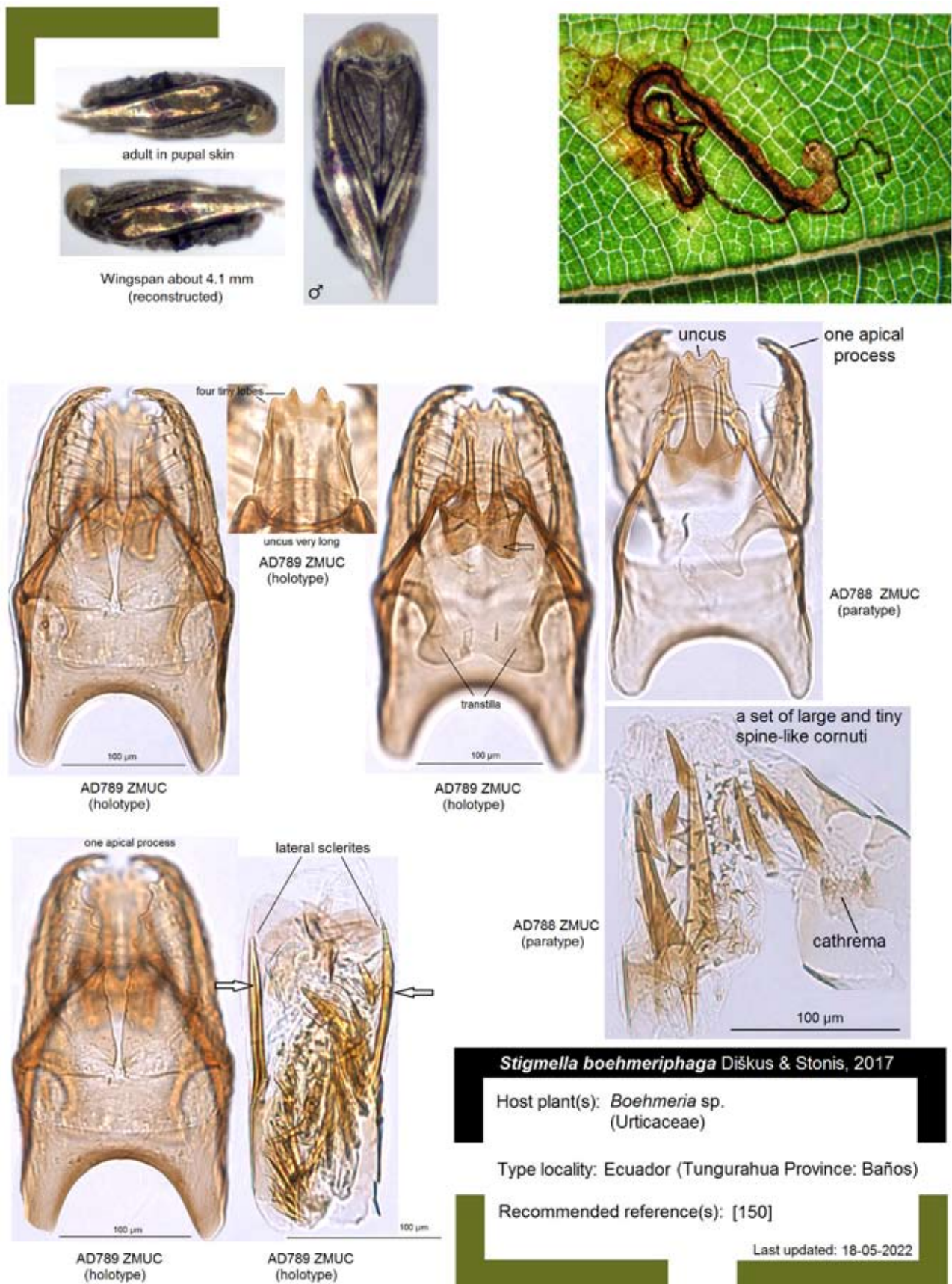
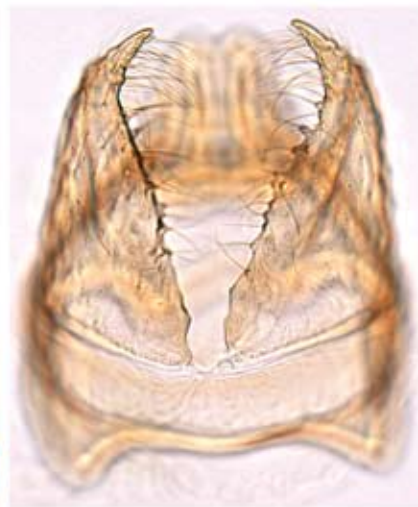


Figure 292. *Stigmella boehmeriphaga* Diškus & Stonis, a species attributed to the *S. incaica* group.

Stigmella lata was described on the basis of the specific male genitalia and leaf-mines alone. Details of adult scaling remain unknown because the currently available holotype specimen was dissected from adult in pupal skin and no pinned specimen was preserved (Stonis *et al.*, 2017 [150])



AD776 ZMUC
(holotype)



100 µm
AD776 ZMUC
(holotype)



AD776 ZMUC (holotype)

Stigmella lata Diškus & Stonis, 2017

Host plant(s): *Phenax hirtus* (Sw.) Wedd.
(Urticaceae)

Type locality: Ecuador (Pichincha Province, NW Alóag)

Recommended reference(s): [150]

Last updated: 18-05-2022

Figure 293. *Stigmella lata* Diškus & Stonis, a species attributed to the *S. incaica* group.

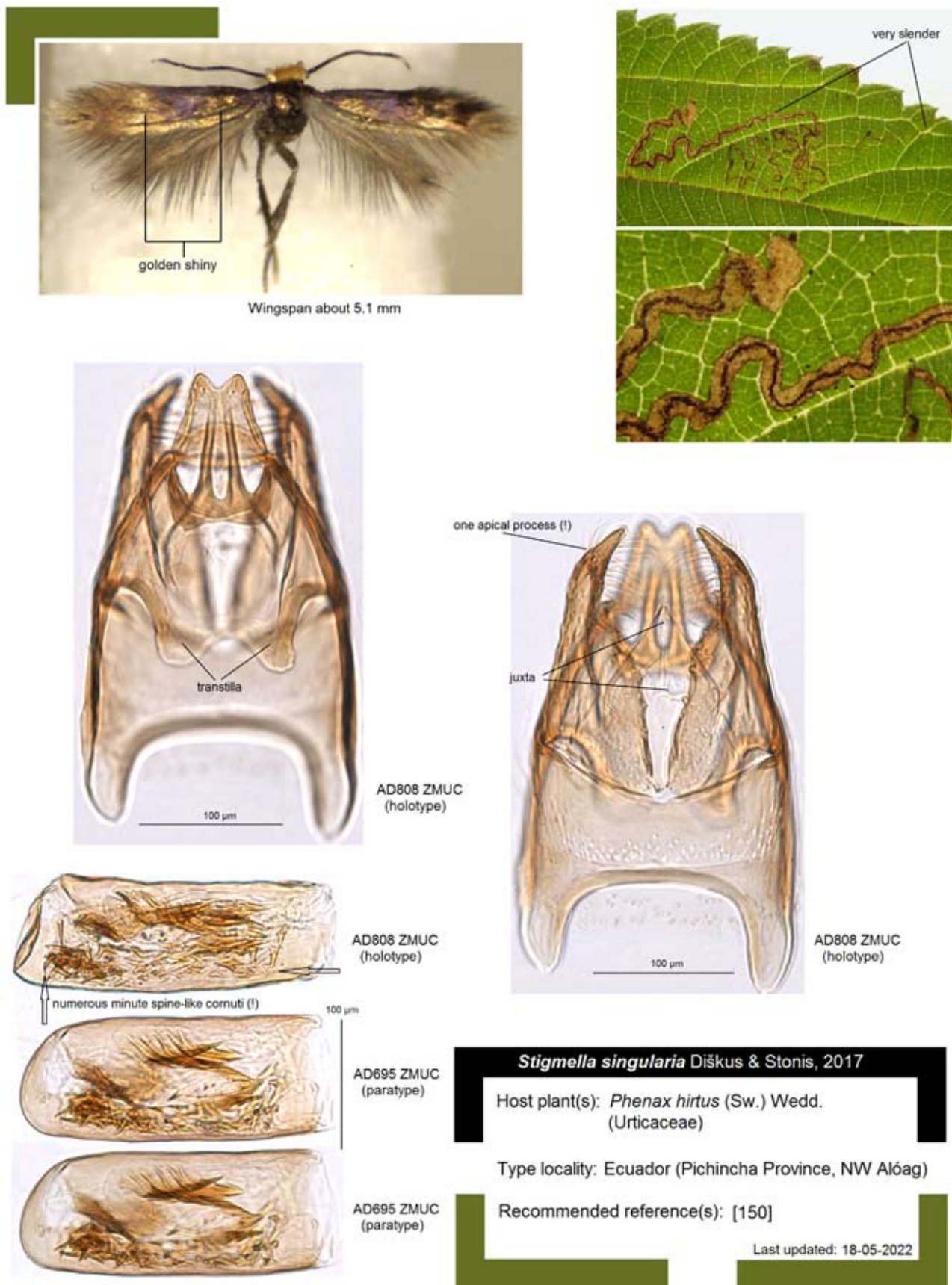


Figure 294. *Stigmella singularia* Diškus & Stonis, a species attributed to the *S. incaica* group.



Wingspan about 4.5–4.6 mm



RA653 ZMUC
(holotype)



RA653 ZMUC
(holotype)



RA653 ZMUC
(holotype)

***Stigmella scutellariae* Remeikis & Stonis, 2017**

Host plant(s): *Salvia scutellarioides* Kunth
(Lamiaceae)

Type locality: Ecuador (Loja Province)

Recommended reference(s): [148]

Last updated: 04-04-2022

Figure 295. *Stigmella scutellariae* Remeikis & Stonis, a species attributed to the *S. incaica* group.

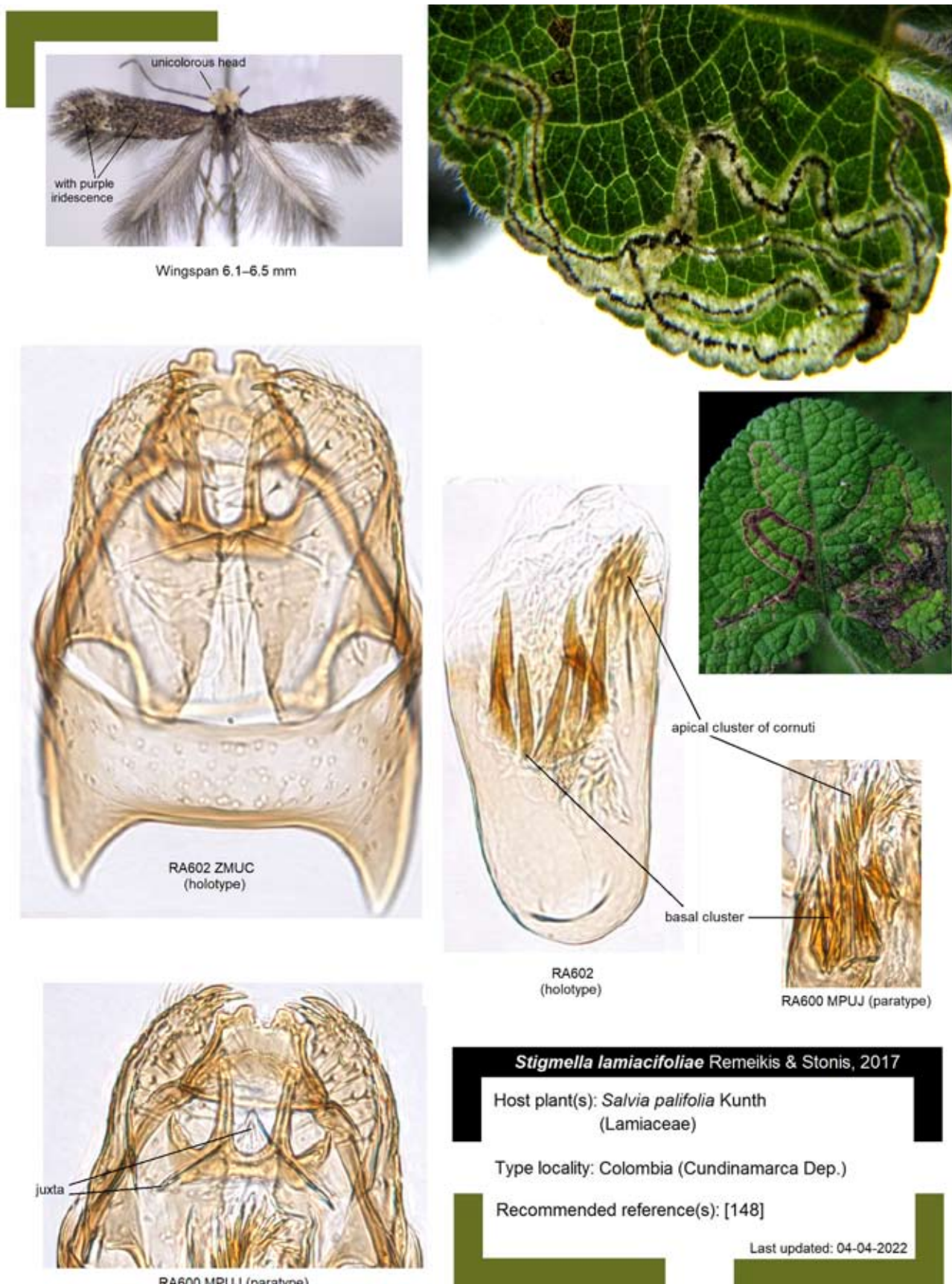


Figure 296. *Stigmella lamiacifoliae* Remeikis & Stonis, a species attributed to the *S. incaica* group.

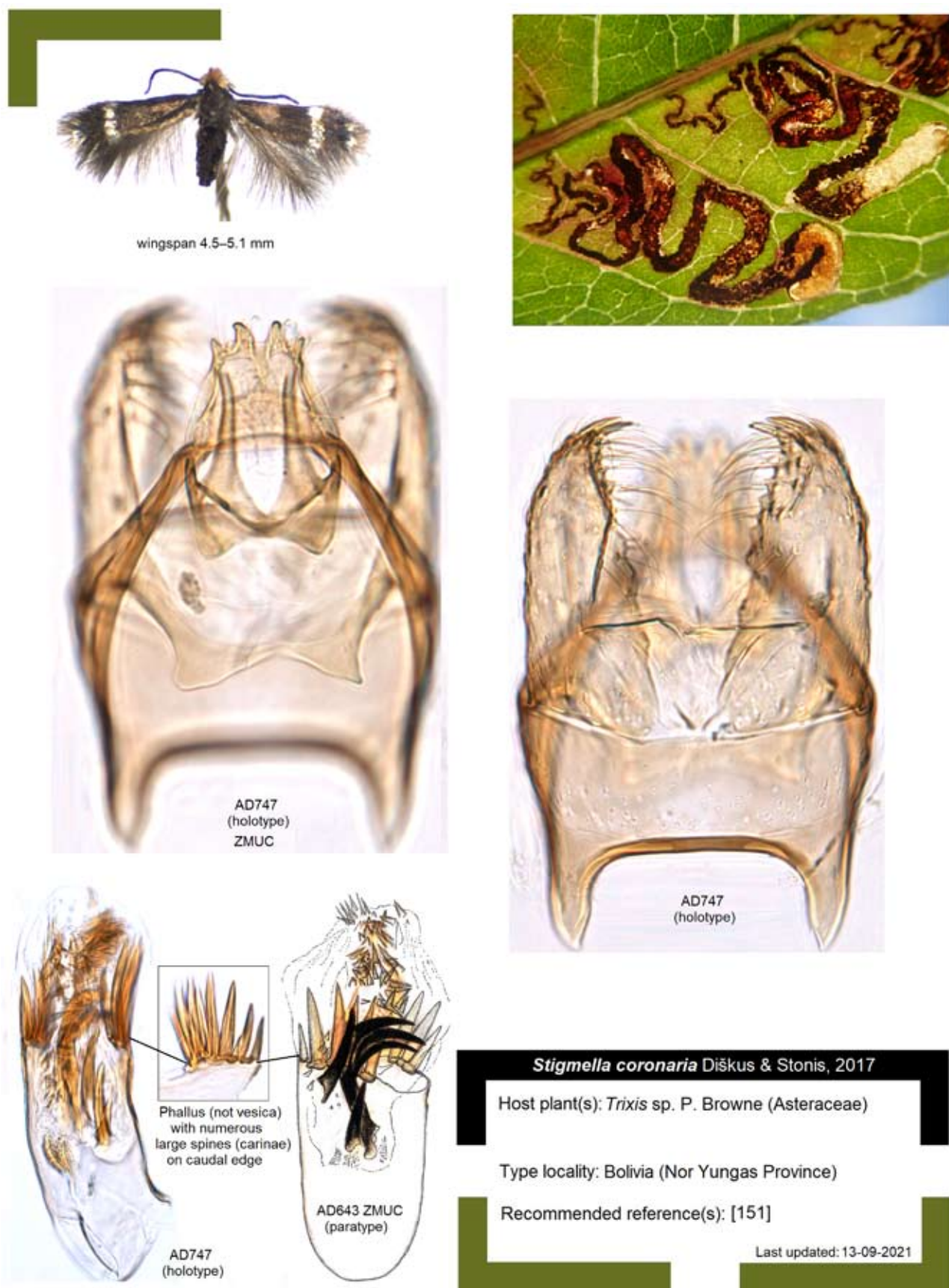


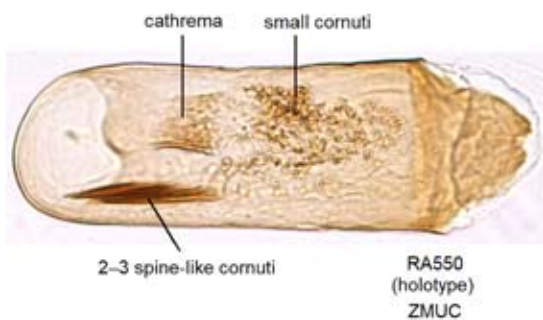
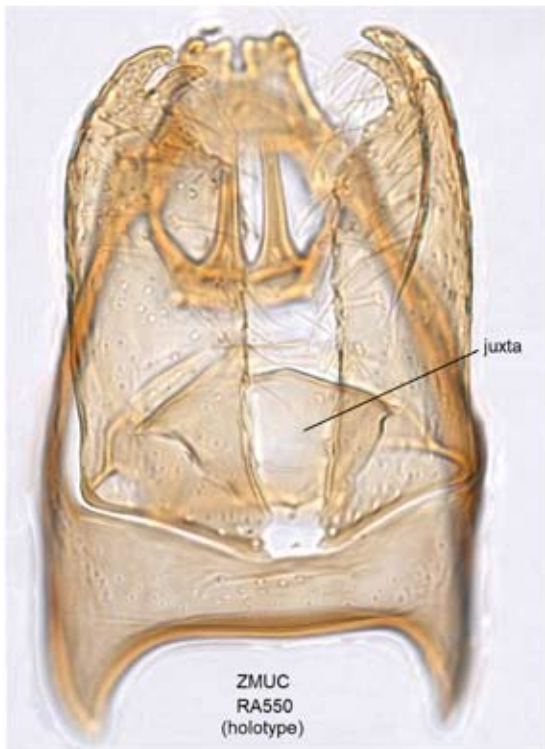
Figure 297. *Stigmella coronaria* Diškus & Stonis, a species attributed to the *S. incaica* group.



Figure 298. *Stigmella jungiae* Diškus & Stonis, a species attributed to the *S. jungiae* group.



Wingspan 6.9–7.6 mm



***Stigmella mustelina* Remeikis & Stonis, 2016**

Host plant(s): Unknown

Type locality: Peru (Lima Departamento)

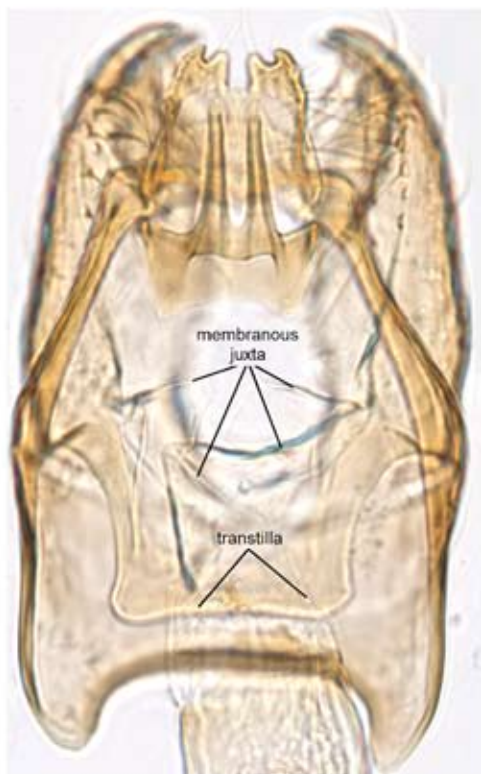
Recommended reference(s): [137], [151]

Last updated: 25-08-2021

Figure 299. *Stigmella mustelina* Remeikis & Stonis, a species attributed to the *S. jungiae* group.



Wingspan 5.9–6.5 mm



AD671 ZMUC
(holotype)



AD671 ZMUC
(holotype)



AD671 ZMUC
(holotype)

***Stigmella misera* Diškus & Stonis, 2017**

Host plant(s): Unknown

Type locality: Peru (Dept. Ayacucho)

Recommended reference(s): [151]

Last updated: 13-09-2021

Figure 300. *Stigmella misera* Diškus & Stonis, a species attributed to the *S. jungiae* group.

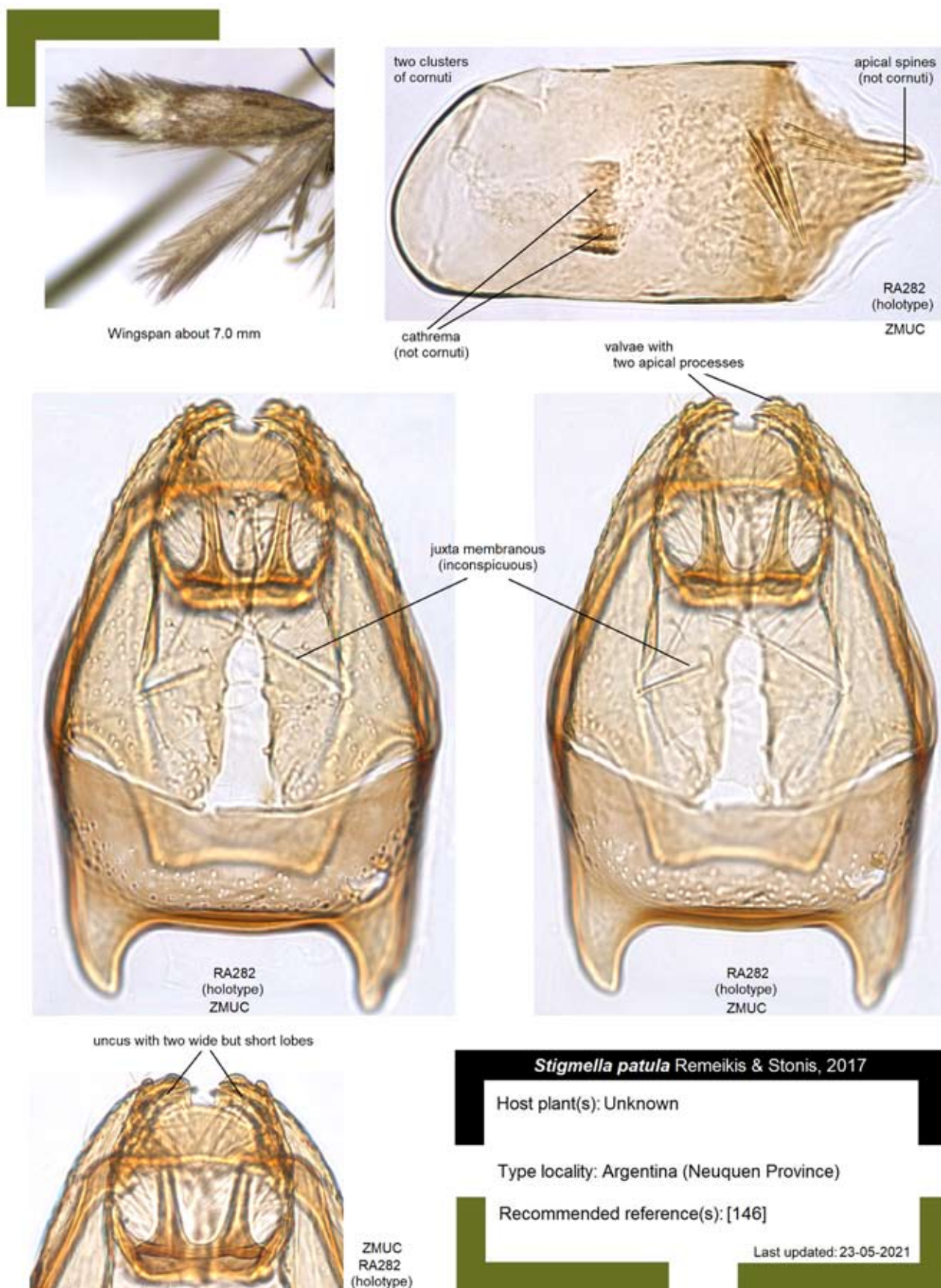


Figure 301. *Stigmella patula* Remeikis & Stonis, a species attributed to the *S. jungiae* group.

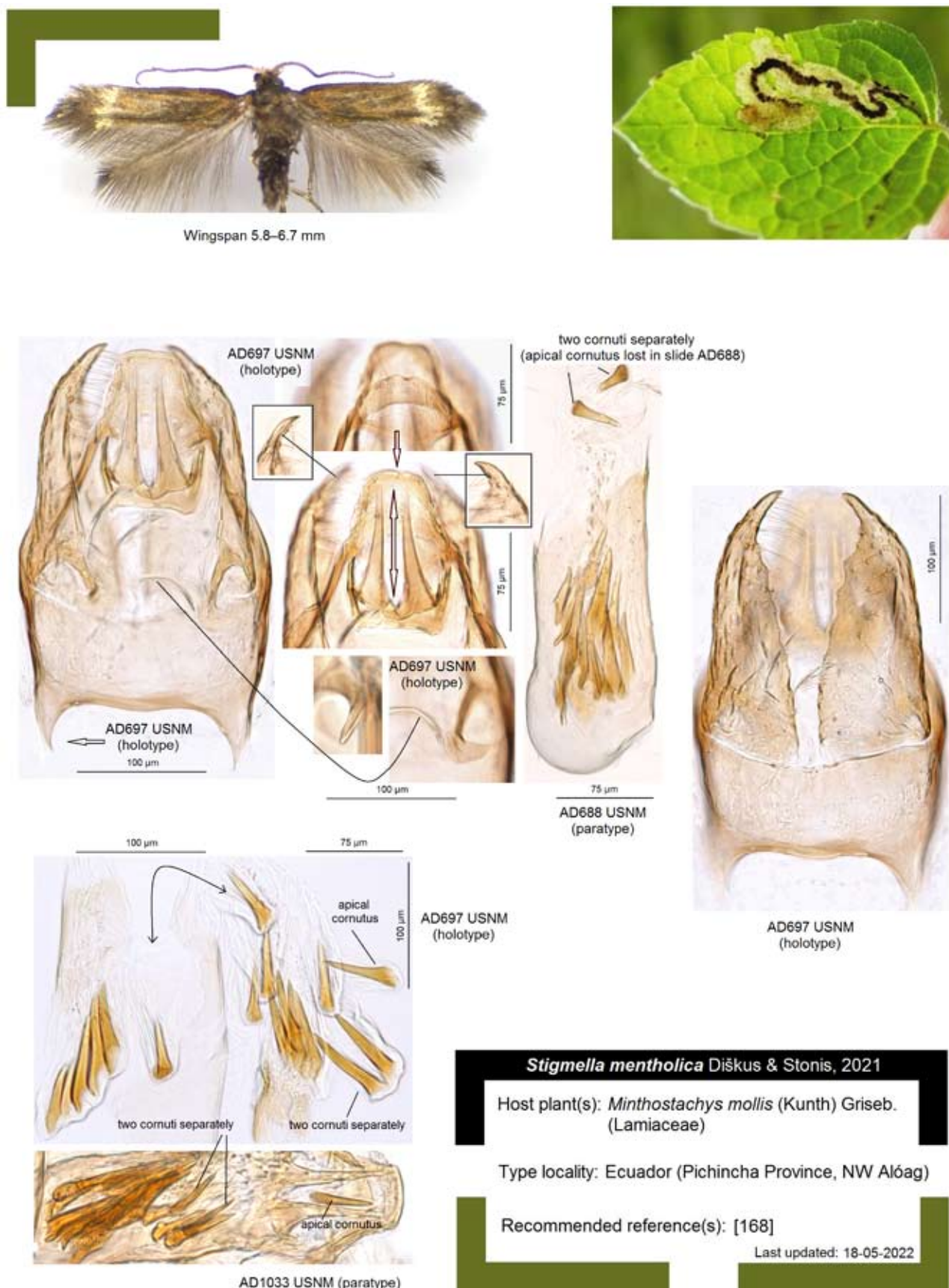
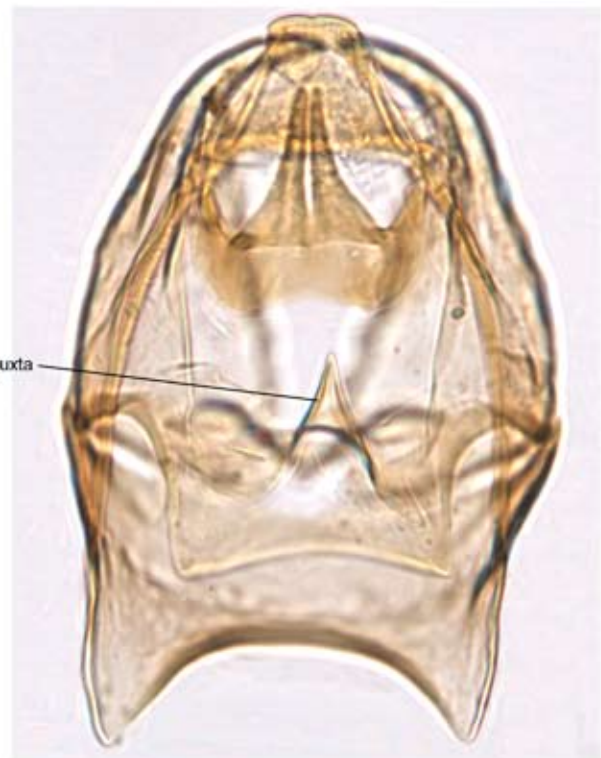


Figure 302. *Stigmella mentholica* Diškus & Stonis, a species attributed to the *S. mentholica* group.

[described from mature pupa]



AD646 ZMUC
(holotype)



AD646 ZMUC
(holotype)



AD646 ZMUC
(holotype)

***Stigmella clinopodiella* Diškus & Stonis, 2016**

Host plant(s): *Clinopodium axillare* (Rusby) Harley
(Lamiaceae)

Type locality: Bolivia (Copacabana)

Recommended reference(s): [137]

Last updated: 17-09-2021

Figure 303. *Stigmella clinopodiella* Diškus & Stonis, a species attributed to the *S. mentholica* group.

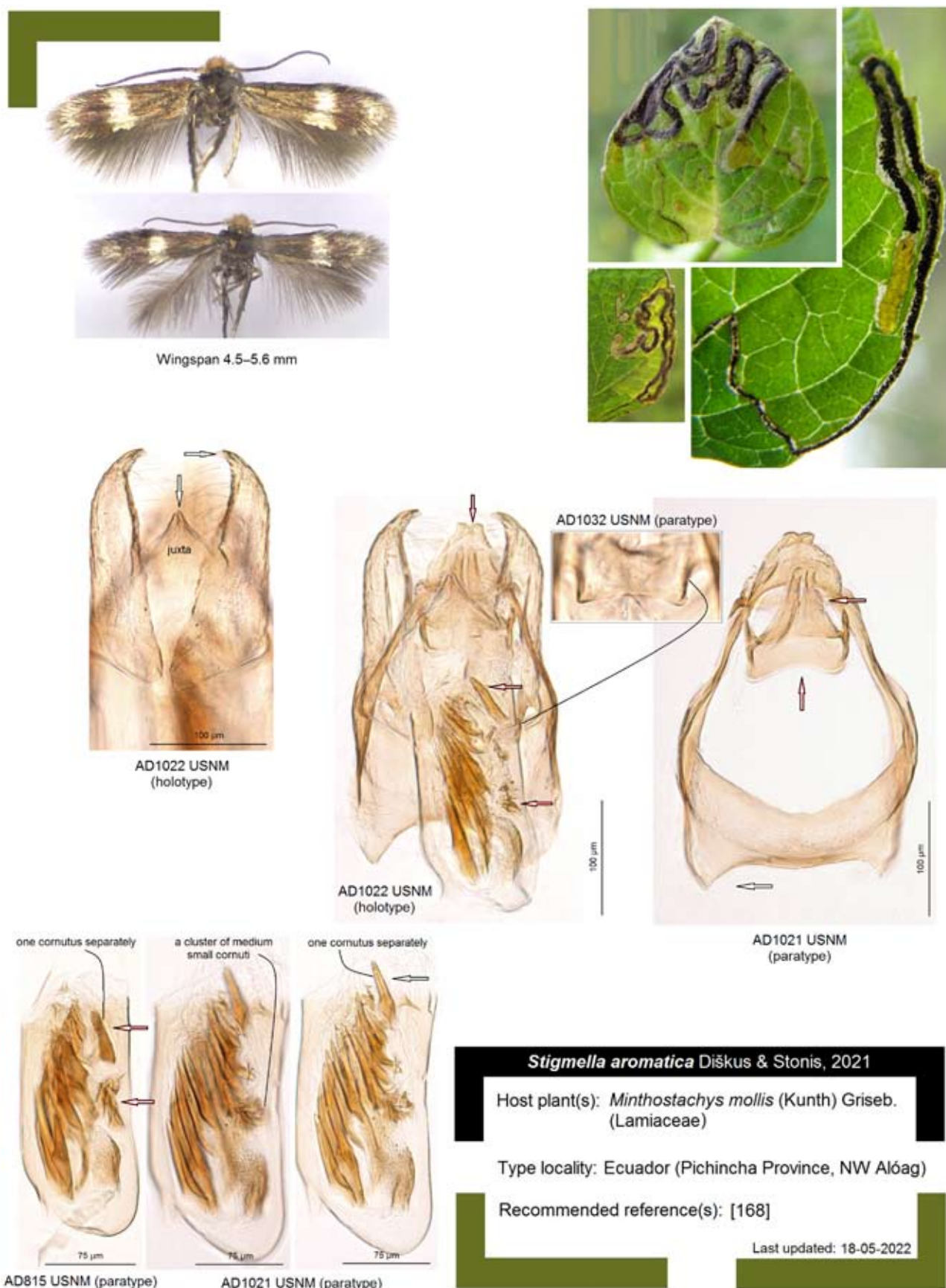


Figure 304. *Stigmella aromatica* Diškus & Stonis, a species attributed to the *S. mentholica* group.

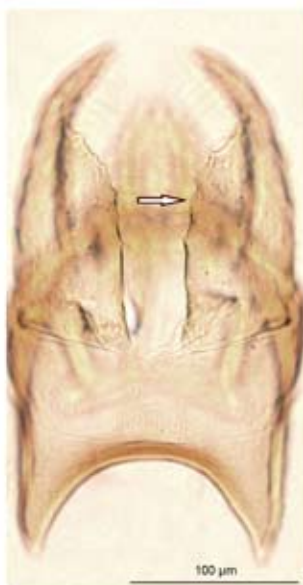
The new species was described based on the genitalia and the leaf mines. Pinned specimens are unavailable, external characters of the species remain unknown (Stonis *et al.*, 2021 [168])



AD685 USNM
(paratype)



AD685 USNM
(paratype)



AD685 USNM
(paratype)



AD821 USNM (holotype)

Stigmella odora Diškus & Stonis, 2021

Host plant(s): *Minthostachys mollis* (Kunth) Griseb.
(Lamiaceae)

Type locality: Ecuador (SE of Ambato, Baños)

Recommended reference(s): [168]

Last updated: 18-05-2022

Figure 305. *Stigmella odora* Diškus & Stonis, a species attributed to the *S. mentholica* group.

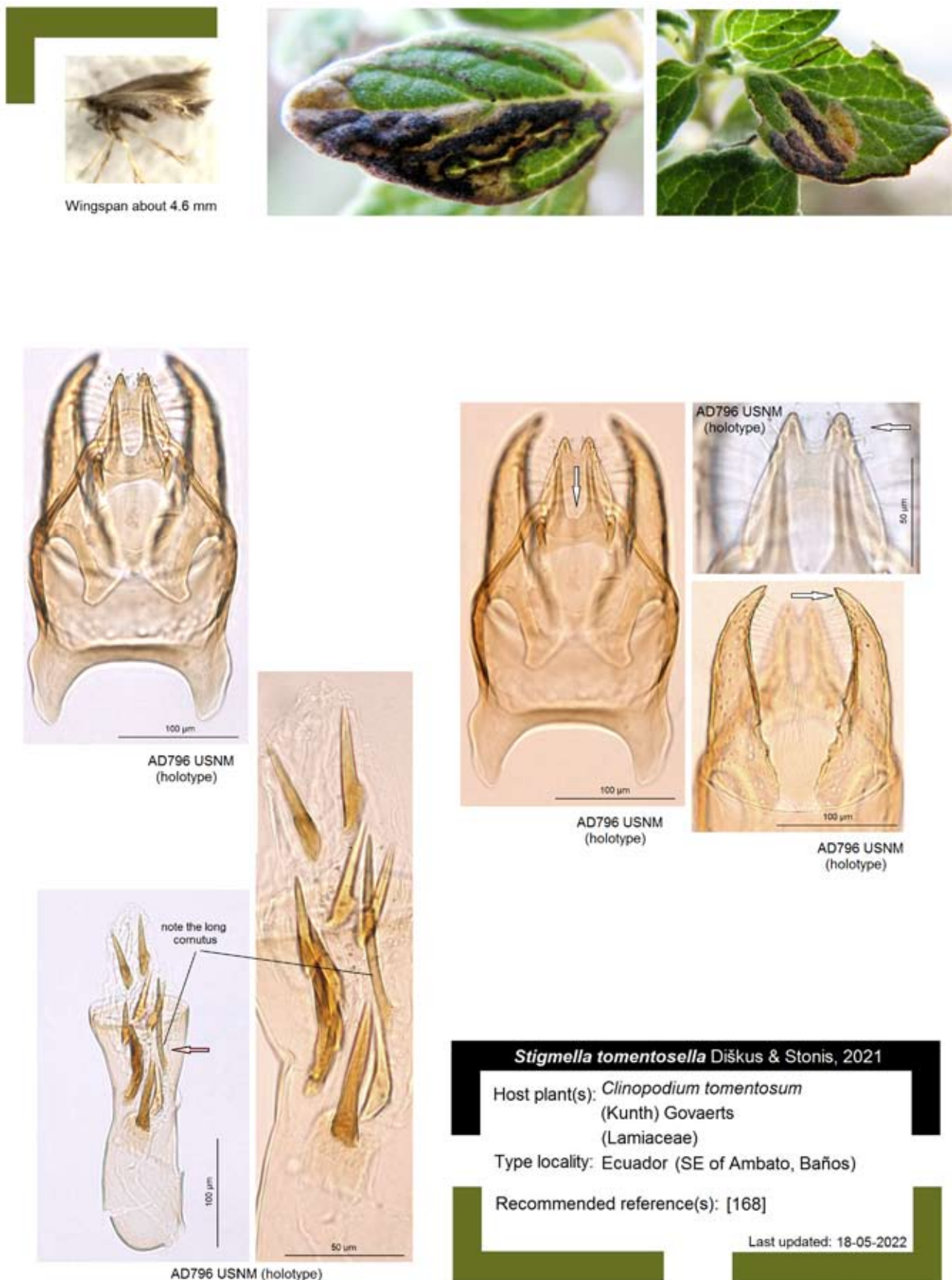
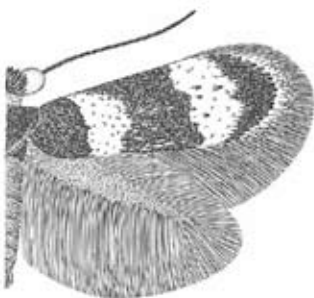


Figure 306. *Stigmella tomentosella* Diškus & Stonis, a species attributed to the *S. mentholica* group.



Wingspan 9.0–10.1 mm

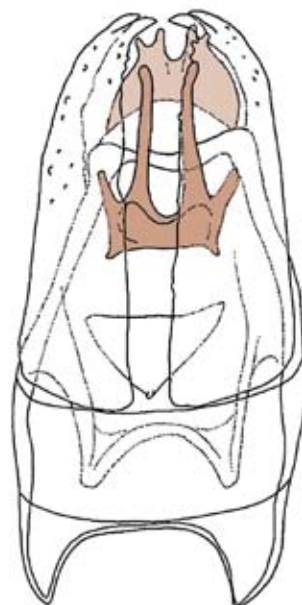


Diškus 182 ZMUC
(holotype)

carinae



Diškus 182 ZMUC
(holotype)



Diškus 182 ZMUC
(holotype)



Diškus 182 ZMUC
(holotype)

***Stigmella marmorea* Puplesis & Robinson, 2000**

Host plant(s): Unknown

Type locality: Peru (Dept. Ancash)

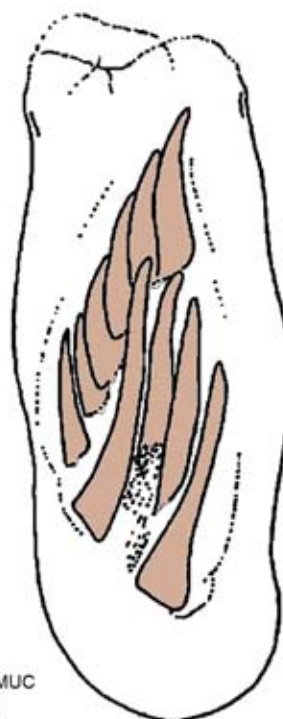
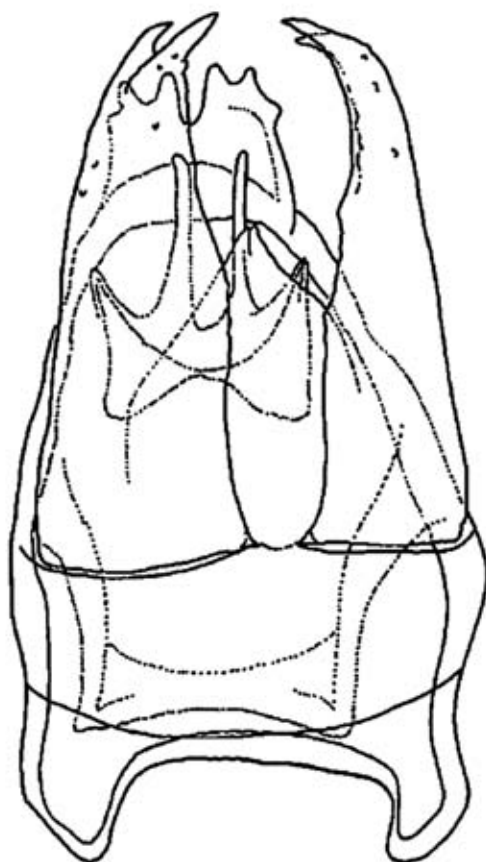
Recommended reference(s): [71], [137]

Last updated: 18-06-2022

Figure 307. *Stigmella marmorea* Puplesis & Robinson, a species attributed to the *S. marmorea* group.



Wingspan about 4.6 mm
(after Puplesis & Robinson, 2000)



Diškus189 ZMUC
(holotype)

***Stigmella peruanica* Puplesis & Robinson, 2000**

Host plant(s): Unknown

Type locality: Peru (Department Puno)

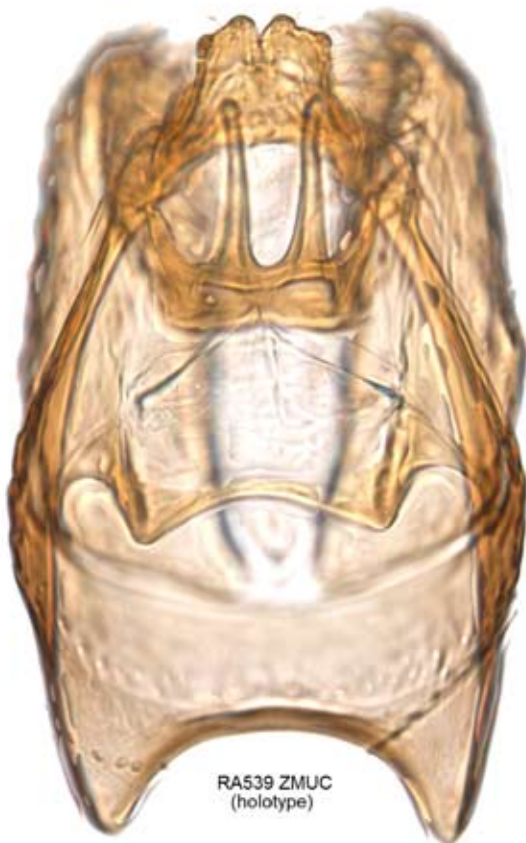
Recommended reference(s): [71], [151]

Last updated: 11-05-2022

Figure 308. *Stigmella peruanica* Puplesis & Robinson, a species attributed to the *S. marmorea* group.



Wingspan 6.1–6.9 mm



RA539 ZMUC
(holotype)



RA539 ZMUC
(holotype)



RA539 ZMUC
(holotype)

***Stigmella altimontana* Remeikis & Stonis, 2016**

Host plant(s): Unknown

Type locality: Peru (Dept. Ancash)

Recommended reference(s): [137], [151]

Last updated: 04-06-2021

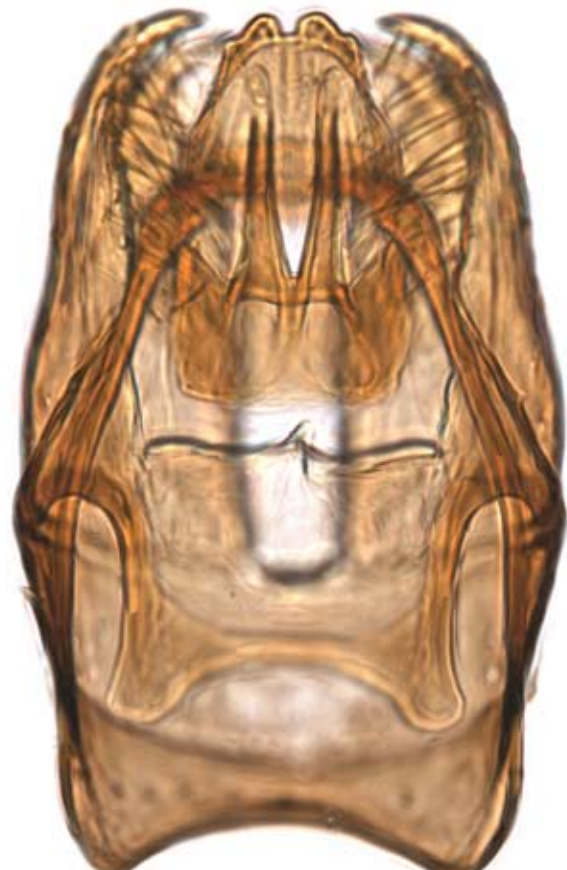
Figure 309. *Stigmella altimontana* Remeikis & Stonis, a species attributed to the *S. marmorea* group.



Wingspan 6.4–6.5 mm



RA537 ZMUC
(holotype)



RA537 ZMUC
(holotype)



RA537 ZMUC
(holotype)

***Stigmella auriargentata* Remeikis & Stonis, 2016**

Host plant(s): Unknown

Type locality: Peru (Dept. Ancash)

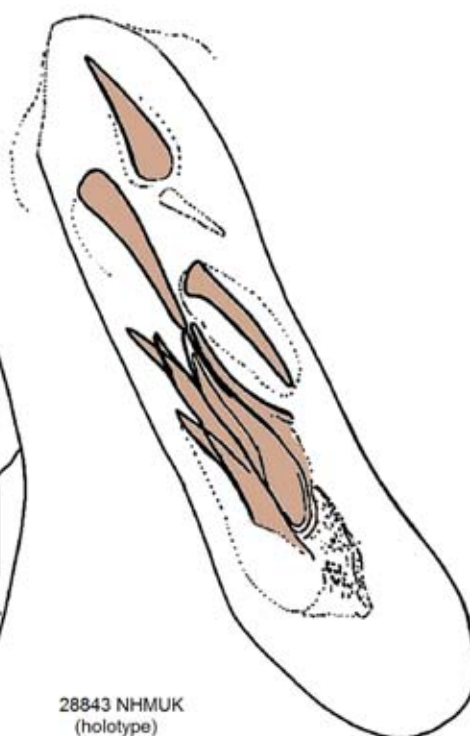
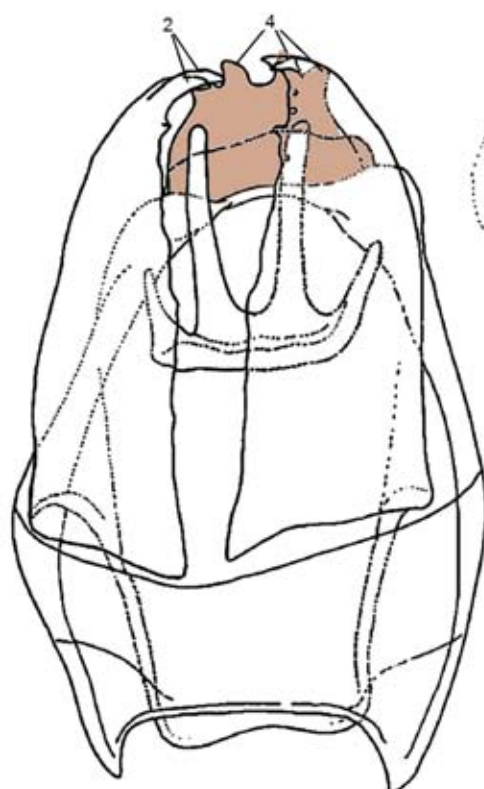
Recommended reference(s): [137], [151]

Last updated: 04-06-2021

Figure 310. *Stigmella auriargentata* Remeikis & Stonis, a species attributed to the *S. marmorea* group.



Wingspan about 5.4 mm



28843 NHMUK
(holotype)

Stigmella johannis (Zeller, 1877)

Host plant(s): Unknown

Type locality: Colombia (Bogotá)

Recommended reference(s): [71], [129]

Last updated: 11-05-2022

Figure 311. *Stigmella johannis* (Zeller), a species attributed to the *S. marmorea* group.

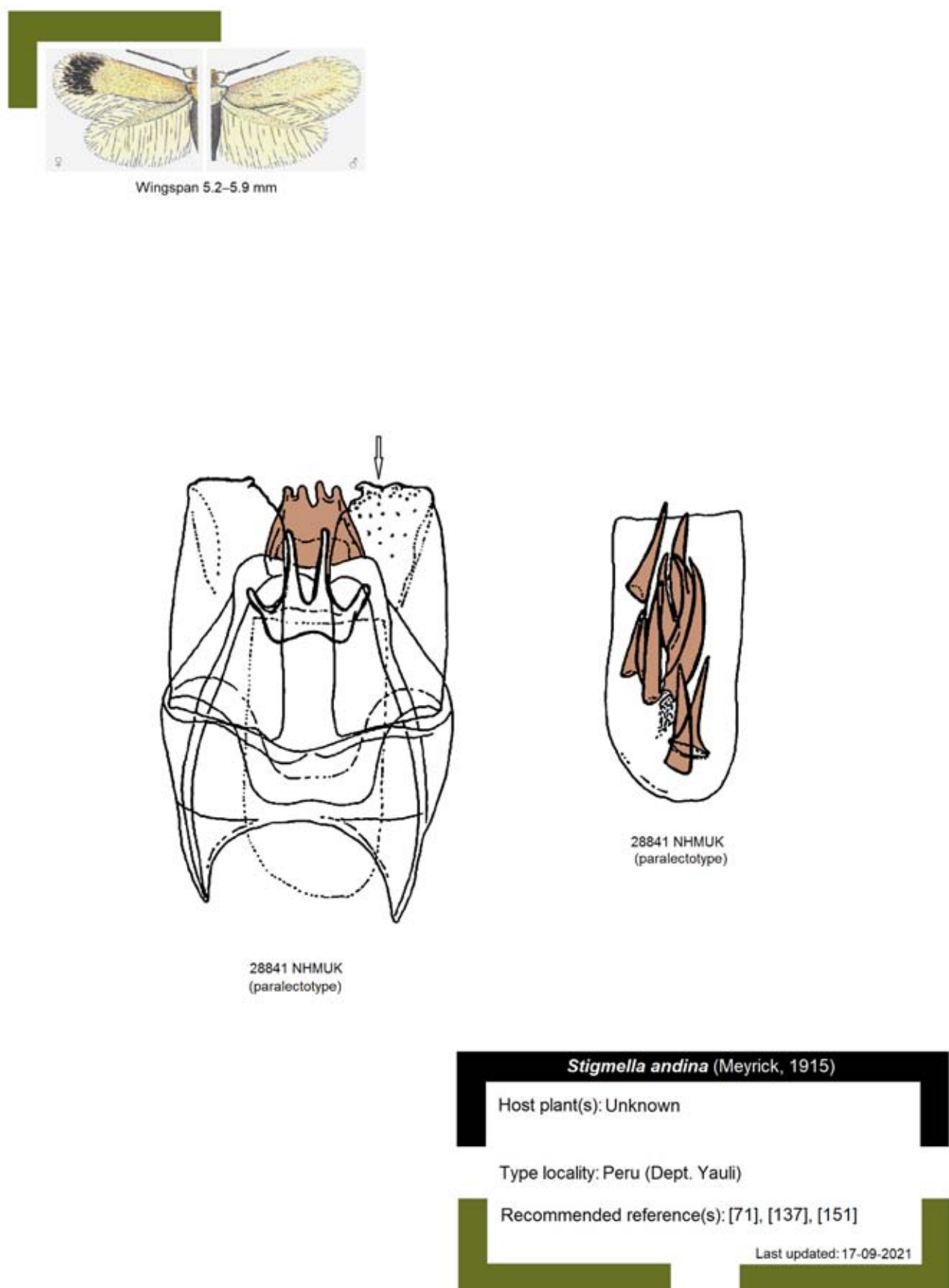


Figure 312. *Stigmella andina* (Meyrick), a species attributed to the *S. marmorea* group.



Male is unknown.
The species was described from a female only

Note. From *S. andina* it differs in the distinctly wide abdominal apex and distally narrowing anterior apophyses in the female genitalia; in contrast to *S. andina*, the posterior apophyses are more or less straight (not outwardly bent as in *S. andina*).
Stonis et al., 2018 [156]

***Stigmella auripennata* Diškus & Stonis, 2018**

Host plant(s): *Baccharis obtusifolia* Kunth
(Asteraceae)

Type locality: Ecuador (Loja Province, 10 km S of Loja)

Recommended reference(s): [156]

Last updated: 18-05-2022

Figure 313. *Stigmella auripennata* Diškus & Stonis, a species attributed to the *S. marmorea* group.



Wingspan about 4.8 mm



100 µm

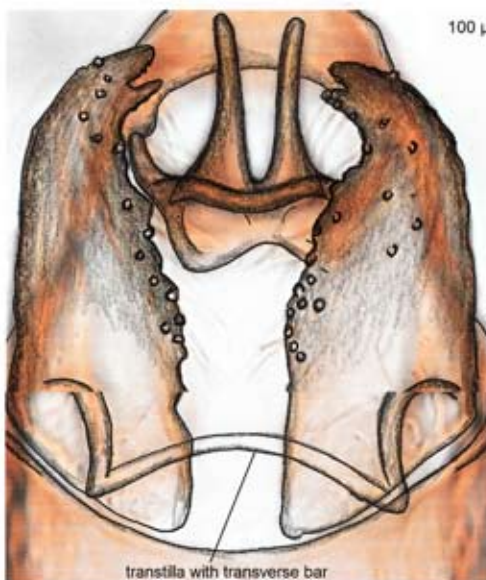


100 µm



100 µm

RA551 ZMUC
(holotype)



100 µm

RA551 ZMUC
(holotype)

transtilla with transverse bar

RA551 ZMUC (holotype)

Stigmella arequipica Remeikis & Stonis, 2017

Host plant(s): Unknown

Type locality: Peru (E Arequipa, Rio Andamayo Valley)

Recommended reference(s): [151]

Last updated: 17-05-2022

Figure 314. *Stigmella arequipica* Remeikis & Stonis, a species attributed to the *S. marmorea* group.

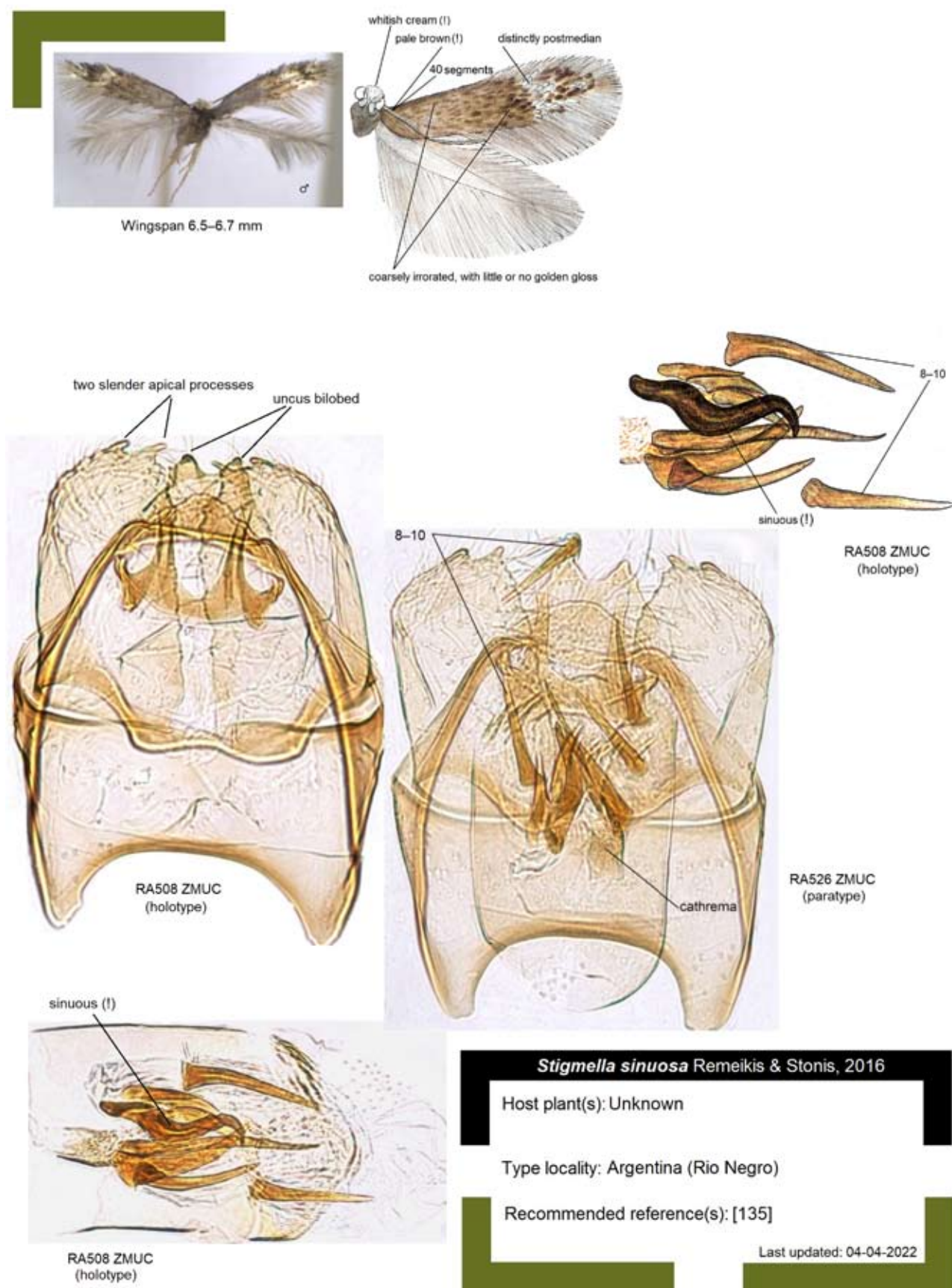


Figure 315. *Stigmella sinuosa* Remeikis & Stonis, a species attributed to the *S. marmorea* group.

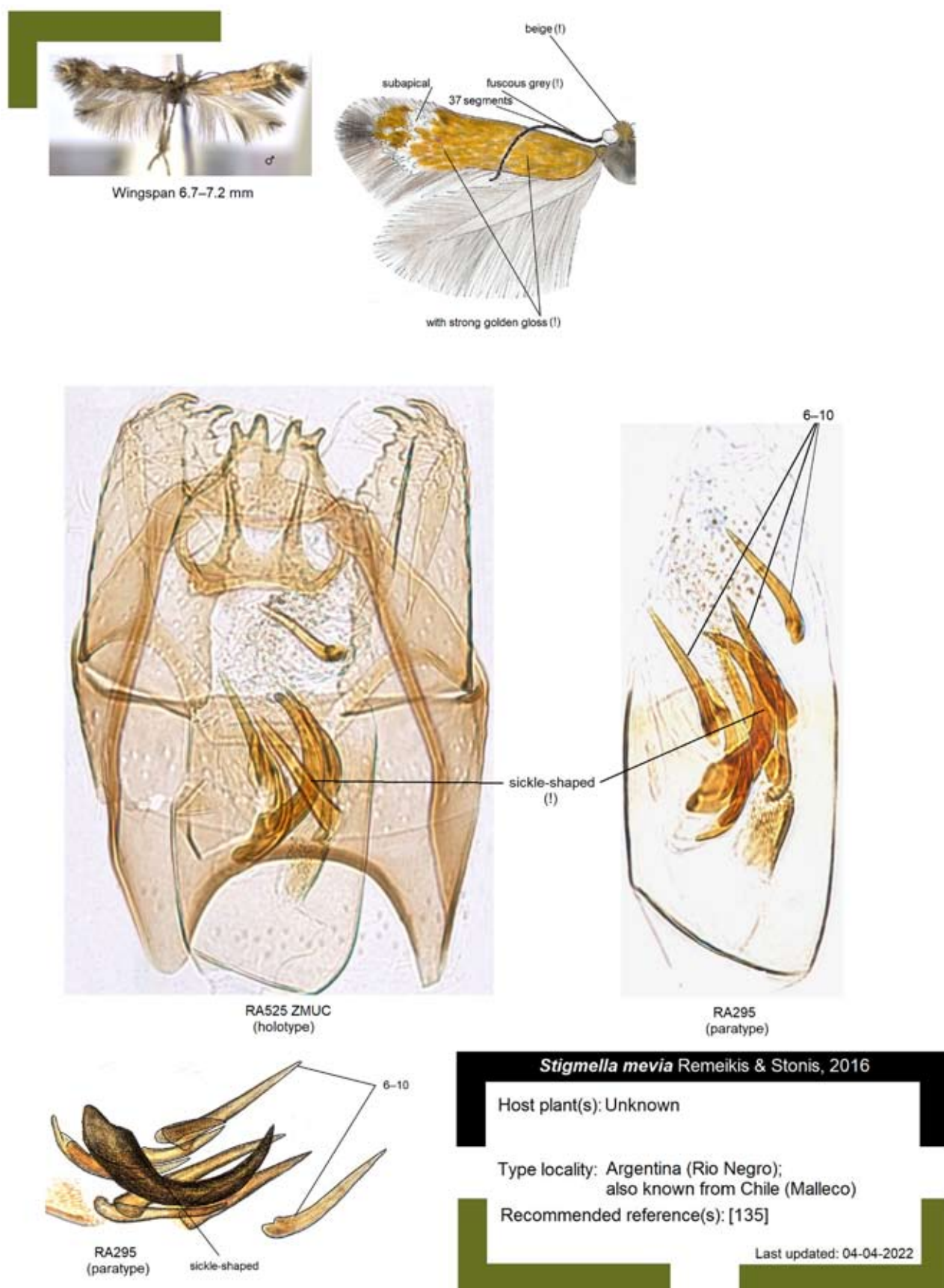
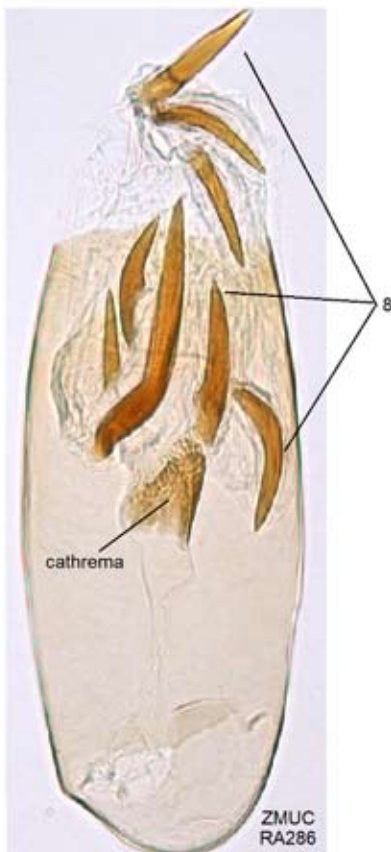


Figure 316. *Stigmella mevia* Remeikis & Stonis, a species attributed to the *S. marmorea* group.



Wingspan 5.3–6.0 mm



***Stigmella hylomaga* (Meyrick, 1931)**

Host plant(s): Unknown

Type locality: Argentina (Rio Negro Province)

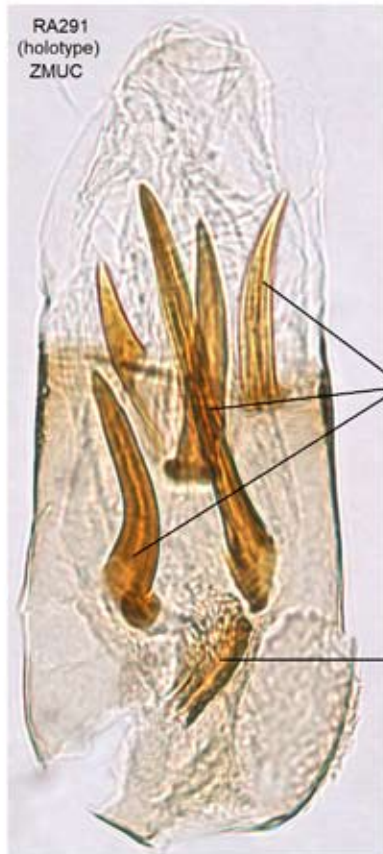
Recommended reference(s): [71], [147]

Last updated: 25-05-2021

Figure 317. *Stigmella hylomaga* (Meyrick), a species attributed to the *S. marmorea* group.



Wingspan 5.7 mm

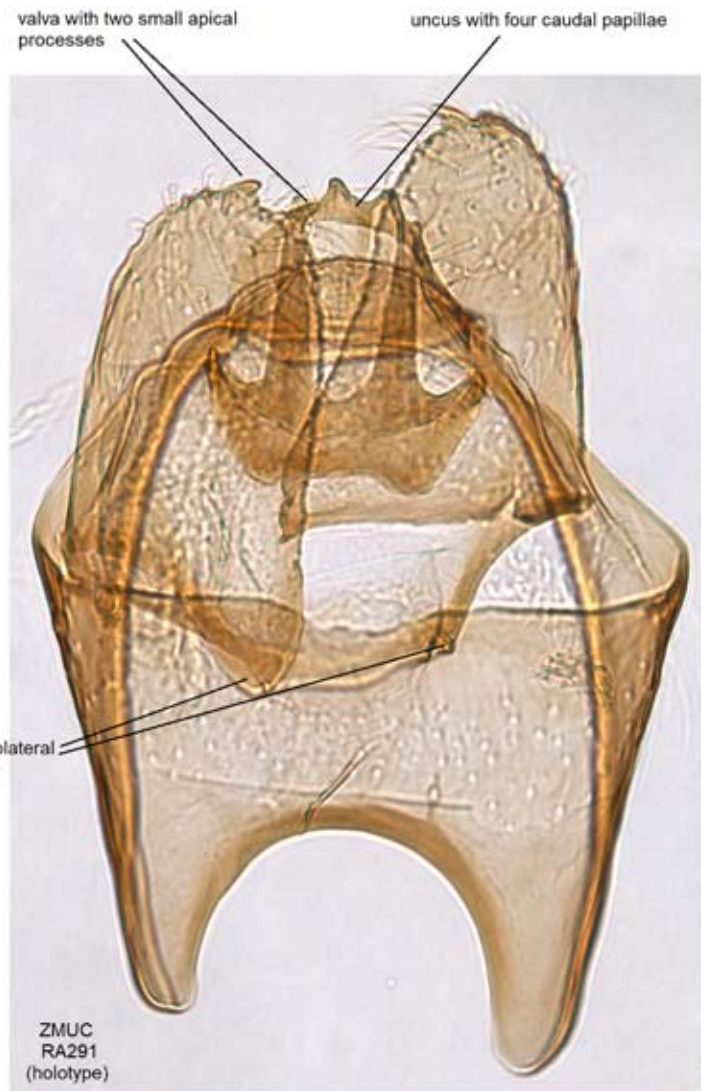


RA291
(holotype)
ZMUC

without sublateral
processes

5

cathrema



valva with two small apical
processes

uncus with four caudal papillae

ZMUC
RA291
(holotype)

Stigmella torosa Remeikis & Stonis, 2017

Host plant(s): Unknown

Type locality: Argentina (Rio Negro Province)

Recommended reference(s): [146]

Last updated: 25-05-2021

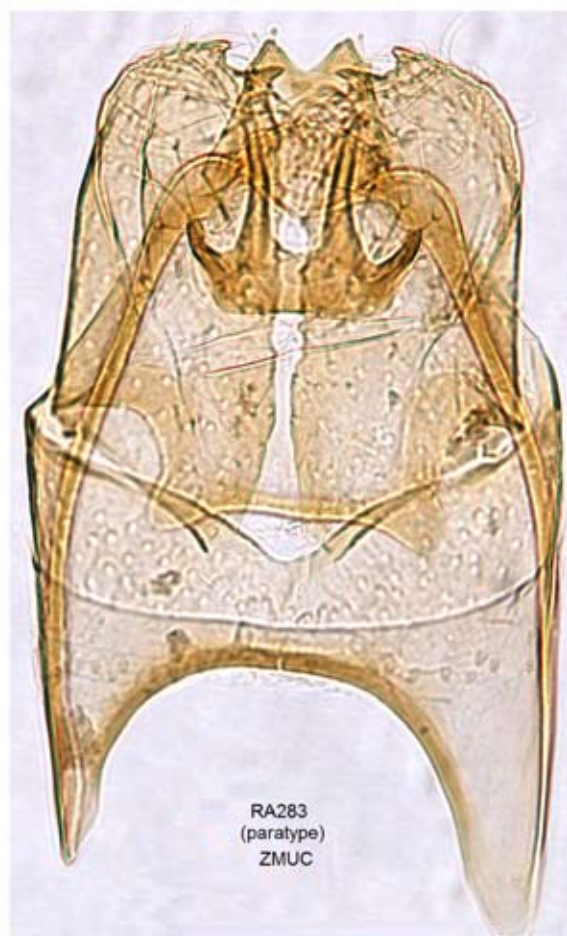
Figure 318. *Stigmella torosa* Remeikis & Stonis, a species attributed to the *S. marmorea* group.



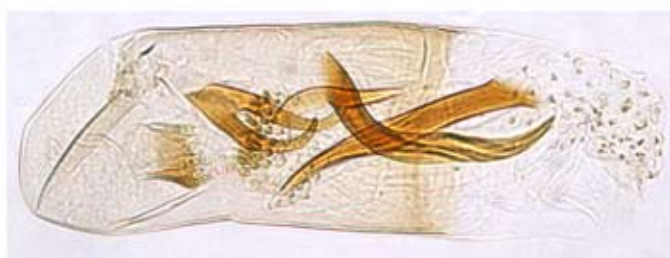
Wingspan 5.3–5.6 mm



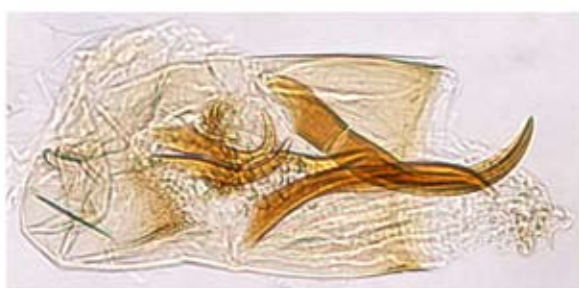
RA284
(holotype)
ZMUC



RA283
(paratype)
ZMUC



RA283
(paratype)



RA284 (holotype)

***Stigmella monstrata* Remeikis & Stonis, 2017**

Host plant(s): Unknown

Type locality: Argentina (Neuquen Province)

Recommended reference(s): [146]

Last updated: 25-05-2021

Figure 319. *Stigmella monstrata* Remeikis & Stonis, a species attributed to the *S. marmorea* group.



Wingspan 7.4–8.0 mm



ZMUC
AD655
(holotype)



ZMUC
AD655
(holotype)



AD655 ZMUC
(holotype)

***Stigmella calceolariae* Diškus & Stonis, 2016**

Host plant(s): *Calceolaria graminifolia* Kunth
(Calceolariaceae)

Type locality: Ecuador (Chimborazo Province)

Recommended reference(s): [137]

Last updated: 17-09-2021

Figure 320. *Stigmella calceolariae* Diškus & Stonis, a species attributed to the *S. marmorea* group.



Stigmella costalimai was described from three specimens in the Bourquin collection, Buenos Aires. The original description of the species does not mention the sex of the specimens of the type series. We have been able to examine only a single female paratype. The single female paratype examined lacks its abdomen; the wings are detached and stored in a gelatine capsule. The holotype and second paratype have not been examined.

<i>Stigmella costalimai</i> (Bourquin, 1962)	
Host plant(s):	Unknown
Type locality:	Argentina (Buenos Aires)
Recommended reference(s):	[71]
Last updated: 11-05-2022	

Figure 321. *Stigmella costalimai* (Bourquin), a species attributed to the *S. marmorea* group.

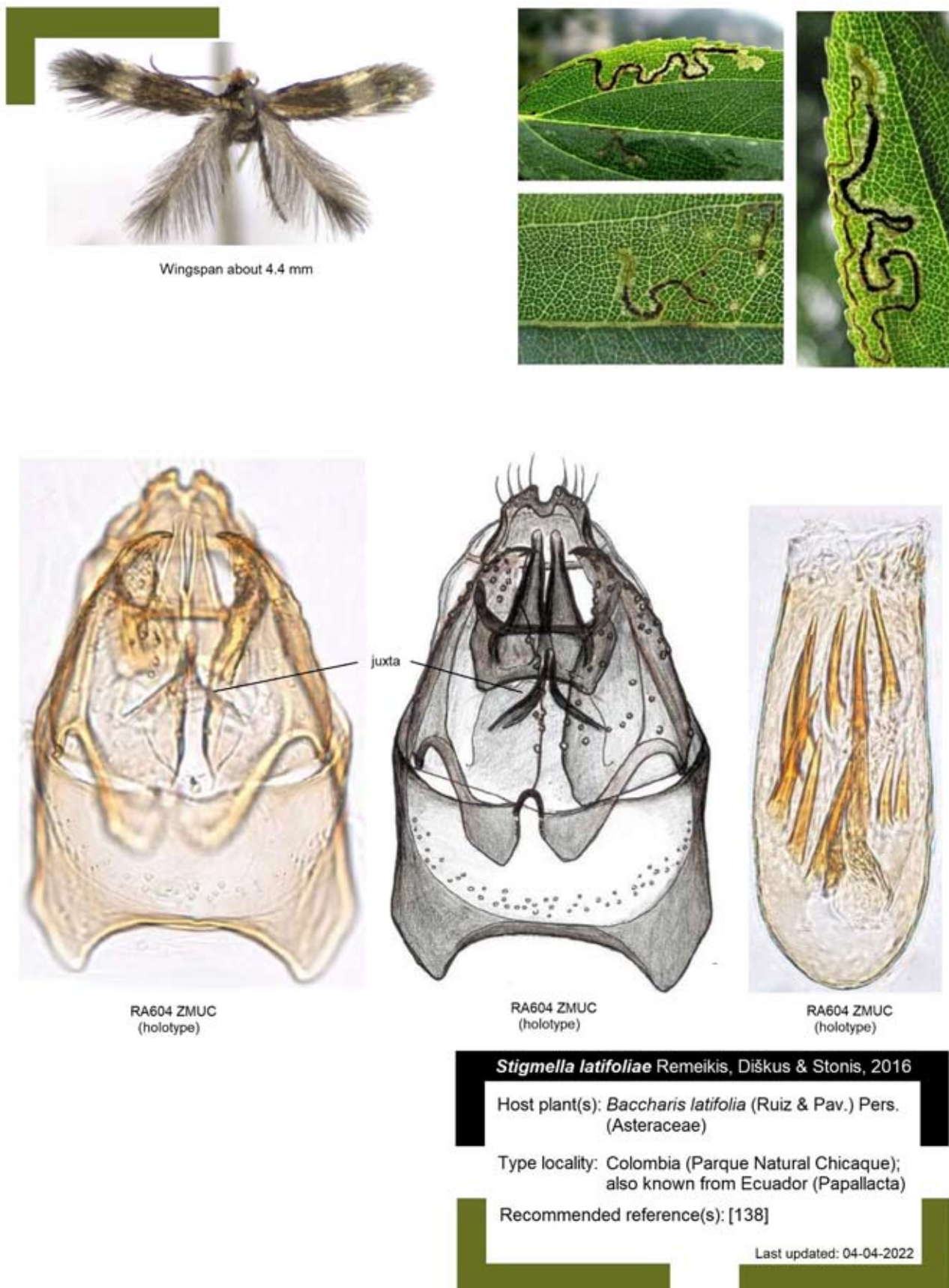


Figure 322. *Stigmella latifoliae* Remeikis, Diškus & Stonis, a species attributed to the *S. marmorea* group.



Figure 323. *Stigmella baccharicola* Diškus & Stonis, a species attributed to the *S. marmorea* group.

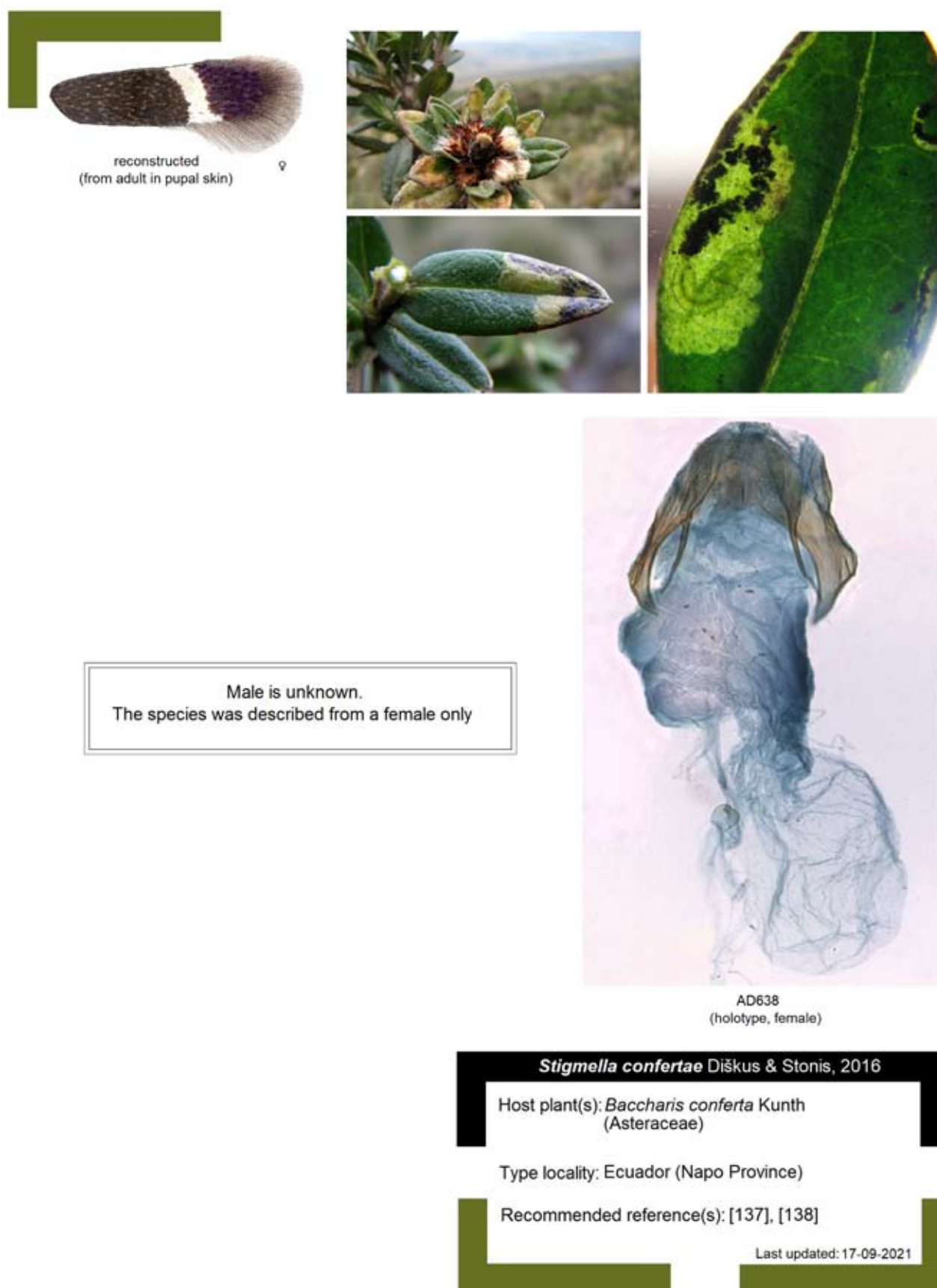


Figure 324. *Stigmella confertae* Diškus & Stonis, a species attributed to the *S. marmorea* group.

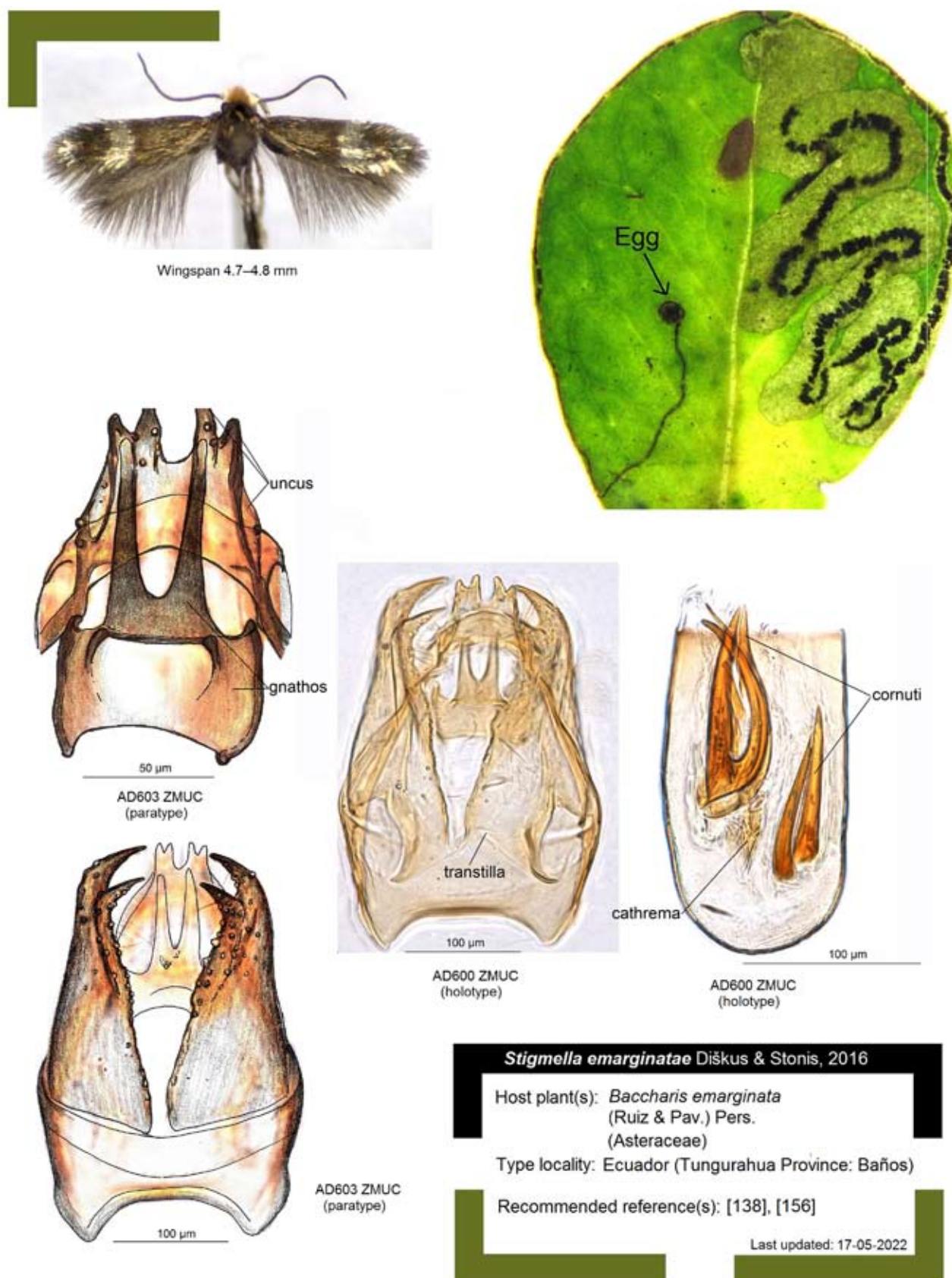


Figure 325. *Stigmella emarginatae* Diškus & Stonis, a species attributed to the *S. marmorea* group.



Wingspan about 4.9 mm
(after Puplesis & Robinson, 2000)

Male not examined. *Stigmella guittonae* was described from three specimens in the Bourquin collection, Buenos Aires. The original description of the species does not mention the sex of the specimens of the type series. We have been able to examine only a single female paratype loaned by MACN.

***Stigmella guittonae* (Bourquin, 1962)**

Host plant(s): According to Bourquin (1962)
the larvae are miners on *Senecio bonariensis* (Asteraceae)

Type locality: Argentina (Buenos Aires)

Recommended reference(s): [71]

Last updated: 11-05-2022

Figure 326. *Stigmella guittonae* (Bourquin), a species attributed to the *S. marmorea* group.

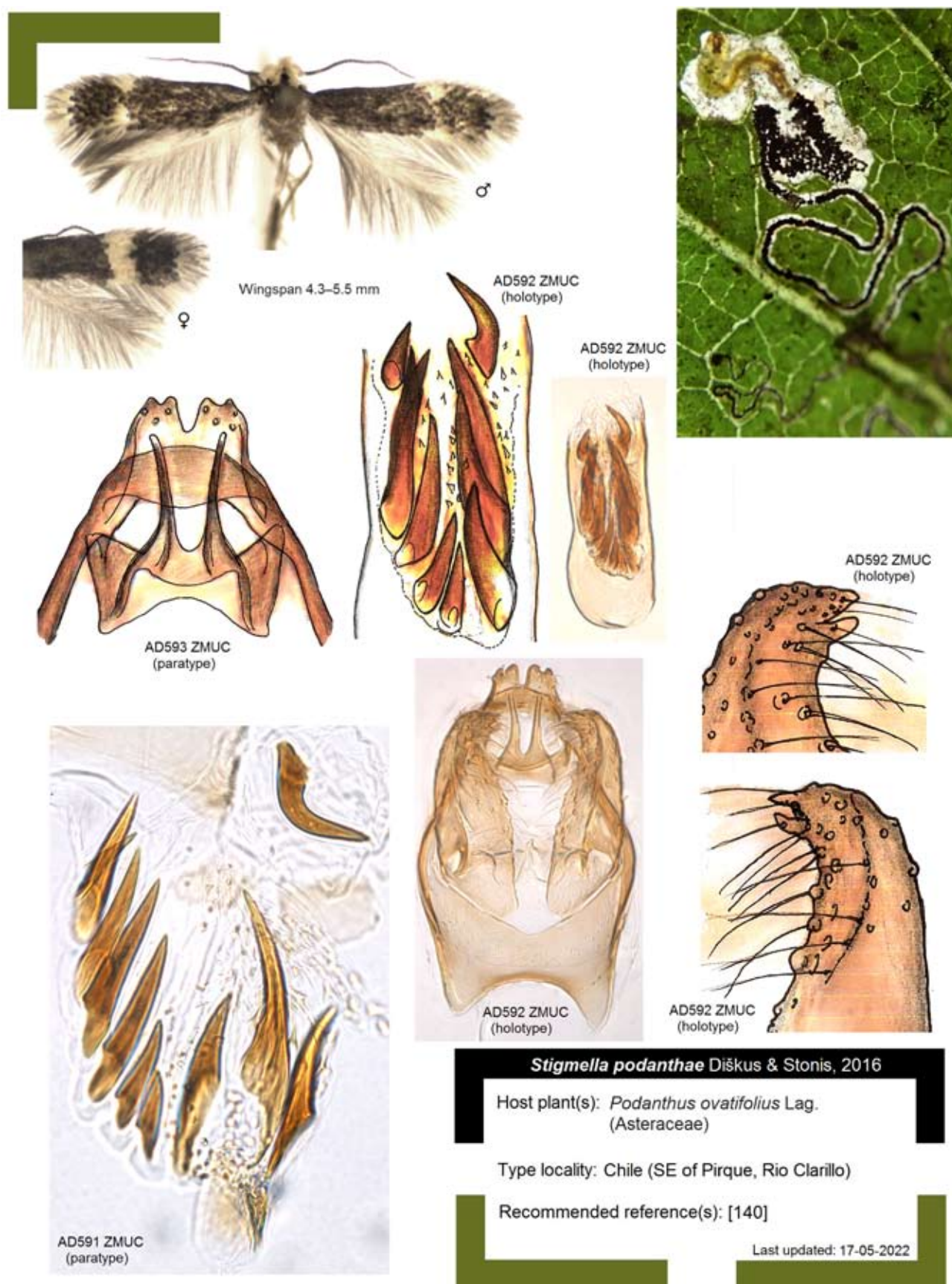


Figure 327. *Stigmella podanthae* Diškus & Stonis, a species attributed to the *S. marmorea* group.

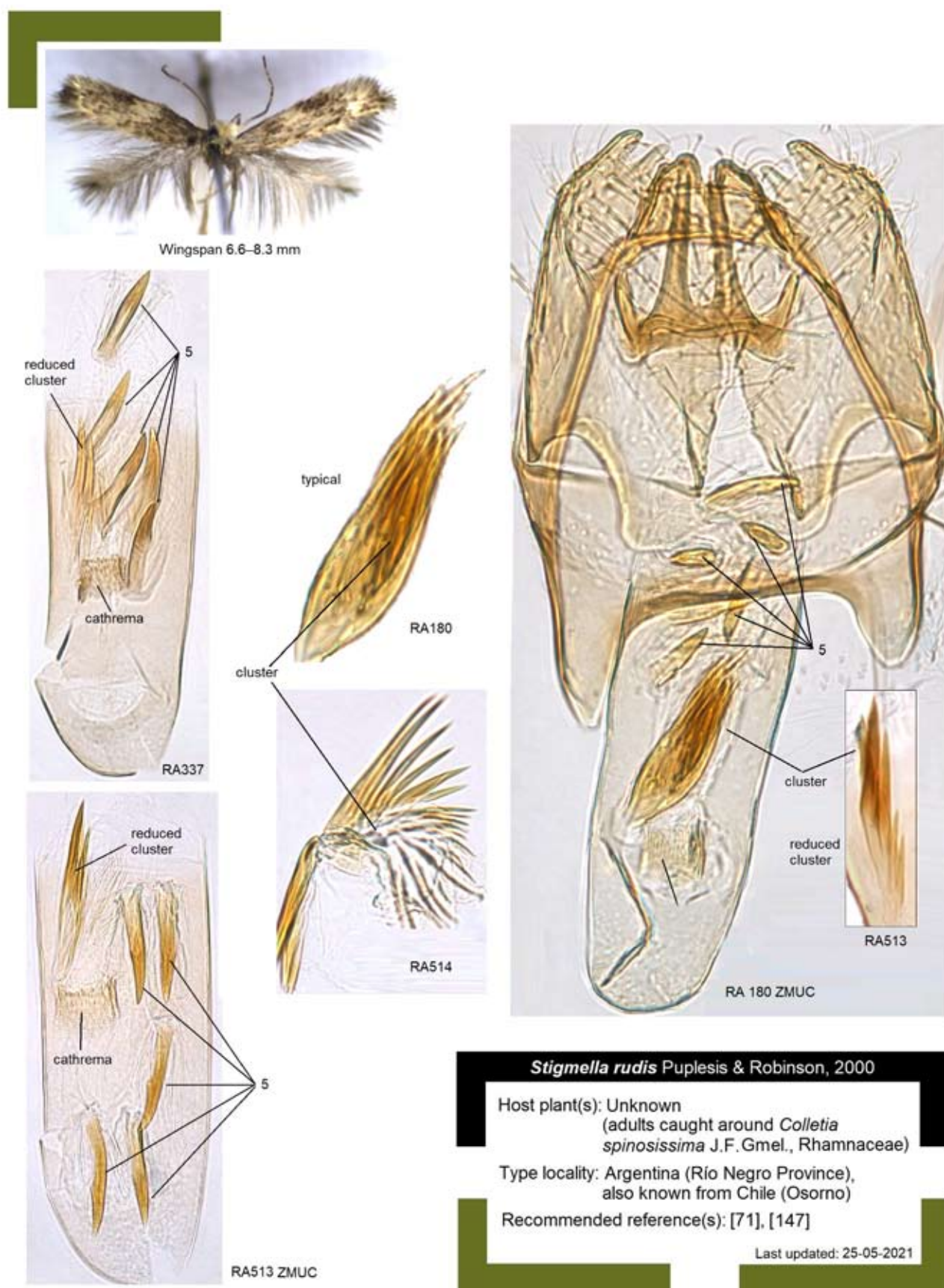
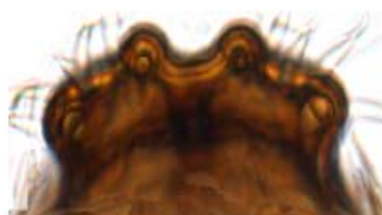


Figure 328. *Stigmella rudis* Puplesis & Robinson, a species attributed to the *S. marmorea* group.

[described from mature pupa]



AD662 ZMUC
(holotype)



AD662
(holotype)



AD662 ZMUC
(holotype)



AD662 ZMUC
(holotype)



AD662 ZMUC
(holotype)

***Stigmella gynoxyphaga* Diškus & Stonis, 2016**

Host plant(s): *Gynoxys buxifolia* (Kunth) Cass.
(Asteraceae)

Type locality: Ecuador (Chimborazo Province)

Recommended reference(s): [137]

Last updated: 17-09-2021

Figure 329. *Stigmella gynoxyphaga* Diškus & Stonis, a species attributed to the *S. marmorea* group.

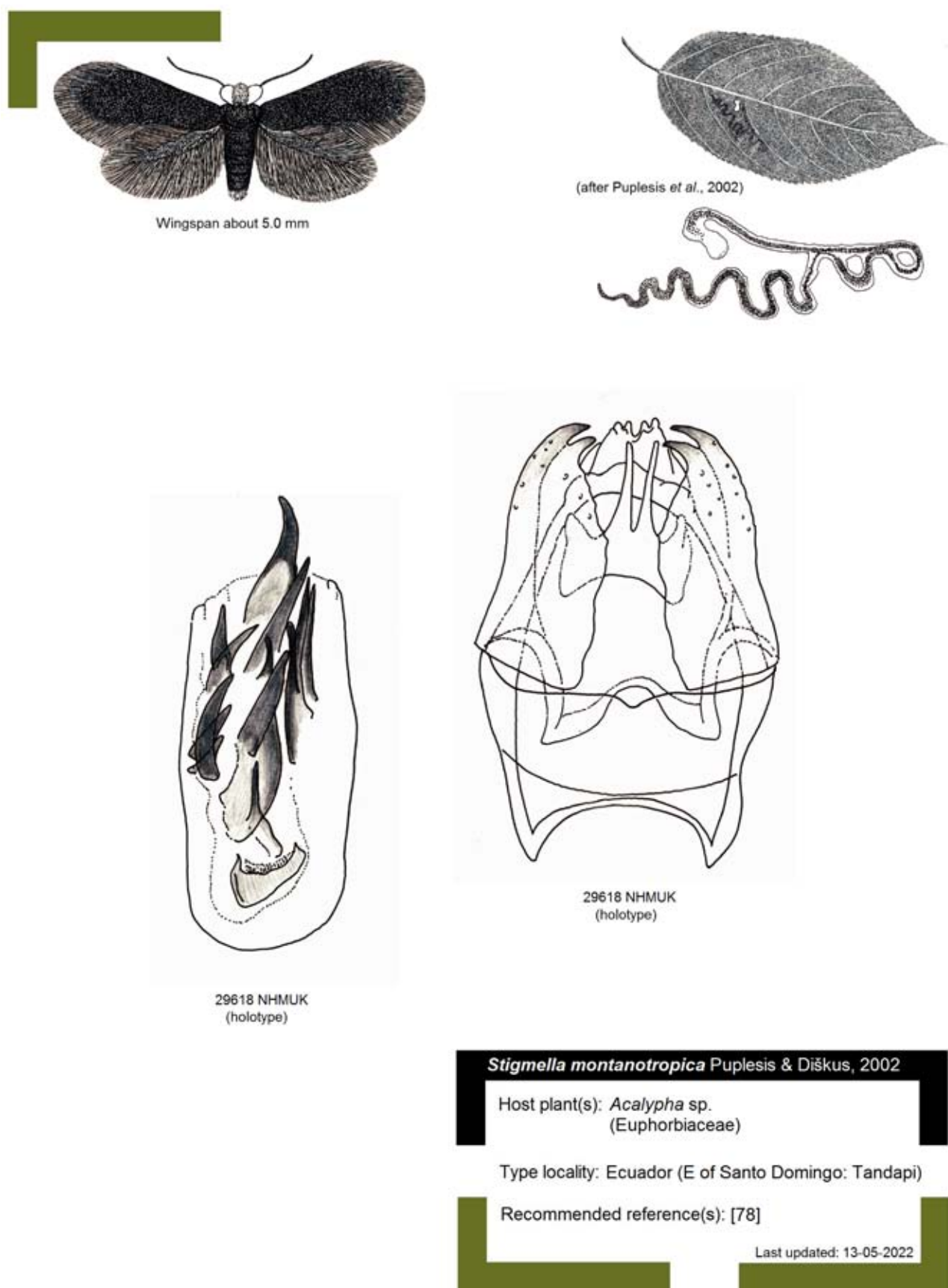


Figure 330. *Stigmella montanotropica* Puplesis & Diškus, a species attributed to the *S. marmorea* group.

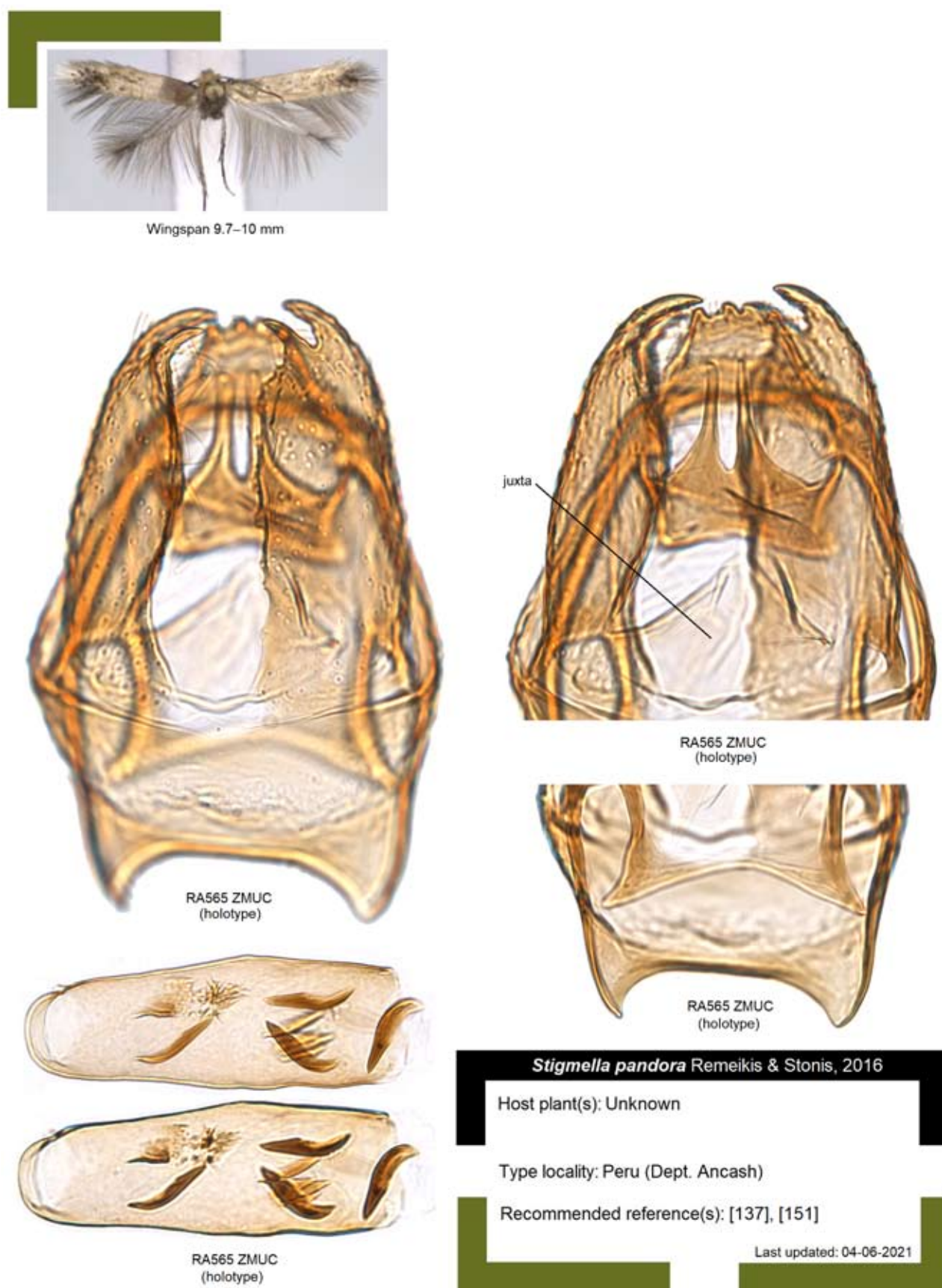


Figure 331. *Stigmella pandora* Remeikis & Stonis, a species attributed to the *S. marmorea* group.

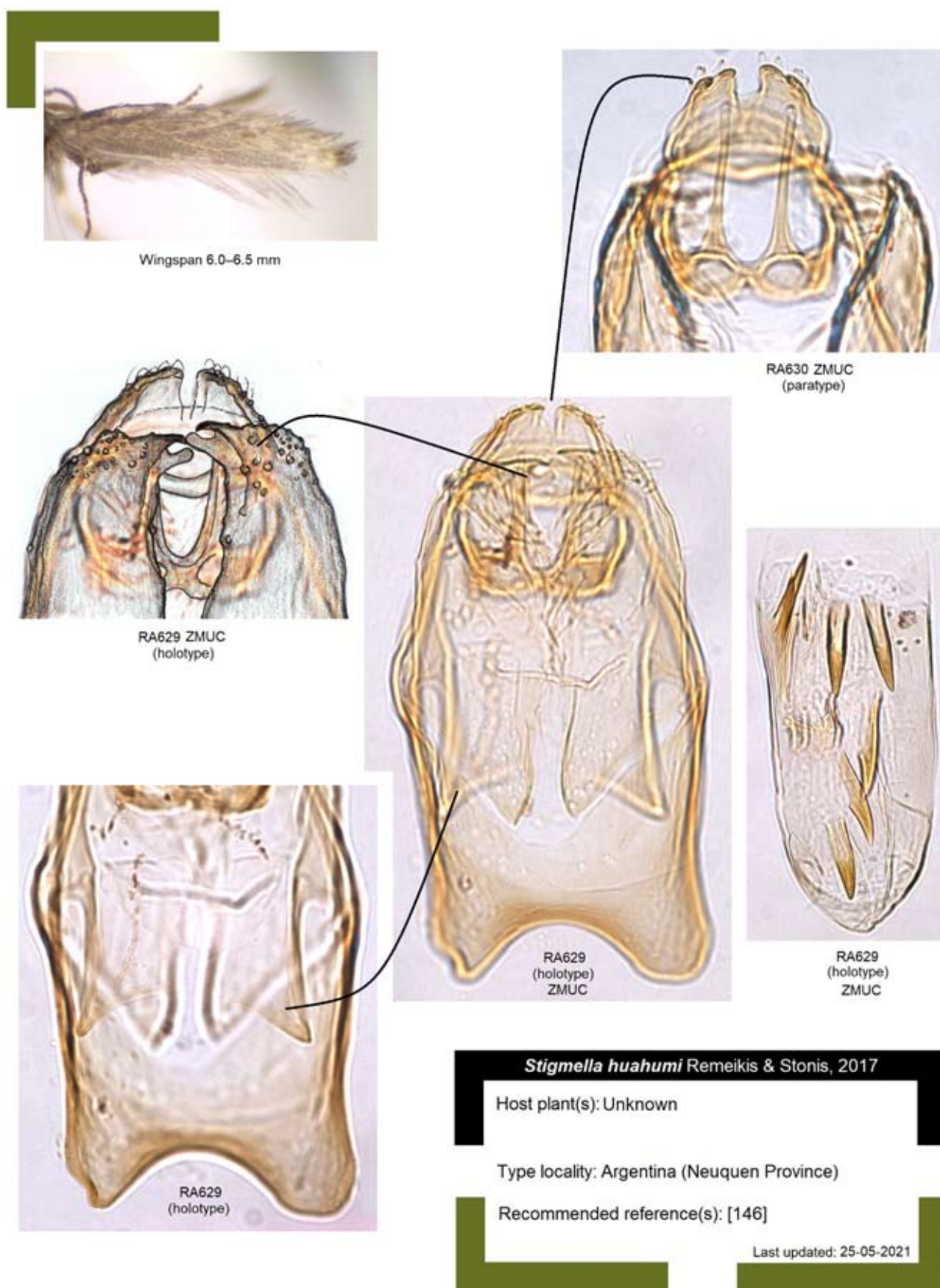


Figure 332. *Stigmella huahumi* Remeikis & Stonis, a species attributed to the *S. marmorea* group.

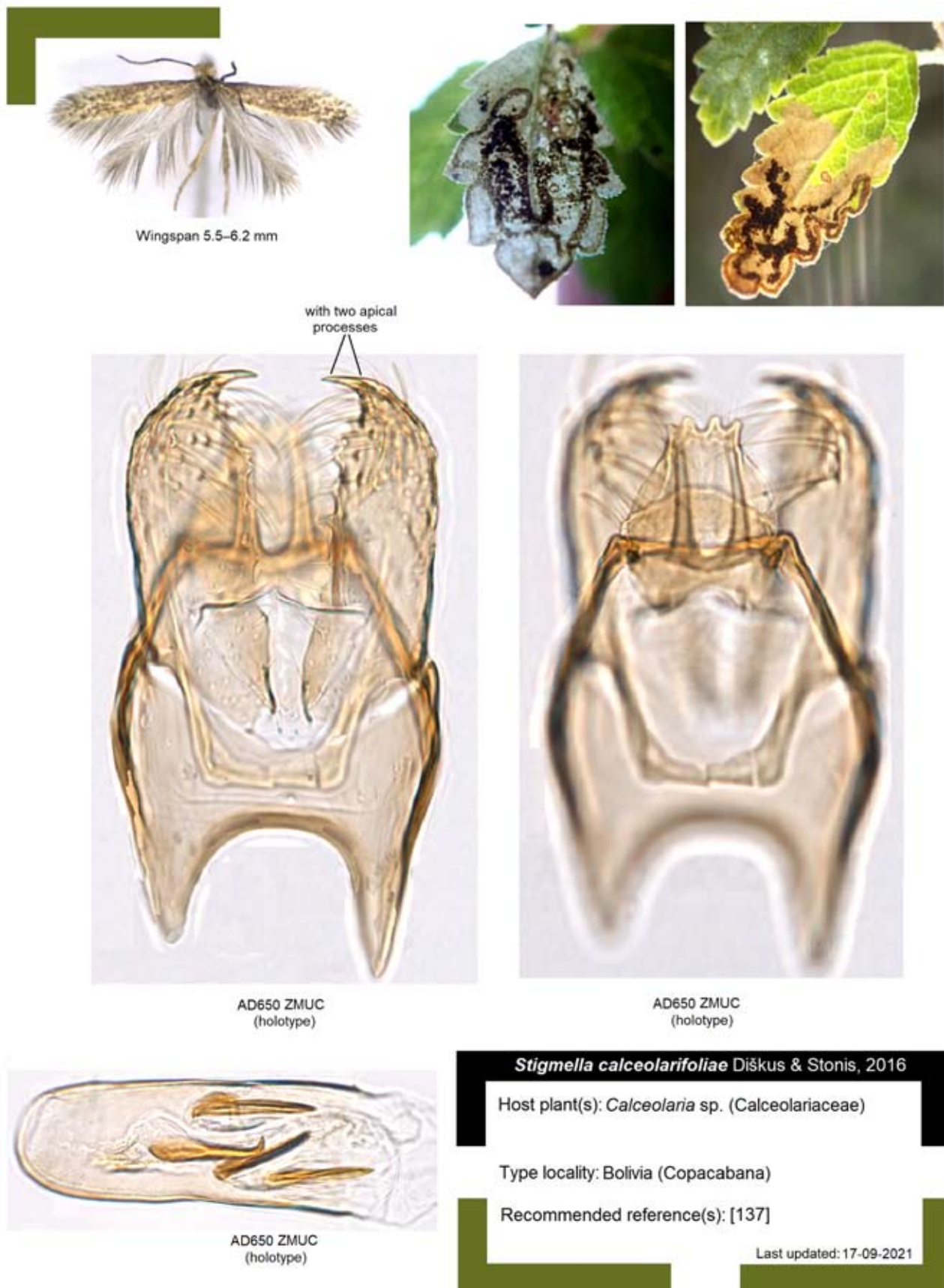


Figure 333. *Stigmella calceolarifoliae* Diškus & Stonis, a species attributed to the *S. marmorea* group.

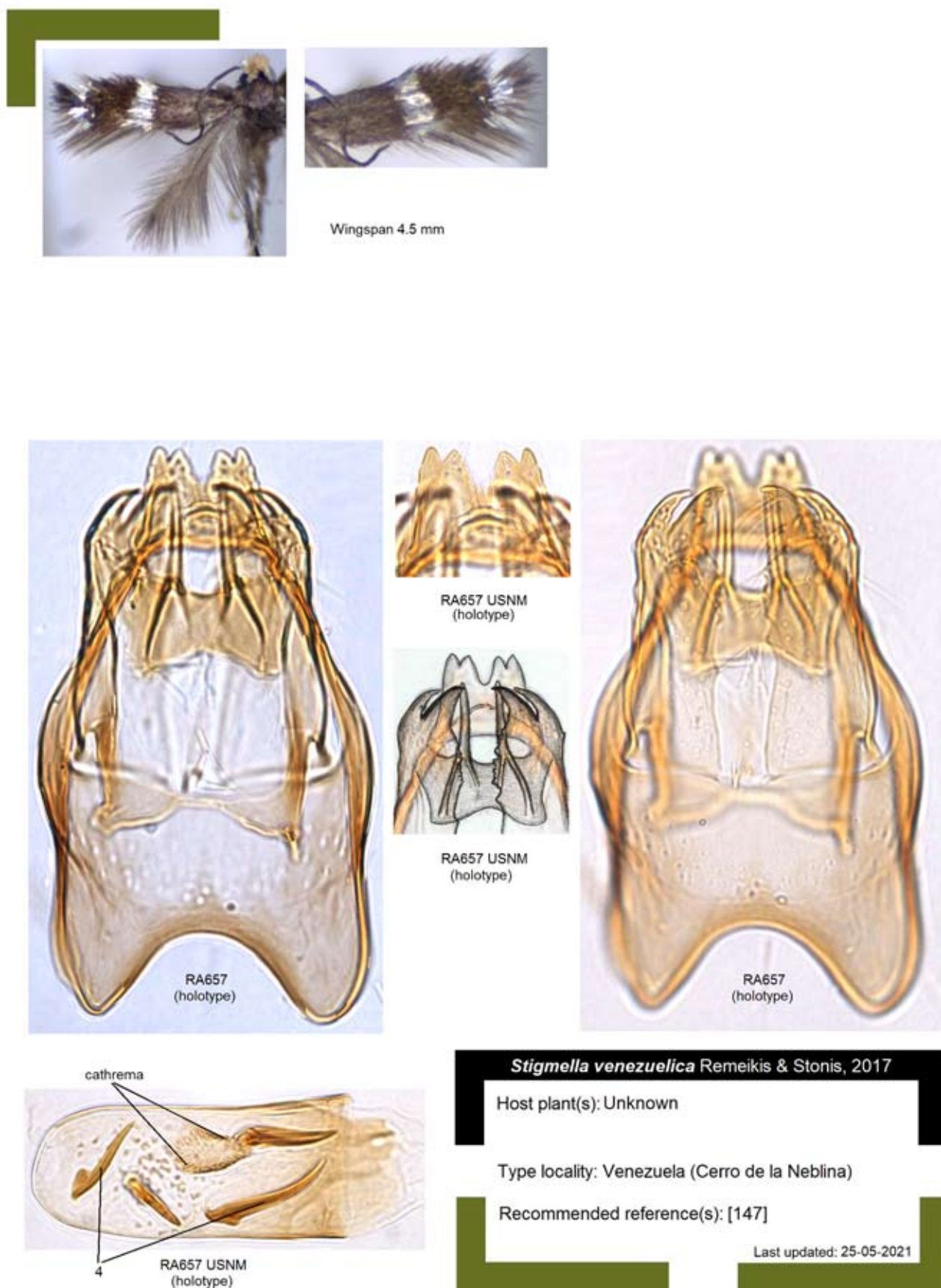
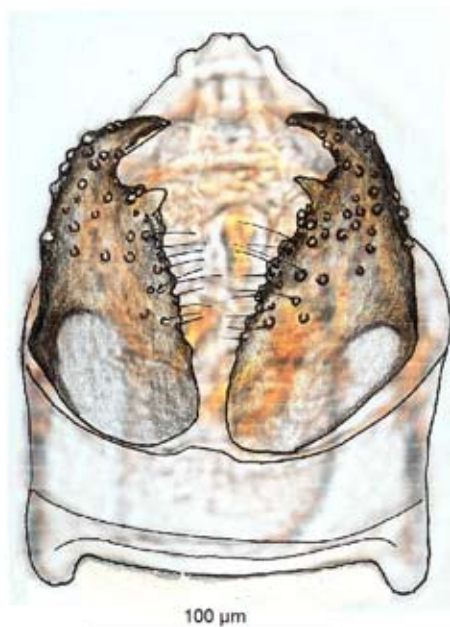


Figure 334. *Stigmella venezuelica* Remeikis & Stonis, a species attributed to the *S. marmorea* group.

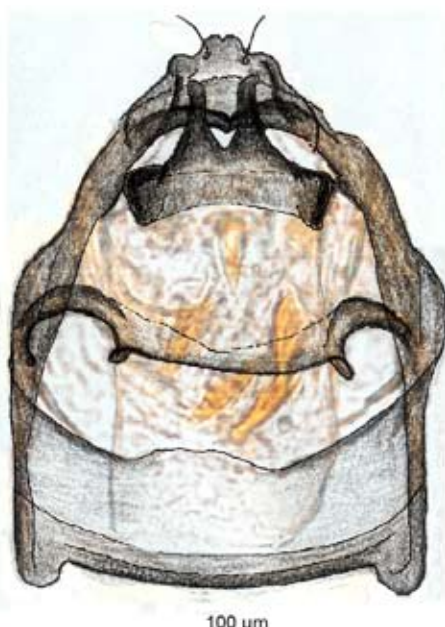
Adults are unknown (the species was documented from dissected, completely developed pupa within the pupal case)



There are certain doubts about morphology of the leaf-mine of the species. During our investigation there were instances of rearing adults of two different species from the same sample as in the case of *Stigmella pauta* and *S. pallatangai*.



AD763 ZMUC
(holotype)



100 µm



100 µm

***Stigmella pallatangai* Diškus & Stonis, sp. nov.**

Host plant(s): *Polylepis pauta* Hieron.
(Rosaceae)

Type locality: Ecuador (30 km NE Pallatanga)

Recommended reference(s): [174]

Last updated: 14-06-2022

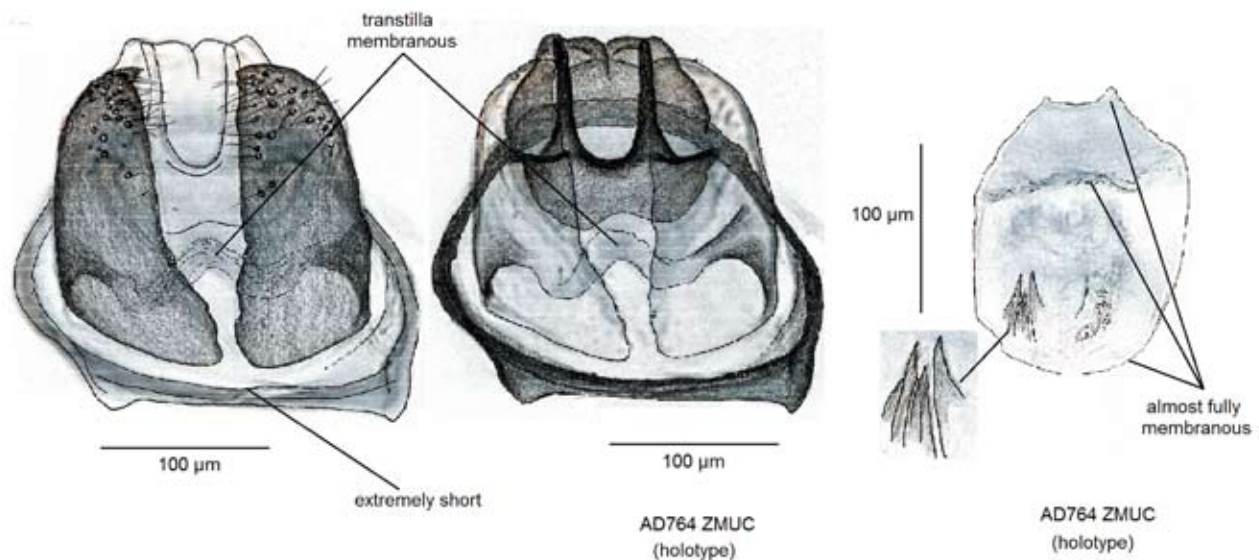
* Formerly known as *Stigmella* species 763 (Stonis *et al.*, 2016 [136])

Figure 335. *Stigmella pallatangai* Diškus & Stonis, a species attributed to the *S. marmorea* group.

Adults are unknown (the species was documented from dissected, completely developed pupa within the pupal case)



There are certain doubts about morphology of the leaf-mine of the species. During our investigation there were instances of rearing adults of two different species from the same sample as in the case of *Stigmella pauta* and *S. pallatangai*.



***Stigmella pauta* Diškus & Stonis, sp. nov.**

Host plant(s): *Polylepis pauta* Hieron.
(Rosaceae)

Type locality: Ecuador (30 km NE Pallatanga)

Recommended reference(s): [174]

Last updated: 14-06-2022

* Formerly known as *Stigmella* species 764 (Stonis *et al.*, 2016 [136])

Figure 336. *Stigmella pauta* Diškus & Stonis, a non-grouped species.

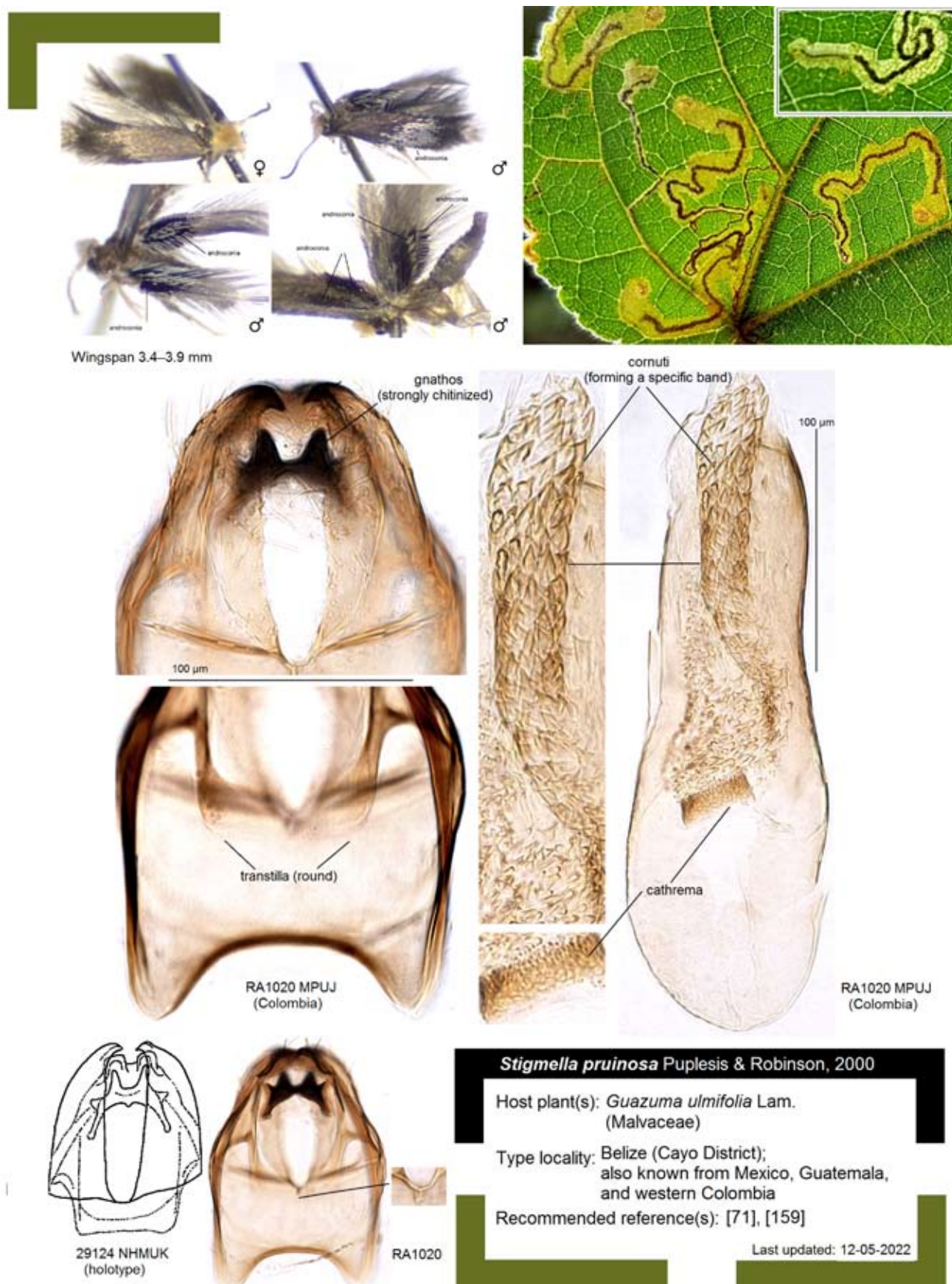
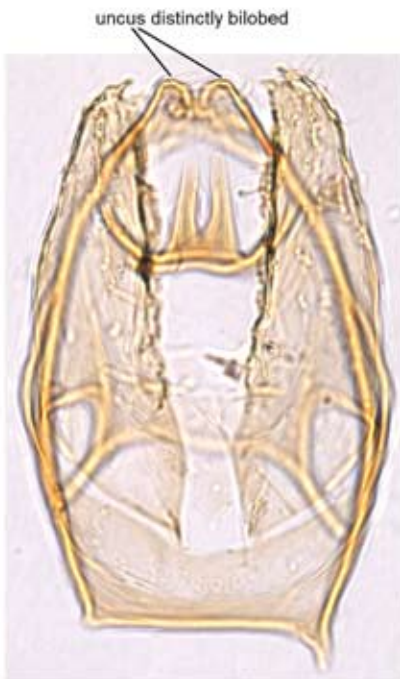


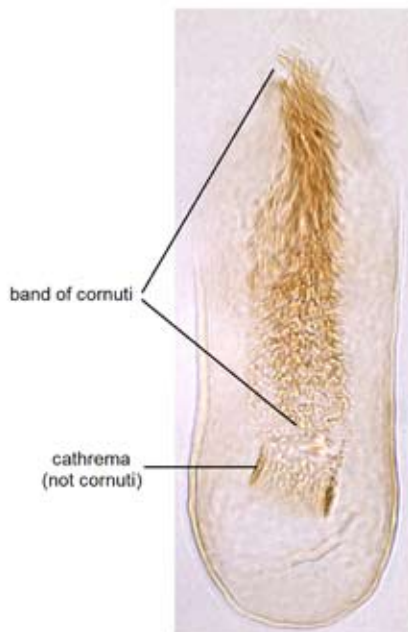
Figure 337. *Stigmella pruinosa* Puplesis & Robinson, a non-grouped species.



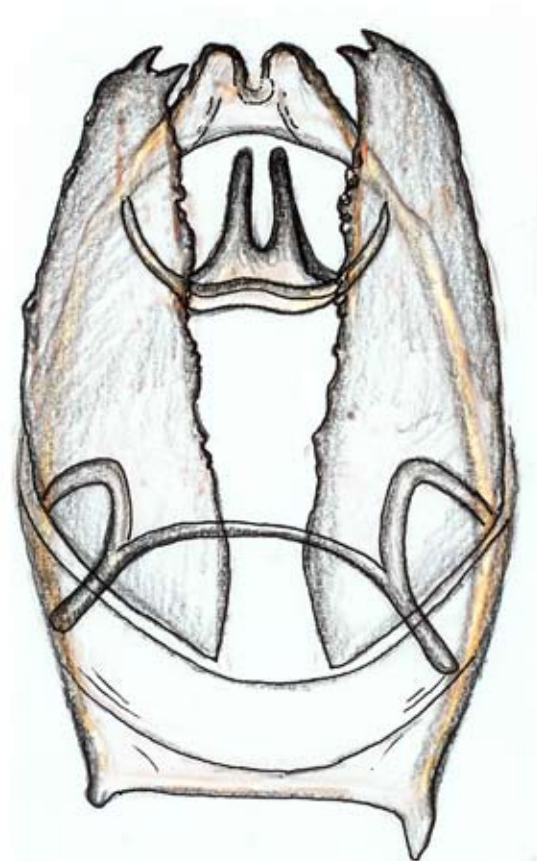
Wingspan 3.8 mm



RA660 USNM
(holotype)



RA660 USNM
(holotype)



RA660 USNM
(holotype)

***Stigmella virginica* Remeikis & Stonis, 2017**

Host plant(s): Unknown

Type locality: British Virgin Islands (Guana Island)

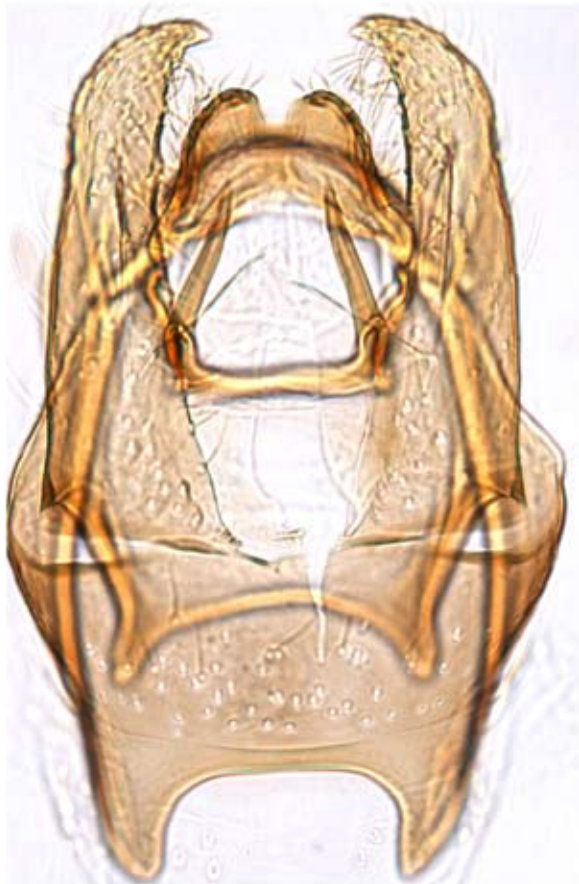
Recommended reference(s): [147]

Last updated: 25-05-2021

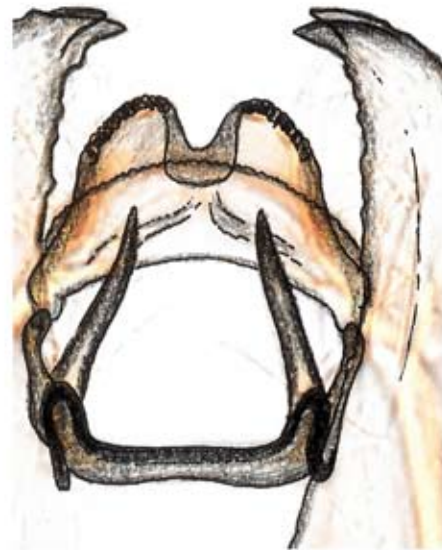
Figure 338. *Stigmella virginica* Remeikis & Stonis, a non-grouped species.



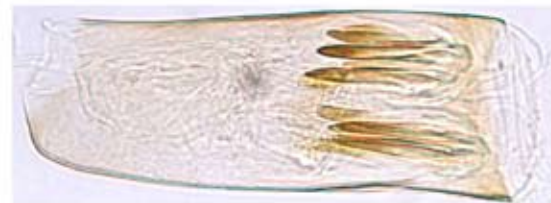
Wingspan about 7.6 mm



Diškus197 ZMUC
(holotype)



Diškus197 ZMUC
(holotype)



Diškus197 ZMUC
(holotype)

***Stigmella sparsella* Diškus & Stonis, 2017**

Host plant(s): Unknown

Type locality: Peru (Dept. Ayacucho)

Recommended reference(s): [151]

Last updated: 13-09-2021

Figure 339. *Stigmella sparsella* Diškus & Stonis, a non-grouped species.



Wingspan about 6.4 mm



RA332 ZMUC
(holotype)



RA332 ZMUC
(holotype)

***Stigmella brutea* Remeikis & Stonis, 2014**

Host plant(s): Unknown

Type locality: southern Andes (Argentina)

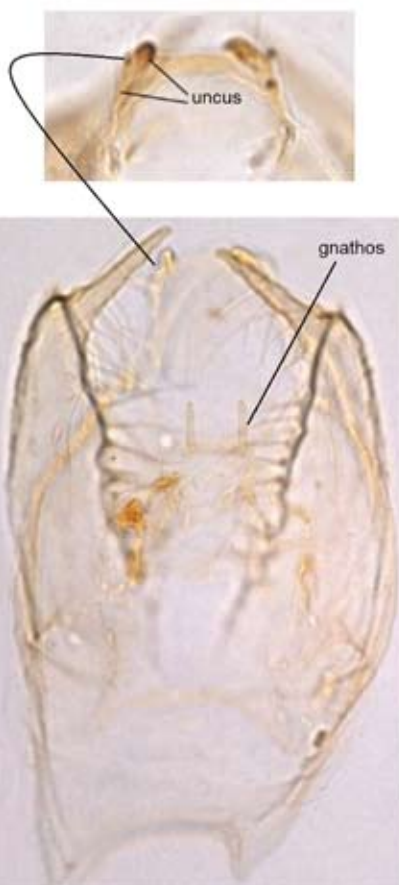
Recommended reference(s): [123]

Last updated: 04-04-2022

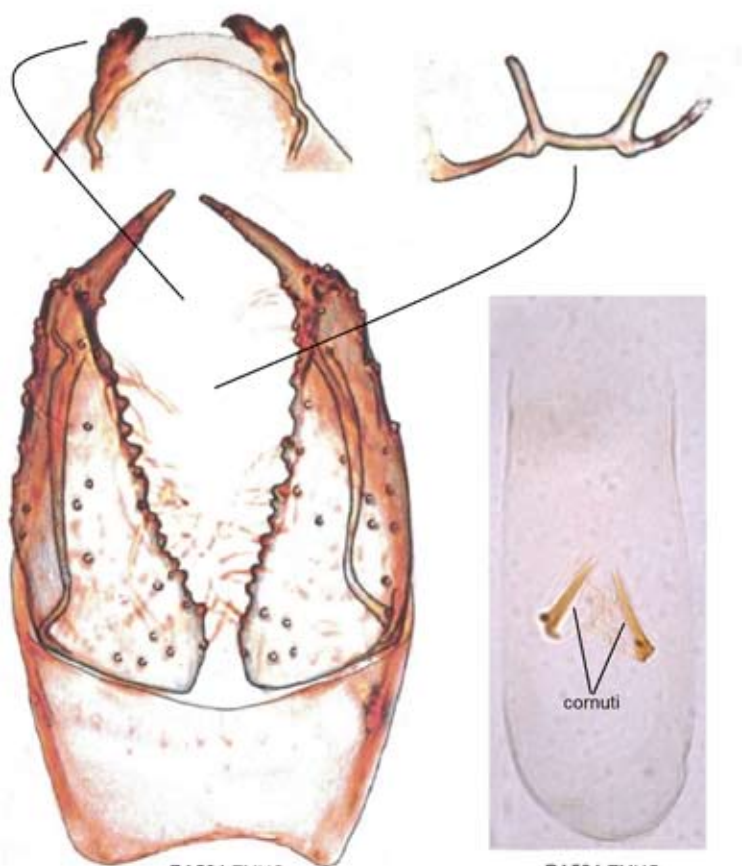
Figure 340. *Stigmella brutea* Remeikis & Stonis, a non-grouped species.



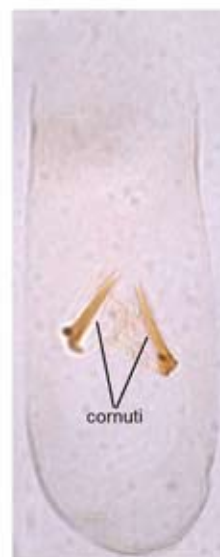
Wingspan about 4.1 mm



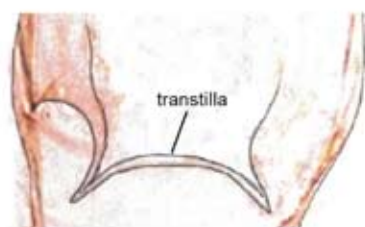
RA584 ZMUC
(holotype)



RA584 ZMUC
(paratype)



RA584 ZMUC
(holotype)



RA584 ZMUC
(holotype)

***Stigmella lilliputica* Remeikis & Stonis, 2017**

Host plant(s): *Schinus polygama* (Cav.) Cabrera
(Anacardiaceae)

Type locality: Argentina (Rio Negro)

Recommended reference(s): [149]

Last updated: 04-04-2022

Figure 341. *Stigmella lilliputica* Remeikis & Stonis, a non-grouped species.



Male is unknown.
The species was described from a female only

***Stigmella mimosae* Diškus & Stonis, 2018**

Host plant(s): *Mimosa albida* Willd.
(Fabaceae)

Type locality: Ecuador (Pichincha Province: Tandapi)

Recommended reference(s): [153]

Last updated: 19-05-2022

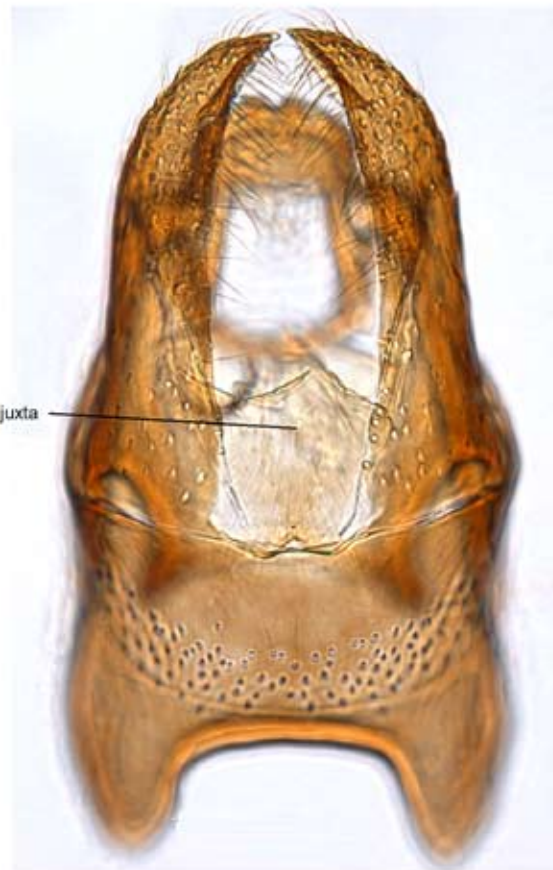
Figure 342. *Stigmella mimosae* Diškus & Stonis, a non-grouped species.



Wingspan 10.2–10.3 mm



AD625 ZMUC
(holotype)



AD625 ZMUC
(holotype)



AD625 ZMUC
(holotype)

***Stigmella rigida* Diškus & Stonis, 2016**

Host plant(s): Unknown

Type locality: Peru (Dept. Ancash)

Recommended reference(s): [137]

Last updated: 17-09-2021

Figure 343. *Stigmella rigida* Diškus & Stonis, a non-grouped species.



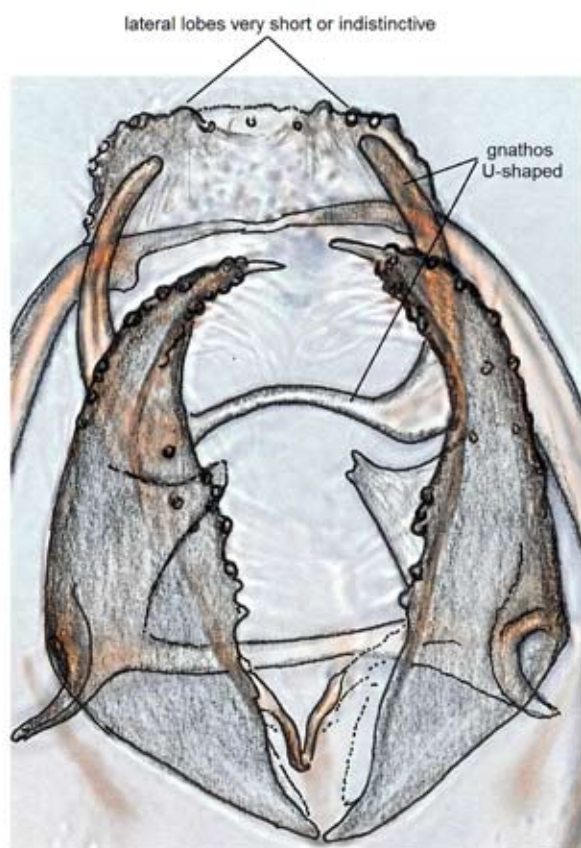
Wingspan 5.8–6.0 mm



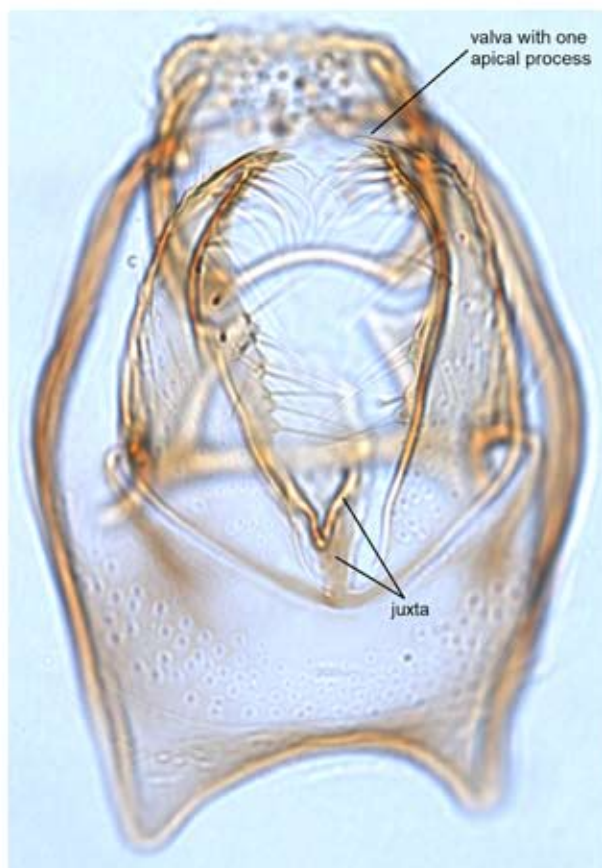
upper side

underside

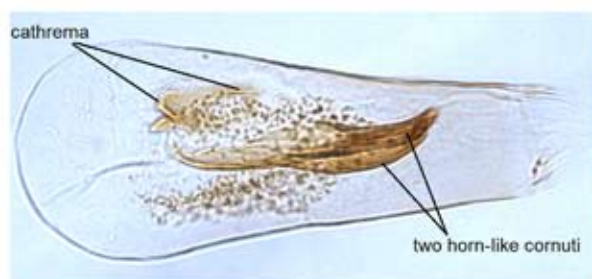
(after van Nieukerken et al. 2016, modified) [143]



RA617 USNM



RA617 USNM



RA617 USNM

Stigmella gallicola van Nieukerken & Nishida, 2016

Host plant(s): *Hampea appendiculata* (Donn.Sm.)
Standl. (Malvaceae)

Type locality: Costa Rica (Puntarenas Province)

Recommended reference(s): [143], [147]

Last updated: 25-05-2021

Figure 344. *Stigmella gallicola* van Nieukerken & Nishida, a non-grouped species.

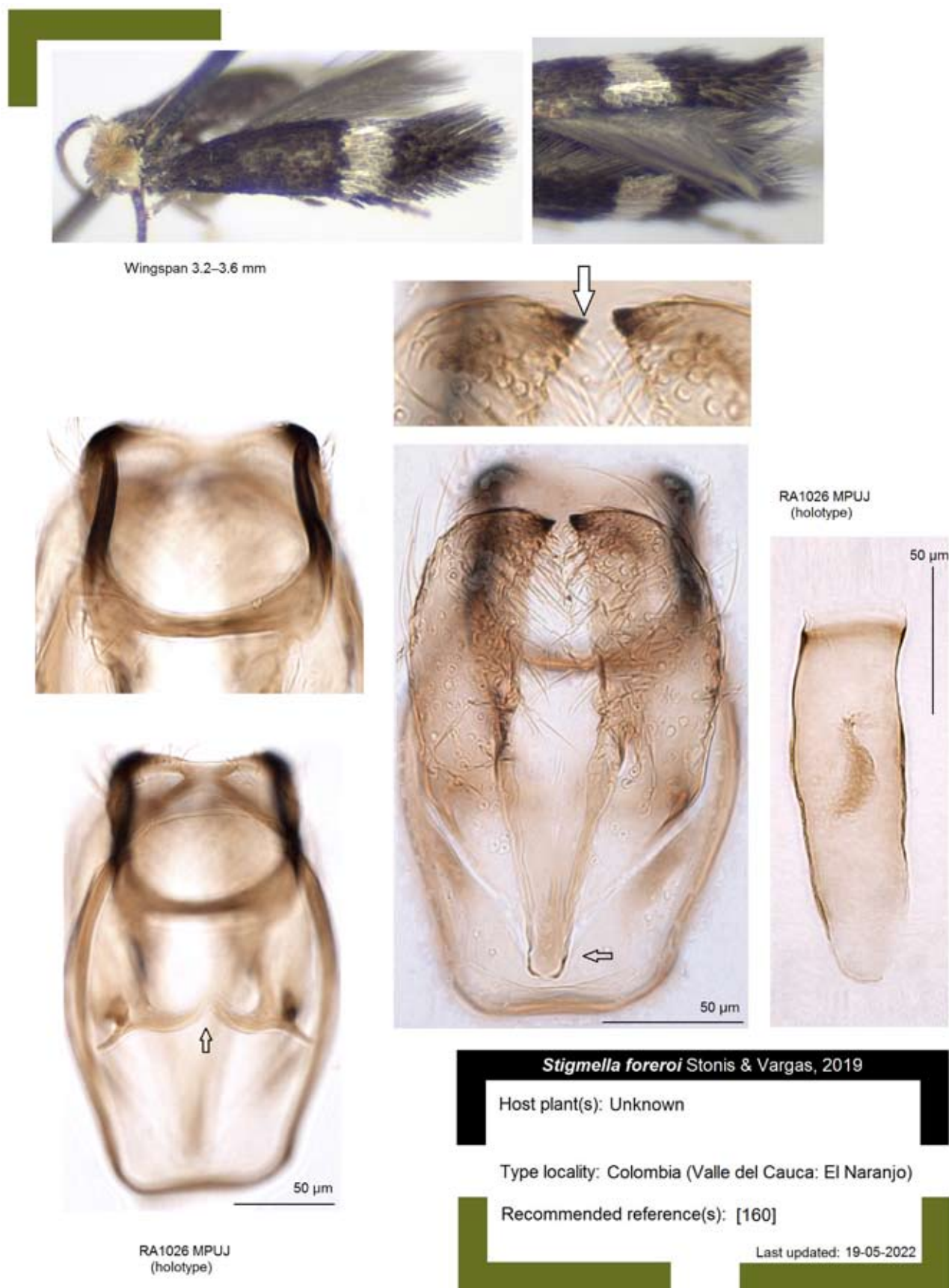
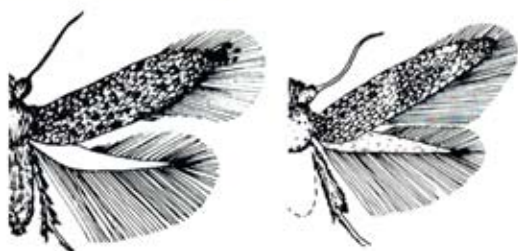
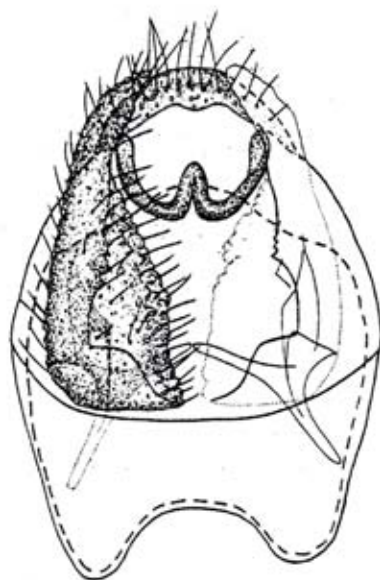


Figure 345. *Stigmella foreroi* Stonis & Vargas, a non-grouped species.

Genus *Ectoedemia* Busck



Wingspan 6.4–9.5 mm (♂)
(after Wilkinson & Newton, 1981)



After Wilkinson, 1981
(*Ectoedemia pipirella* from Florida, USA)



After Wilkinson, 1981
(*Ectoedemia pipirella* from Florida, USA)

Ectoedemia obrutella (Zeller, 1873)*

Host plant(s): Probably *Quercus* spp.
(Fagaceae)

Locality: USA (including Florida)

Recommended reference(s): [16], [17], [71], [144]

Last updated: 12-05-2022

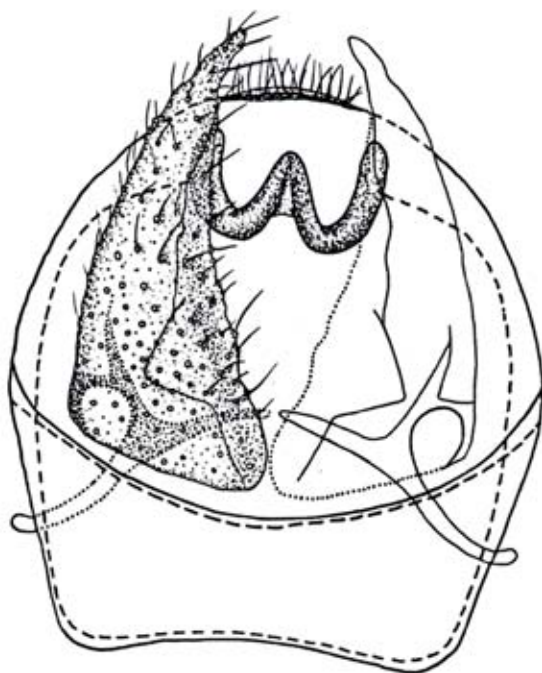
* New recent synonymy by
van Nieukerken *et al.*, 2016 [144]

Ectoedemia pipirella Wilkinson & Newton, 1981 (accepted);
Ectoedemia reneella Wilkinson, 1981 (accepted).

Figure 346. *Ectoedemia obrutella* (Zeller), a species of the subgenus *Zimmermannia* Hering.



Wingspan 6.0–10.0 mm
(after Wilkinson & Newton, 1981; Wilkinson, 1981)



(*Ectoedemia helenella* from Florida, USA)
(after Wilkinson, 1981)



(*Ectoedemia helenella* from Florida, USA)
(after Wilkinson, 1981)

Ectoedemia bosquella* (Chambers, 1878)

Host plant(s): *Quercus palustris*, *Castanea* sp.
(Fagaceae)

Locality: USA (including Florida for *E. helenella*, syn.)

Recommended reference(s): [16], [17], [144]

Last updated: 12-05-2022

* New recent synonymy by
van Nieukerken *et al.*, 2016 [144]
Ectoedemia castaneae Busck, 1913;
Ectoedemia heinrichi Busck, 1914;
Ectoedemia helenella Wilkinson, 1981

Figure 347. *Ectoedemia bosquella* (Chambers), a species of the subgenus *Zimmermannia* Hering.

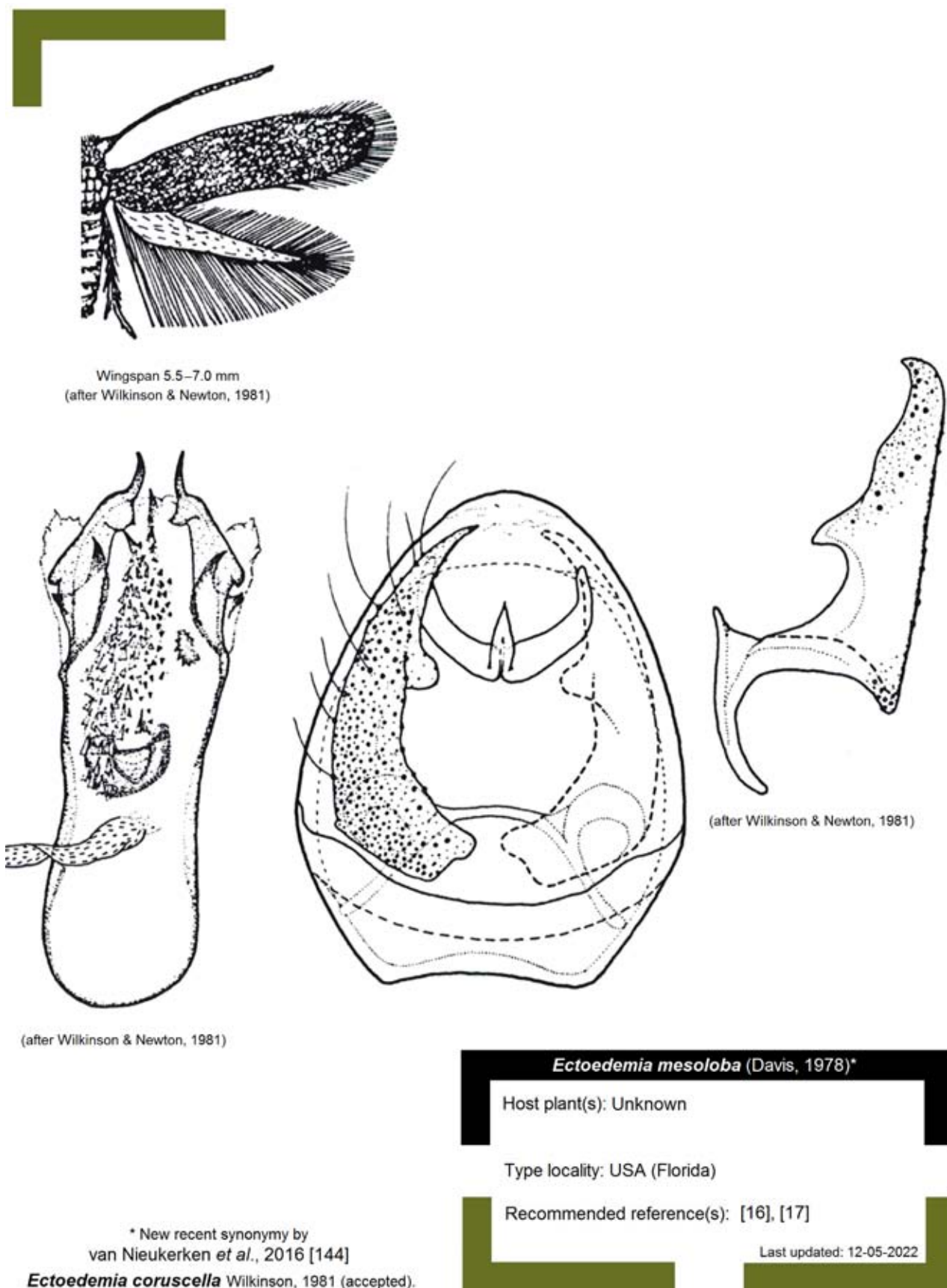


Figure 348. *Ectoedemia mesoloba* Davis, a species of the subgenus *Zimmermannia* Hering.

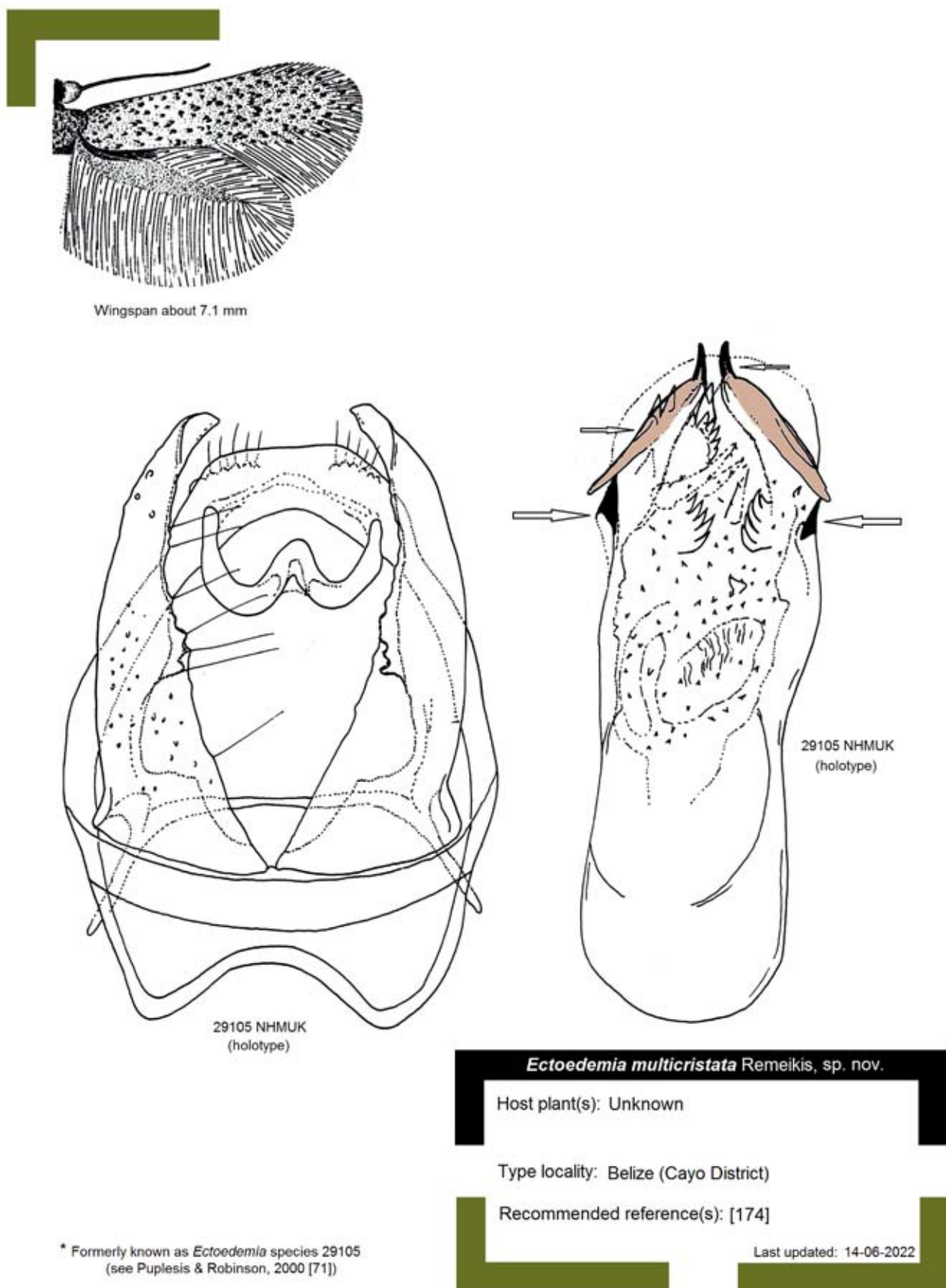


Figure 349. *Ectoedemia multicristata* Remeikis, a species of the subgenus *Zimmermannia* Hering.

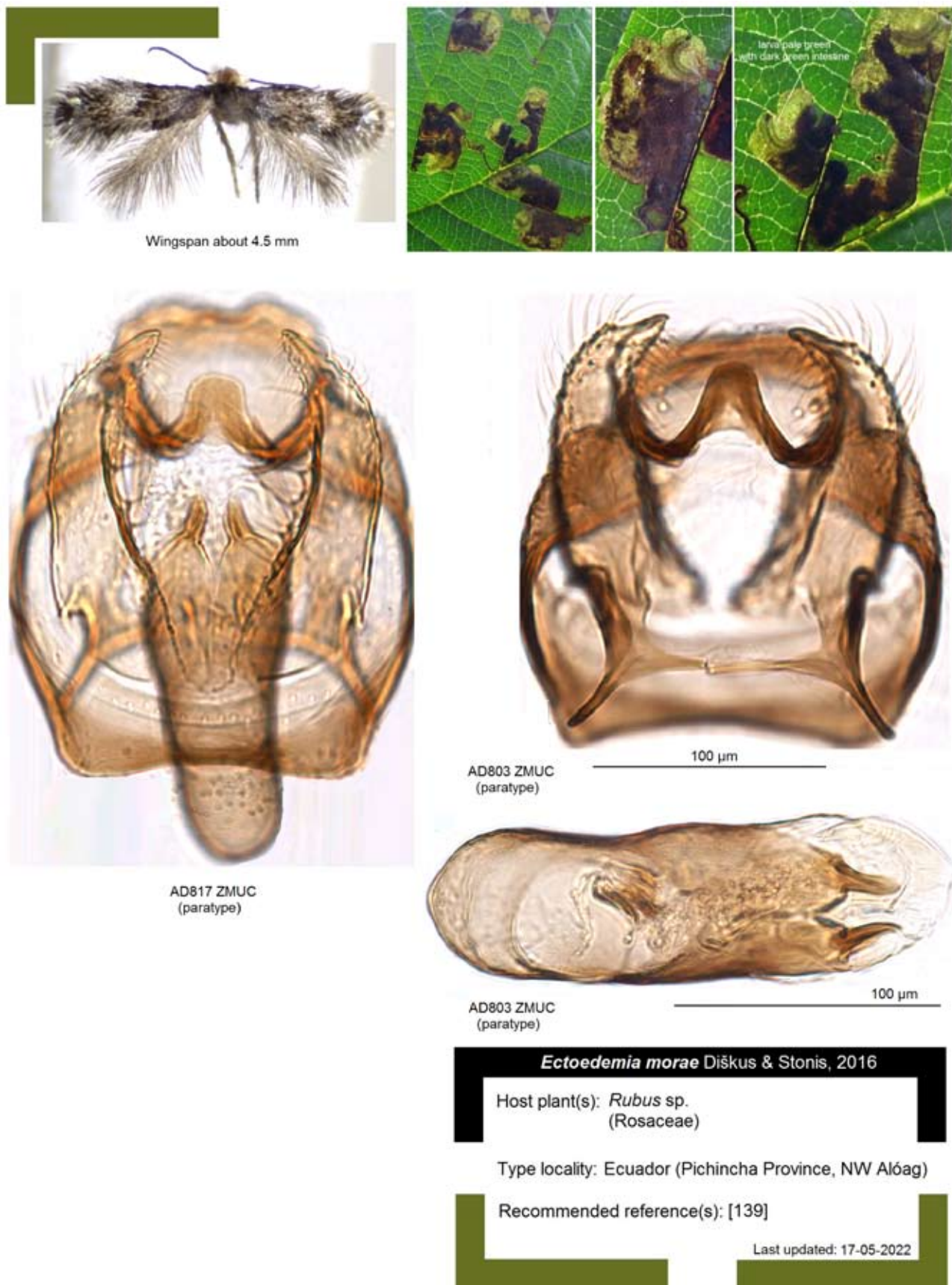


Figure 350. *Ectoedemia morae* Diškus & Stonis, a species attributed to the *E. angulifasciella* group.

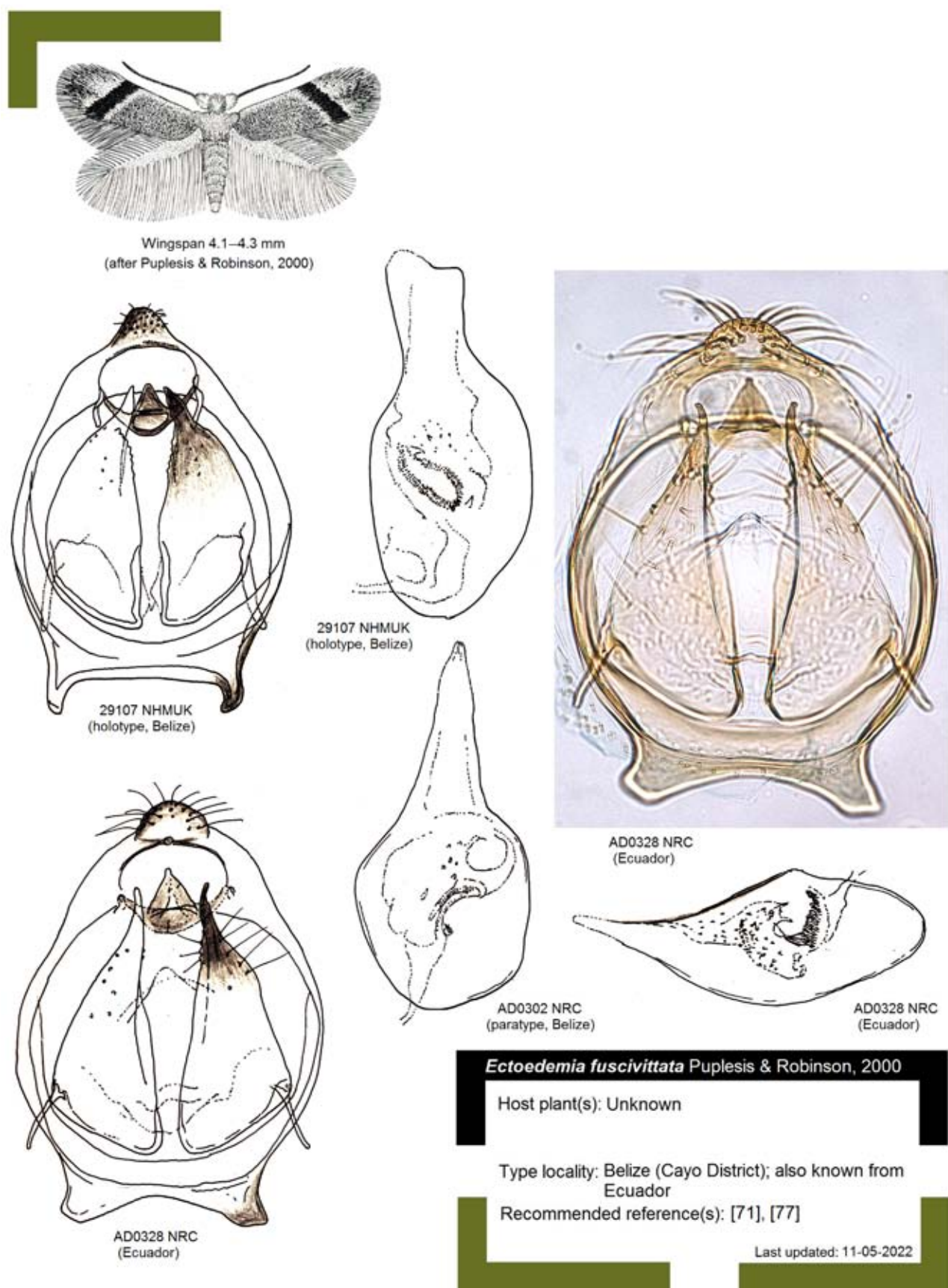
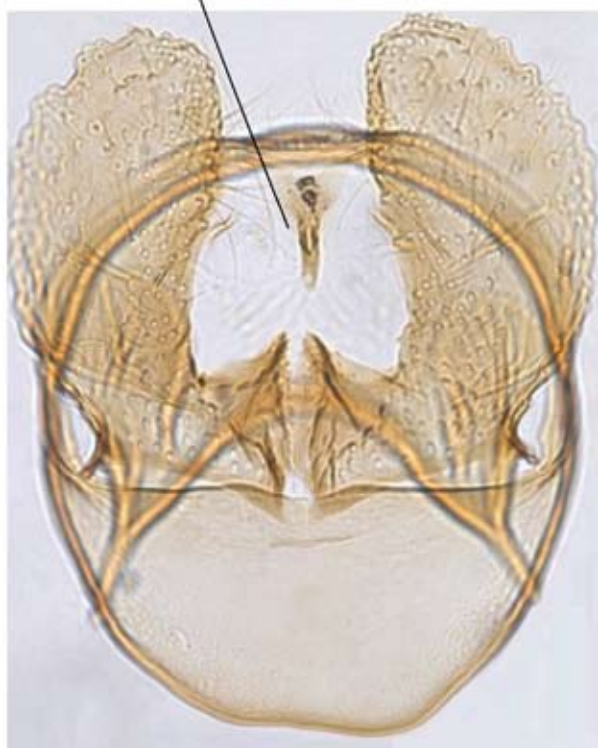
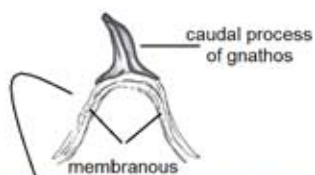


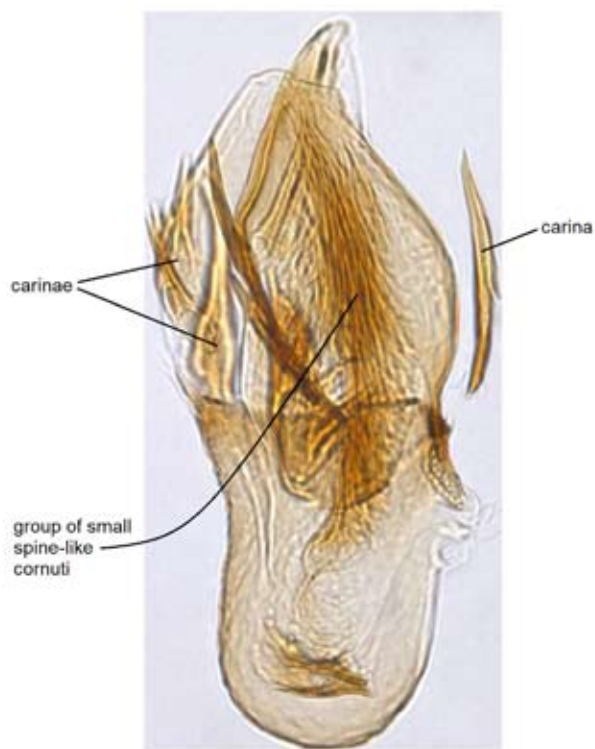
Figure 351. *Ectoedemia fuscivittata* Puplesis & Robinson, a species attributed to the *E. fuscivittata* group.



Wingspan 6.2 mm



RA650 USNM
(holotype)



RA650 USNM
(holotype)

***Ectoedemia bulbosa* Remeikis & Stonis, 2018**

Host plant(s): Unknown

Type locality: Chile (Osorno)

Recommended reference(s): [152]

Last updated: 04-04-2022

Figure 352. *Ectoedemia bulbosa* Remeikis & Stonis, a species of provisional (uncertain) placement in *Ectoedemia*.



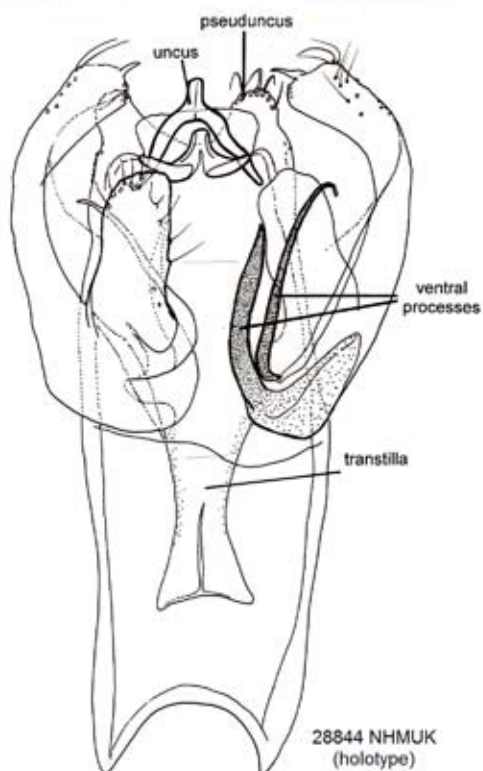
apex caudally

ventrally

laterally

AD989 NHMUK
(paratype)

100 µm



AD989 NHMUK
(paratype)

Last updated: 13-05-2022

Stonis J. R., Remeikis A., Diškus A. (2022) *Neotropical Nepticulidae* 289



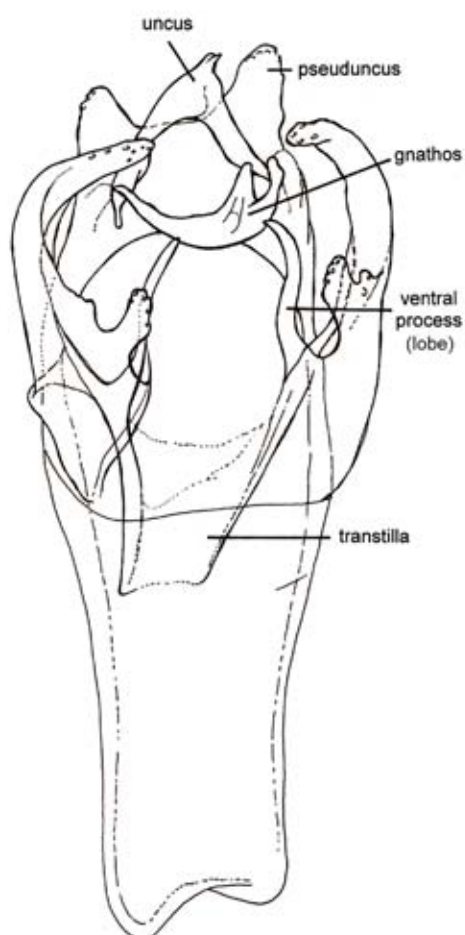
Wingspan about 8.5 mm
(after Puplesis & Robinson, 2000)



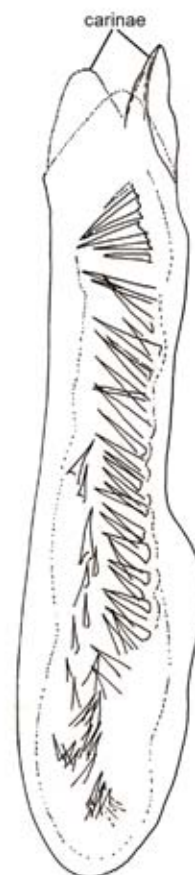
ventral lobe (process)
relatively small



phallus



25651 NHMUK
(holotype)



25651 NHMUK
(holotype)

Hesperolyra molybdis (Zeller, 1877)

Host plant(s): Unknown

Type locality: Colombia (Bogotá)

Recommended reference(s): [71], [129], [161]

Last updated: 13-05-2022

Figure 354. A species profile of *Hesperolyra molybdis* (Zeller).

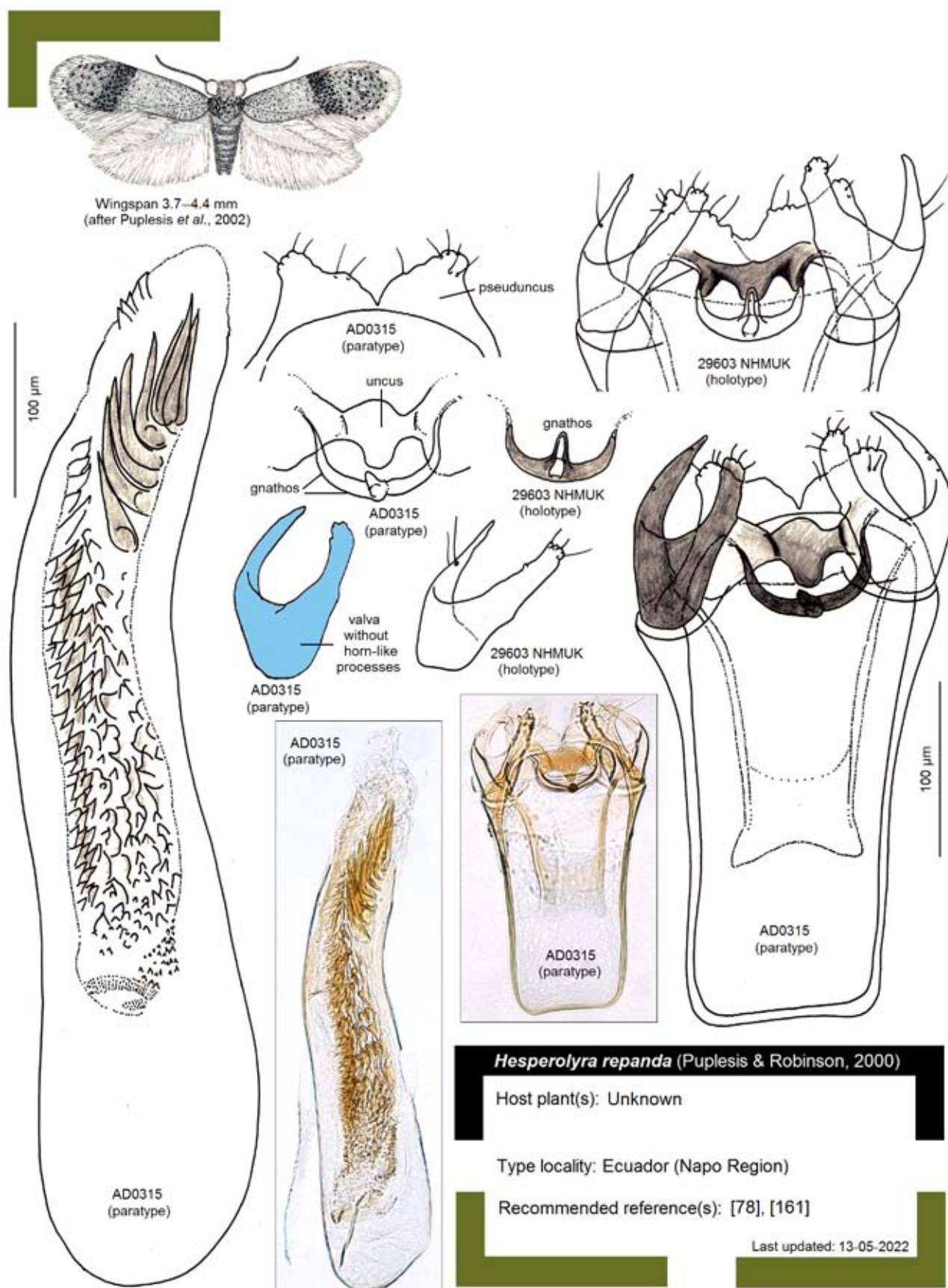


Figure 355. A species profile of *Hesperolyra repanda* (Puplesis & Diškus).



lead color to silvery shiny

Wingspan 4.0–4.6 mm (♀)
(after van Nieukerken *et al.*, 2016)



(after van Nieukerken *et al.*, 2016)

Male is unknown.
The species was described from a female only

***Hesperolyra saopaulensis* van Nieukerken, 2016**

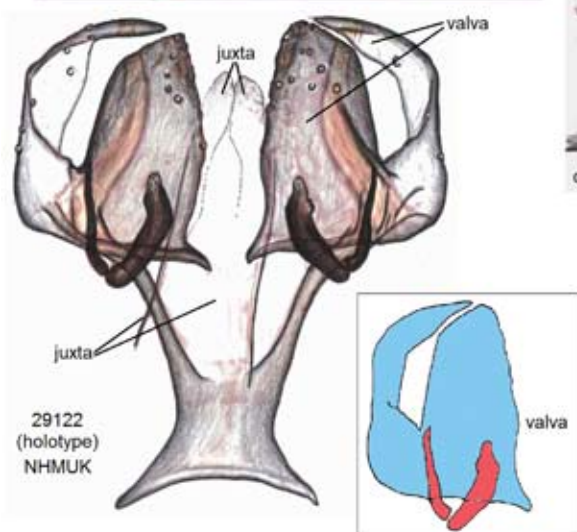
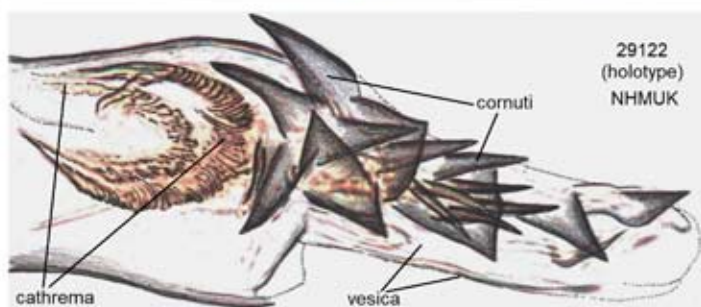
Host plant(s): probably *Eugenia* or *Myrcia* sp.
(Myrtaceae)

Type locality: Brazil (Sao Paulo)

Recommended reference(s): [143], [161]

Last updated: 13-05-2022

Figure 356. A species profile of *Hesperolyra saopaulensis* van Nieukerken.



***Hesperolyra robinsoni* Stonis, 2017**

Host plant(s): Unknown

Type locality: Belize (Cayo District, Las Cuevas)

Recommended reference(s): [71], [147]

Last updated: 25-05-2021

Figure 357. A species profile of *Hesperolyra robinsoni* Stonis.

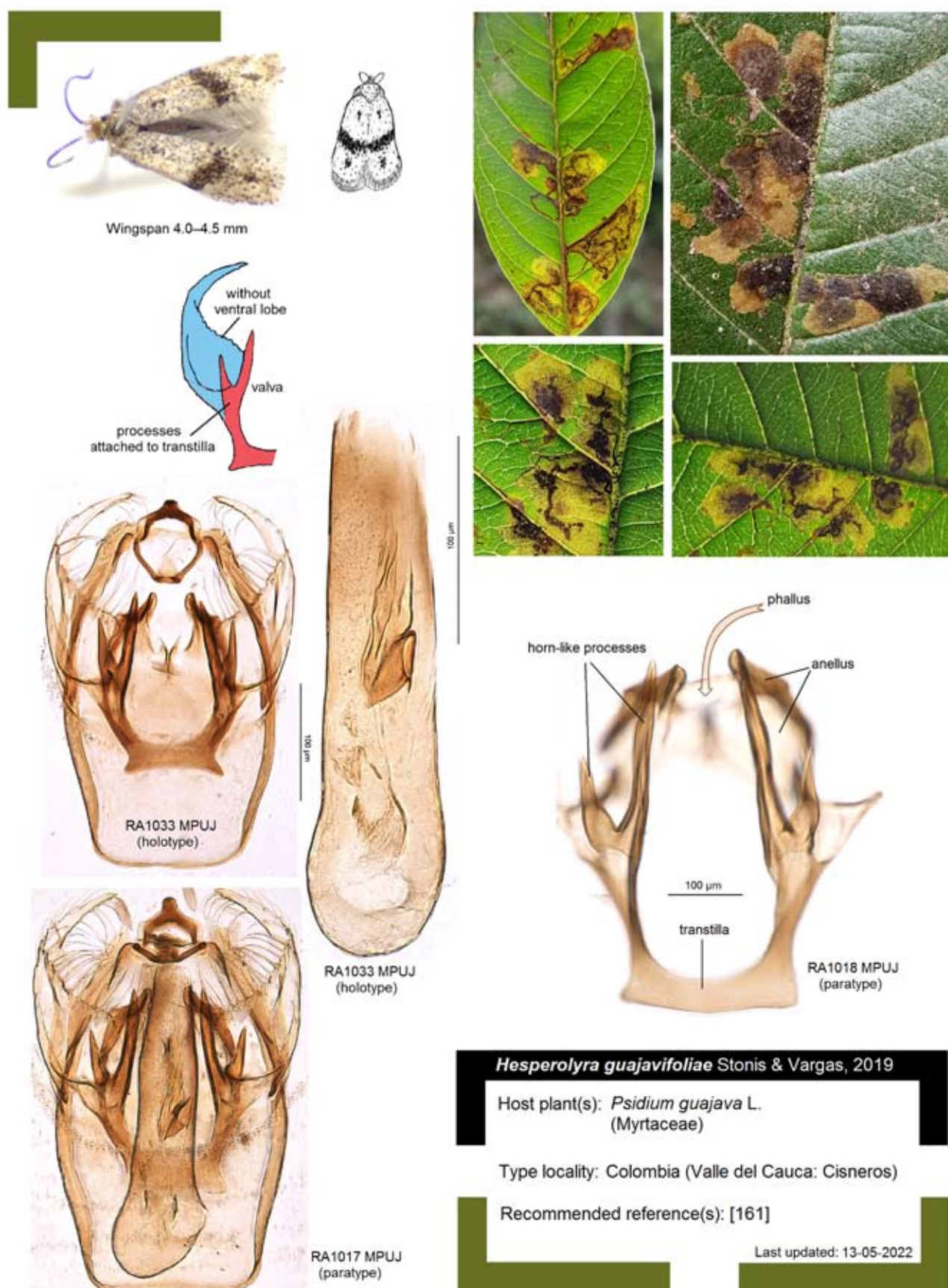


Figure 358. A species profile of *Hesperolyra guajavifoliae* Stonis & Vargas.

Genus *Fomoria* Beirne



Wingspan about 5.6 mm
(after Puplesis *et al.*, 2002)



29625 NHMUK
(holotype)



29625 NHMUK
(holotype)

* The taxonomic position of this species
is uncertain and, therefore, provisional.

***Fomoria** *tabulosa* Puplesis & Diškus, 2002**

Host plant(s): Unknown

Type locality: Ecuador (Napo Region: Yasuni N. P.)

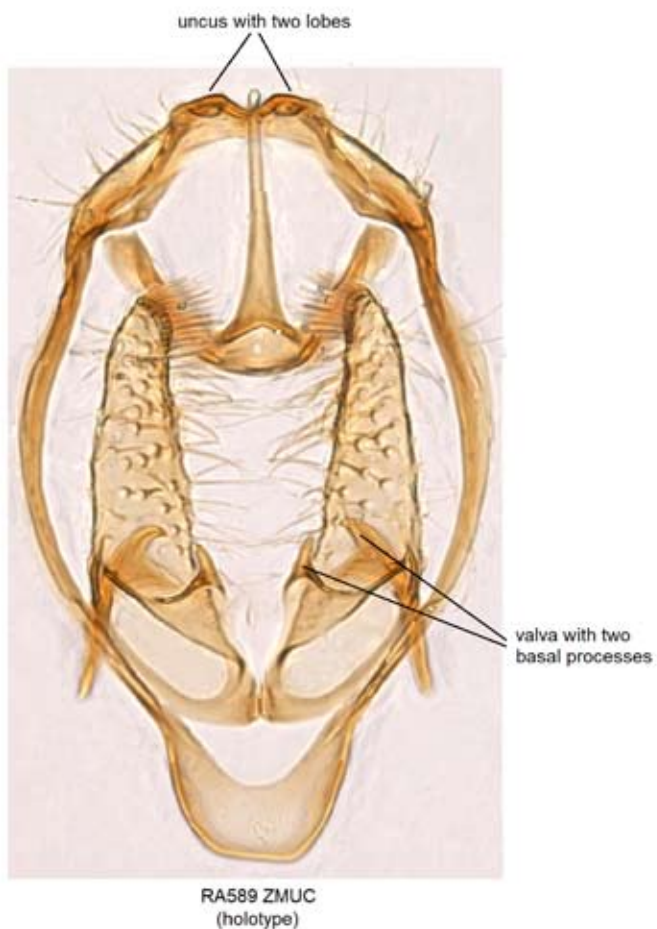
Recommended reference(s): [78]

Last updated: 13-05-2022

Figure 359. *Fomoria tabulosa* Puplesis & Diškus, a species of uncertain placement in *Fomoria*.



Wingspan 7.6 mm



***Fomoria cornijuxtata* Remeikis & Stonis, 2018**

Host plant(s): Unknown

Type locality: Argentina (Neuquen)

Recommended reference(s): [152]

Last updated: 04-04-2022

Figure 360. *Fomoria cornijuxtata* Remeikis & Stonis, a species of uncertain placement in *Fomoria*.

Genus *Acalyptris* Meyrick

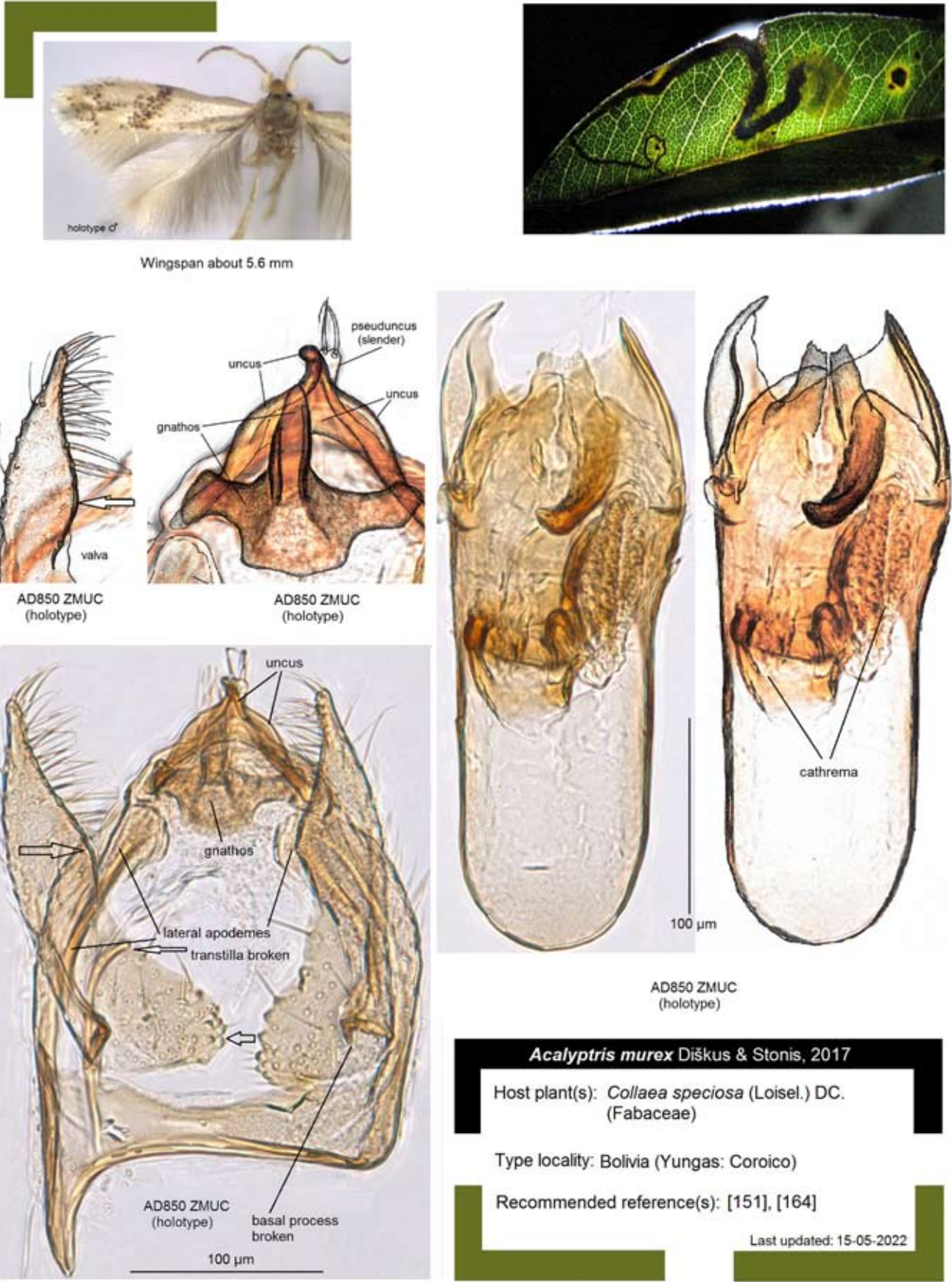


Figure 361. *Acalyptris murex* Diškus & Stonis, a species attributed to the *A. murex* group.

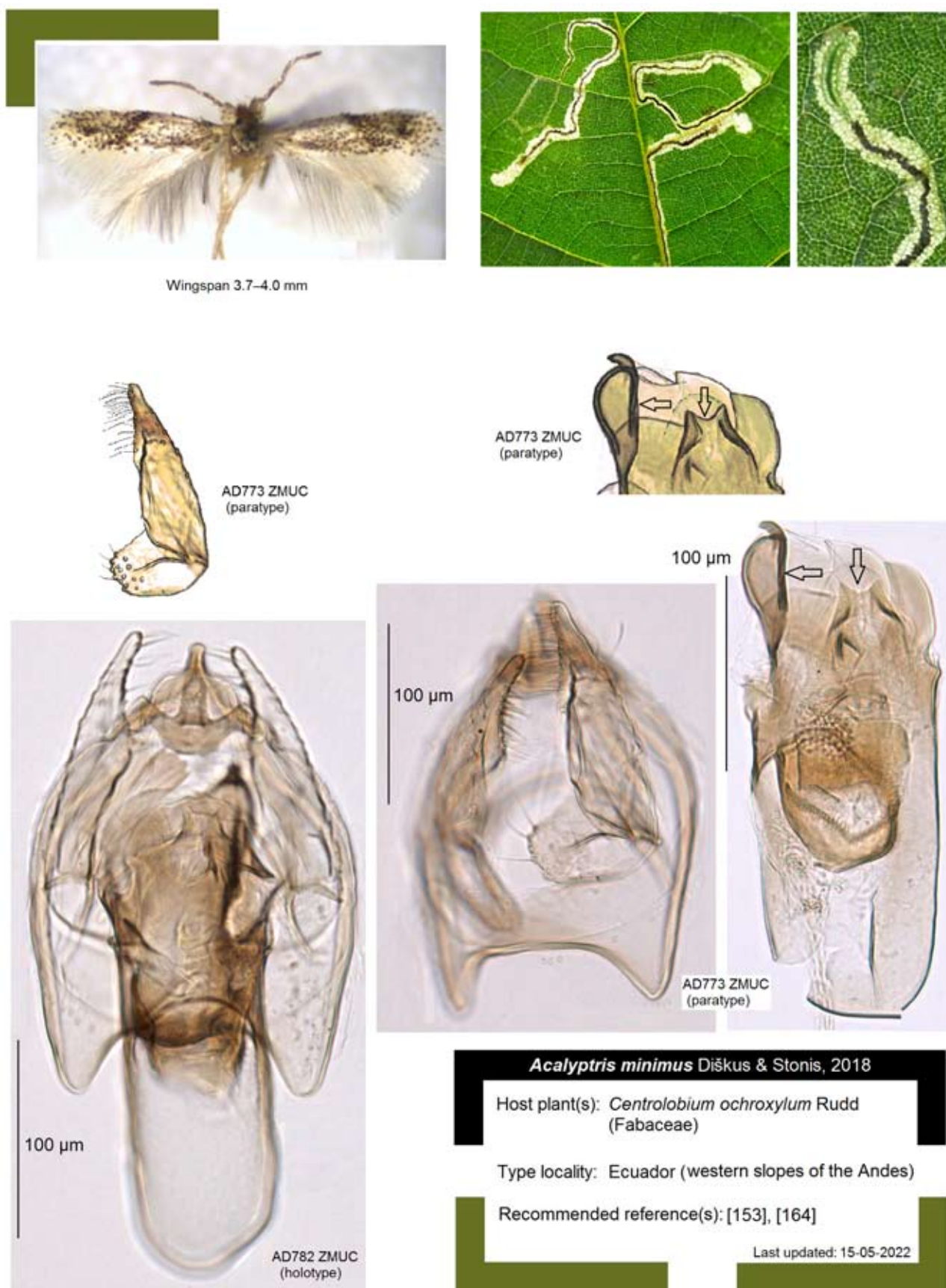
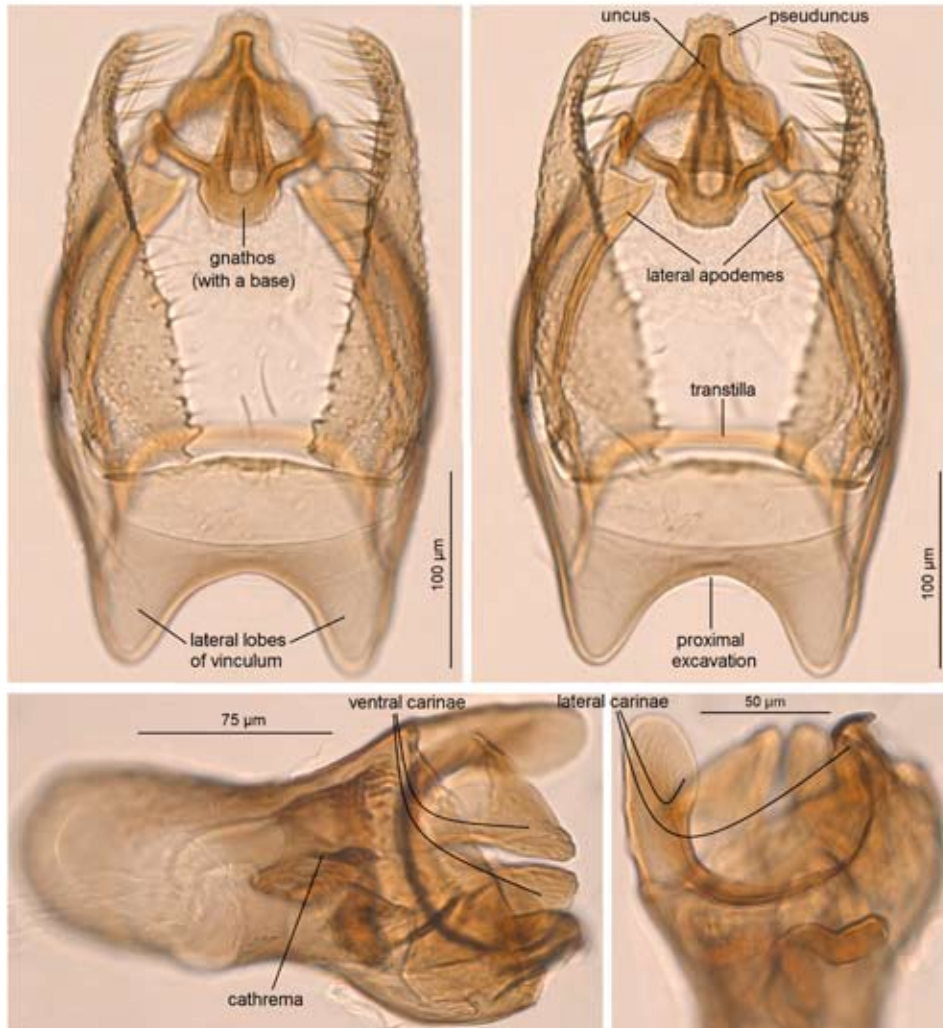


Figure 362. *Acalyptris minimus* Diškus & Stonis, a species attributed to the *A. murex* group.



Wingspan about 5.5 mm



AD950 ZMUC
(holotype)

***Acalyptris marmor* Stonis & Diškus, 2020**

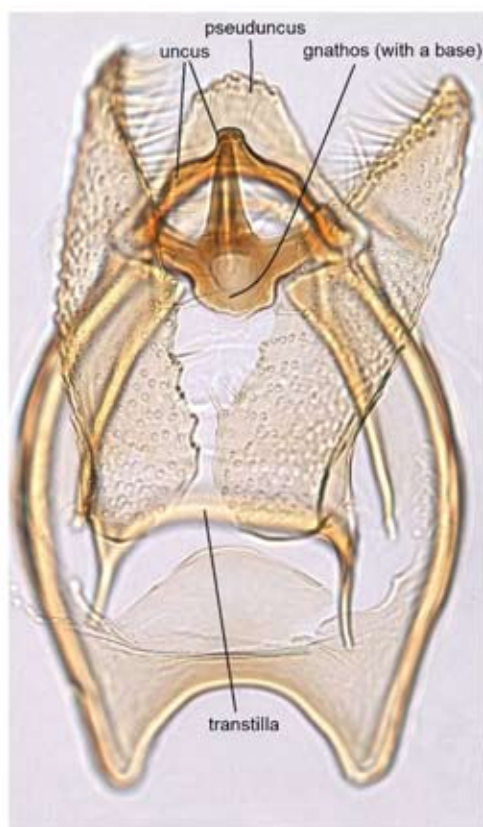
Host plant(s): Unknown

Type locality: Peru (Departamento de Junín: Satipo)

Recommended reference(s): [164]

Last updated: 15-05-2022

Figure 363. *Acalyptris marmor* Stonis & Diškus, a species attributed to the *A. murex* group.



RA1005 ZMUC
(holotype)



RA1005 ZMUC
(holotype)



RA1005 ZMUC
(holotype)

***Acalyptris barbudo* Stonis & Remeikis, 2020**

Host plant(s): Unknown

Type locality: Peru (Junín Region)

Recommended reference(s): [164]

Last updated: 04-04-2022

Figure 364. *Acalyptris barbudo* Stonis & Remeikis, a species attributed to the *A. murex* group.

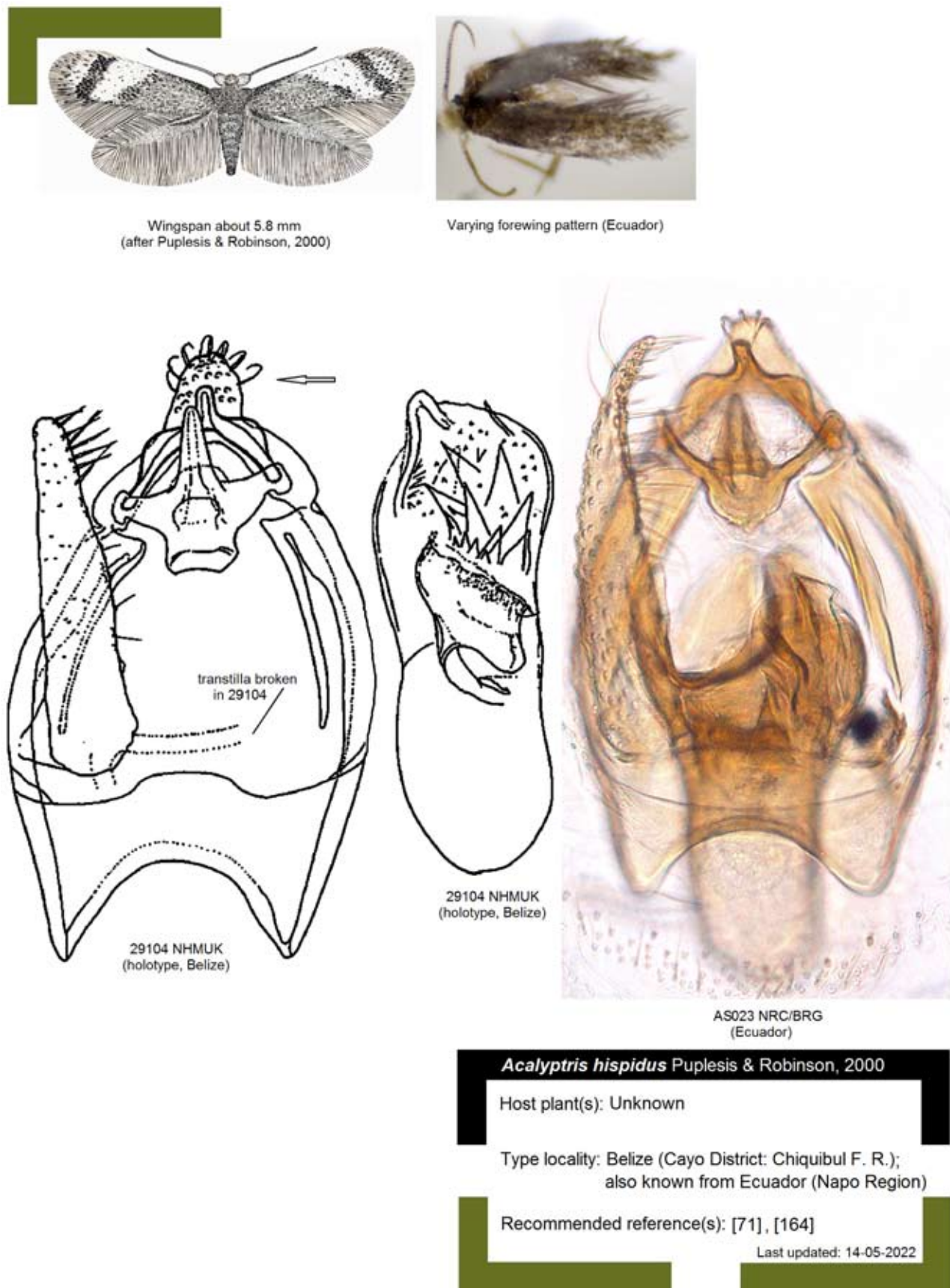


Figure 365. *Acalypttris hispidus* Puplesis & Robinson, a satellite species resembling of the *A. murex* group.

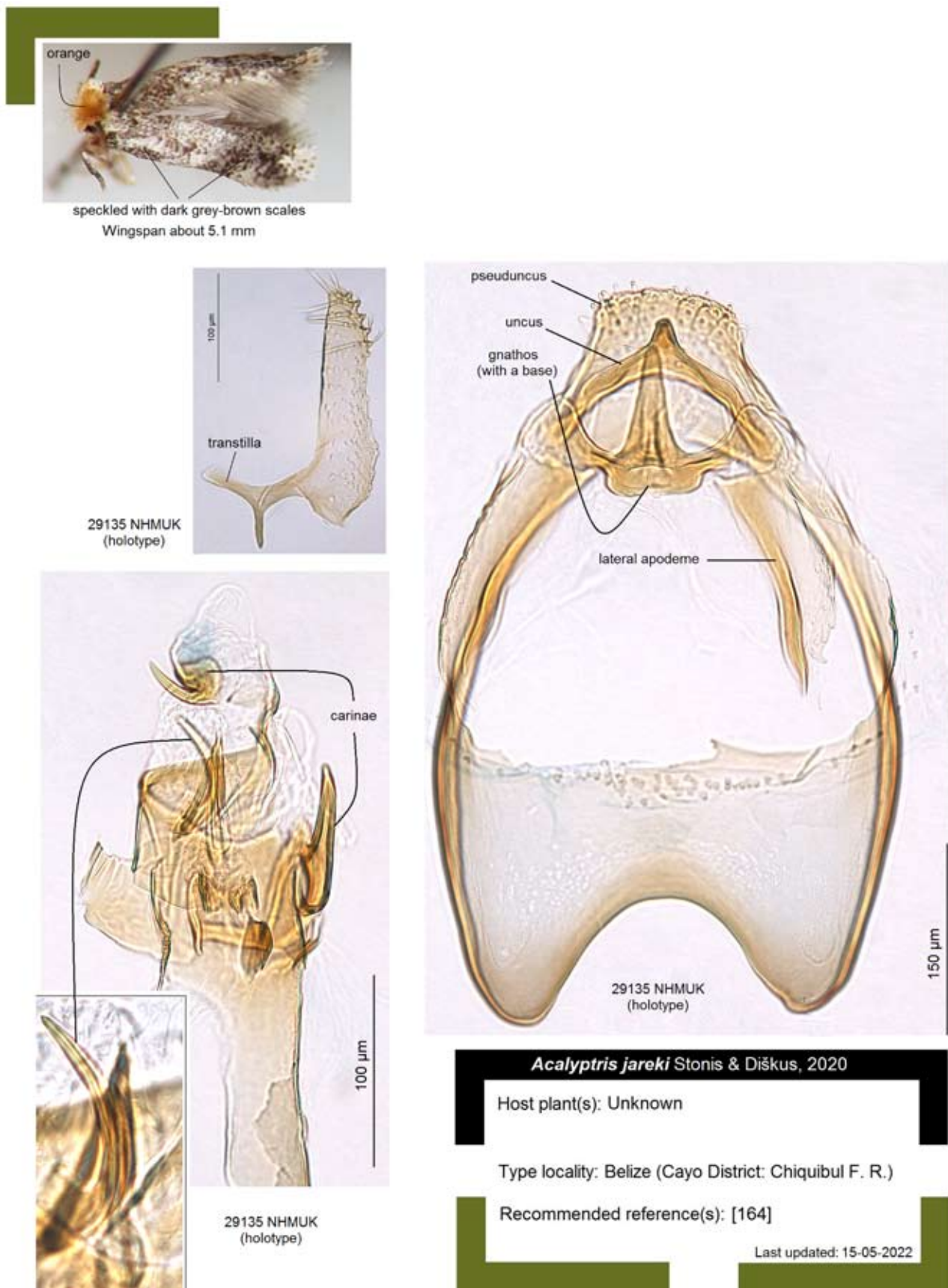


Figure 366. *Acalyptris jareki* Stonis & Diškus, a satellite species resembling of the *A. murex* group.

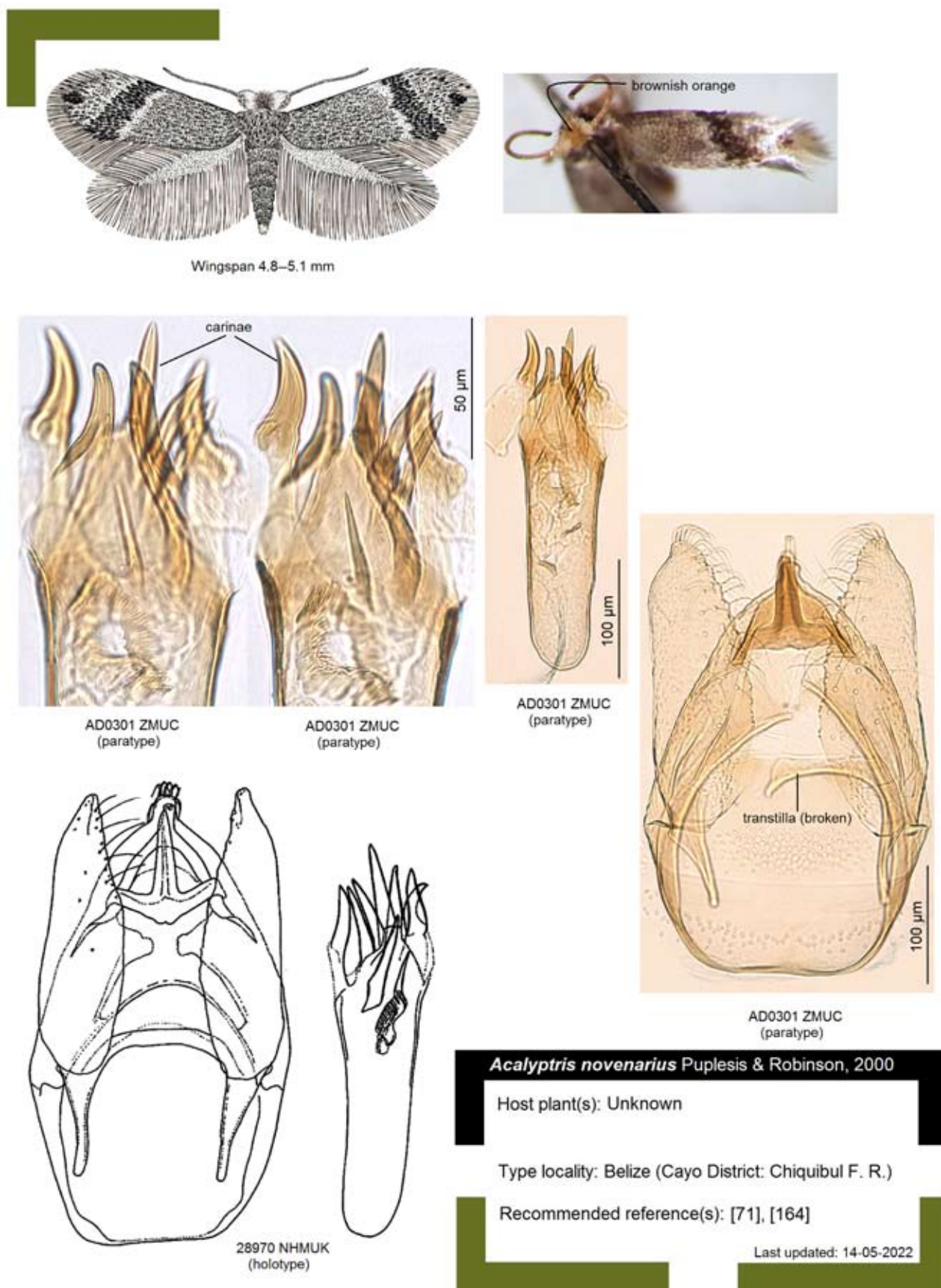


Figure 367. *Acalyptris novenarius* Puplesis & Robinson, a satellite species resembling of the *A. murex* group.

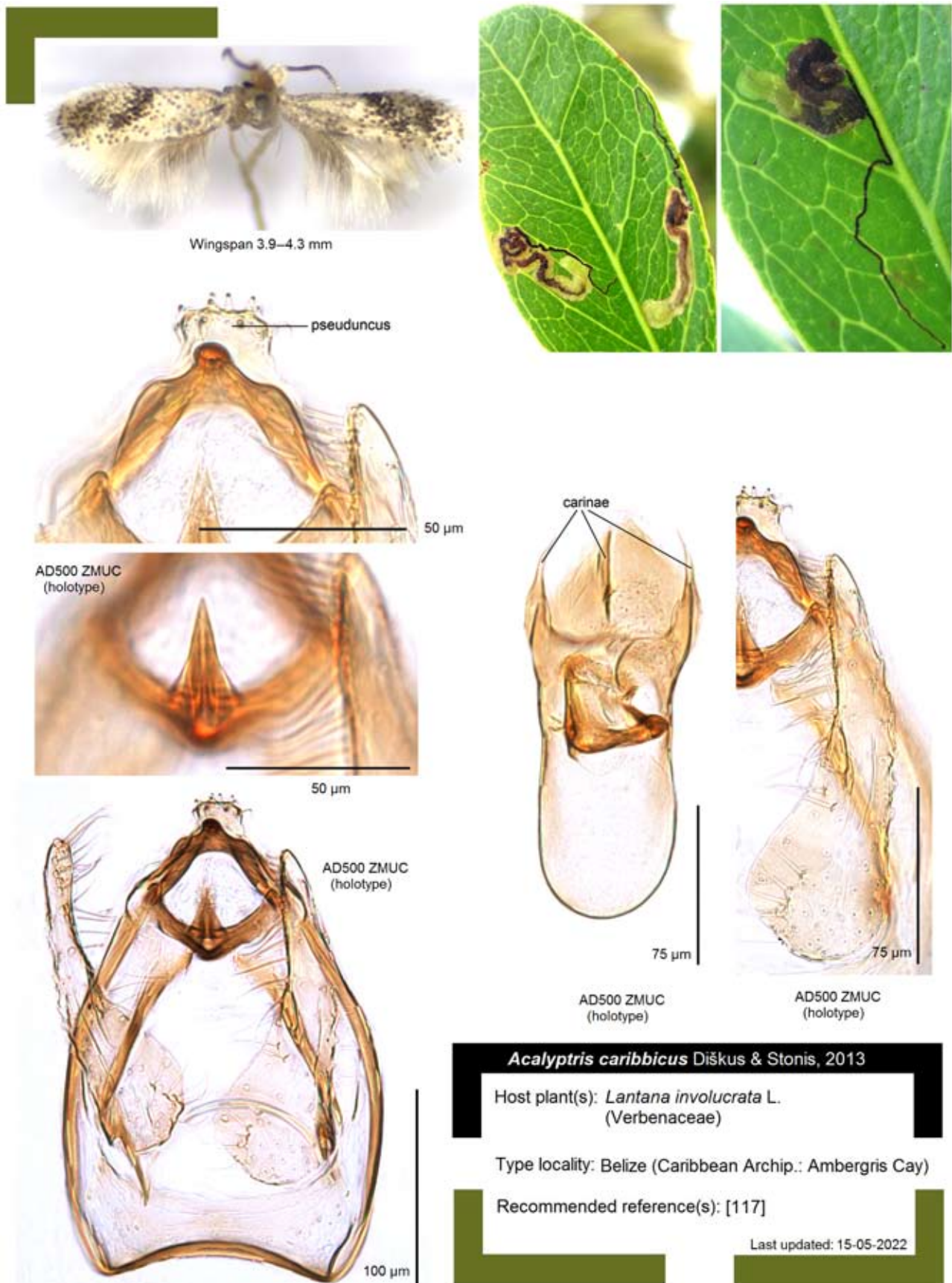


Figure 368. *Acalyptris caribbicus* Diškus & Stonis, a satellite species resembling of the *A. murex* group.

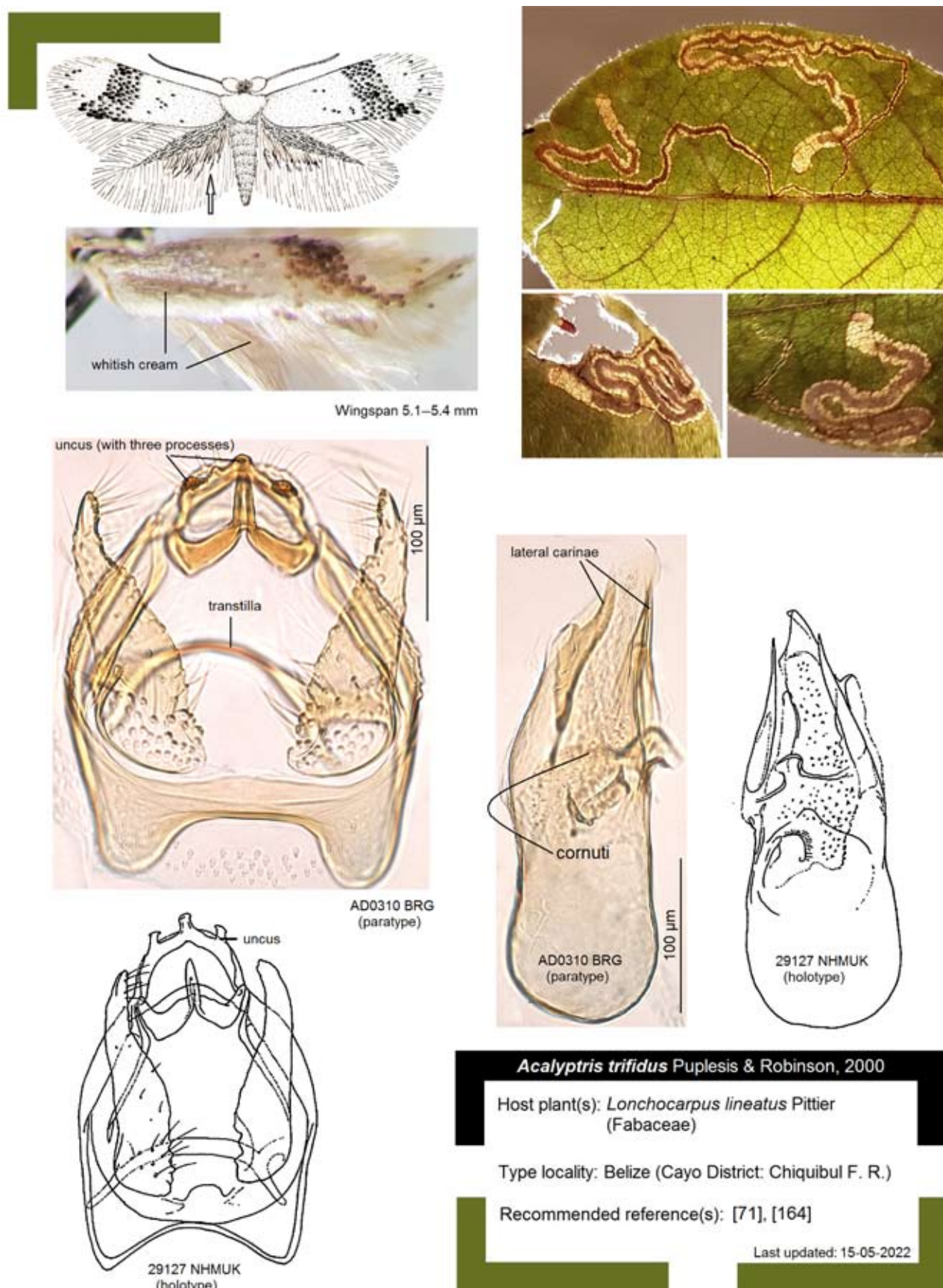
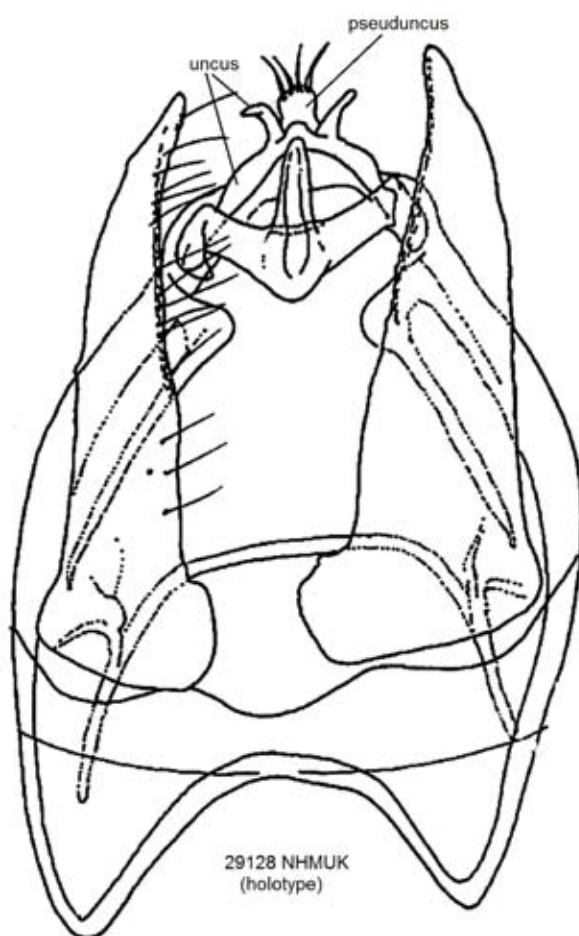


Figure 369. *Acalyptris trifidus* Puplesis & Robinson, a species attributed to the *A. trifidus* group.



Wingspan about 4.9 mm
(after Puplesis & Robinson, 2000)



29128 NHMUK
(holotype)



29128 NHMUK
(holotype)

***Acalypttris laxibasis* Puplesis & Robinson, 2000**

Host plant(s): Unknown

Type locality: Belize (Cayo District: Chiquibul F. R.)

Recommended reference(s): [71]

Last updated: 15-05-2022

Figure 370. *Acalypttris laxibasis* Puplesis & Robinson, a species attributed to the *A. trifidus* group.

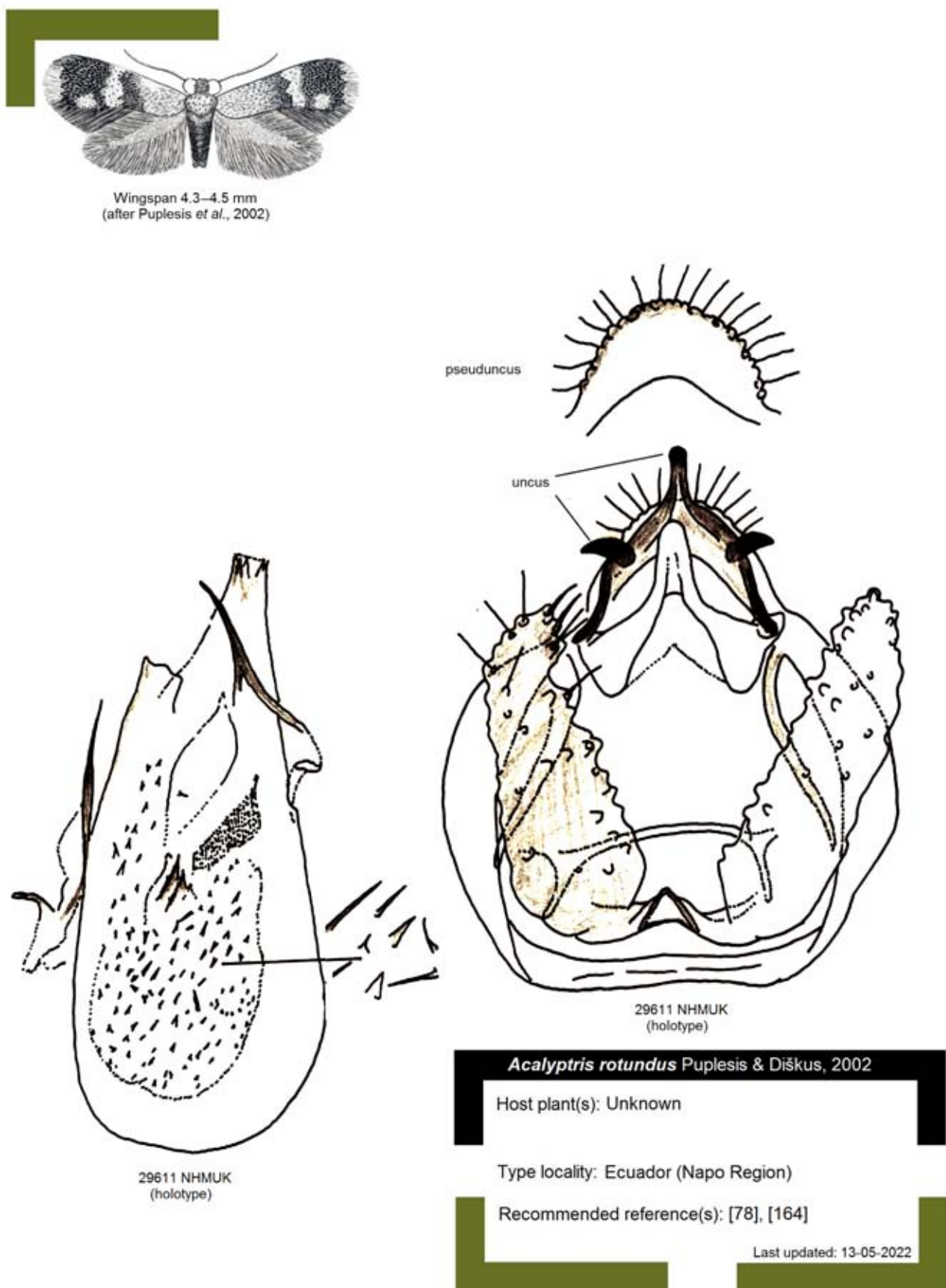


Figure 371. *Acalyptris rotundus* Puplesis & Diškus, a species attributed to the *A. trifidus* group.

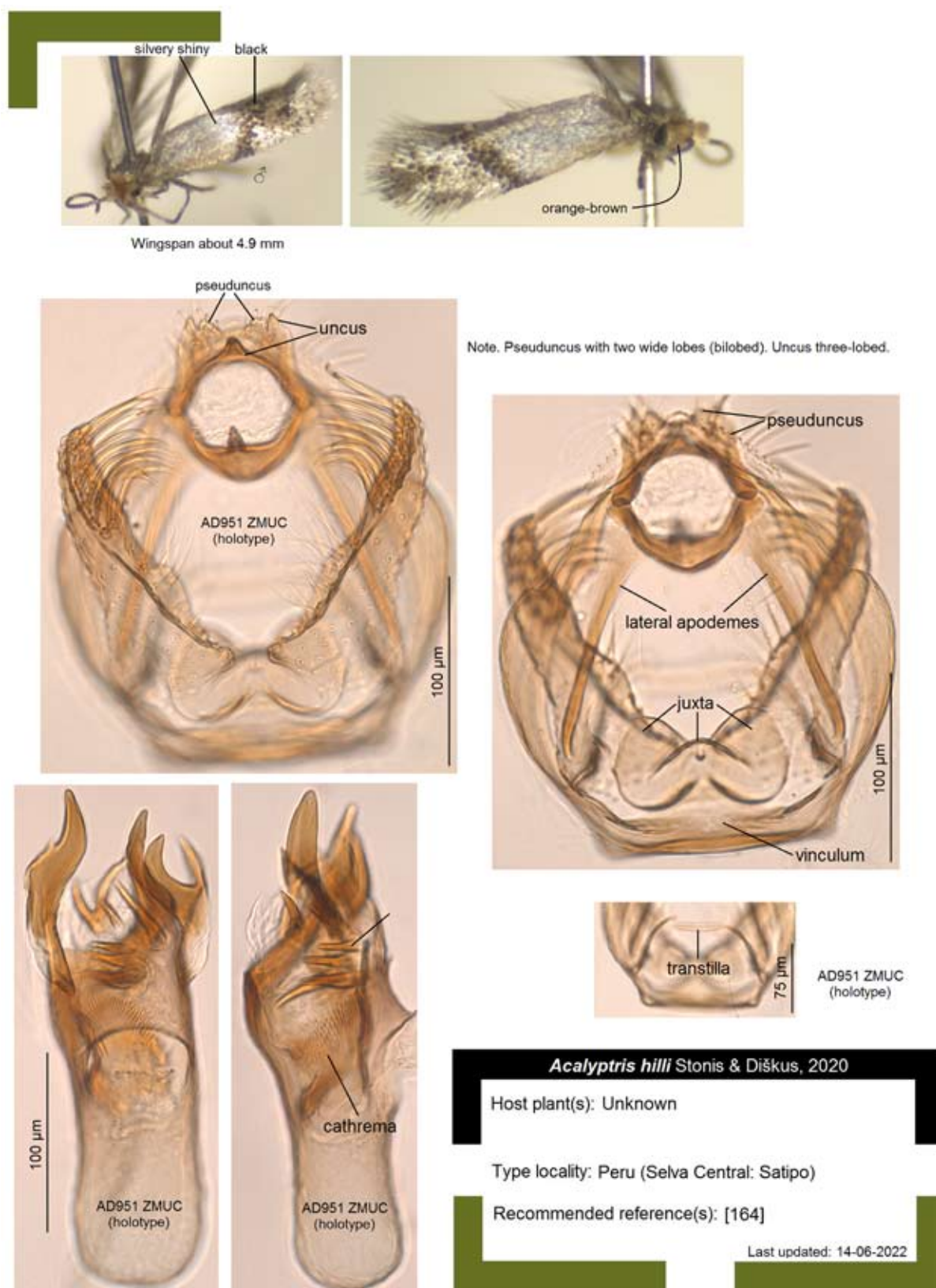


Figure 372. *Acalyptris hilli* Stonis & Diškus, a species attributed to the *A. trifidus* group.



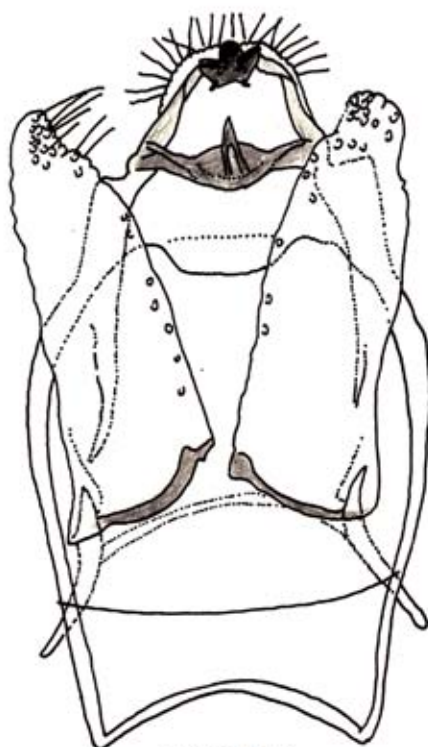
Wingspan 3.4–3.5 mm
(after Puplesis *et al.*, 2002)



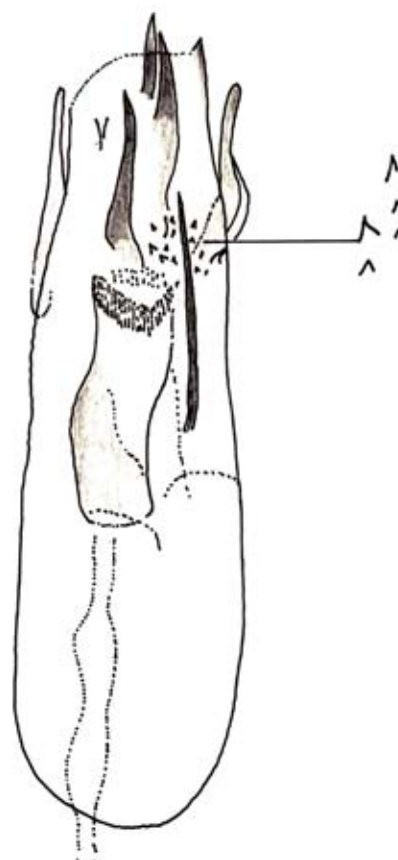
pseuduncus



uncus



29612 NHMUK
(holotype)



29612 NHMUK
(holotype)

Acalyptris amazonius Puplesis & Diškus, 2002

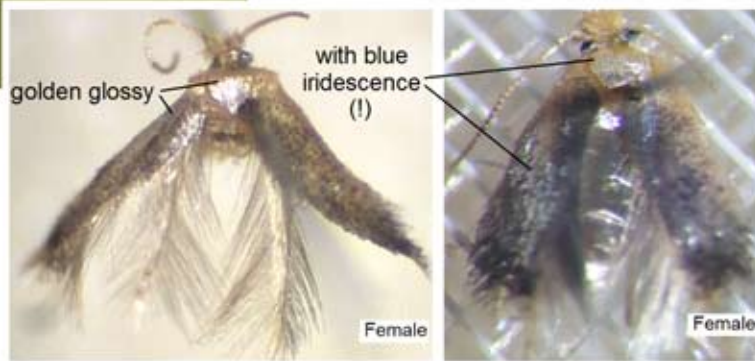
Host plant(s): Unknown

Type locality: Ecuador (Napo Region)

Recommended reference(s): [78], [164]

Last updated: 13-05-2022

Figure 373. *Acalyptris amazonius* Puplesis & Diškus, a species attributed to the *A. trifidus* group.



Wingspan about 3.8 mm

Male is unknown.
The species was described from a female only

***Acalyptris hyacinthum* Stonis & Vargas, 2020**

Host plant(s): Unknown

Type locality: Colombia (Valle del Cauca: El Naranjo)

Recommended reference(s): [164]

Last updated: 15-05-2022

Figure 374. *Acalyptris hyacinthum* Stonis & Vargas, a species attributed to the *A. trifidus* group.

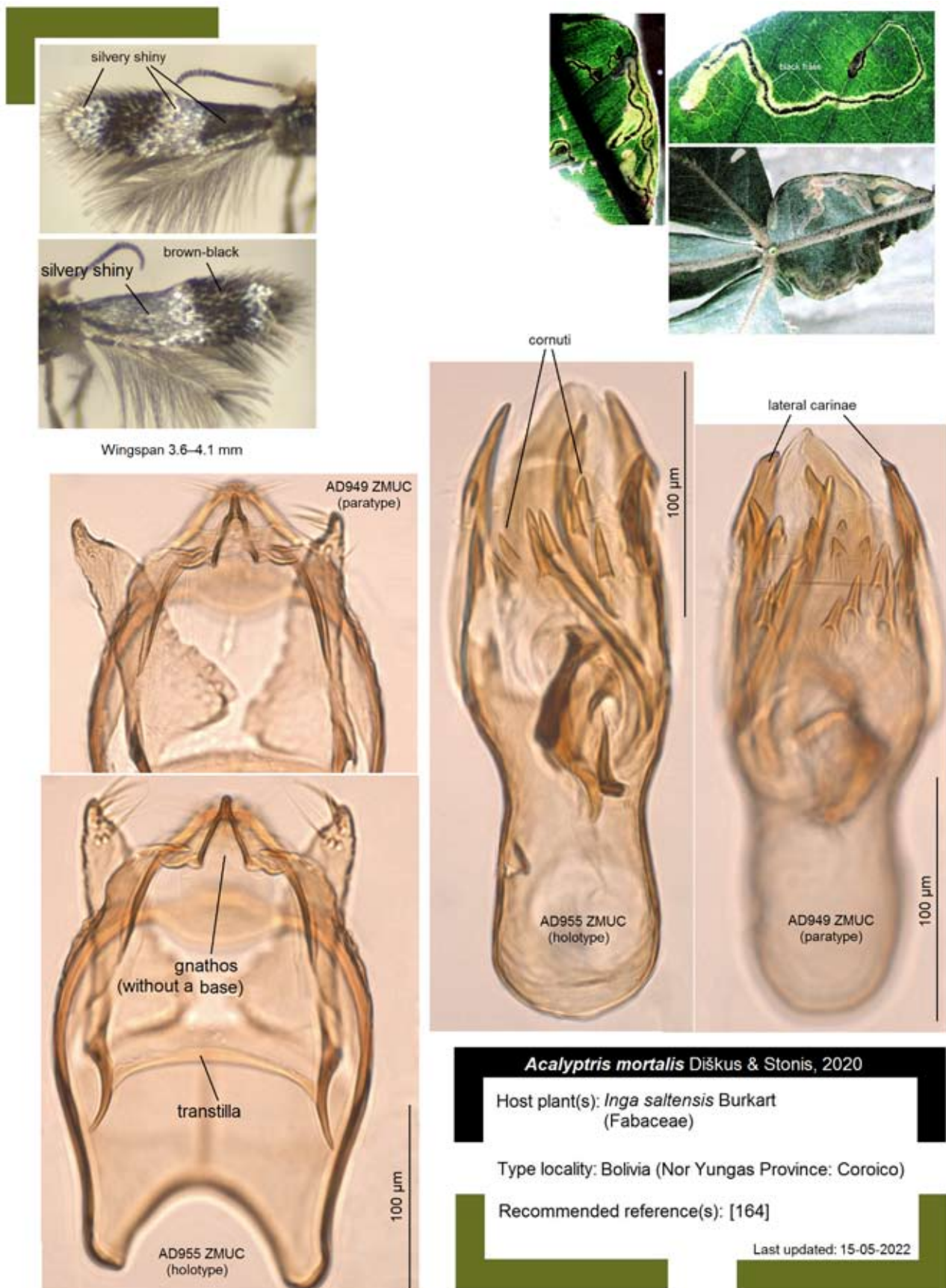


Figure 375. *Acalyptris mortalis* Diškus & Stonis, a species attributed to the *A. trifidus* group.



Wingspan 4.5 mm



Male is unknown.
The species was described from a female only

***Acalyptris miranda* (Diškus & Stonis, 2017)**

Host plant(s): *Inga spectabilis* (Vahl) Willd.
or *I. edulis* Mart. (Fabaceae)

Type locality: Ecuador (western slopes of the Andes)

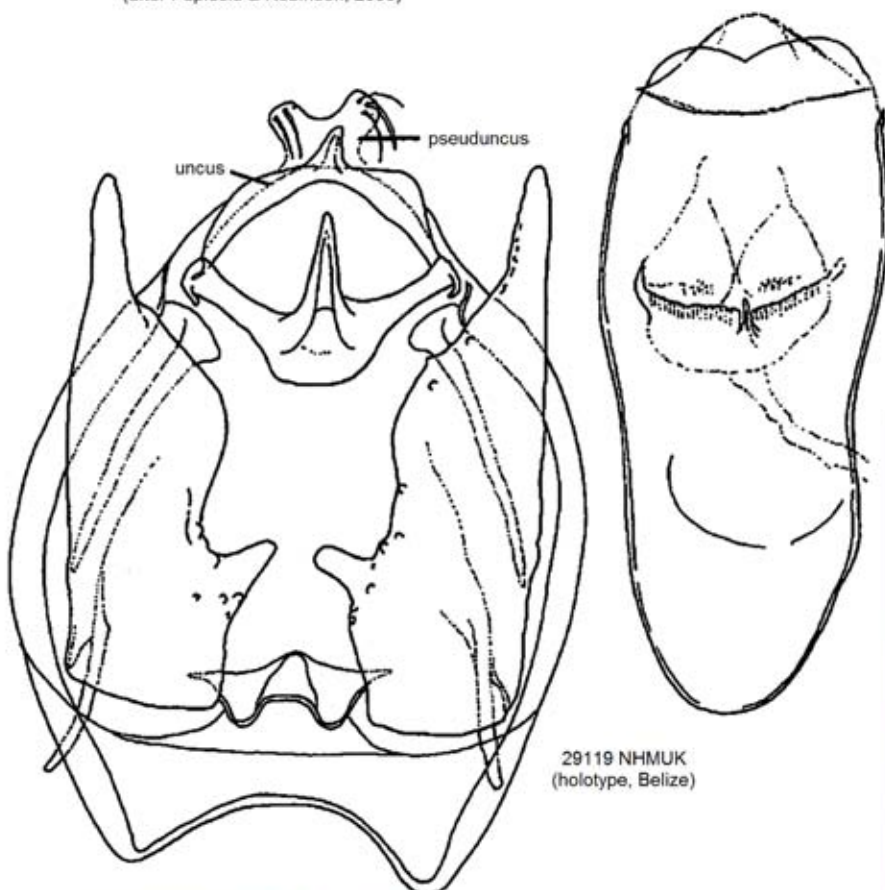
Recommended reference(s): [147], [164]

Last updated: 15-05-2022

Figure 376. *Acalyptris miranda* (Diškus & Stonis), a species attributed to the *A. trifidus* group.



Wingspan about 4.5 mm
(after Puplesis & Robinson, 2000)



29119 NHMUK
(holotype, Belize)



AG011 BRG
(Mexico)



AG009 BRG
(Mexico)

***Acalypttris lascuevella* Puplesis & Robinson, 2000**

Host plant(s): Unknown

Type locality: Belize (Chiquibul Forest Reserve);
also known from Mexico (Pacific Coast)

Recommended reference(s): [71], [96], [164]

Last updated: 14-05-2022

Figure 377. *Acalypttris lascuevella* Puplesis & Robinson, a species attributed to the *A. bifidus* group.

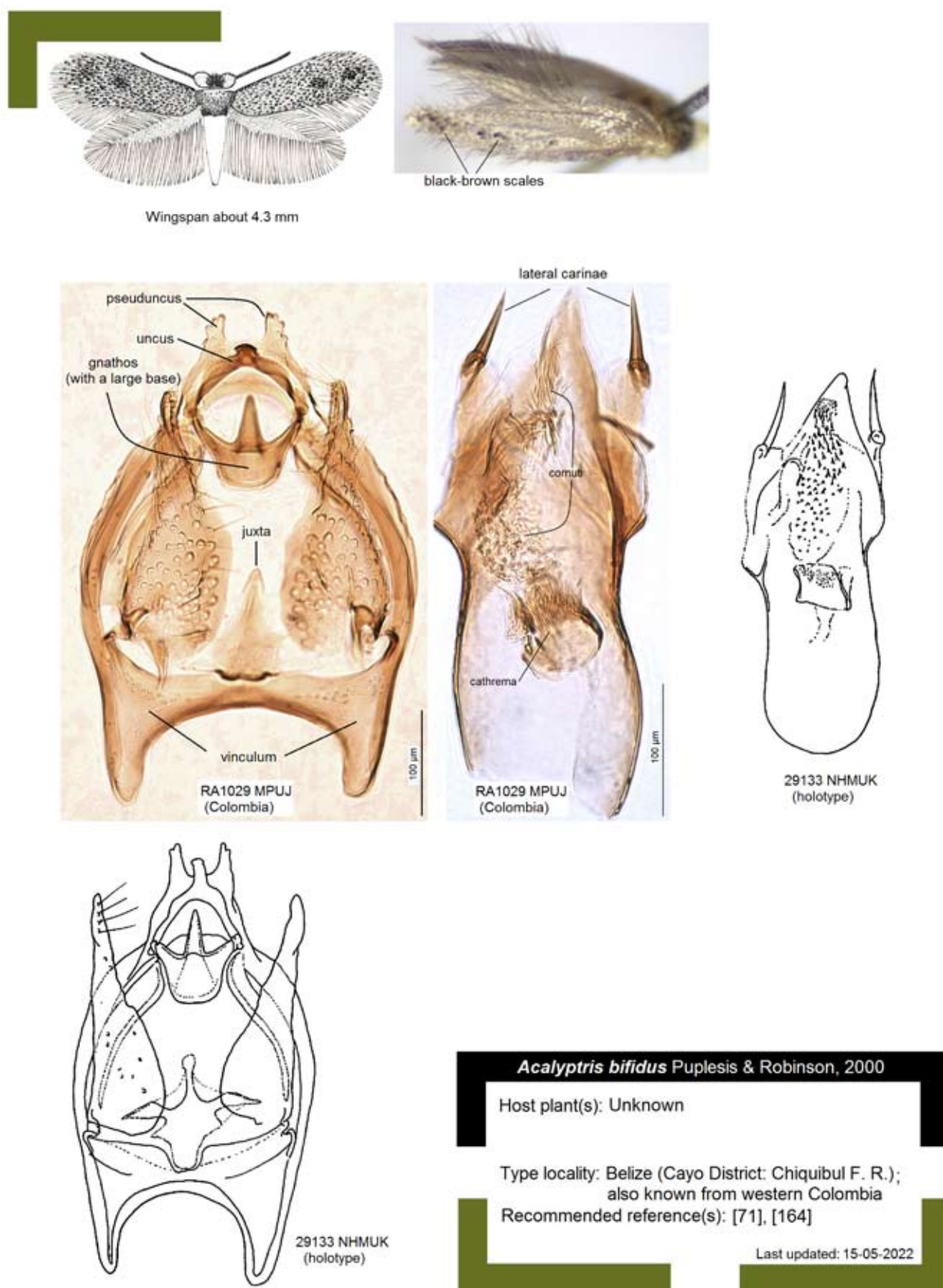


Figure 378. *Acalyptris bifidus* Puplesis & Robinson, a species attributed to the *A. bifidus* group.

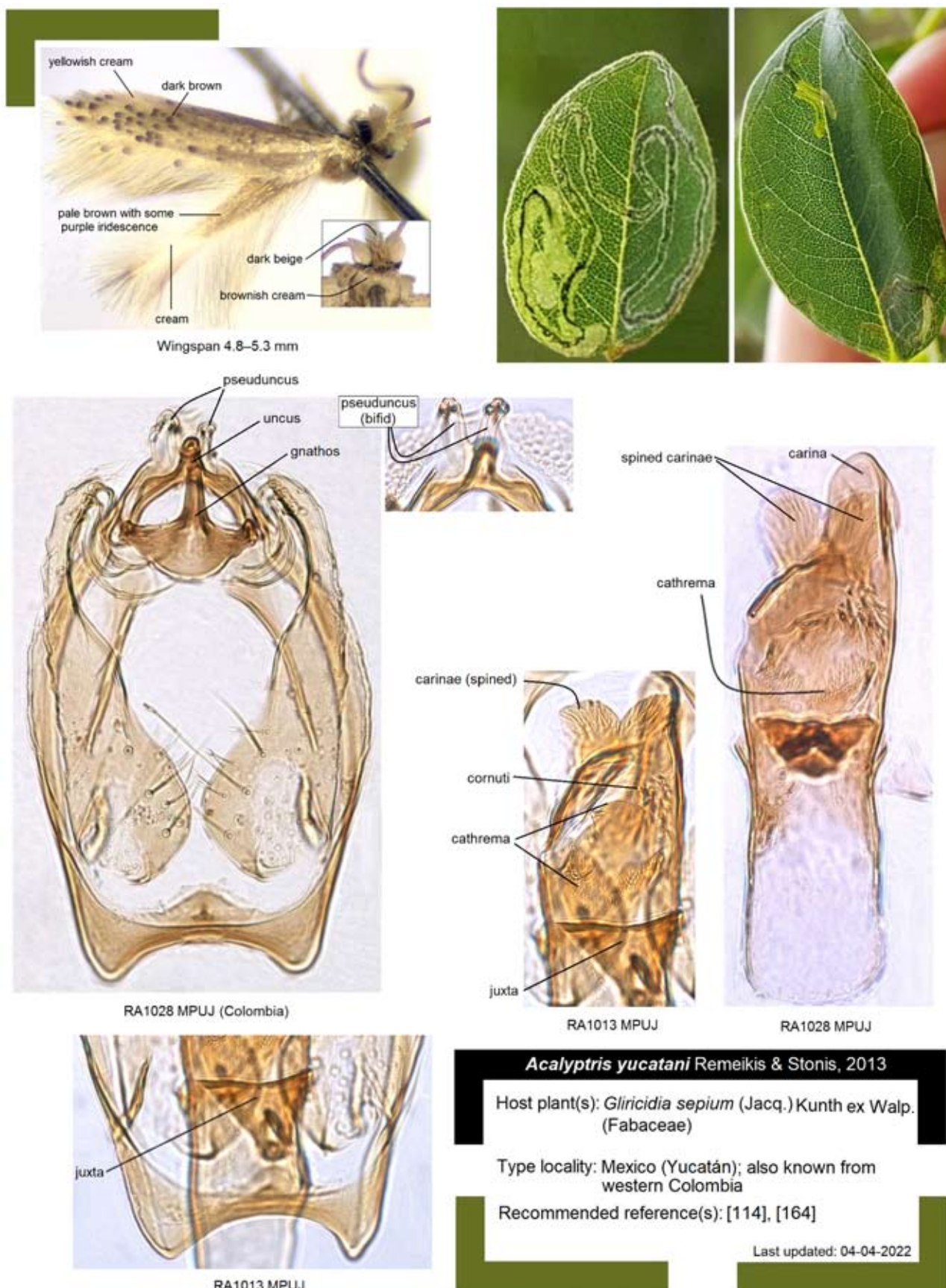


Figure 379. *Acalyptris yucatani* Remeikis & Stonis, a species attributed to the *A. bifidus* group.

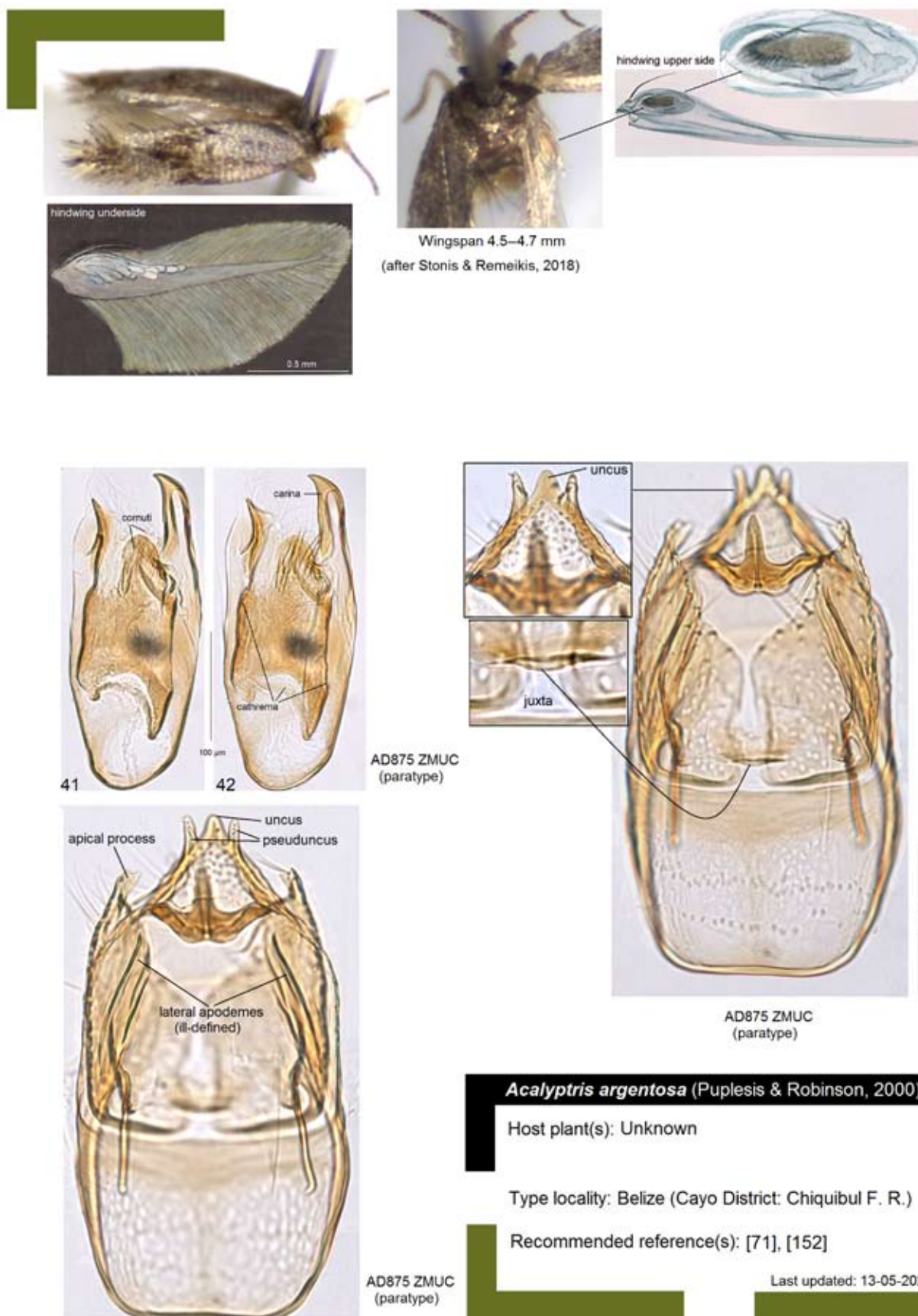
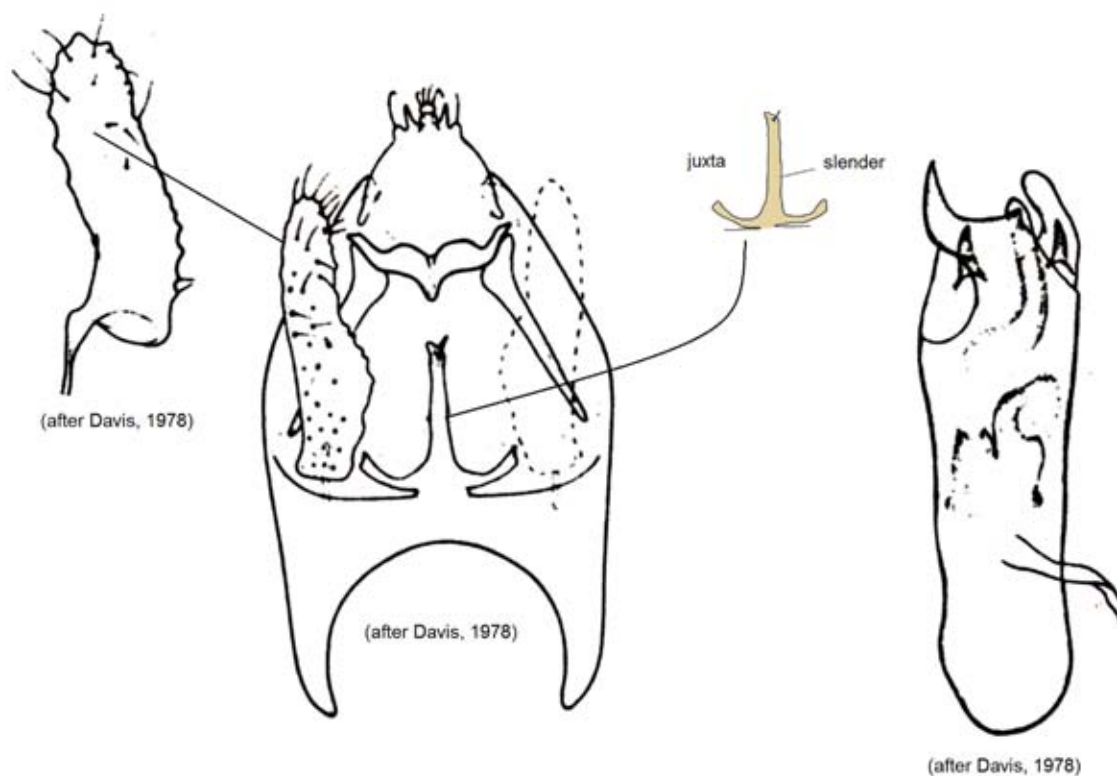
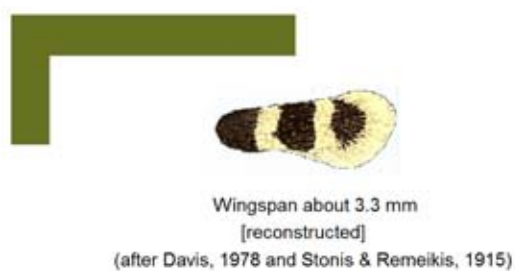


Figure 380. *Acalyptris argentosa* (Puplesis & Robinson), a species attributed to the *A. bifidus* group.



***Acalyptris tenuijuxtus* (Davis, 1978)**

Host plant(s): *Galactia* sp.
(E. J. van Nieukerken, pers. comm. 22.xi.2013)
(Fabaceae)

Type locality: USA (Florida Keys)

Recommended reference(s): [9], [130], [164]

Last updated: 15-05-2022

Figure 381. *Acalyptris tenuijuxtus* (Davis), a species attributed to the *A. peteni* group.

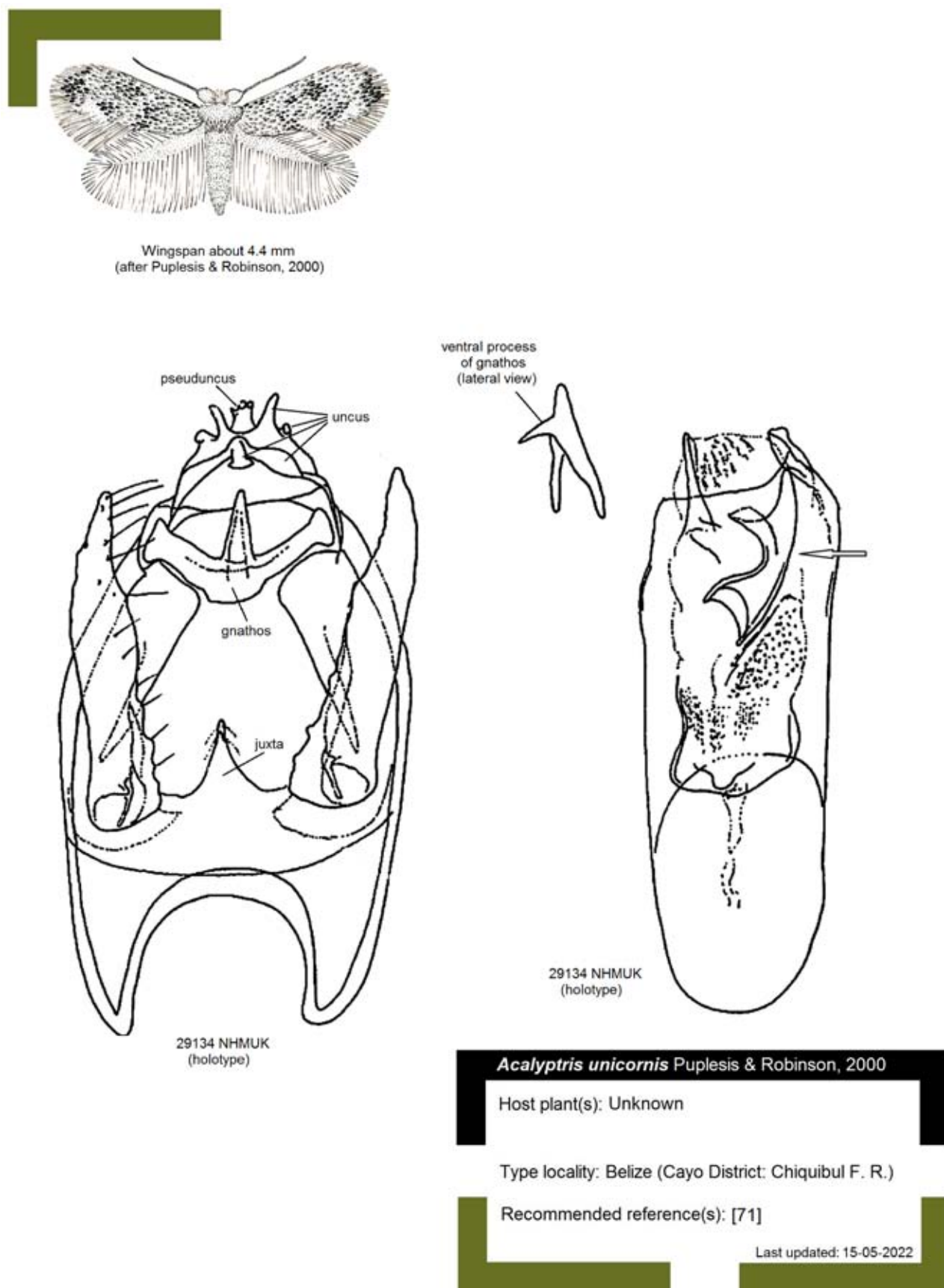


Figure 382. *Acalyptris unicornis* Puplesis & Robinson, a species attributed to the *A. peteni* group.

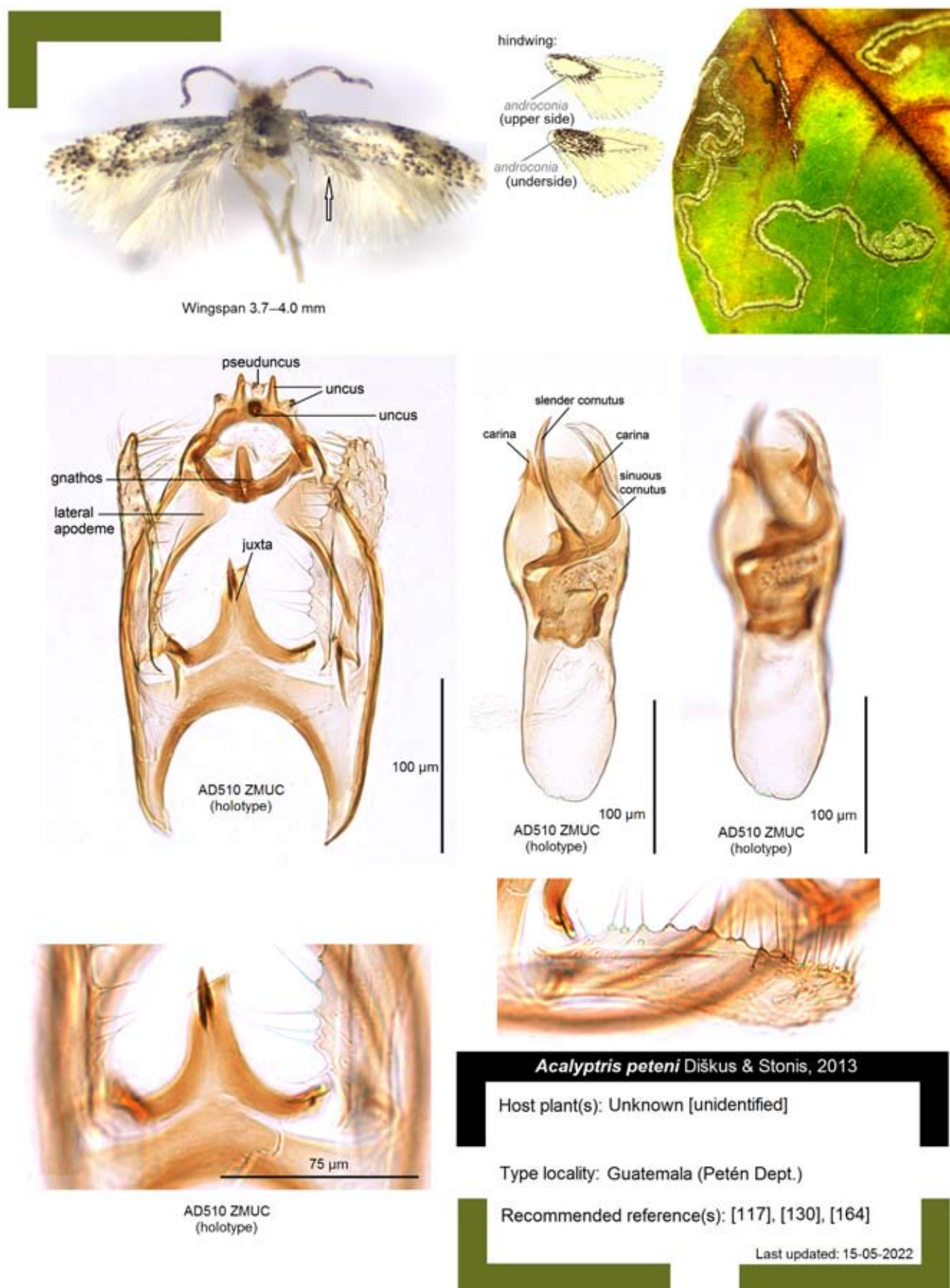
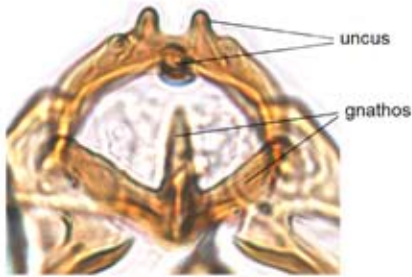


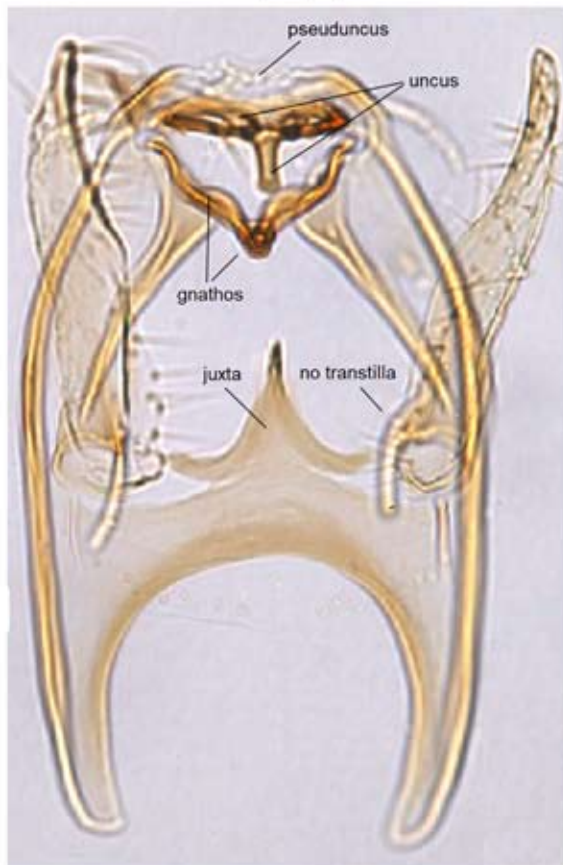
Figure 383. *Acalyptris peteni* Diškus & Stonis, a species attributed to the *A. peteni* group.



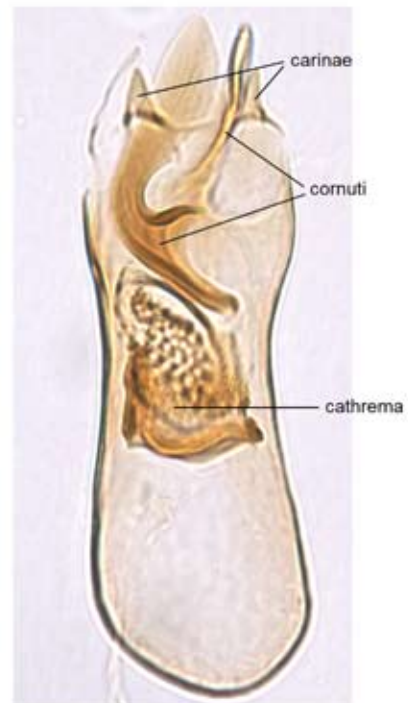
Wingspan 3.6 mm



RA612 USNM
(holotype)



RA612 USNM
(holotype)



RA612 USNM
(holotype)

***Acalyptris trigonijuxtus* Remeikis & Stonis, 2015**

Host plant(s): Unknown

Type locality: British Virgin Islands

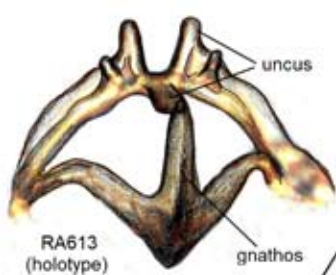
Recommended reference(s): [130]

Last updated: 04-04-2022

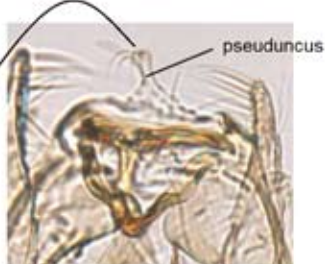
Figure 384. *Acalyptris trigonijuxtus* Remeikis & Stonis, a species attributed to the *A. peteni* group.



Wingspan 3.7–3.8 mm



RA613
(holotype)



pseuduncus

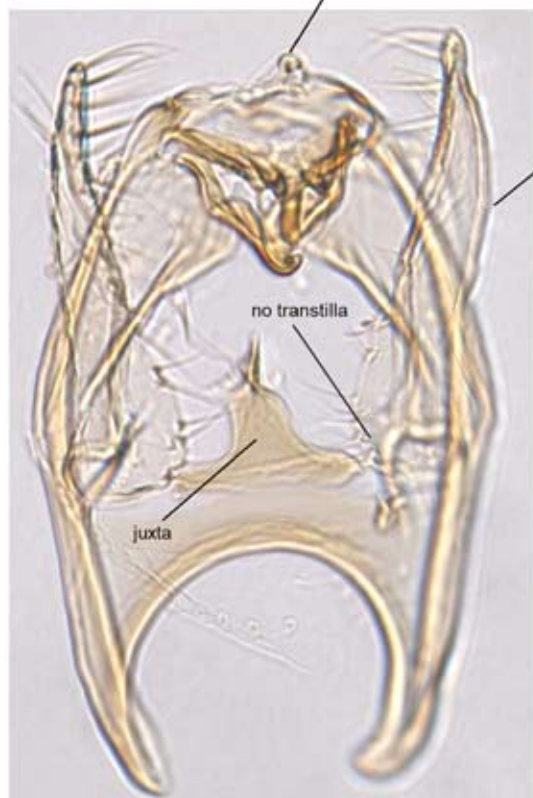


carinae

cornutus

cathrema

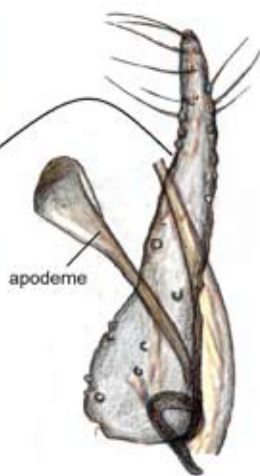
RA613 USNM
(holotype)



no transtilla

juxta

RA613 USNM
(holotype)



apodeme

***Acalyptris dominicanus* Remeikis & Stonis, 2015**

Host plant(s): Unknown

Type locality: Dominica (Commonwealth of Dominica)

Recommended reference(s): [130]

Last updated: 04-04-2022

Figure 385. *Acalyptris dominicanus* Remeikis & Stonis, a species attributed to the *A. peteni* group.

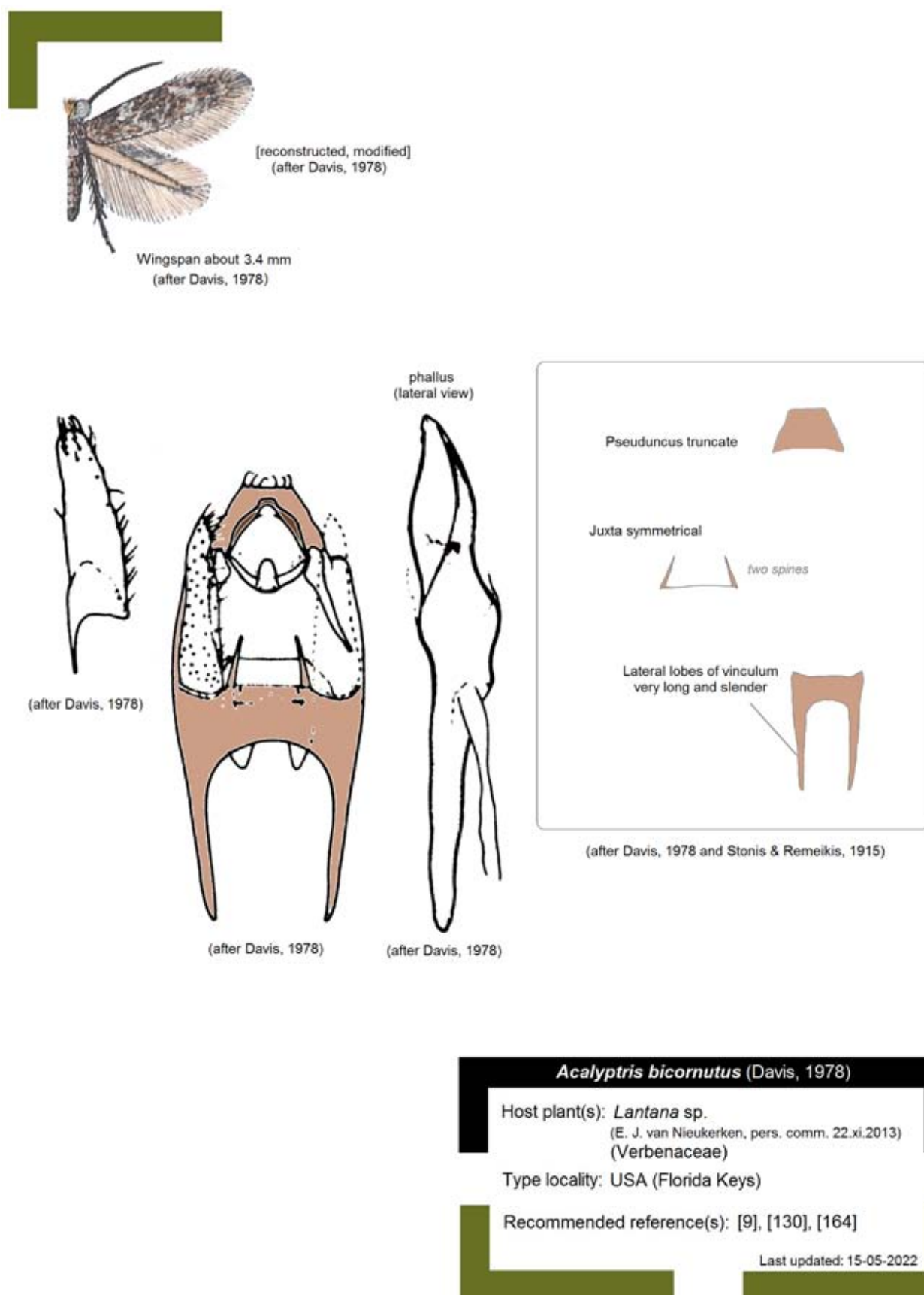


Figure 386. *Acalyptis bicornutus* (Davis), a species attributed to the *A. statuarius* group.

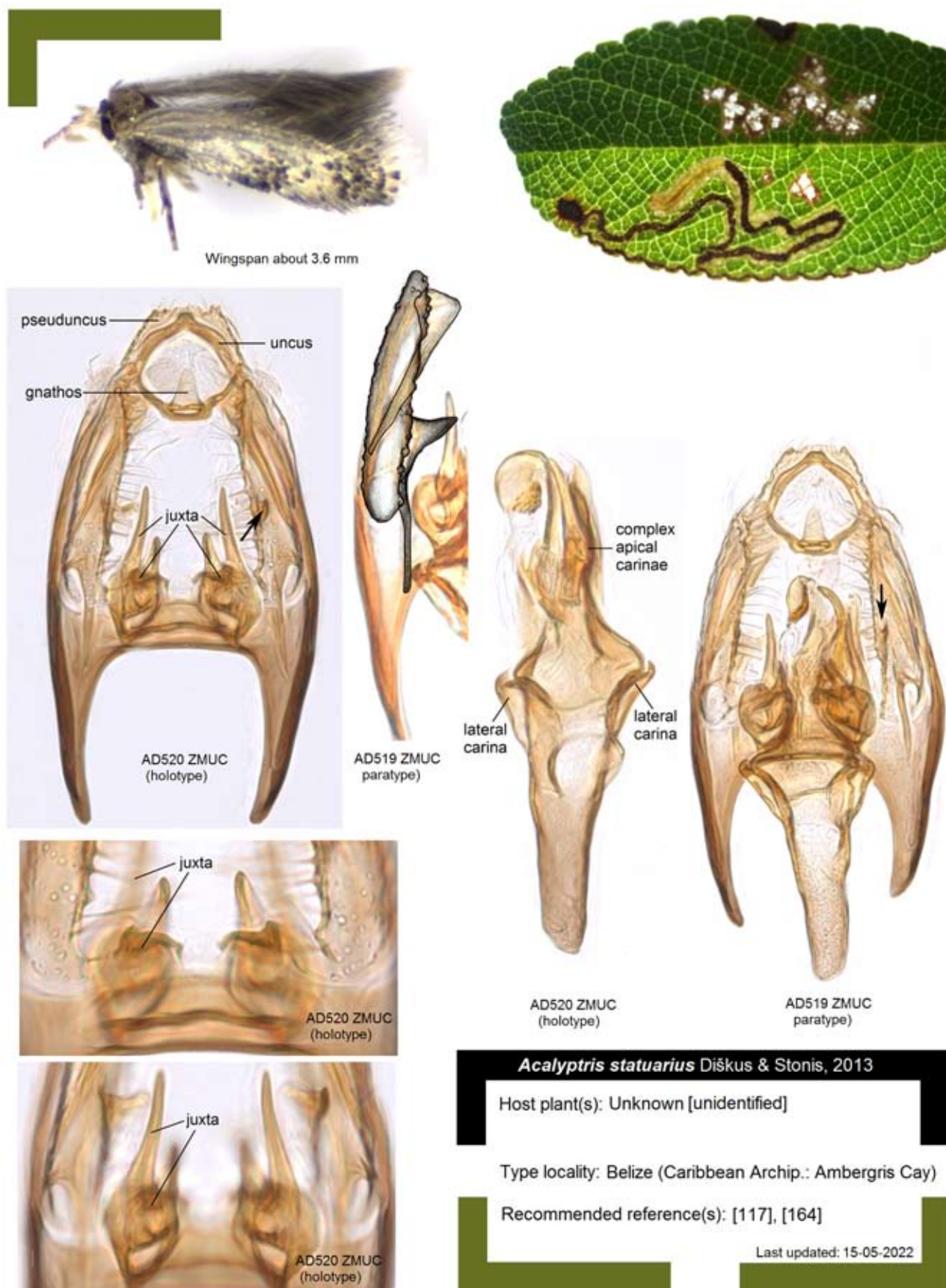


Figure 387. *Acalyptris statuarius* Diškus & Stonis, a species attributed to the *A. statuarius* group.

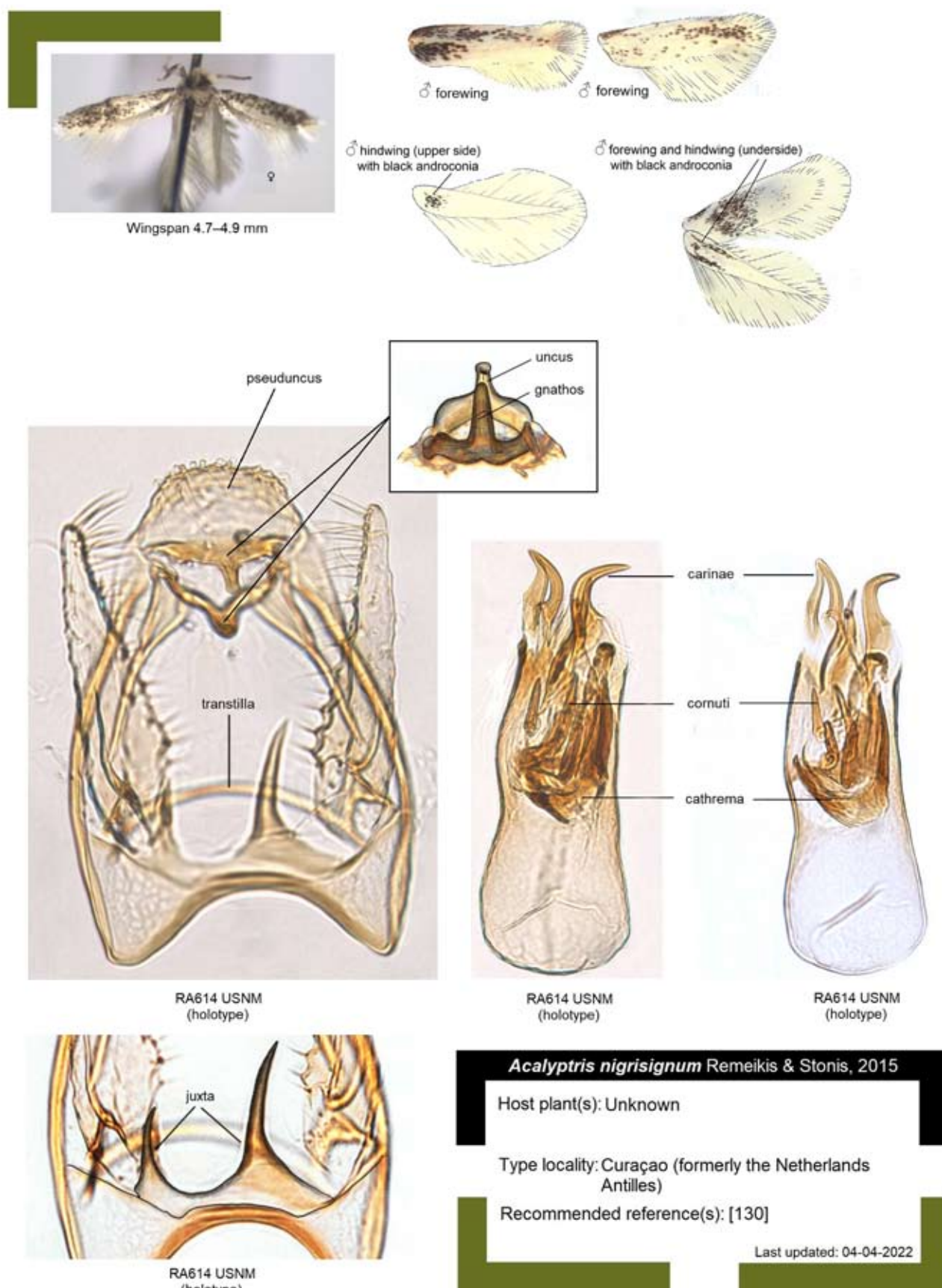
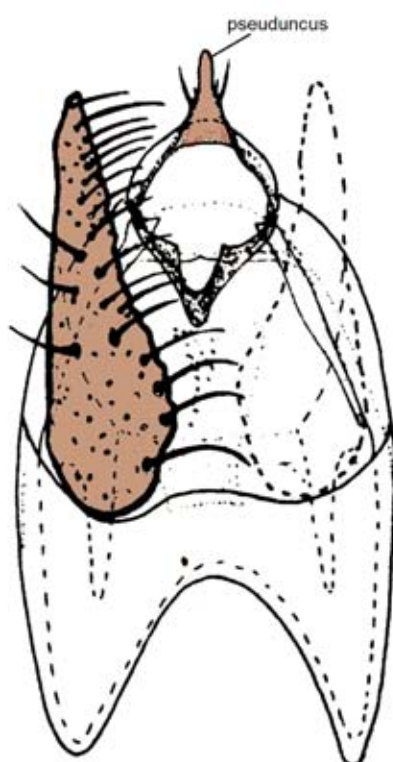


Figure 388. *Acalyptris nigrisignum* Remeikis & Stonis, a species attributed to the *A. statuarius* group.



Wingspan 4.6–5.6 mm
(after Wilkinson, 1979)



(after Wilkinson, 1979)

***Acalyptris bipinnatellus* (Wilkinson, 1979)**

Host plant(s): Cyperaceae (E. J. van Nieuwerkerken,
unpublished, pers. comm. 22.xi.2013)

Type locality: USA (Florida: Lake Placid)

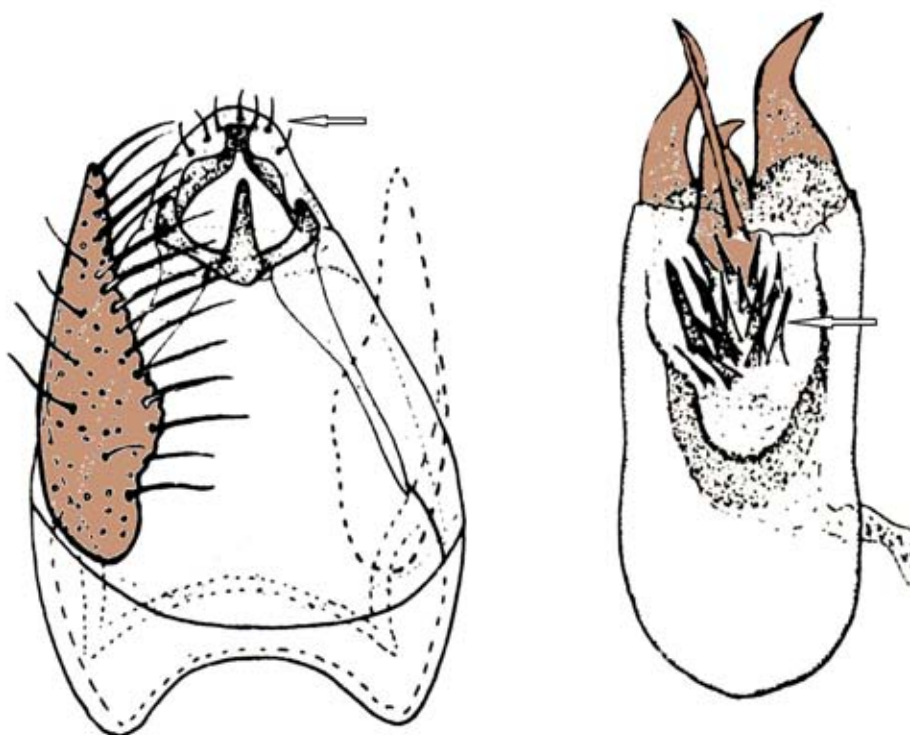
Recommended reference(s): [11]

Last updated: 16-05-2022

Figure 389. *Acalyptris bipinnatellus* (Wilkinson, 1979), a species attributed to the *A. scirpi* group.



Wingspan about 5.4 mm
(after Wilkinson, 1979)



(after Wilkinson, 1979; modified)

***Acalyptris postalatratus* (Wilkinson, 1979)**

Host plant(s): Unknown

Type locality: USA (Arizona: Chiricahua Mts.)

Recommended reference(s): [11]

Last updated: 16-05-2022

Figure 390. *Acalyptris postalatratus* (Wilkinson), a species attributed to the *A. scirpi* group.

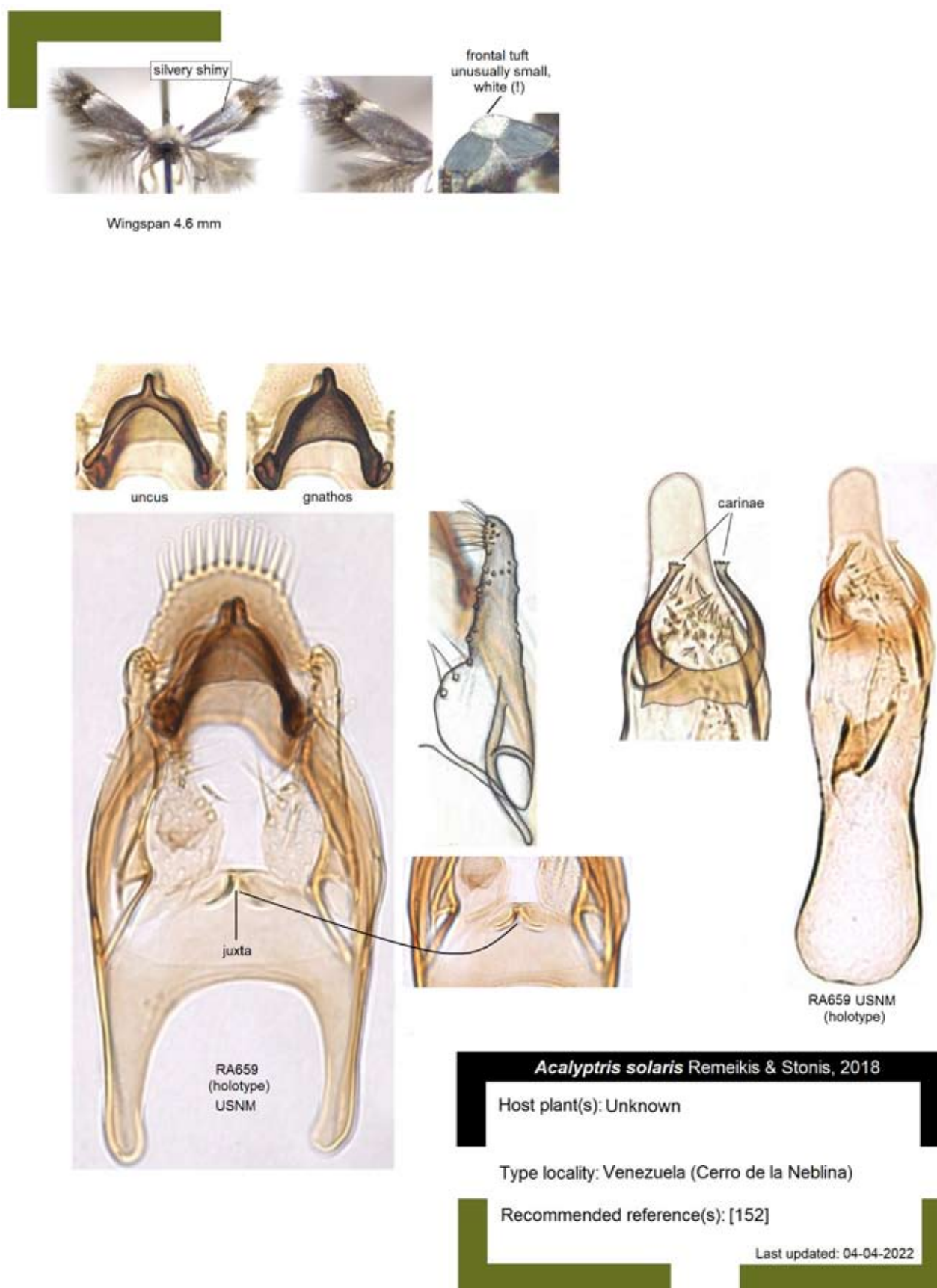


Figure 391. *Acalyptris solaris* Remeikis & Stonis, a satellite species resembling of the *A. scirpi* group.

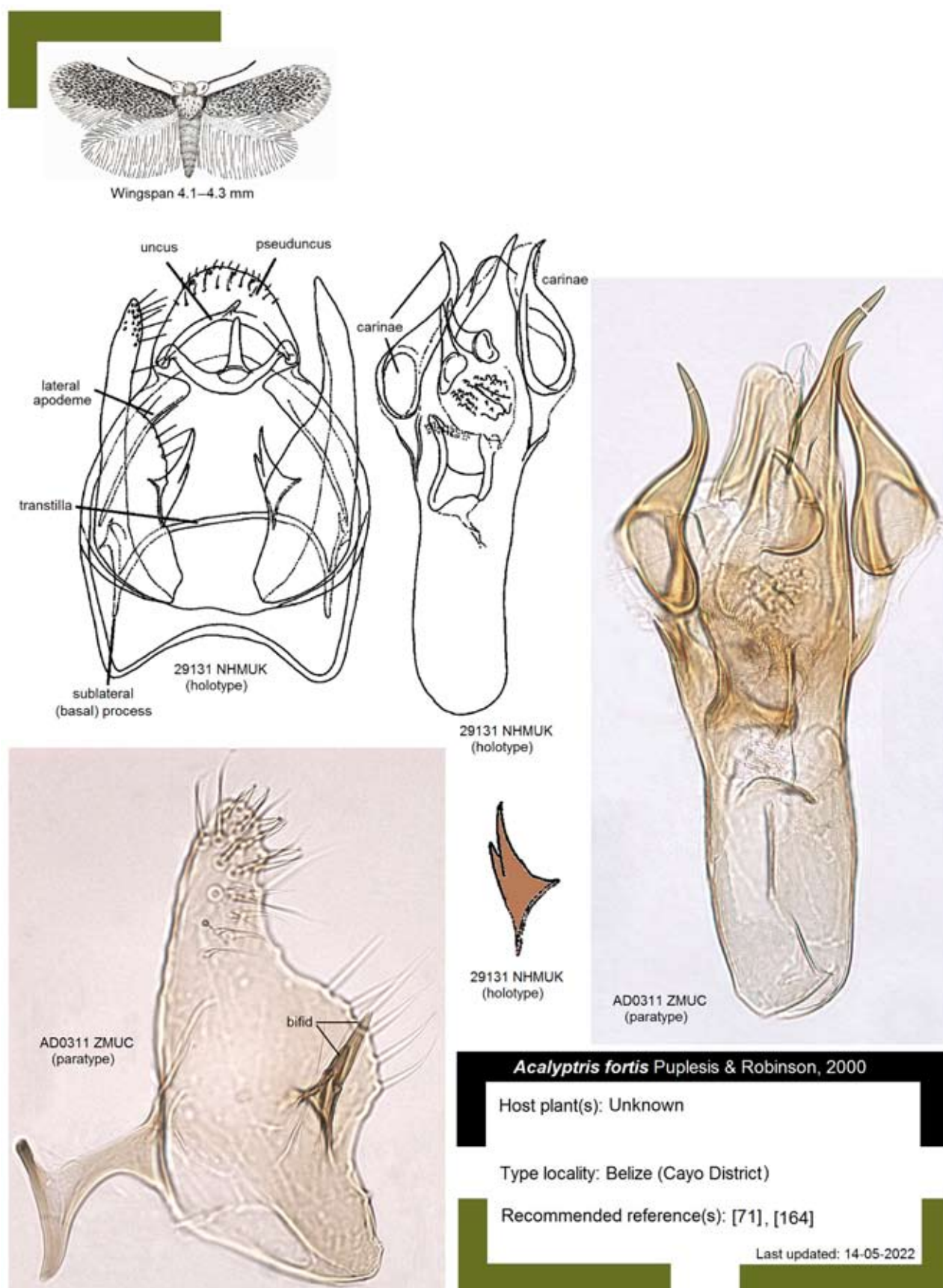


Figure 392. *Acalyptris fortis* Puplesis & Robinson, a species attributed to the *A. fortis* group.

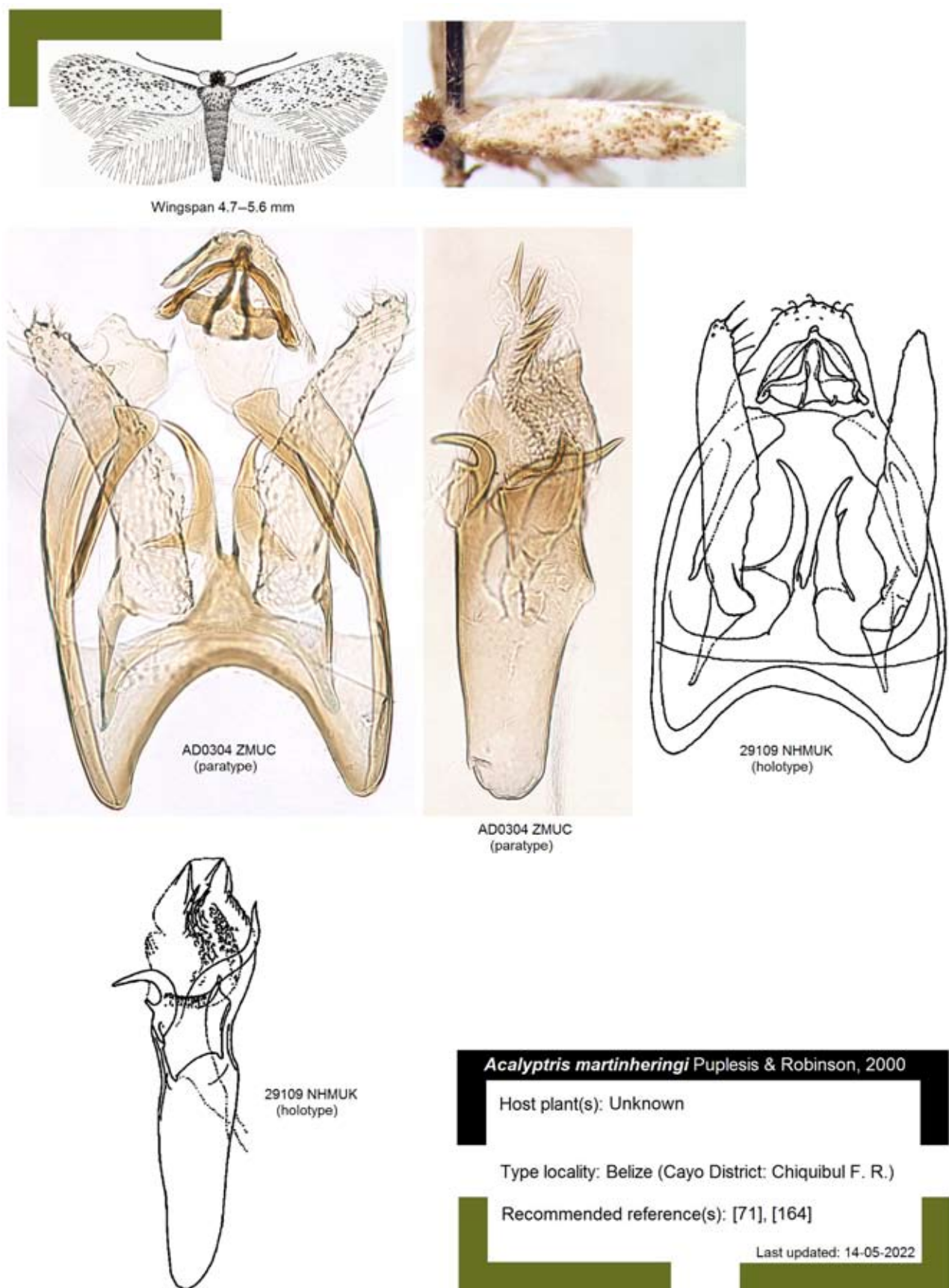


Figure 393. *Acalyptris martinheringi* Puplesis & Robinson, a species attributed to the *A. fortis* group.

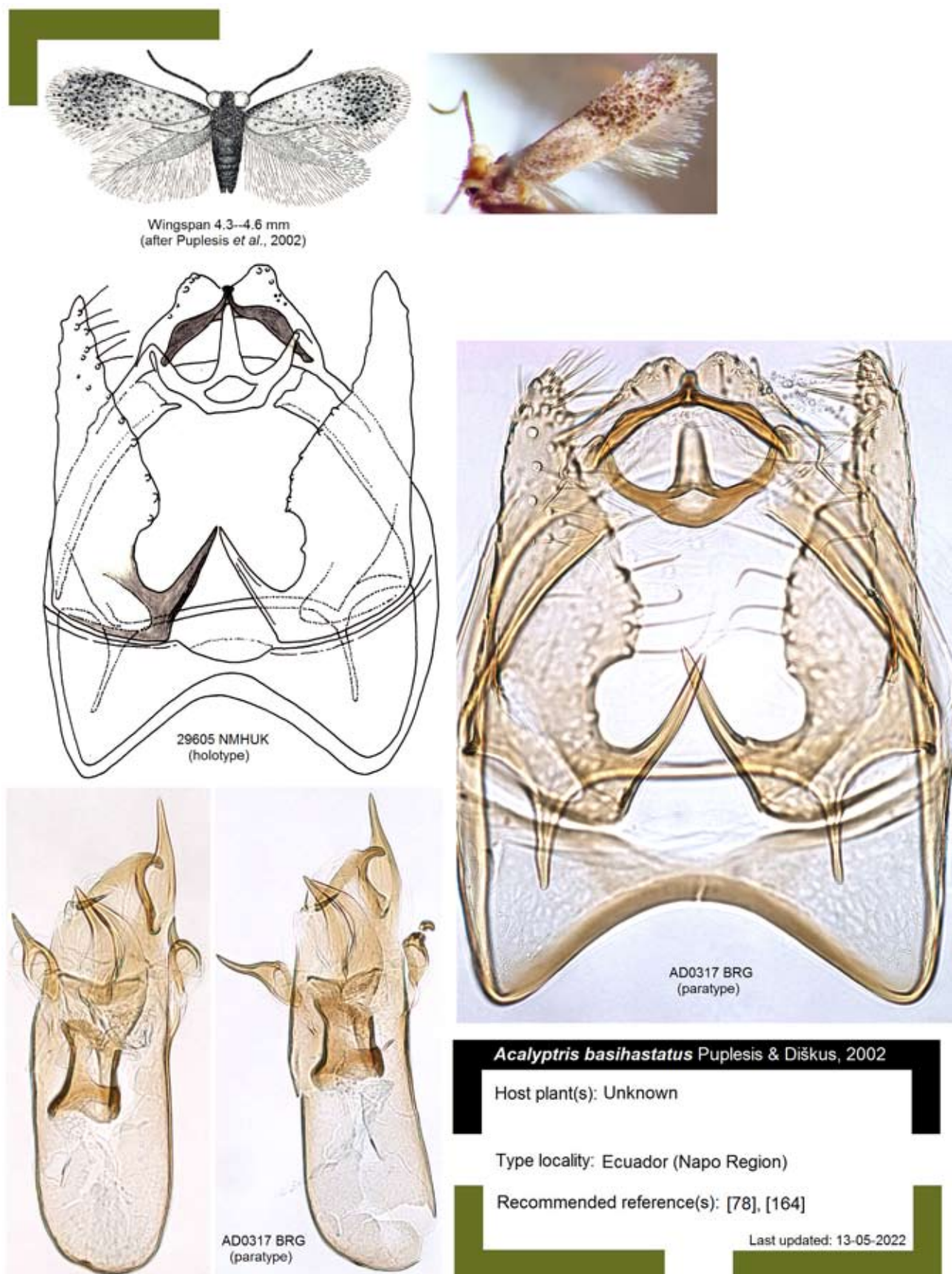


Figure 394. *Acalyptris basihastatus* Puplesis & Diškus, a species attributed to the *A. fortis* group.

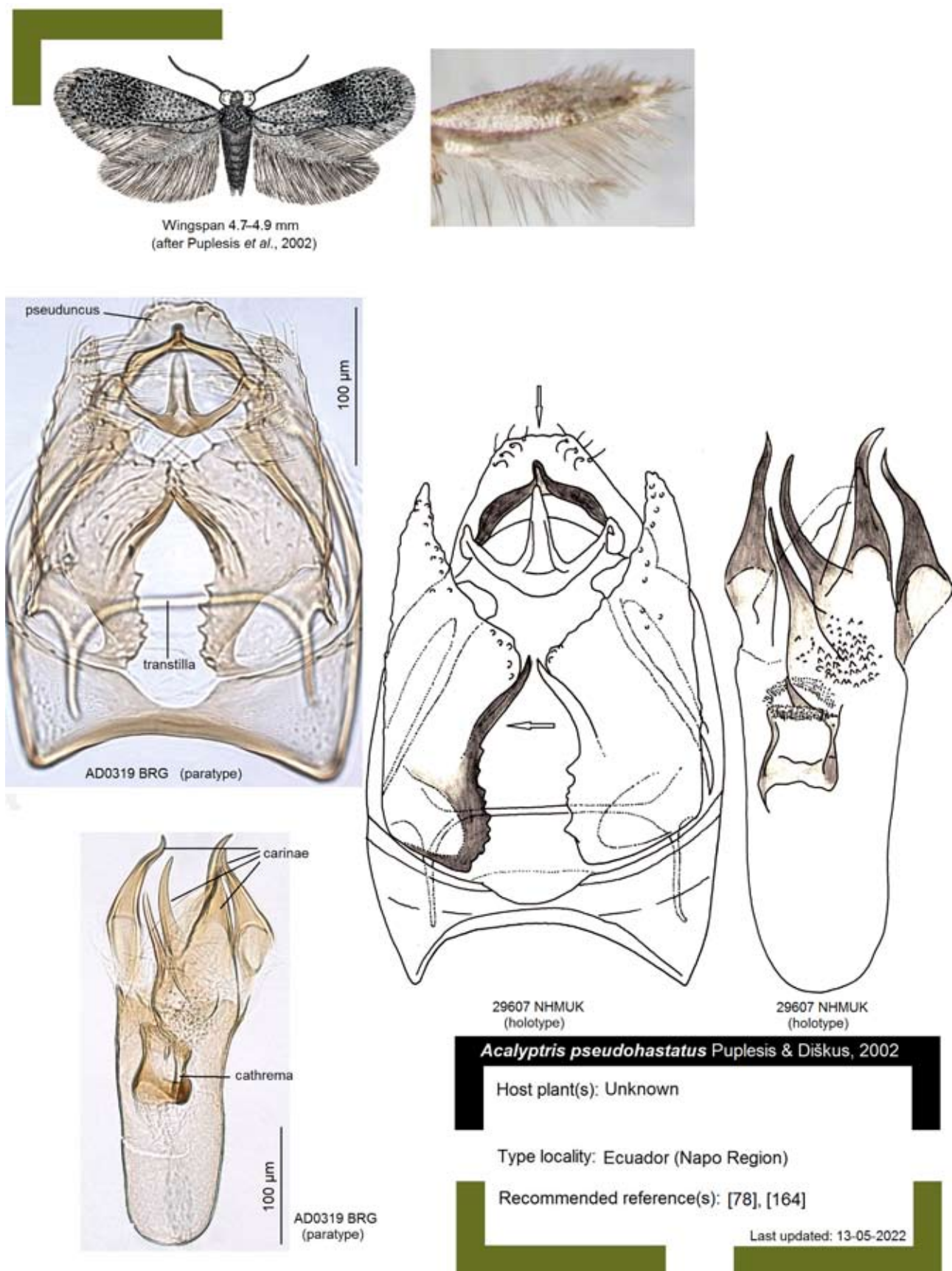


Figure 395. *Acalyptris pseudohastatus* Puplesis & Diškus, a species attributed to the *A. fortis* group.

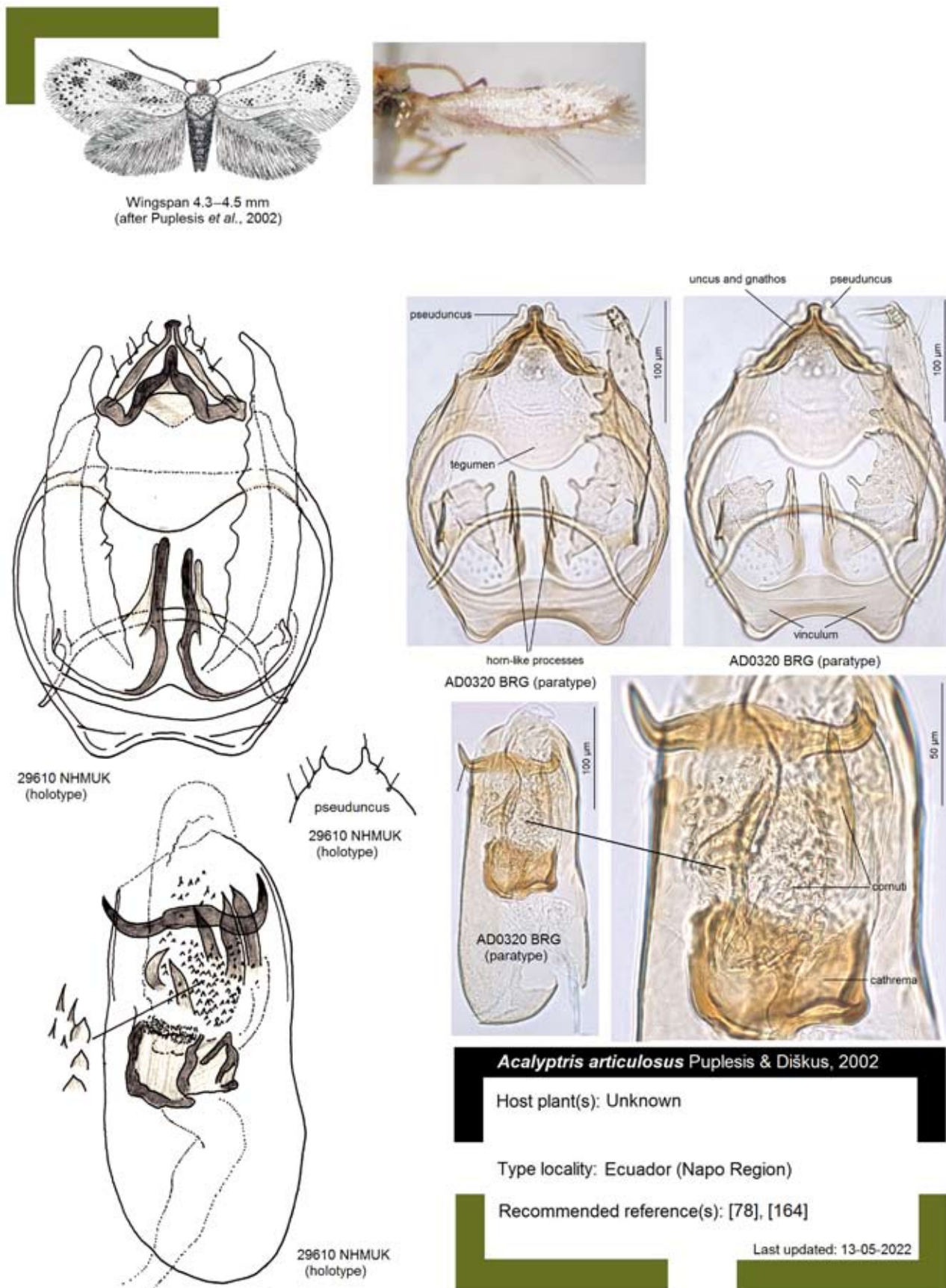
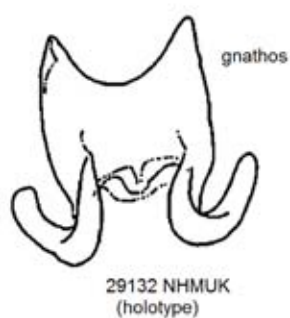
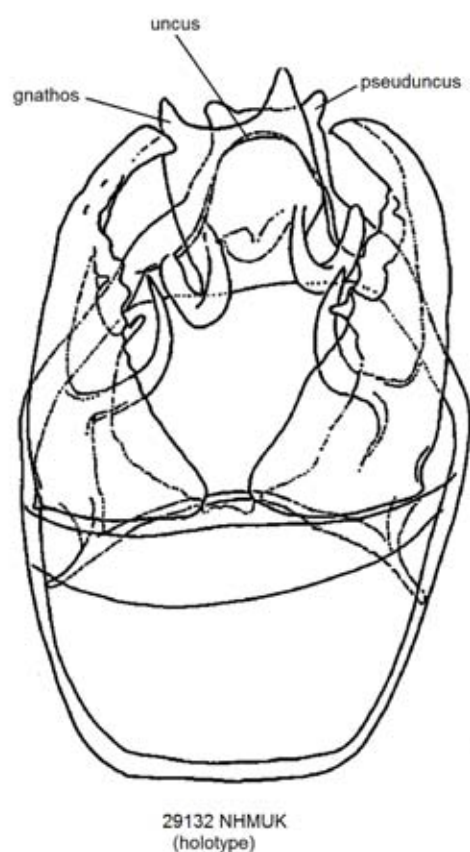


Figure 396. *Acalypttris articulatus* Puplesis & Diškus, a species attributed to the *A. fortis* group.



***Acalyptris platygnathos* Puplesis & Robinson, 2000**

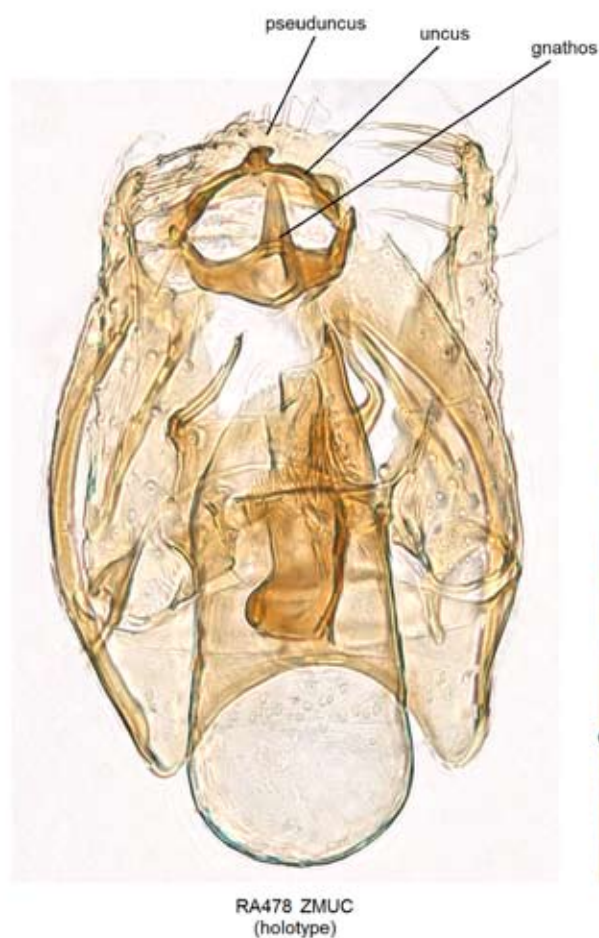
Host plant(s): Unknown

Type locality: Belize (Cayo District: Chiquibul F. R.)

Recommended reference(s): [71]

Last updated: 15-05-2022

Figure 397. *Acalyptris platygnathos* Puplesis & Robinson, a species attributed to the *A. fortis* group.



***Acalyptris basicornis* Remeikis & Stonis, 2013**

Host plant(s): Unknown

Type locality: Guatemala (Petén Dept., El Remate)

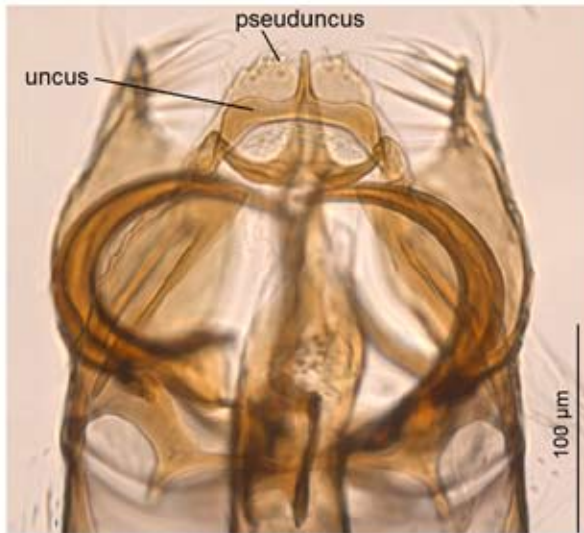
Recommended reference(s): [117]

Last updated: 04-04-2022

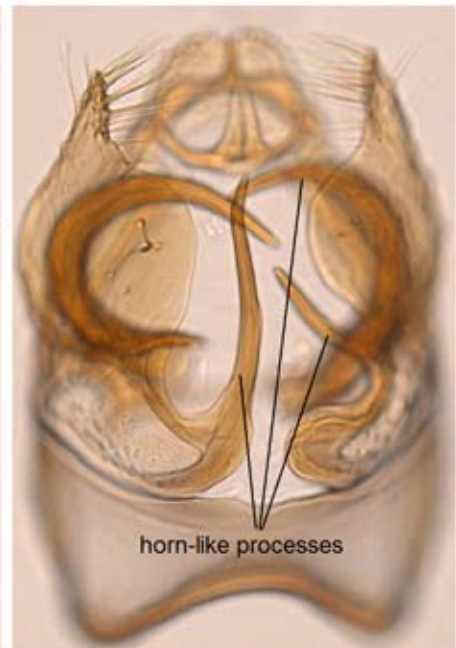
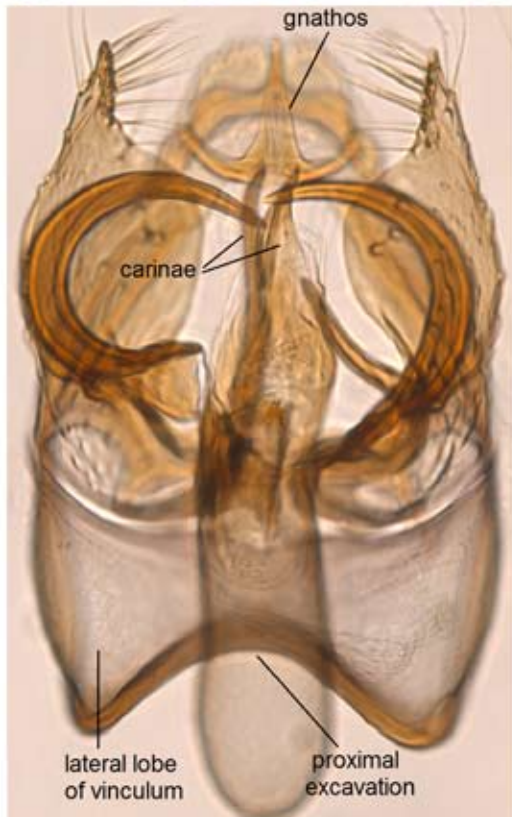
Figure 398. *Acalyptris basicornis* Remeikis & Stonis, a species attributed to the *A. fortis* group.



Wingspan about 4.7 mm



AD945 ZMUC
(holotype)



AD945 ZMUC
(holotype)

***Acalyptris extremus* Stonis & Diškus, 2020**

Host plant(s): Unknown

Type locality: Bolivia (Yungas: Coroico)

Recommended reference(s): [164]

Last updated: 15-05-2022

Figure 399. *Acalyptris extremus* Stonis & Diškus, a species attributed to the *A. fortis* group.

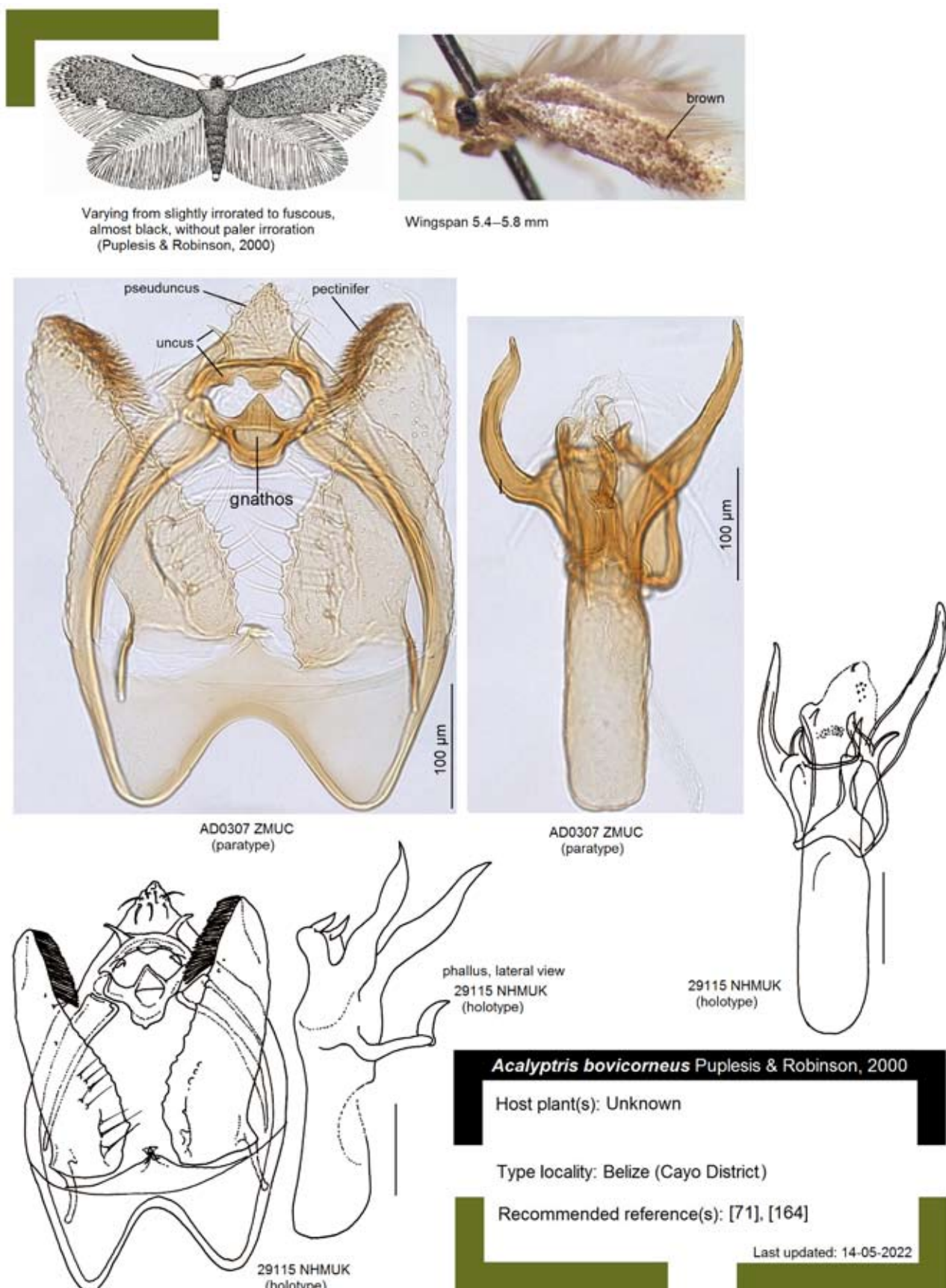


Figure 400. *Acalyptris bovicorneus* Puplesis & Robinson, a species attributed to the *A. bovicorneus* group.

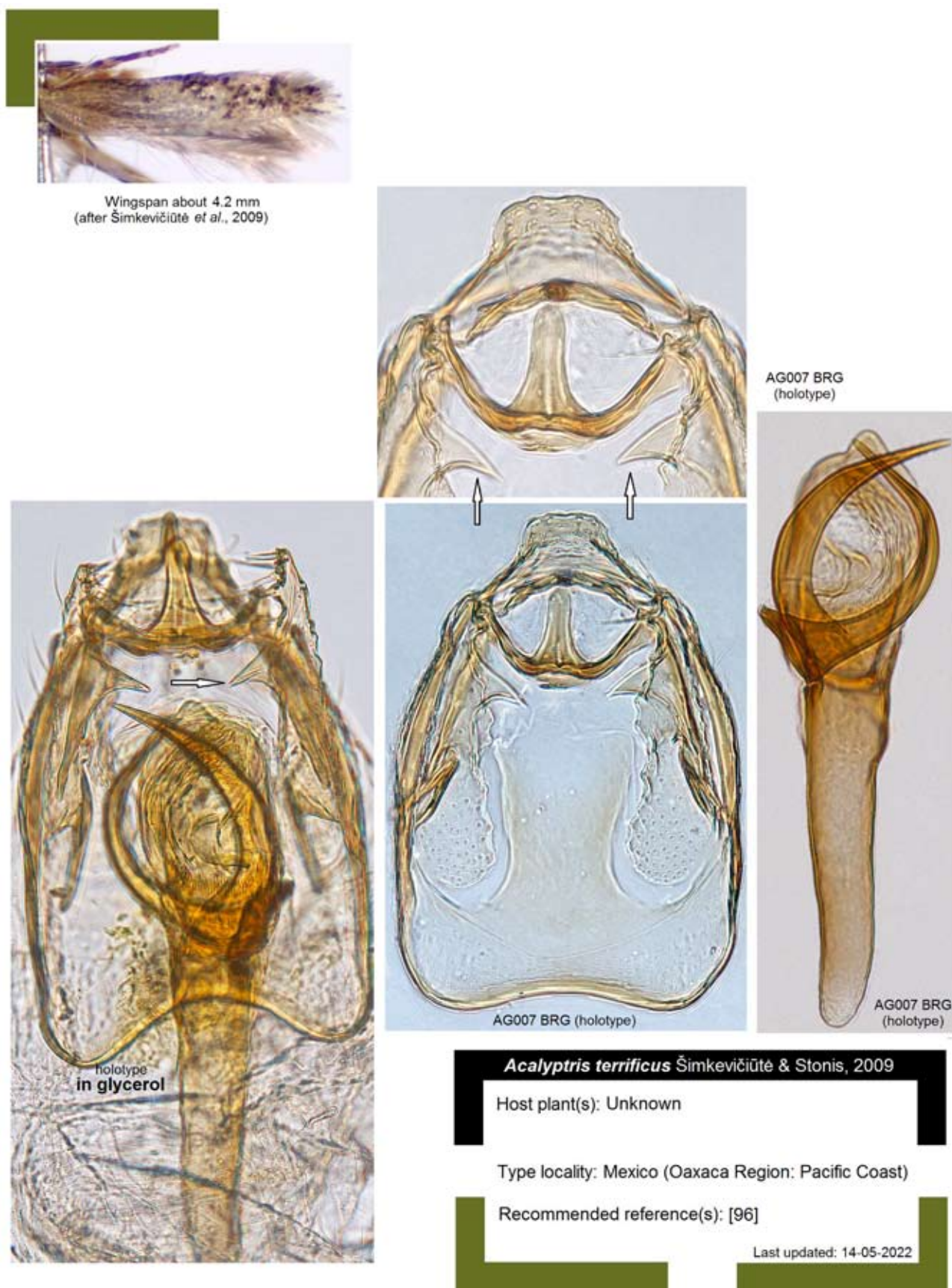


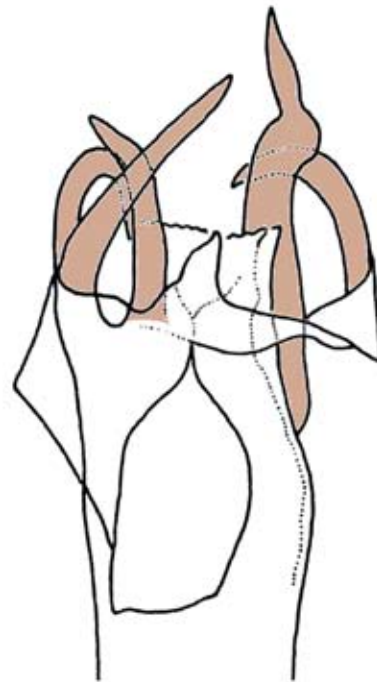
Figure 401. *Acalyptris terrificus* Šimkevičiūtė & Stonis, a species attributed to the *A. bovicorneus* group.



Wingspan about 4.2 mm
(after van Nieukerken *et al.*, 2016)



(after van Nieukerken *et al.*, 2016; slightly modified)



(after van Nieukerken *et al.*, 2016; slightly modified)

***Acalyptris janzeni* van Nieukerken & Nishida, 2016**

Host plant(s): Unknown

Type locality: Costa Rica (Guanacaste Province)

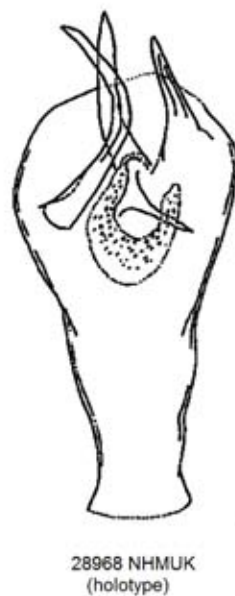
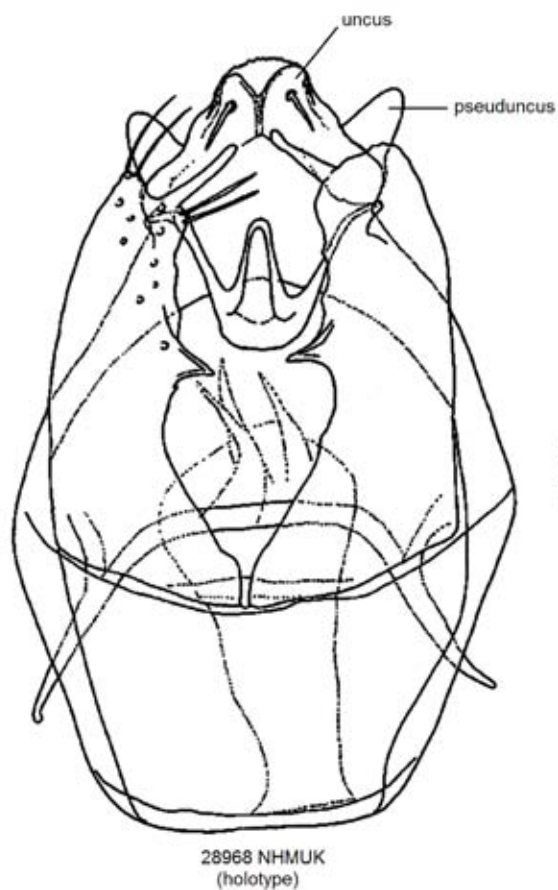
Recommended reference(s): [143]

Last updated: 15-05-2022

Figure 402. *Acalyptris janzeni* van Nieukerken & Nishida, a species attributed to the *A. bovicorneus* group.



Wingspan 5.4–5.5 mm
(after Puplesis & Robinson, 2000)



***Acalypttris latipennata* (Puplesis & Robinson, 2000)**

Host plant(s): Unknown

Type locality: Belize (Cayo District: Chiquibul F. R.)

Recommended reference(s): [71], [164]

Last updated: 14-05-2022

Figure 403. *Acalypttris latipennata* (Puplesis & Robinson), a species attributed to the *A. latipennata* group.

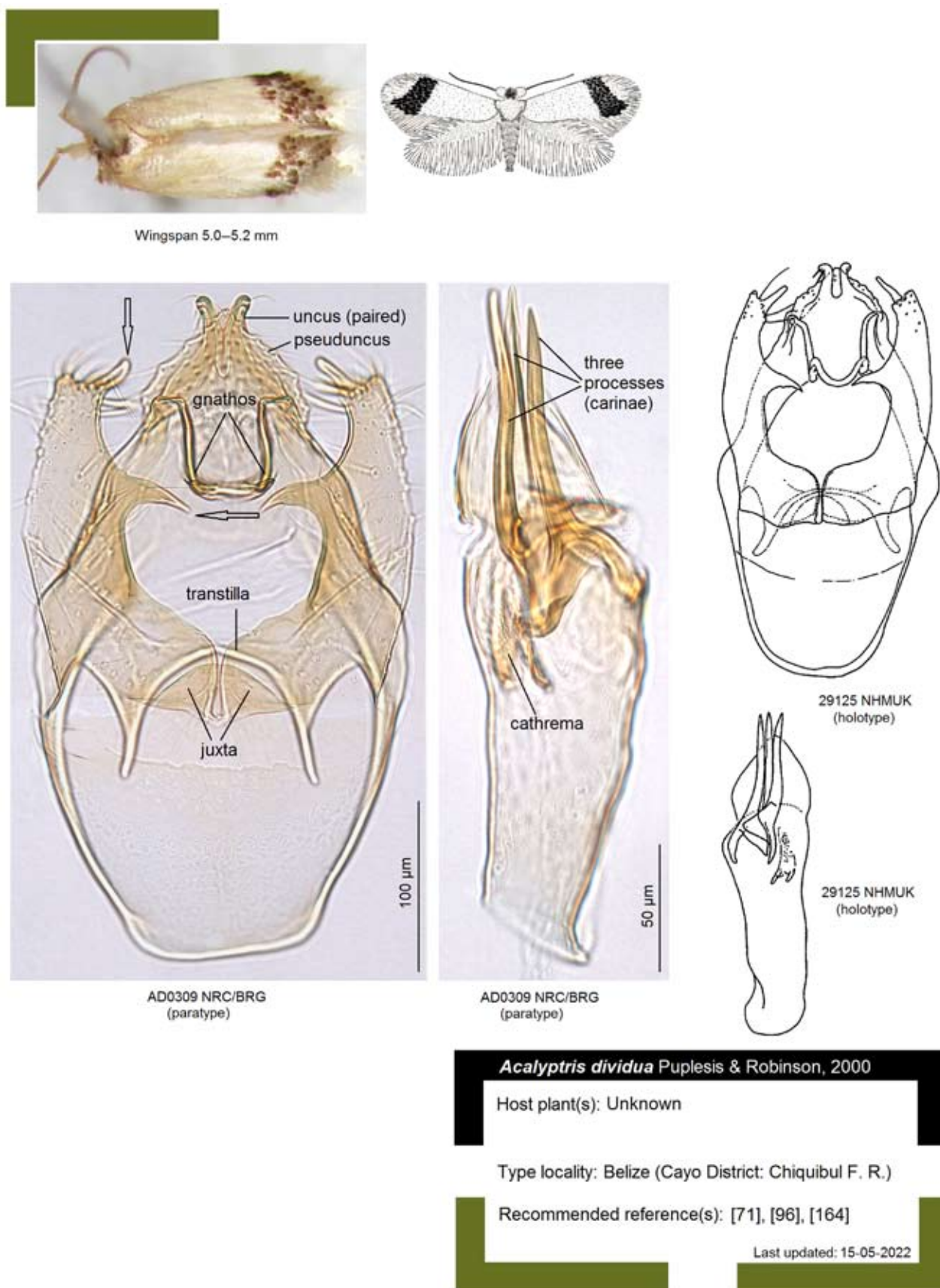


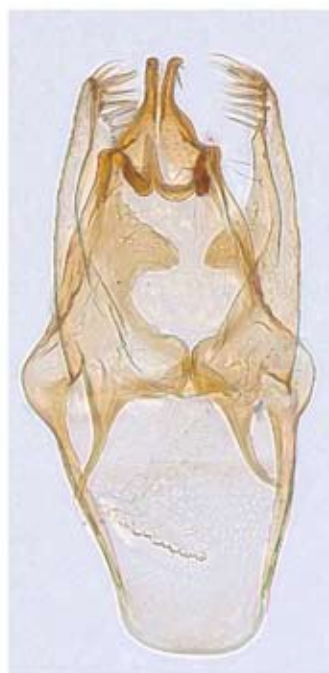
Figure 404. *Acalyptris dividua* Puplesis & Robinson, a species attributed to the *A. latipennata* group.



Wingspan about 5.5 mm
(after Šimkevičiūtė *et al.*, 2009)



AG013 BRG
(holotype)



AG013 BRG
(holotype)



***Acalyptris paravidua* Šimkevičiūtė & Stonis, 2009**

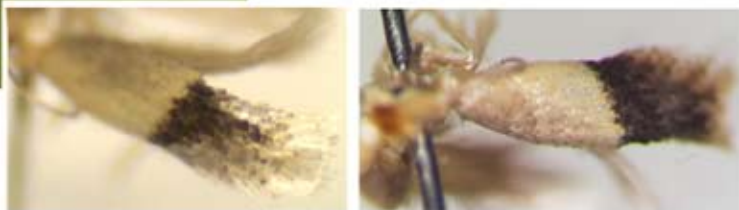
Host plant(s): Unknown

Type locality: Mexico (Oaxaca Region: Pacific Coast)

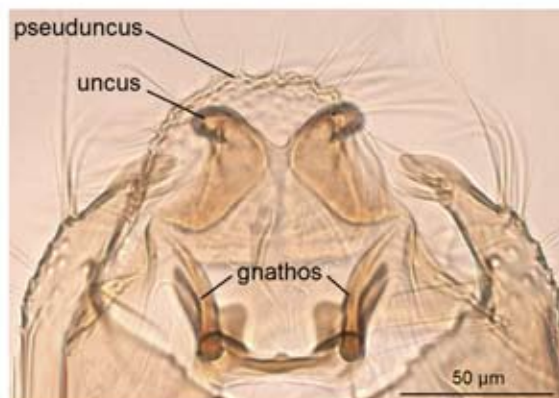
Recommended reference(s): [96]

Last updated: 14-05-2022

Figure 405. *Acalyptris paravidua* Šimkevičiūtė & Stonis, a species attributed to the *A. latipennata* group.



Wingspan 5.4–5.5 mm



AD352 ZMUC
(paratype)



AD352 ZMUC
(paratype)



***Acalypttris ecuadoriana* Puplesis & Diškus, 2002**

Host plant(s): Unknown

Type locality: Ecuador (Napo Region)

Recommended reference(s): [78], [157]

Last updated: 13-05-2022

Figure 406. *Acalypttris ecuadoriana* Puplesis & Diškus, a species attributed to the *A. latipennata* group.

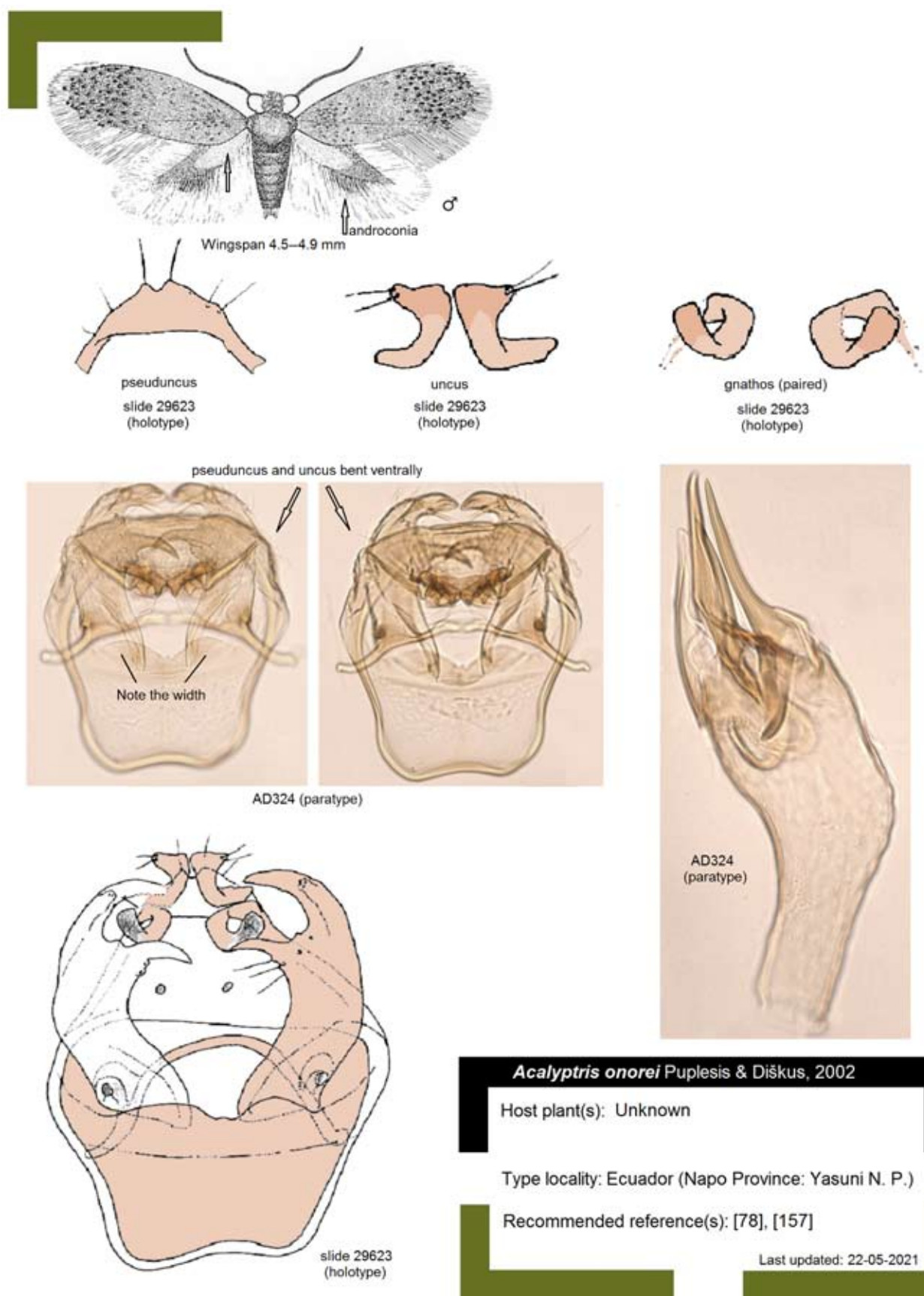


Figure 407. *Acalyptris onorei* Puplesis & Diškus, a species attributed to the *A. latipennata* group.

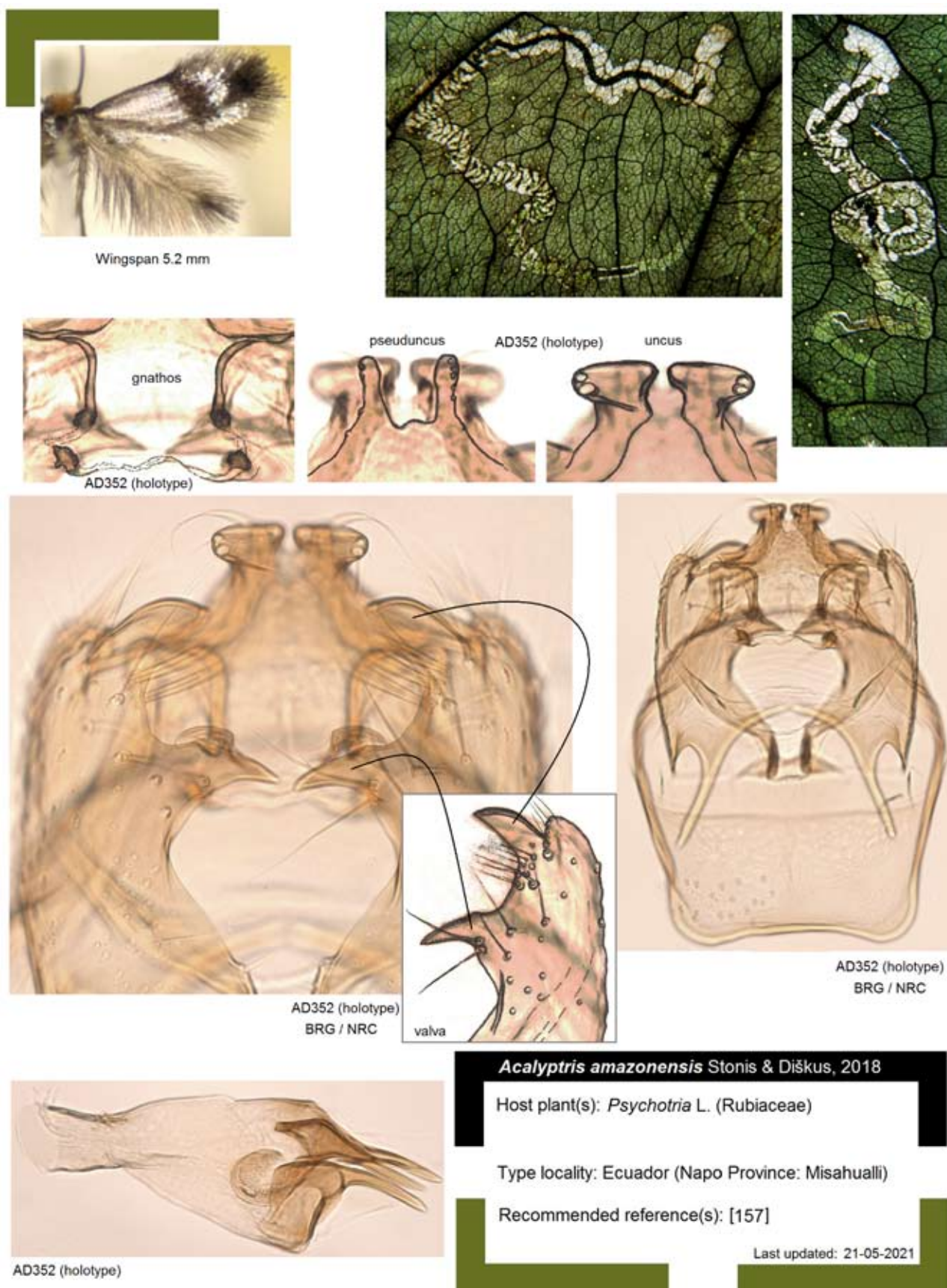


Figure 408. *Acalyptis amazonensis* Stonis & Diškus, a species attributed to the *A. latipennata* group.

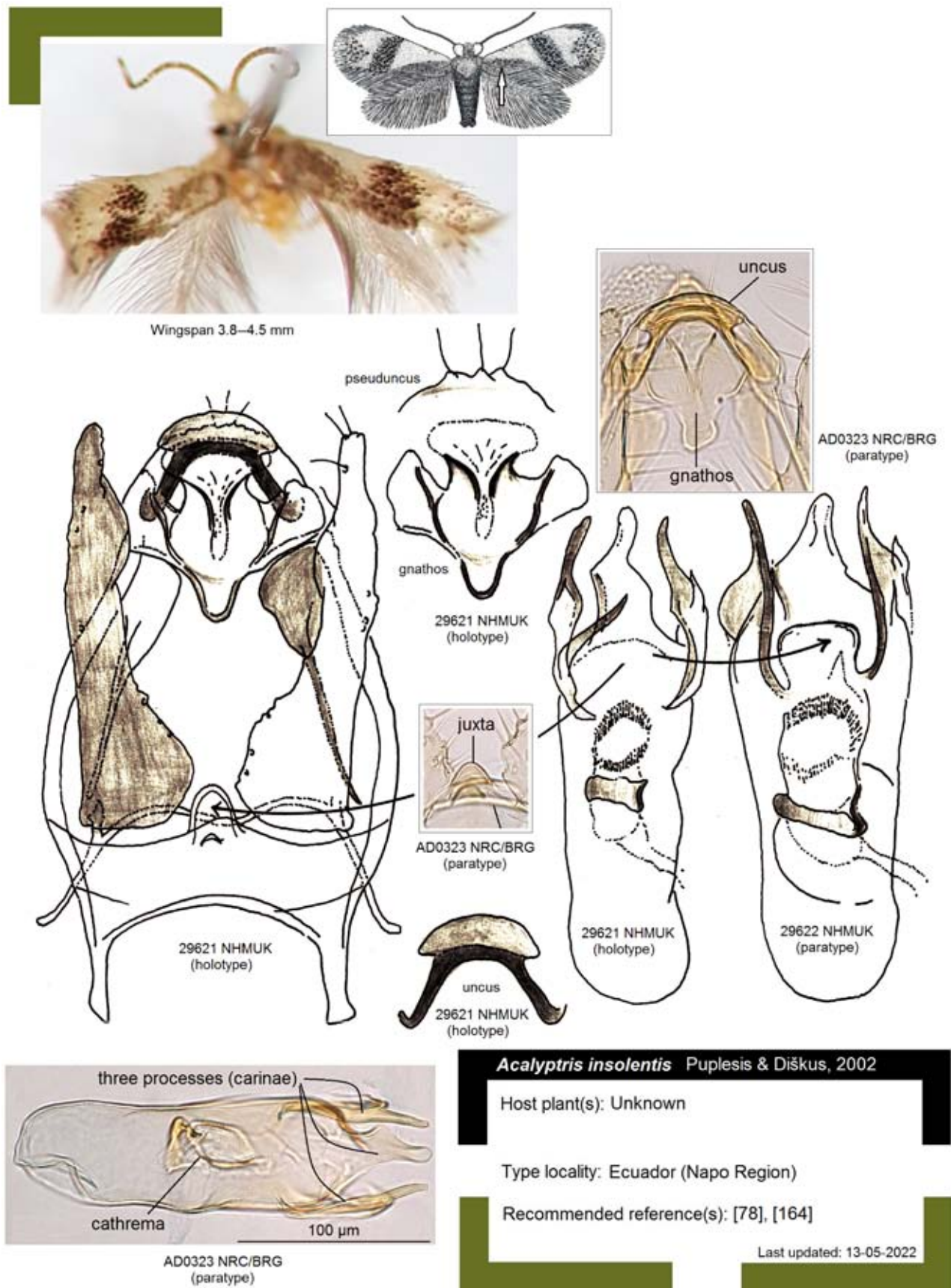


Figure 409. *Acalyptris insolentis* Puplesis & Diškus, a species attributed to the *A. latipennata* group.



Wingspan about 5.2 mm
(after Wilkinson, 1979)



(after Wilkinson, 1979)



(after Wilkinson, 1979)

***Acalyptris distaleus* (Wilkinson, 1979) ***

Host plant(s): Unknown

Type locality: USA (Arizona; also known from California)

Recommended reference(s): [11]

Last updated: 15-05-2022

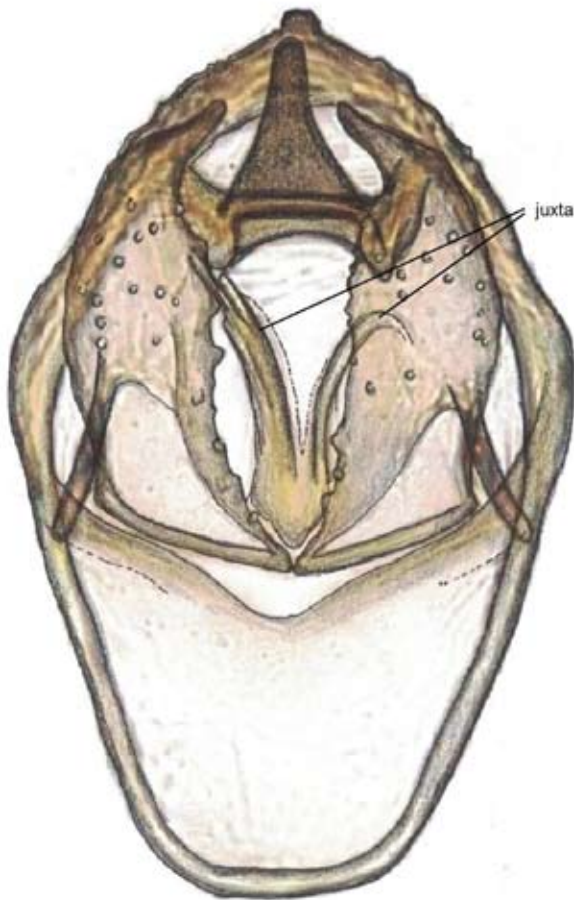
* Remark: This species may not belong to *Acalyptris* (Stonis *et al.*, 2020 [164])

Figure 410. *Acalyptris distaleus* (Wilkinson), a species with provisional (uncertain) placement in *Acalyptris*.

Genus *Glaucolepis* Braun



Wingspan 5.9–6.8 mm



RA370 ZMUC
(holotype)



RA370 ZMUC
(holotype)

Glaucolepis flagellata Remeikis & Stonis, 2017

Host plant(s): Unknown
(caught around *Podocarpus salignus*)

Type locality: Chile (Valdivia)

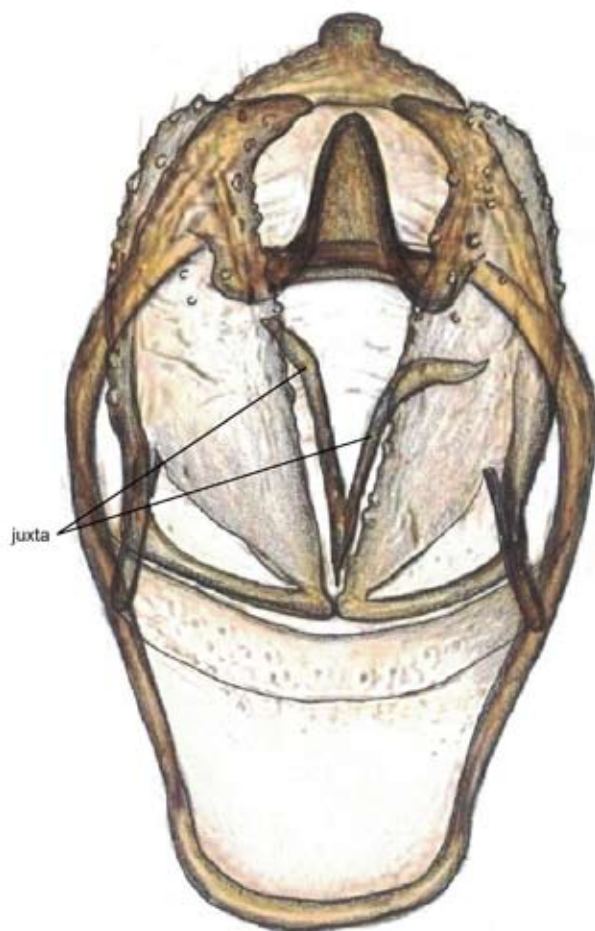
Recommended reference(s): [146]

Last updated: 22-05-2021

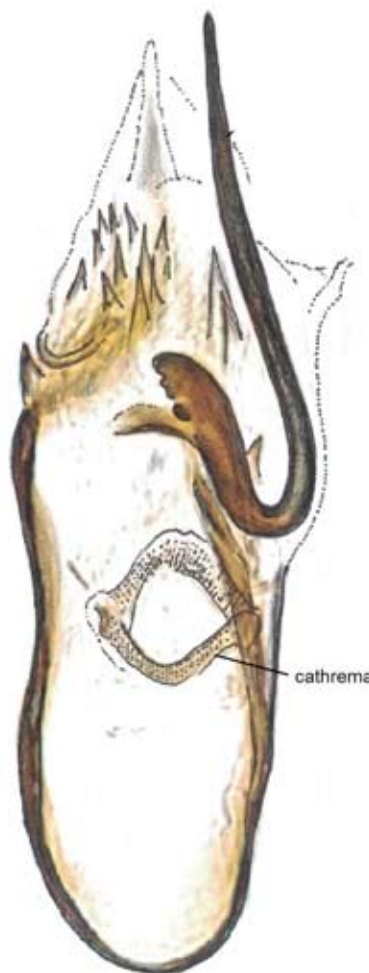
Figure 411. *Glaucolepis flagellata* Remeikis & Stonis, a species attributed to the *G. flagellata* group.



Wingspan 6.1–8.3 mm



RA587 ZMUC
(holotype)



RA587 ZMUC
(holotype)

***Glaucolepis pseudoflagellata* Remeikis & Stonis, 2017**

Host plant(s): Unknown

Type locality: Argentina (Neuquen: Lago Lacar)

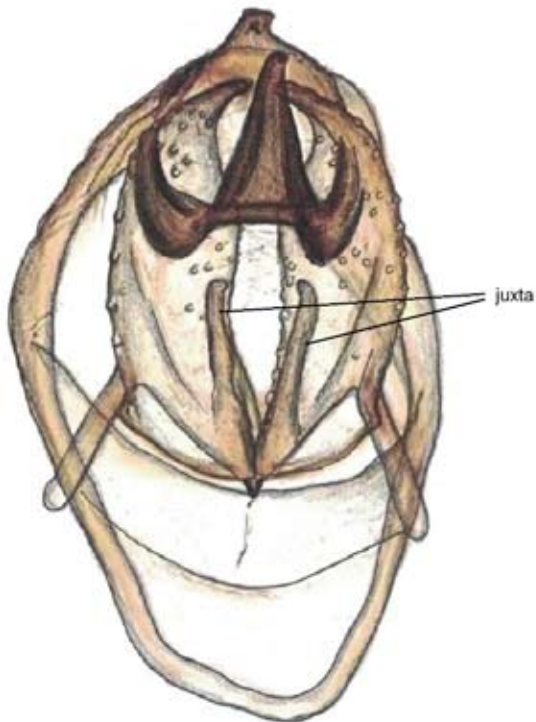
Recommended reference(s): [146]

Last updated: 22-05-2021

Figure 412. *Glaucolepis pseudoflagellata* Remeikis & Stonis, a species attributed to the *G. flagellata* group.



Wingspan 8.7–10.1 mm
(courtesy of E. J. van Nieukerken)



EvN703 CvdB067
after van Nieukerken *et al.* 2016 (modified)
and Stonis *et al.* 2017



EvN703 CvdB067
after van Nieukerken *et al.* 2016 (modified)
and Stonis *et al.* 2017

***Glaucolepis gielisorum* (van Nieukerken, 2016)**

Host plant(s): Unknown

Type locality: Chile (E. Chilan: Las Trancas)

Recommended reference(s): [143], [146]

Last updated: 22-05-2021

Figure 413. *Glaucolepis gielisorum* (van Nieukerken), a species attributed to the *G. flagellata* group.

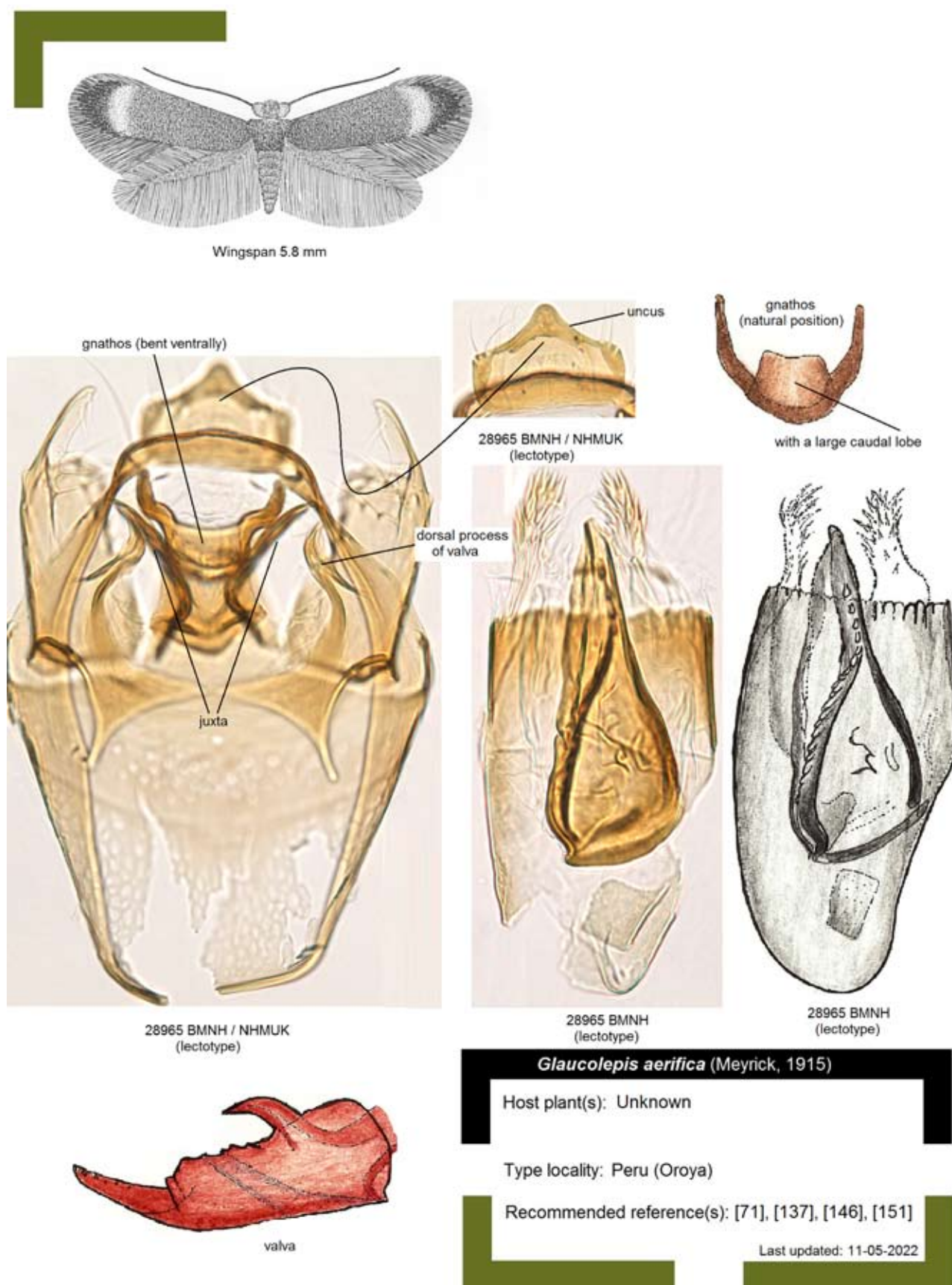


Figure 414. *Glaucolepis aerifica* (Meyrick), a non-grouped species.

Recommended Literature

(compiled by A. Diškus)

2022

174. Stonis, J.R., Remeikis, A. & Diškus, A. (2022) Neotropical Nepticulidae (a pictorial monograph introducing an electronic identification tool). Nature Research Centre, Vilnius, 363 pp.
173. Dobrynina, V., Stonis, J.R., Diškus, A., Solis, M.A., Baryshnikova, S.V. & Young-Min, S. (2022) Global Nepticulidae, Opostegidae, and Tischeriidae (Lepidoptera): temporal dynamics of species descriptions and their authors. *Zootaxa*, 5099 (4), 450–474.
<https://doi.org/10.11646/zootaxa.5099.4.2>
172. Stonis, J.R., Diškus, A., Dobrynina, V., Remeikis, A. & Buchner, P. (2022) *A guide to leafmines of the Lithuanian Nepticulidae* (Introducing an electronic identification tool). Nature Research Centre, Vilnius, 122 pp.
<https://doi.org/10.35513/2022.Nepticulidae>
171. Stonis, J.R., Diškus, A. & Dobrynina, V. (2022) What are the most typical leaf mines of Nepticulidae? Identified diagnostic characters and their detection frequency. *Biologija*, 68 (1), 1–13.
<https://doi.org/10.6001/biologija.v68i1.4700>
170. Remeikis, A. & Dobrynina, V. (2022) Differentiation of the Andean *Ozadelpha ovata* and *O. rionegrella* sp. nov. (Lepidoptera, Nepticulidae) based on characters of the male genitalia. *Zootaxa*, 5016 (2), 283–288.
<https://doi.org/10.11646/zootaxa.5016.2.8>

2021

169. Huemer, P. & Nieuwerkerken, E.J. van (2021) Identity of some recently described Lepidoptera from France – re-assessed with DNA barcodes and morphology. *Zootaxa* 4941 (3), 301–337.
<https://doi.org/10.11646/zootaxa.4941.3.1>
168. Stonis, J.R., Diškus, A., Fernández-Alonso, J.L., Remeikis, A. & Solis, M.A. (2021) New leaf-mining Nepticulidae (Lepidoptera): potential pests of aromatic Lamiaceae plants from equatorial Andes. *Zootaxa*, 4926 (3), 363–383.
<https://doi.org/10.11646/zootaxa.4926.3.3>
167. Stonis, J.R., Remeikis, A., Diškus, A., Baryshnikova, S. & Solis, M.A. (2021) What are the smallest moths (Lepidoptera) in the world? *Zootaxa*, 4942 (2), 269–289.
<https://doi.org/10.11646/zootaxa.4942.2.8>

2020

166. Nieuwerkerken, E.J. van (2020) Nieuwe mineervlinder op berk nu al gewoon in groot deel van Nederland. Available from: <https://www.naturetoday.com/intl/nl/nature-reports/message/?msg=26865> (accessed 6 June 2022)
165. Schulz, T. & Nieuwerkerken, E.J. van (2020) The elusive pygmy moth *Bohemannia auriciliella* (De Joannis, 1909): overview of its distribution, with new records for Germany and Bulgaria (Lepidoptera: Nepticulidae). *Entomologische Zeitschrift: mit Insektenbörse*, 130 (3), 143–147.
<https://repository.naturalis.nl/pub/800014>
164. Stonis, J.R., Diškus, A., Remeikis, A., Vargas, A.S. & Solis, M.A. (2020) Diagnostics and updated catalogue of *Acalyptris* Meyrick, the second largest genus of Nepticulidae (Lepidoptera) in the Americas. *Zootaxa*, 4748 (2), 201–247.
<https://doi.org/10.11646/zootaxa.4748.2.1>
163. Stonis, J.R., Remeikis, A., Diškus, A. & Navickaitė, A. (2020) Documenting new and little known leaf-mining Nepticulidae from middle and southwestern areas of the Asian continent. *Zootaxa*, 4881 (3), 401–452.
<https://doi.org/10.11646/zootaxa.4881.3.1>

2019

162. Stonis, J.R., Diškus, A., Remeikis, A. & Nishida, K. (2019) Discovery of a new species of *Ozadelpha* van Nieuwerkerken sheds more light on the diagnostics of this controversial genus of Nepticulidae (Lepidoptera). *Biologija*, 65 (4), 223–235.
<https://doi.org/10.6001/biologija.v65i4.4116>

161. Stonis, J.R., Remeikis, A., Diškus, A., Orlovskytė, S., Vargas, S.A. & Solis M.A. (2019) A new leafmining pest of guava: *Hesperolyra guajavifoliae* sp. nov., with comments on the diagnostics of the endemic Neotropical genus *Hesperolyra* van Nieukerken (Lepidoptera, Nepticulidae). *ZooKeys*, 900, 87–110.
<https://zookeys.pensoft.net/article/46332/>
160. Stonis, J.R., Remeikis, A. & Vargas, S. (2019) Colombian Nepticuloidea and Tischerioidea: a small step out of obscurity? *Biologija*, 65 (2), 48–55.
<https://doi.org/10.6001/biologija.v65i2.4023>
159. Stonis, J.R., Remeikis, A. & Vargas, S. (2019) *Stigmella pruinosa* (Lepidoptera: Nepticulidae), a species feeding on *Guazuma* and exhibiting extraordinary sexual dimorphism, now known to be occurring from Mexico to Colombia. *Biologija*, 65 (3), 151–164.
<https://doi.org/10.6001/biologija.v65i3.4084>

2018

158. Nieukerken, E.J. van, Gilrein, D.O. & Eiseman, C.S. (2018) *Stigmella multispicata* Rociene & Stonis, an Asian leafminer on Siberian elm, now widespread in eastern North America (Lepidoptera, Nepticulidae). *ZooKeys*, 784, 95–125.
<https://doi.org/10.3897/zookeys.784.27296>
157. Stonis, J.R. & Diškus, A. (2018) *Acalypttris amazonensis* sp. nov.: documentation of another leaf-mining species supplementing the unique but disputable *A. latipennata* group (Lepidoptera: Nepticulidae). *Biologija*, 64 (3), 191–202.
<https://doi.org/10.6001/biologija.v64i3.3824>
156. Stonis, J.R., Diškus, A., Katinas, L. & Solis, M.A. (2018) Asteraceae: host to the greatest diversity of leafmining Nepticulidae (Lepidoptera) in South America? *Proceedings of the Entomological Society of Washington*, 120 (4), 856–902.
<https://doi.org/10.4289/0013-8797.120.4.856>
155. Stonis, J.R., Diškus, A., Remeikis, A. & Solis, M.A. (2018) A Gondwanan concept of *Simplimorpha* Scoble (*sensu lato*): a step toward clarity in the generic diagnostics of global Nepticulidae (Lepidoptera). *Zootaxa*, 4521 (2), 151–182.
<https://doi.org/10.11646/zootaxa.4521.2.1>
154. Stonis, J.R., Diškus, A., Remeikis, A. & Solis, M.A. (2018) The American *Brachinepticula* gen. nov. and *Manoneura* Davis (Nepticulidae): a new generic concept based on a reinforced cathrema in the phallus. *Biologija*, 64 (2), 99–128.
<https://doi.org/10.6001/biologija.v64i2.3735>
153. Stonis, J.R., Diškus, A. & Solis, M.A. (2018) Two new Fabaceae-feeding Nepticulidae (Lepidoptera) from the Western Hemisphere, including a potential pest of the economically important *Centrolobium* Mart. ex Benth. *Proceedings of the Entomological Society of Washington*, 120 (4), 842–855.
<https://doi.org/10.4289/0013-8797.120.4.842>
152. Stonis, J.R. & Remeikis, A. (2018) Odd species of Nepticulidae (Lepidoptera) from the American rainforest and southern Andes. *Zootaxa*, 4392 (3), 458–468.
<https://doi.org/10.11646/zootaxa.4392.3.2>

2017

151. Stonis, J.R., Diškus, A., Remeikis, A., Karsholt, O. & Cumbicus Torres, N. (2017) Illustrated review of the leaf-mining Nepticulidae (Lepidoptera) of the central Andes (Peru and Bolivia). *Zootaxa*, 4257 (1), 1–70.
<https://doi.org/10.11646/zootaxa.4257.1.1>
150. Stonis, J.R., Diškus, A., Remeikis, A. & Monroe, A. (2017) The mystery of the tiny Urticaceae-feeders: documentation of the first leaf-mining Nepticulidae (Lepidoptera) species from equatorial America associated with *Phenax*, *Boehmeria* and *Pilea*. *Biologija*, 63 (2), 105–125.
<https://doi.org/10.6001/biologija.v63i2.3523>
149. Stonis, J.R. & Remeikis, A. (2017) Anacardiaceae-feeding Nepticulidae in the Neotropics: description of *Stigmella lilliputica* sp. nov. from Argentina, a pest on Chilean peppertree *Schinus polygama*. *Biologija*, 63 (3), 230–237.
<https://doi.org/10.6001/biologija.v63i3.3577>

148. Stonis, J.R., Remeikis, A., Diškus, A., Forero, D. & Cumbicus Torres, N. (2017) A report on Lamiaceae-feeding Nepticulidae (Lepidoptera) from South America. *Zootaxa*, 4338 (1), 128–140.
<https://doi.org/10.11646/zootaxa.4338.1.6>
 147. Stonis, J.R., Remeikis, A., Diškus, A. & Megoran, N. (2017) New species of leaf-mining Nepticulidae (Lepidoptera) from the Neotropical and Ando-Patagonian regions, with new data on host-plants. *Zootaxa*, 4272 (1), 1–39.
<https://doi.org/10.11646/zootaxa.4272.1.1>
 146. Stonis, J.R., Remeikis, A., Diškus, A. & Solis, M.A. (2017) The American species of the genus *Glaucolepis* Braun, 1917 (*Neotrifurcula* van Nieukerken, syn. nov.) (Lepidoptera: Nepticulidae). *Zootaxa*, 4338 (3), 489–506.
<https://doi.org/10.11646/zootaxa.4338.3.5>
 145. Tokár, Z., Laštůvka, A. & Nieukerken, E.J. van (2017). A new pygmy leafmining moth, *Stigmella tatrica* sp. n., from the alpine zone of the Tatra Mountains (Lepidoptera, Nepticulidae). *Nota Lepidopterologica*, 40 (1), 131–140.
<https://doi.org/10.3897/nl.40.12674>
- 2016
144. Nieukerken, E.J. van, Doorenweerd, C., Hoare, R. & Davis, D.R. (2016) Revised classification and catalogue of global Nepticulidae and Opistegidae (Lepidoptera, Nepticuloidea). *ZooKeys*, 628, 65–246.
<https://doi.org/10.3897/zookeys.628.9799>
 143. Nieukerken, E.J. van, Doorenweerd, C., Nishida, K. & Snyers, C. (2016) New taxa, including three new genera show uniqueness of Neotropical Nepticulidae (Lepidoptera). *ZooKeys*, 628, 1–63.
<https://doi.org/10.3897/zookeys.628.9805>
 142. Remeikis, A., Diškus, A. & Stonis, J.R. (2016) Preliminary trophic analysis of leaf-mining Nepticulidae: pronounced feeding strategies in Middle and South America? *Biologija*, 62 (4), 207–214.
<https://doi.org/10.6001/biologija.v62i4.3411>
 141. Remeikis, A., Stonis, J.R., Diškus, A., Davis, D.R. & Solis, M.A. (2016) Report on the first records of *Baccharis* L. (Asteraceae) as a host-plant genus for Nepticulidae (Lepidoptera). *The First North American Microlepidopterists Meeting*. Denver. Available from:
[doi: 10.13140/RG.2.1.2616.2163](https://doi.org/10.13140/RG.2.1.2616.2163) (accessed 6 June 2022)
 140. Stonis, J.R., Diškus, A., Remeikis, A. & Cumbicus Torres, N. (2016) First description of leaf-mining Nepticulidae and Tischeriidae (Insecta, Lepidoptera) feeding on the Chilean endemic plant genus *Podanthus* Lag. (Asteraceae). *Zootaxa*, 4061 (2), 119–130.
<http://doi.org/10.11646/zootaxa.4061.2.2>
 139. Stonis, J.R., Diškus, A., Remeikis, A. & Cumbicus Torres, N. (2016) Rosaceae-feeding Nepticulidae (Lepidoptera) of South America: some taxonomic and trophic diversity revealed. *Biologija*, 62 (4), 215–232.
<https://doi.org/10.6001/biologija.v62i4.3412>
 138. Stonis, J.R., Diškus, A., Remeikis, A., Davis, D.R., Solis, M.A. & Cumbicus Torres, N. (2016) The first record of *Baccharis* L. (Asteraceae) as a host-plant genus for Nepticulidae (Lepidoptera), with description of new *Stigmella* species from South America. *Zootaxa*, 4136 (1), 101–128.
<http://doi.org/10.11646/zootaxa.4136.1.4>
 137. Stonis, J.R., Diškus, A., Remeikis, A., Gerulaitis, V. & Karsholt, O. (2016) Leaf-mining Nepticulidae (Lepidoptera) from record high altitudes: documenting an entire new fauna in the Andean páramo and puna. Monograph. *Zootaxa*, 4181 (1), 1–94.
<http://doi.org/10.11646/zootaxa.4181.1.1>
 136. Stonis, J.R., Diškus, A., Remeikis, A. & Karsholt, O. (2016) Do leaf-mining Nepticulidae occur in the natural but so threatened Andean *Polylepis* forests? *Biologija*, 62 (2), 83–97.
<http://dx.doi.org/10.6001/biologija.v62i2.3334>
 135. Stonis, J.R. & Remeikis, A. (2016) Southern Andean *Stigmella sinuosa* complex (Lepidoptera, Nepticulidae): unraveling problematic taxonomy with a pictorial key of adults? *Zootaxa*, 4136 (2), 309–322.
<http://doi.org/10.11646/zootaxa.4136.2.3>

134. Stonis, J.R., Remeikis, A., Diškus, A. & Gerulaitis, V. (2016) The Ando-Patagonian *Stigmella magnispinella* group (Lepidoptera, Nepticulidae) with description of new species from Ecuador, Peru and Argentina. *Zootaxa*, 4200 (4), 561–579.
<http://doi.org/10.11646/zootaxa.4200.4.7>

2015

133. Remeikis, A. & Stonis, J.R. (2015) First discovery of *Quercus*-feeding Nepticulidae (Lepidoptera) in South America, with description of new species and designation of the *S. nigriverticella* complex in the *S. saginella* group. *Zootaxa*, 4057 (3), 409–429.
<http://dx.doi.org/10.11646/zootaxa.4057.3.7>
132. Stonis, J.R., Diškus, A. & Remeikis, A. (2015) The first description of the leaf-mining Nepticulidae (Lepidoptera) feeding on the South American plant genus *Liabum*, Asteraceae. *Zootaxa*, 4040 (5), 576–582.
<http://dx.doi.org/10.11646/zootaxa.4040.5.6>
131. Stonis, J.R., Navickaitė, A. & Diškus, A. (2015) A puzzle regarding the Siberian *Ectoedemia jacutica* (Lepidoptera: Nepticulidae): re-examination and the first photographic documentation of the type series. *Biologija*, 61 (3/4), 116–122.
<https://doi.org/10.6001/biologija.v61i3-4.3203>
130. Stonis, J.R. & Remeikis, A. (2015) The first records on the genus *Acalypttris* from the Caribbean (Lepidoptera: Nepticulidae). *Zootaxa*, 4057 (1), 79–90.
<http://dx.doi.org/10.11646/zootaxa.4057.1.4>
129. Stonis, J.R., Remeikis, A., Gerulaitis, V. & Forero, D. (2015) An embarrassing situation requiring urgent action: Colombia, a country of extraordinary biodiversity, still counts only few species of Nepticuloidea (Insecta, Lepidoptera). *Biologija*, 61 (3/4), 123–129.
<https://doi.org/10.6001/biologija.v61i3-4.3204>

2014

128. Navickaitė, A., Diškus, A. & Stonis, J.R. (2014) An updated checklist of Nepticulidae (Lepidoptera) of the Crimea, Sub-Mediterranean SE Europe. *Zootaxa*, 3847 (2), 151–202.
<https://doi.org/10.11646/zootaxa.3847.2.1>
127. Navickaitė, A., Diškus, A. & Stonis, J.R. (2014) What is new and most interesting about the Nepticulidae of the Crimea and Lithuania. In: Stonis, J.R., Hill, S.R., Diškus, A. & Auškalnis, T. (Eds.), *Selected abstracts and papers of the First Baltic International Conference on Field Entomology and Faunistics*. Edukologija Publishers, Vilnius, pp. 96–117.
126. Remeikis, A., Stonis, J.R., Diškus, A. & Davis, D.R. (2014) The first photographic documentation and new data on *Enteucha guajavae* (Lepidoptera, Nepticulidae), a pest of guava from equatorial America. In: Stonis, J.R., Hill, S.R., Diškus, A. & Auškalnis, T. (Eds.), *Selected abstracts and papers of the First Baltic International Conference on Field Entomology and Faunistics*. Edukologija Publishers, Vilnius, pp. 65–74.
125. Rocienė, A. & Stonis, J.R. (2014) Revised fauna of the Nepticulidae (Lepidoptera) of continental East Asia: lots of effort to elucidate the little-known diversity of pygmy moths. In: Stonis, J.R., Hill, S.R., Diškus, A. & Auškalnis, T. (Eds.), *Selected abstracts and papers of the First Baltic International Conference on Field Entomology and Faunistics*. Edukologija Publishers, Vilnius, pp. 51–62.
124. Stonis, J.R., Diškus, A., Remeikis, A. & Navickaitė, A. (2014) Study methods of Nepticulidae: micro-mounts of genitalia structures. In: Stonis, J.R., Hill, S.R., Diškus, A. & Auškalnis, T. (Eds.), *Selected abstracts and papers of the First Baltic International Conference on Field Entomology and Faunistics*. Edukologija Publishers, Vilnius, pp. 32–35.
123. Stonis, J.R., Remeikis, A. & Davis, D.R. (2014) Ten new species from the Patagonian Andes (Argentina and Chile), mostly belonging to a newly designated *Stigmella purpurimaculae* group (Lepidoptera: Nepticulidae). *Zootaxa*, 3887 (3), 321–353.
<http://dx.doi.org/10.11646/zootaxa.3887.3.3>
122. Stonis, J.R. & Rocienė, A. (2014) Additions to the Nepticulidae (Lepidoptera) of East Asia, with descriptions of three new species from Primorskiy Kray. *Zootaxa*, 3846 (2), 204–220.
<https://doi.org/10.11646/zootaxa.3846.2.2>

121. Hoare, R.J.B. & Nieukerken, E.J. van (2013) Phylogeny and host-plant relationships of the Australian Myrtaceae leafmining moth genus *Pectinivalva* (Lepidoptera, Nepticulidae), with new subgenera and species. *Zookeys*, 278, 1–64.
<https://doi.org/10.3897/zookeys.278.4743>
120. Laštůvka, Z., Laštůvka, A. & Nieukerken, E.J. van (2013) The *Bupleurum* (Apiaceae) feeding species of *Trifurcula* (*Glaucolepis*): new species, biology and distribution (Lepidoptera: Nepticulidae). *Tijdschrift voor Entomologie*, 156, 191–210.
<https://doi.org/10.1163/22119434-00002028>
119. Rocienė, A. & Stonis, J.R. (2013) Nepticulidae (Lepidoptera) of East Asia (2). Study of a collection sample deposited at the Russian Academy of Sciences, with descriptions of new species and a checklist. *Zootaxa*, 3652 (1), 75–116.
<http://dx.doi.org/10.11646/zootaxa.3652.1>
118. Stonis, J.R., Diškus, A., Remeikis, A., Navickaitė, A. & Rocienė, A. (2013) Description of new species of oak leaf-miners (Lepidoptera: Nepticulidae), with notes on the species groups of *Stigmella* Schrank associated with *Quercus* as a host-plant. *Zootaxa*, 3737 (3), 201–222.
<https://doi.org/10.11646/zootaxa.3737.3.1>
117. Stonis, J.R., Diškus, A., Remeikis, A., Noreika, R. & Schuster, J. (2013) Four new leaf-mining *Acalyptris* species from Guatemala and Belize, with new data on bionomics of *Stigmella pruinosa* (Lepidoptera: Nepticulidae). *Zootaxa*, 3737 (2), 101–117.
<http://dx.doi.org/10.11646/zootaxa.3737.2.1>
116. Stonis, J.R., Diškus, A., Remeikis, A. & Schuster, J. (2013) First discovery of *Quercus* feeding Nepticulidae (Lepidoptera) in Central America. *Zootaxa*, 3737 (1), 1–23.
<https://doi.org/10.11646/zootaxa.3737.1.1>
115. Stonis, J.R., Navickaitė, A., Rocienė, A., Remeikis, A. & Diškus, A. (2013) A provisional checklist of the Nepticulidae (Insecta, Lepidoptera) of the Crimea. *Zoology and Ecology*, 23 (1), 20–28.
<https://doi.org/10.1080/21658005.2012.754150>
114. Stonis, J.R., Remeikis, A., Diškus, A. & Noreika, R. (2013) New Nepticulidae species (Insecta, Lepidoptera) from the Yucatán Peninsula (SE Mexico). *Zootaxa*, 3609 (2), 223–230.
<https://doi.org/10.11646/zootaxa.3609.2.8>
113. Stonis, J.R. & Rocienė, A. (2013) Nepticulidae (Lepidoptera) of East Asia (1). Re-examination of the male genitalia of types deposited at the Russian Academy of Sciences. *Zootaxa*, 3652 (1), 1–59.
<http://dx.doi.org/10.11646/zootaxa.3652.1.1>

112. Diškus, A. & Stonis, J.R. (2012) *Leaf-mining insects of Lithuania. The Nepticulidae (Lepidoptera): taxonomy, chorological composition and trophic relationships. Monograph.* Lututė Publishers, Kaunas, 220 pp. [in Lithuanian]
111. Ivinskis, P., Nieukerken, E.J. van & Rimsaite, J. (2012) *Trifurcula (Glaucolepis) lituanica* sp. nov., an unexpected new stem-miner on *Salvia pratensis* occurring in eastern Europe (Lepidoptera: Nepticulidae). *Zootaxa*, 3570 (1), 41–55.
<https://doi.org/10.11646/zootaxa.3570.1.3>
110. Nieukerken, E.J. van, Doorenweerd, C., Stokvis, F.R. & Groenenberg, D.S.J. (2012) DNA barcoding of the leaf-mining moth subgenus *Ectoedemia* s. str. (Lepidoptera: Nepticulidae) with COI and EF1- α : two are better than one in recognising cryptic species. *Contributions to Zoology*, 81 (1), 1–24.
<https://doi.org/10.1163/18759866-08101001>
109. Nieukerken, E.J. van, Mutanen, M. & Doorenweerd, C. (2012) DNA barcoding resolves species complexes in *Stigmella salicis* and *S. aurella* species groups and shows additional cryptic speciation in *S. salicis* (Lepidoptera: Nepticulidae). *Entomologisk Tidskrift*, 132 (4), 235–255.
<http://www.repository.naturalis.nl/document/363525>
108. Shinozaki, Y., Yamamoto, A., Oishi, M. & Sato, H. (2012) Early leaf abscission has little effect on larval mortality of *Ectoedemia cerviparadisicola* (Lepidoptera, Nepticulidae) associated with *Quercus gilva*. *Annals of the Entomological Society of America*, 105 (4), 572–581.
<https://doi.org/10.1603/AN11185>

107. Laštůvka, A. & Laštůvka, Z. (2011) New records of Nepticulidae and Gracillariidae from Iberian Peninsula (Insecta: Lepidoptera). *Shilap Revista de Lepidopterologia*, 39 (156), 379–387.
<https://www.redalyc.org/pdf/455/45522548004.pdf>
106. Navickaitė, A., Diškus, A. & Stonis, J.R. (2011) Review of Nepticulidae (Insecta: Lepidoptera) occurring in the Curonian Spit (Baltic Coast of Lithuania). *Acta Zoologica Lituanica*, 21 (3), 221–231.
<http://dx.doi.org/10.2478/v10043-011-0023-1>
105. Navickaitė, A., Diškus, A., Stonis, J.R. & Dobrynina, V. (2011) Taxonomic catalogue of the world Nepticuloidea and Tischerioidea (Lepidoptera) described by members of the Biosystematics Research Group (Lithuania) up to 2009. *Acta Zoologica Lituanica*, 21 (2), 113–132.
<https://doi.org/10.2478/v10043-011-0014-2>
104. Nieuwerkerken, E.J. van & Berggren, K. (2011) *Ectoedemia rosae*, a new species with disjunct distribution in the French Alps and Norway (Lepidoptera: Nepticulidae). *Tijdschrift voor Entomologie*, 154, 181–191.
<https://doi.org/10.1163/22119434-900000316>
103. Nieuwerkerken, E.J. van, Berg, C. den van & Hoare, R.J.B. (2011) A new species of the endemic Australian genus *Roscidotoga* Hoare from rainforests in southern Queensland (Lepidoptera: Nepticulidae). *Tijdschrift voor Entomologie*, 154, 193–201.
<https://doi.org/10.1163/22119434-900000318>
102. Stonis, J.R. & Remeikis, A. (2011) *Acalyptris platani* (Müller-Rutz) in the Crimea, Ukraine – The easternmost record of the Sub-mediterranean species in Europe (Insecta: Lepidoptera: Nepticulidae). *Acta Zoologica Lituanica*, 21 (2), 89–95.
<https://doi.org/10.2478/v10043-011-0011-5>

2010

101. Hirano, N. (2010) Description of five new *Stigmella* and one *Bohemannia* species from Japan, with a new record of one *Bohemannia* species (Lepidoptera, Nepticulidae). *Japan Heterocerists Journal*, 256, 124–134.
<http://publ.moth.jp/tsushin/251-300/jhj256.pdf>
100. Nieuwerkerken, E.J. van (2010) Order Lepidoptera, family Nepticulidae. In: Harten, A. van (Ed.), *Arthropod Fauna of the United Arab Emirates*, 3. Dar Al Ummah, Abu Dhabi, pp. 492–514.
<http://repository.naturalis.nl/document/201468>
99. Nieuwerkerken, E.J. van, Laštůvka, A. & Laštůvka, Z. (2010) Western Palearctic *Ectoedemia* (*Zimmermannia*) Hering and *Ectoedemia* Busck s. str. (Lepidoptera, Nepticulidae): five new species and new data on distribution, hostplants and recognition. *ZooKeys*, 32, 1–82.
<https://doi.org/10.3897/zookeys.32.282>

2009

98. Laštůvka, A. & Laštůvka, Z. (2009) Morphology, biology and distribution of *Stigmella irregularis* Puplesis (Lepidoptera: Nepticulidae). *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 57 (5), 193–196.
[doi: 10.11118/actaun200957050193](https://doi.org/10.11118/actaun200957050193)
97. Laštůvka, A. & Laštůvka, Z. (2009) New records of mining Lepidoptera from the Iberian Peninsula (Lepidoptera: Nepticulidae, Opostegidae, Bucculatricidae, Gracillariidae). *Shilap Revista de Lepidopterologia*, 37 (148), 485–494.
<https://www.redalyc.org/pdf/455/45515028007.pdf>
96. Šimkevičiūtė, A., Stonis, J.R. & Diškus, A. (2009) Taxonomic checklist of Nepticulidae of Mexico, with the description of three new species from the Pacific Coast (Insecta, Lepidoptera). *Acta Zoologica Lituanica*, 19 (4), 268–277.
<https://doi.org/10.2478/v10043-009-0037-0>
95. Vargas, A.H. (2009) *Stigmella epicosma* (Meyrick) (Lepidoptera: Nepticulidae): first distribution records from Chile first host plant record. *Neotropical Entomology*, 40 (1), 152–153.
<https://doi.org/10.1590/S1519-566X2011000100026>

2008

94. Laštůvka, A. & Laštůvka, Z. (2008) Seven Nepticulidae new to the Iberian Peninsula and several new province records (Lepidoptera: Nepticulidae). *Shilap Revista de Lepidopterologia*, 36 (144), 457–464.
<https://www.redalyc.org/pdf/455/45511220007.pdf>

2007

93. Laštůvka, Z. & Laštůvka, A. (2007) Seven new species of the subgenus *Glaucolepis* Braun from southern Europe (Lepidoptera: Nepticulidae, *Trifurcula*). *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 55 (5), 101–110.
[doi: 10.11118/actaun200755050101](https://doi.org/10.11118/actaun200755050101)
92. Nieuwerkerken, E.J. van (2007) *Acalyptris* Meyrick: revision of the *platani* and *staticis* groups in Europe and the Mediterranean (Lepidoptera: Nepticulidae). *Zootaxa*, 1436 (1), 1–48.
<https://doi.org/10.11646/zootaxa.1436.1.1>
91. Nieuwerkerken, E.J. van (2007) Review of the subgenus *Trifurcula* (*Leverchama*), with two new species (Lepidoptera: Nepticulidae). *Acta Zoologica Academiae Scientiarum Hungaricae*, 53 (1), 101–140.
<http://www.repository.naturalis.nl/record/261195>

2006

90. Anisimovas, E., Diškus, A. & Stonis, J.R. (2006) First survey of Nepticulidae (Insecta: Lepidoptera) in Čepkeliai State Nature Reserve, Lithuania. *Acta Zoologica Lituanica*, 16 (3), 221–228.
<https://doi.org/10.1080/13921657.2006.10512735>

2005

89. Laštůvka, A. & Laštůvka, Z. (2005) Four new *Trifurcula* species and additional faunal data on Nepticulidae from Italy (Lepidoptera: Nepticulidae). *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 53 (1), 7–14.
[doi: 10.11118/actaun200553010007](https://doi.org/10.11118/actaun200553010007)
88. Laštůvka, A. & Laštůvka, Z. (2005) *Parafomoria fumanae* sp. n. a new stem miner on *Fumana procumbens* (Lepidoptera: Nepticulidae). *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 53 (1), 15–17.
[doi: 10.11118/actaun200553010015](https://doi.org/10.11118/actaun200553010015)
87. Nieuwerkerken, E.J. van & Kuroko, H. (2005) Redescription of *Stigmella kurilensis* Puplesis (Lepidoptera, Nepticulidae), found on Hokkaido. *Transactions of the Lepidopterological Society of Japan*, 56 (1), 31–35.
<http://www.repository.naturalis.nl/record/227765>

2004

86. Nieuwerkerken, E.J. van, Laštůvka, A. & Laštůvka, Z. (2004) Annotated catalogue of the Nepticulidae and Opostegidae (Lepidoptera: Nepticulidae of the Iberian Peninsula). *Shilap Revista de Lepidopterologia*, 32 (127), 211–260.
<https://www.redalyc.org/pdf/455/45512710.pdf>
85. Nieuwerkerken, E.J. van, Mazurkiewicz, A. & Palka, K. (2004) *Trifurcula pallidella* (Duponchel, 1843) (Nepticulidae): distribution, biology and immature stages, particularly in Poland. *Nota lepidopterologica*, 27 (2/3), 159–178.
<https://biostor.org/reference/145299>
84. Nieuwerkerken, E.J. van, Zolotuhin, V.V. & Mistchenko, A. (2004) Nepticulidae from the Volga and Ural region. *Nota lepidopterologica*, 27 (2/3), 125–127.
<https://biostor.org/reference/145298>

2003

83. Nieuwerkerken, E.J. van & Berg, C. den van (2003) A new *Stigmella* feeding on Urticaceae from Guam: first record of Nepticulidae (Lepidoptera) from Micronesia and Polynesia. *Invertebrate Systematics*, 17 (1), 27–37.
<https://doi.org/10.1071/IS02019>

82. Nieuwerkerken, E.J. van & Johansson, R. (2003) The *Quercus* feeding *Stigmella* species of the West Palaearctic: new species, key and distribution (Lepidoptera: Nepticulidae). *Tijdschrift voor Entomologie*, 146 (2), 307–370.
<https://doi.org/10.1163/22119434-900000129>
81. Puplesis, R. & Diškus, A. (2003) *The Nepticuloidea & Tischerioidea (Lepidoptera) — a global review, with strategic regional revisions*. Lututė Publishers, Kaunas, 512 pp.

2002

80. Laštůvka, A. & Huemer, P. (2002) *Stigmella gutlebiella* sp. n., eine neue Schmetterlingsart aus dem Iran (Lepidoptera, Nepticulidae). *Carinthia II*, 192 (112), 603–606.
https://www.zobodat.at/pdf/CAR_192_112_0603-0606.pdf
79. Nieuwerkerken, E.J. van & Laštůvka, A. (2002) *Ectoedemia (Etainia) obtusa* (Puplesis & Diškus, 1996) new for Europe: taxonomy, distribution and biology (Nepticulidae). *Nota lepidopterologica*, 25 (2/3), 87–95.
<http://biostor.org/reference/143089>
78. Puplesis, R., Diškus, A. & Robinson, G.S. (2002) New Neotropical Nepticulidae (Lepidoptera) from the western Amazonian rainforest and the Andes of Ecuador. *Bulletin of the Natural History Museum, London, Entomology*, 71 (1), 19–58.
<https://doi.org/10.1017/S0968045402000020>
77. Puplesis, R., Diškus, A., Robinson, G.S. & Onore, G. (2002) A review and checklist of the Neotropical Nepticulidae (Lepidoptera). *Bulletin of the Natural History Museum, London, Entomology*, 71 (1), 59–76.
<http://dx.doi.org/10.1017/S0968045402000032>

2000

76. Hoare, R.J.B. (2000) A new genus of primitive Nepticulidae (Lepidoptera) from eastern Australia, with a revised diagnosis of nepticulid subfamilies. *Zoological Journal of the Linnean Society*, 128 (3), 289–317.
<https://doi.org/10.1006/zjls.1998.0189>
75. Hoare, R.J.B. (2000) Gondwanan Nepticulidae (Lepidoptera)? Systematics and biology of the *Ectoedemia (Fomoria) vannifera* group. *Tijdschrift voor Entomologie*, 142 (1/2), 299–316.
<https://doi.org/10.1163/22119434-99900031>
74. Laštůvka, A. & Laštůvka, Z. (2000) The *Ectoedemia (Fomoria) weaveri*-group of the southern Balkans with description of two new species (Lepidoptera, Nepticulidae). *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 48 (3), 19–26.
<https://eurekamag.com/research/003/579/003579044.php>
73. Laštůvka, A. & Laštůvka, Z. (2000) Zwei neue *Globularia* minierende *Trifurcula* – Arten (Lepidoptera, Nepticulidae). *Acta Musei Moraviae, Scientiae biologicae*, 85 (2), 289–296.
http://www.ammobiol.com/fileadmin/user_upload/09LastuvkaAZ_AmmSB85_2.pdf
72. Nieuwerkerken, E.J. van & Liu, Y. (2000) Nepticulidae (Lepidoptera) in China, 1. Introduction and *Stigmella* Schrank feeding on Fagaceae. *Tijdschrift voor Entomologie*, 143 (2), 145–181.
<https://doi.org/10.1163/22119434-99900042>
71. Puplesis, R. & Robinson, G.S. (2000) A review of the Central and South American Nepticulidae (Lepidoptera) with special reference to Belize. *Bulletin of the Natural History Museum, London, Entomology*, 69 (1), 1–114.
<http://www.biodiversitylibrary.org/part/76459>

1998

70. Laštůvka, Z. & Laštůvka, A. (1998) Beitrag zur Kenntnis der Nepticulidenfauna Griechenlands (Lepidoptera, Nepticulidae). *Stapfia*, 55, 313–326.
https://www.zobodat.at/pdf/STAPFIA_0055_0313-0326.pdf

1997

69. Hoare, R.J.B., Johansson, R., Nieuwerkerken, E.J. van & Nielsen, E.S. (1997) Australian Nepticulidae (Lepidoptera): redescription of the named species. *Entomologica Scandinavica*, 28 (1), 1–26.
<https://doi.org/10.1163/187631297X00132>

68. Laštůvka, A. & Laštůvka, Z. (1997) *Nepticulidae Mitteleuropas. Ein illustrierter Begleiter (Lepidoptera)*. Konvoj Publishers, Brno, 230 pp.
67. Puplesis, R. & Diškus, A. (1997) Sem. Nepticulidae – neptikulidy. In: Ler, P.A. (Ed.), *Key to the insects of Russian Far East. Trichoptera and Lepidoptera*, 5 (1). Dal'nauka Publishers, Vladivostok, pp. 302–319. [in Russian]
66. Puplesis, R., Diškus, A. & Nieuwerkerken, E.J. van (1997) *Stigmella divina* sp. n., a remarkable species from Turkmenistan and Turkey (Lepidoptera, Nepticulidae). *Tijdschrift voor Entomologie*, 140 (1), 55–58.
<https://repository.naturalis.nl/pub/227746>

1996

65. Puplesis, R. & Diškus, A. (1996) A review of the *Stigmella sorbi* species-group with descriptions of two new species from Turkmenistan and Tadzhikistan (Lepidoptera: Nepticulidae). *Phegea*, 24 (4), 171–182.
http://www.phegea.org/Phegea/1996/Phegea24-4_171-182.pdf
64. Puplesis, R. & Diškus, A. (1996) First record of the genus *Etainia* Beirne from Central Asia with descriptions of two new species and some provisional notes on the world fauna (Lepidoptera: Nepticulidae). *Phegea*, 24 (1), 41–48.
http://www.phegea.org/Phegea/1996/Phegea24-1_41-48.pdf
63. Puplesis, R. & Diškus, A. (1996) Five new mining Lepidoptera (Nepticulidae, Bucculatricidae) from Central Asia. *Tijdschrift voor Entomologie*, 139 (2), 181–190.
<http://www.biodiversitylibrary.org/part/65974>
62. Puplesis, R., Diškus, A., Noreika, R. & Saparmamedova, N. (1996) Revised check-list of mining Lepidoptera (Nepticuloidea, Tischerioidea and Gracillarioidea) from Central Asia. *Tijdschrift voor Entomologie*, 139 (2), 191–200.
<http://www.biodiversitylibrary.org/part/65975>

1995

61. Kumata, T. & Nakatani, M. (1995) Discovery of three lepidopterous leaf-miners on *Vaccinium vitis-idaea* from Hokkaido, Japan (Nepticulidae, Gracillariidae and Coleophoridae). *Transactions of the Lepidopterological Society of Japan*, 46 (2), 91–102.
<https://eurekamag.com/research/020/871/020871494.php>
60. Puplesis, R. & Diškus, A. (1995) *Acalyptris argyraspis* sp. n., a remarkable species from Tadzhikistan (Lepidoptera: Nepticulidae). *Phegea*, 23 (1), 51–54.
http://www.phegea.org/Phegea/1995/Phegea23-1_51-54.pdf

1994

59. Kuznetzov, V.I. & Puplesis, R. (1994) Fam. Nepticulidae (Stigmellidae)—pygmy moths. In: Kuznetzov, V.I. (Ed.), *Insects and mites—pests of agricultural plants. Lepidoptera*, 3 (1). Nauka Publishers, St. Petersburg, pp. 12–23. [in Russian]
58. Laštůvka, Z. & Laštůvka, A. (1994) Drei neue Arten der *Trifurcula pallidella* – Gruppe aus Mitteleuropa (Lepidoptera: Nepticulidae). *Entomologia Generalis*, 18 (3/4), 201–212.
<https://doi.org/10.1127/entom.gen/18/1994/201>
57. Puplesis, R. (1994) *The Nepticulidae of Eastern Europe and Asia: western, central and eastern parts*. Backhuys Publishers, Leiden, 291 pp., 840 figs.
56. Puplesis, R. & Schoorl, J.W. (1994) Notes on the species of the *Stigmella oxyacanthella* species-group (Lepidoptera: Nepticulidae) in the Palearctic. *Lietuvos Respublikos aukštųjų mokyklų mokslo darbai, Biologija*, 31, 33–43.
<https://eurekamag.com/research/002/907/002907247.php>

1993

55. Laštůvka, A. & Laštůvka, Z. (1993) *Acalyptris pyrenaica* sp. n. aus Spanien (Lepidoptera: Nepticulidae). *SHILAP Revista de Lepidopterologia*, 21 (83), 157–160.
https://www.researchgate.net/publication/310794244_Acalyptris_pyrenaica_spn_aus_Spanien_Lepidoptera_Nepticulidae

1992

54. Puplesis, R., Seksjaeva, S., Noreika, R. & Puplesienė, J. (1992) Some leaf-mining Lepidoptera from the Aksu Dzhabagly Reserve (western Tian Shan) with the descriptions of four new species (Lepidoptera: Nepticulidae, Bucculatricidae). *Nota lepidopterologica*, 15 (1), 47–64.
<https://biostor.org/reference/117056>

1991

53. Nieuwerkerken, E.J. van & Puplesis, R. (1991) Taxonomy and distribution of the *Trifurcula* (*Glaucolepis*) *raikhonae* group (Lepidoptera: Nepticulidae). *Tijdschrift voor Entomologie*, 134, 201–210.
<http://biostor.org/reference/49992>
52. Puplesis, R. (1991) The *Stigmella paradoxa* species-group (Lepidoptera: Nepticulidae) in the USSR. *Entomologica scandinavica*, 22 (1), 123–127.
<https://doi.org/10.1163/187631291X00345>
51. Puplesis, R. & Arutyunova, N.V. (1991) Two new species of nepticulid moths (Lepidoptera, Nepticulidae), mining apple-tree leaves, from Tajikistan. *Entomologicheskoe obozrenie*, 70 (3), 571–573. [in Russian]
<https://eurekamag.com/research/007/974/007974630.php>

1990

50. Johansson, R., Nielsen, E.S., Nieuwerkerken, E.J. van & Gustafsson, B. (1990) The Nepticulidae and Opostegidae (Lepidoptera) of north west Europe. *Fauna Entomologica Scandinavica*, 23 (1/2), 1–739.
49. Laštůvka, A. & Laštůvka, Z. (1990) *Stigmella inopinata* sp. n. und *Parornix mixta* (Triberti) in Mitteleuropa (Lepidoptera). *Acta Universitatis Agriculturae, Facultas Agronomica (Brno)*, 38 (1/2), 197–203.
48. Nieuwerkerken, E.J. van (1990) The *Trifurcula subnitidella* group (Lepidoptera: Nepticulidae): taxonomy, distribution and biology. *Tijdschrift voor Entomologie*, 133 (2), 205–238.
<https://biostor.org/reference/49974>
47. Nieuwerkerken, E.J. van (1990) *Stigmella rolandi* sp. n.: a widespread southern European species on *Rosa* (Lepidoptera: Nepticulidae). *Tijdschrift voor Entomologie*, 133 (2), 239–243.
<https://biostor.org/reference/49975>
46. Puplesis, R. (1990) The genus *Acalyptis* Meyrick (Lepidoptera, Nepticulidae) in the USSR: Distribution and taxonomy. *Nota lepidopterologica*, 13 (1), 62–88.
<https://biostor.org/reference/135054>
45. Puplesis, R., Ivinskis, P.P. & Pakalniškis, S.A. (1990) Six species of nepticulid moths (Lepidoptera, Nepticulidae) new to Lithuania, found in 1972–1987. In: Jonaitis, V. (Ed.), *New and rare for Lithuania insect species. Records and descriptions of 1990*. Vilnius, pp. 14–18. [in Russian]

1989

44. Donner, H. & Wilkinson, C. (1989) Nepticulidae (Insecta: Lepidoptera). *Fauna of New Zealand*, 16, 1–88.
<https://doi.org/10.7931/J2/FNZ.16>
43. Puplesis, R. (1989) Descriptions of females of five species of the genus *Acalyptis* (Lepidoptera, Nepticulidae). In: Skarlato, O.A. (Ed.), *Insects of Mongolia*, 10. Nauka Publishers, Leningrad, pp. 506–511. [in Russian]

1988

42. Puplesis, R. (1988) New species of plant mining Lepidoptera (Nepticulidae, Tischeriidae) from Central Asia. *Stapfia*, 16, 273–290.
http://www.zobodat.at/pdf/STAPFIA_0016_0273-0290.pdf
41. Puplesis, R. (1988) Three new species of nepticulid moths (Lepidoptera, Nepticulidae) from the Asian part of USSR. *Lietuvos TSR aukštųjų mokyklų mokslo darbai, Biologija*, 26, 24–29. [in Russian]
<https://eurekamag.com/research/022/011/022011008.php>
40. Puplesis, R. & Kozlov, M.V. (1988) Functional morphology of male genitalia in Nepticulidae (Lepidoptera). *Zoologicheskii zhurnal*, 67 (4), 557–566. [in Russian]
<https://eurekamag.com/research/005/492/005492657.php>

1987

39. Puplesis, R. (1987) Short zoogeographical review of nepticulids (Lepidoptera, Nepticulidae) of southern Far East with description of new species. In: Ler, P.A. (Ed.), *Lepidoptera of the Far East of the USSR*. Far East Scientific Center, Vladivostok, pp. 4–13. [in Russian]

1986

38. Nieuwerkerken, E.J. van (1986) A provisional phylogenetic check-list of the western Palaearctic Nepticulidae, with data on hostplants (Lepidoptera). *Entomologica Scandinavica*, 17 (1), 1–27.
<https://doi.org/10.1163/187631286X00099>
37. Nieuwerkerken, E.J. van (1986) Systematics and phylogeny of Holarctic genera of Nepticulidae (Lepidoptera, Heteroneura: Monotrysia). *Zoologische Verhandelingen*, 236 (1), 1–93.
<https://repository.naturalis.nl/pub/317599>
36. Schoorl, J.W. & Wilkinson, C. (1986) The *Stigmella betulicola* species-group in Europe (Lepidoptera: Nepticulidae). *Journal of Natural History*, 20 (1), 225–244.
<https://doi.org/10.1080/00222938600770181>

1985

35. Davis, D.R. (1985) A re-examination of *Enteucha cyanochlora* Meyrick and its subsequent transfer to the Nepticulidae (Lepidoptera: Nepticuloidea). *Proceedings of the Entomological Society of Washington*, 87 (1), 142–145.
<https://www.biodiversitylibrary.org/page/16218435#page/150/mode/1up>
34. Ivinskis, P., Pakalniškis, S. & Puplesis, R. (1985) *Augalus minuojantys vabzdžiai*. Moksas, Vilnius, 240 pp. [in Lithuanian]
33. Kemperman, T.C.M. & Wilkinson, C. (1985) Japanese species of the genus *Stigmella* (Nepticulidae: Lepidoptera) [with biological data provided by Kuroko, H. & Kumata, T.]. *Insecta Matsumurana* n. s., 32, 1–107.
<http://hdl.handle.net/2115/9830>
32. Nieuwerkerken, E.J. van (1985) A new species of *Parafomoria* van Nieuwerkerken, and some additional notes on the genus (Lepidoptera: Nepticulidae). *Entomologische Berichten*, 45 (2), 24–28.
<http://www.repository.naturalis.nl/document/50160>
31. Nieuwerkerken, E.J. van (1985) A taxonomic revision of the Western Palaearctic species of the subgenera *Zimmermannia* Hering and *Ectoedemia* Busck s. str. (Lepidoptera, Nepticulidae), with notes on their phylogeny. *Tijdschrift voor Entomologie*, 128 (1), 1–164.
<https://biostor.org/reference/61076>
30. Puplesis, R. (1985) New species of the nepticulid moths (Lepidoptera, Nepticulidae) from southern Far East and Tadzhikistan. *Proceedings of the Zoological Institute USSR Academy of Sciences*, 134, 59–72. [in Russian]
29. Puplesis, R. & Ivinskis, P.P. (1985) Review of nepticulid moths fauna of the *Obrussa* Braun genus in the USSR and a description of 4 new species—*Obrussa capesella* sp. n., *O. tigrinella* sp. n., *O. peterseni* sp. n., *O. sabina* sp. n. *Lietuvos TSR Mokslų Akademijos darbai* (C), 4 (92), 36–46. [in Russian]

1984

28. Gustafsson, B. (1984) New species of *Stigmella* from the Gambia (Lepidoptera, Nepticulidae). *Tijdschrift voor Entomologie*, 127 (8), 165–177.
<https://www.biodiversitylibrary.org/page/43079333#page/223/mode/1up>
27. Puplesis, R. (1984) A review of nepticulid moths of the genus *Microcalyptris* (Lepidoptera, Nepticulidae) from the deserts of Mongolia and the USSR. In: Skarlato, O.A. (Ed.), *Insects of Mongolia*, 9. Nauka Publishers, Leningrad, pp. 484–507. [in Russian]
26. Puplesis, R. (1984) Contribution to the classification of the Palearctic Nepticulidae (Lepidoptera). *Entomological Review*, 3, 149–164.
25. Puplesis, R. (1984) First records of the genera *Stigmella* and *Ectoedemia* (Lepidoptera, Nepticulidae) in Mongolia. In: Skarlato, O.A. (Ed.), *Insects of Mongolia*, 9. Nauka Publishers, Leningrad, pp. 508–510. [in Russian]
24. Puplesis, R. (1984) New species of (Lepidoptera) Nepticulidae. *Entomological Review*, 1, 96–110.

23. Puplesis, R. (1984) New species of nepticulids (Lepidoptera, Nepticulidae) from southern Primorye. *Entomologicheskoe Obozrenie*, 63 (1), 111–125. [in Russian]
22. Puplesis, R. (1984) To the classification of nepticulids (Lepidoptera, Nepticulidae) of the Palaearctic fauna. *Entomologicheskoe Obozrenie*, 63 (3), 582–597. [in Russian]

1983

21. Nieuwerkerken, E.J. van (1983) The Cistaceae-feeding Nepticulidae (Lepidoptera) of the western Palaearctic region. *Systematic Entomology*, 8, 453–478.
<https://doi.org/10.1111/j.1365-3113.1983.tb00495.x>
20. Scoble, M.J. (1983) *A revised cladistic classification of the Nepticulidae (Lepidoptera) with descriptions of new taxa mainly from South Africa*. *Transvaal Museum Monograph*, 2, 1–105.
https://hdl.handle.net/10520/AJA090799001_84

1982

19. Newton, P.J. & Wilkinson, C. (1982) A taxonomic revision of the North American species of *Stigmella* (Lepidoptera: Nepticulidae). *Systematic Entomology*, 7 (4), 367–463.
<https://doi.org/10.1111/j.1365-3113.1982.tb00455.x>

1981

18. Gustafson, B. (1981) New leaf-mining moths of the family Nepticulidae from Cyprus, Greece (Lepidoptera). *Entomologica Scandinavica*, 12 (4), 453–469.
<https://doi.org/10.1163/187631281X00553>
17. Wilkinson, C. (1981) A supplement to the genus *Ectoedemia* Busck (Nepticulidae: Lepidoptera) in North America, dealing with some difficult species and also some new ones. *Tijdschrift voor Entomologie*, 124 (3), 93–110.
<http://biostor.org/reference/49900>
16. Wilkinson, C. & Newton, P.J. (1981) The micro-lepidopteran genus *Ectoedemia* Busck (Nepticulidae) in North America. *Tijdschrift voor Entomologie*, 124 (2), 27–92.
<http://biostor.org/reference/49899>

1980

15. Scoble, M.J. (1980) The genus *Niepeltia* Strand: taxonomy, and comments on structure and relationships (Lepidoptera: Nepticulidae). *Annals of the Transvaal Museum*, 32 (8), 197–229.
https://hdl.handle.net/10520/AJA00411752_178
14. Scoble, M.J. (1980) *Trifurcula* Zeller: a critical analysis of the genus, cladistic relationships and descriptions of two new species from South Africa (Lepidoptera: Nepticulidae). *Journal of the Entomological Society of Southern Africa*, 43 (1), 139–150.

1979

13. Davis, D.R. (1979) *Manoneura*, a new name to replace the generic homonym *Oligoneura* Davis (Lepidoptera: Nepticulidae). *Florida Entomologist*, 62 (3), 276.
<https://journals.flvc.org/flaent/article/view/57388>
12. Scoble, M.J. (1979) A new species of *Ectoedemia* Busck from Botswana with observations on its imaginal skeletal anatomy (Lepidoptera: Nepticulidae). *Annals of the Transvaal Museum*, 32 (2), 35–54.
https://hdl.handle.net/10520/AJA00411752_183
11. Wilkinson, C. (1979) A taxonomic study of the micro-lepidopteran genera *Microcalyptris* Braun and *Fomoria* Beirne occurring in the United States of America (Lepidoptera, Nepticulidae). *Tijdschrift voor Entomologie*, 122 (4), 59–90.
<http://biostor.org/reference/49894>
10. Wilkinson, C. & Scoble, M.J. (1979) The Nepticulidae (Lepidoptera) of Canada. *Memoirs of the Entomological Society of Canada*, 111, 1–129, pls 10.
<https://doi.org/10.4039/entm111107fv>

1978

9. Davis, D.R. (1978) New leaf-mining moths of the family Nepticulidae from Florida. *Florida Entomologist*, 61 (4), 209–224.
<https://www.jstor.org/stable/3494210?seq=1>
8. Kuroko, H. (1978) A new species of Nepticulid moth from Japan (Lepidoptera: Nepticulidae). *Akitu n. s.*, 18, 1–5.
7. Scoble, M.J. (1978) Nepticulidae (Lepidoptera) of southern Africa: the genus *Ectoedemia* Busck. *Journal of the Entomological Society of Southern Africa*, 41 (1), 81–86.
<https://agris.fao.org/agris-search/search.do?recordID=US201302433493>
6. Scoble, M.J. (1978) Nepticulidae of southern Africa: a taxonomic revision of the genus *Stigmella* Schrank (Lepidoptera: Monotrypia). *Annals of the Transvaal Museum*, 31 (9), 87–129, pl. 15.
https://journals.co.za/doi/pdf/10.10520/AJA00411752_192

1976

5. Emmet, A.M. (1976) Tischeriidae. In: Heath, J. (Ed.), *The moths and butterflies of Great Britain and Ireland*, 1. Micropterigidae – Heliozelidae. Blackwell Scientific Publications and Curwen Press, Oxford & London, pp. 272–276.
4. Gustafsson, B. (1976) A new species of *Nepticula* v. Heyden and redescription of *Trifurcula clinomochla* (Meyrick) from Sri Lanka. *Entomologisk Tidskrift*, 97 (1/2), 45–49.
<https://agris.fao.org/agris-search/search.do?recordID=US201302479159>

1973

3. Gustafsson, B. (1973) A new species of *Nepticula* v. Heyden from Rhodes (Lep. Nepticulidae). *Entomologisk Tidskrift*, 94 (3/4), 197–198.
https://www.sef.nu/download/et_vol_94_1973/ET1973-sid-197_198.pdf

1972

2. Gustafsson, B. (1972) Three new species of *Nepticula* from Gambia (Lep. Nepticulidae). *Entomologisk Tidskrift*, 93 (4), 156–159.
http://www.sef.nu/download/et_vol_93_1972/ET-1972-156-159.pdf

1971

1. Johansson, R. (1971) Notes on Nepticulidae (Lepidoptera) I. A revision of the *Nepticula ruficapitella* group. *Entomologica Scandinavica*, 2 (4), 241–262.
<https://doi.org/10.1163/187631271X00257>