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Four Tischeriidae species in Colombia, including a new *Astrotischeria* species: is it not too little for a megadiverse country?

Jonas R. Stonis[1*],

Arūnas Diškus[2],

Wolfram Mey[3]

[1] *State Research Institute Nature Research Centre, Akademijos g. 2, Vilnius 08412, Lithuania*

[2] *Vytautas Magnus University, K. Donelaičio g. 58, Kaunas 44248, Lithuania*

[3] *Museum für Naturkunde, Invalidenstr. 43, 10115, Berlin, Germany*

Until 2019, Tischeriidae, or trumpet moths, were totally unknown in Colombia. Here we review all currently available scanty data on the Colombian Tischeriidae and describe *Astrotischeria recta* Diškus, Mey & Stonis, sp. nov., a new species of trumpet moths from Valle de Cauca, Colombia. The new species is illustrated with photographs of the male genitalia, adults, and their habitats. In the current paper, we also briefly discuss the number of the Tischeriidae species in other Neotropical countries and provide renewed data.

Keywords: Astrotischeria, leaf miners, new species, trumpet moths

INTRODUCTION

Biologically, phylogenetically, and judging by the results of various previous studies, trumpet moths, Tischeriidae, or trumpet leaf miner moths, are one of the most intriguing families of the leaf-mining Lepidoptera. The unique specialised morphological characters of Tischeriidae were surveyed in the monographs by Braun (1972) and Puplesis, Diškus (2003) as well as discussed in numerous recent papers (Kobayashi et al., 2016; Xu et al., 2017, 2018, 2021; Stonis et al., 2018, 2020a, 2020b, 2021a, 2021b, 2021c; Stonis & Solis, 2020). Recently, it was estimated that by the end of 2021, 170 tischeriid species were described and named globally (Dobrynina et al., 2022); currently, the number for the world fauna has reached 183 species. The authors of the latter publication have also provided temporal dynamics and

* Corresponding author. Email: stonis.biotaxonomy@gmail.com

charts of authors involved in the description of the Tischeriidae species. However, some areas of South East Asia, equatorial Africa, and tropical America are still poorly investigated (Stonis, Solis, 2020). Moreover, despite the fact that many new species were already collected, they still await taxonomic description.

The history of Tischeriidae research is considered to have begun in 1898 with the naming of the family, or even much earlier, some 227 years ago (Dobrynina et al., 2022), with the description of the very first species *Tischeria ekebladella* (Bjerkander, 1795) that currently belongs to the family. In the Neotropics, the study of the Tischeriidae fauna began in the late 19th-early 20th centuries with descriptions of two species from the Caribbean (Walsingham, 1897), one species from southwestern Mexico (Walsingham, 1914), one species from Guyana, and three species from Ecuador and Peru (Meyrick, 1915) (see Stonis et al., 2019a). At present, twenty species in total are described from the Neotropics.

For a long time, nothing was known about Tischeriidae from Colombia. Only in 2019, thanks to some collecting in the Valle del Cauca region, southwestern Colombia, the first two species of Colombian Tischeriidae were discovered. By drawing on these findings, two new species, *A. colombiana* Stonis & Vargas and *A. ochrimaculosa* Diškus, Stonis & Vargas, were described and named. The latter species, *A. ochrimaculosa*, is also known to occur in Peru, whereas *A. colombiana* is currently known only from Colombia (see Stonis et al., 2019a). The discovery of these species in Colombia also revealed previously unknown host plants from the Asteraceae and Malvaceae families (Stonis et al., 2019b).

Approximately at the same time, Wolfram Mey was collecting in Cundinamarca, Choachi (Colombia), and his fieldwork resulted in an unexpected discovery of a new *Dishkeya* species, *D. ursipedella* Diškus, Mey & Stonis (Stonis et al., 2022a). *D. ursipedella* is characterised by rather outstanding morphology of the male genitalia, and these data contributed to our general knowledge about a very peculiar Tischeriidae genus, *Dishkeya* Stonis (see Stonis & Solis, 2020).

Our current examination of the material collected by Wolfram Mey in Charca Azul, El Cairo and Risaralda Sanctuario de Flora y Fauna, Otún-Quimbaya Station (Figs 1–4) in Colombia has resulted in the discovery of one more Tischeriidae species, *Astrotischeria recta* sp. nov. This new species is characterised by distinctive, relatively straight dorsal processes of the valva and an asymmetrical phallus of the male genitalia; therefore, the data on the species morphology and distribution broaden our knowledge about the Colombian Tischeriidae and *Astrotischeria* in general.

In this paper, we document and name the new species and briefly discuss the number of the Tischeriidae species in other Neotropical countries as well as provide renewed data.

MATERIALS AND METHODS

The description of *Astrotischeria recta* sp. nov. is based on materials deposited in the collection of the Natural History Museum in Berlin (*Museum für Naturkunde*, MfN), Germany, with further transfer of the holotype to the Universidad Nacional de Colombia.

Adults were caught at night time by using a battery (12 V)-operated light tower (F. Weber company, Germany), equipped with two 15 W super actinic light tubes.

Genitalia mounts on microscope slides were prepared following the 'traditional' method described in detail by Stonis et al. (2022b). The maceration of dissected abdomens was done in 10% KOH. Genitalia capsules and phallus were mounted in Euparal. Temporary and permanent genitalia mounts were examined and documented by using a Leica DM2500 microscope with an attached Leica DFC420 digital camera. Adults were measured and studied with a Lomo 10 and a Leica S6D stereoscopic microscopes, then photographed with a Leica S6D stereoscopic microscope and a Leica DFC290 digital camera.

Figs 1–4. Sites in Valle de Cauca, Colombia. 1 – habitat of *Astrotischeria recta* Diškus, Mey & Stonis sp. nov., Charca Azul, El Cairo; 2, 3 – same, Risaralda Sanctuario de Flora y Fauna; 4 – Otún-Quimbaya Station

DESCRIPTION OF THE NEW SPECIES

***Astrotischeria recta* Diškus, Mey & Stonis, sp. nov.**

urn:lsid:zoobank.org:act:F1F192B5-5398-4932-B4A2-22DAE13647F0

Type material. Holotype: 1 ♂, COLOMBIA: Valle de Cauca, El Cairo, Charca Azul, 4°49'13"N, 76°10'16"W, elevation 1750 m, 18.ii.2019, leg. Wolfram Mey, genitalia slide no. AD1122♂ (MfN). Paratypes (19 ♂): 16 ♂, COLOMBIA: same label data as holotype, genitalia slide no. AD1121♂ (one specimen without abdomen) (MfN); 3 ♂, COLOMBIA: Risaralda Sanctuario de Flora y Fauna, Otún-Quimbaya Station, 4°44'30"N, 75°34'76"W, elevation 1900m, 16.ii.2019, leg. W. Mey, collected at night time, genitalia slide no. AD1123 (one specimen with abdomen lost) (MfN).

Diagnosis. From the most similar *Astrotischeria atlantica* Diškus & Stonis, *A. baccharipha*ga Diškus & Stonis, and *A. cornuata* Diškus & Stonis, the new species differs in the relatively straight and wide dorsal processes of the valva, short lateral lobes of the uncus, and apically asymmetrical phallus.

Male (Figs 5–7). Forewing length 3.7–4.1 mm; wingspan 7.9–8.8 mm (n = 20).

Head. Frons and palpi golden cream; pecten small, slender, golden cream; frontal tuft comprised of long lamellar scales, yellowish grey, sometimes glossy white to golden brownish distally; collar relatively short and indistinctive, glossy, comprised of brownish grey lamellar scales; antenna longer than one half the length of forewing; flagellum dark grey on upper side and underside, with first basal segments (flagellomeres) usually yellowish cream on upper side.

Thorax. Tegula densely covered with brown-black ochre-tipped or brown-grey yellow-tipped scales. Thorax and forewing densely speckled with brown-grey ochre-tipped scales; spots, if present, indistinctive, irregular, formed of dark grey scales near to the tornus and costal margin of the forewing; fringe pale grey to cream grey, usually with an indistinctive (sometimes doubled) fringe line of brown-black scales; forewing underside grey-brown, slightly golden glossy with weak purple iridescence, without androconia or spots, except for some blackish special scales along the costal margin basally. Hindwing grey to pale grey on upper side and underside, without androconia; fringe pale grey. Legs brownish cream; forelegs and midlegs densely covered with brown-grey (occasionally brown-black) scales on upper side.

Abdomen. Brown-grey on upper side, yellowish ochre, speckled with grey-brown scales on underside; anal tufts lateral, indistinctive, brownish cream; genital segments covered with brownish cream lamellar scales.

Genitalia (Figs 9–17) with capsule 550–655 μm long (or 650–670 μm long if measured from vinculum to valval tips), 280–300 μm wide. Uncus (Figs 13–15) comprised of two longer lateral lobes and two short, rounded, distally pointed medial lobes (Fig. 14). Valva 410–430 μm long (excluding the basal process), with long, relatively straight and wide dorsal lobe (Fig. 10). Anellus (Fig. 11) thickened only laterally, with indistinctive 1–2 papillae basally. Vinculum large, distally triangular or rounded. Phallus about 550–590 μm long, slender, apically divided, with two asymmetrical apical lobes (Figs 8, 9).

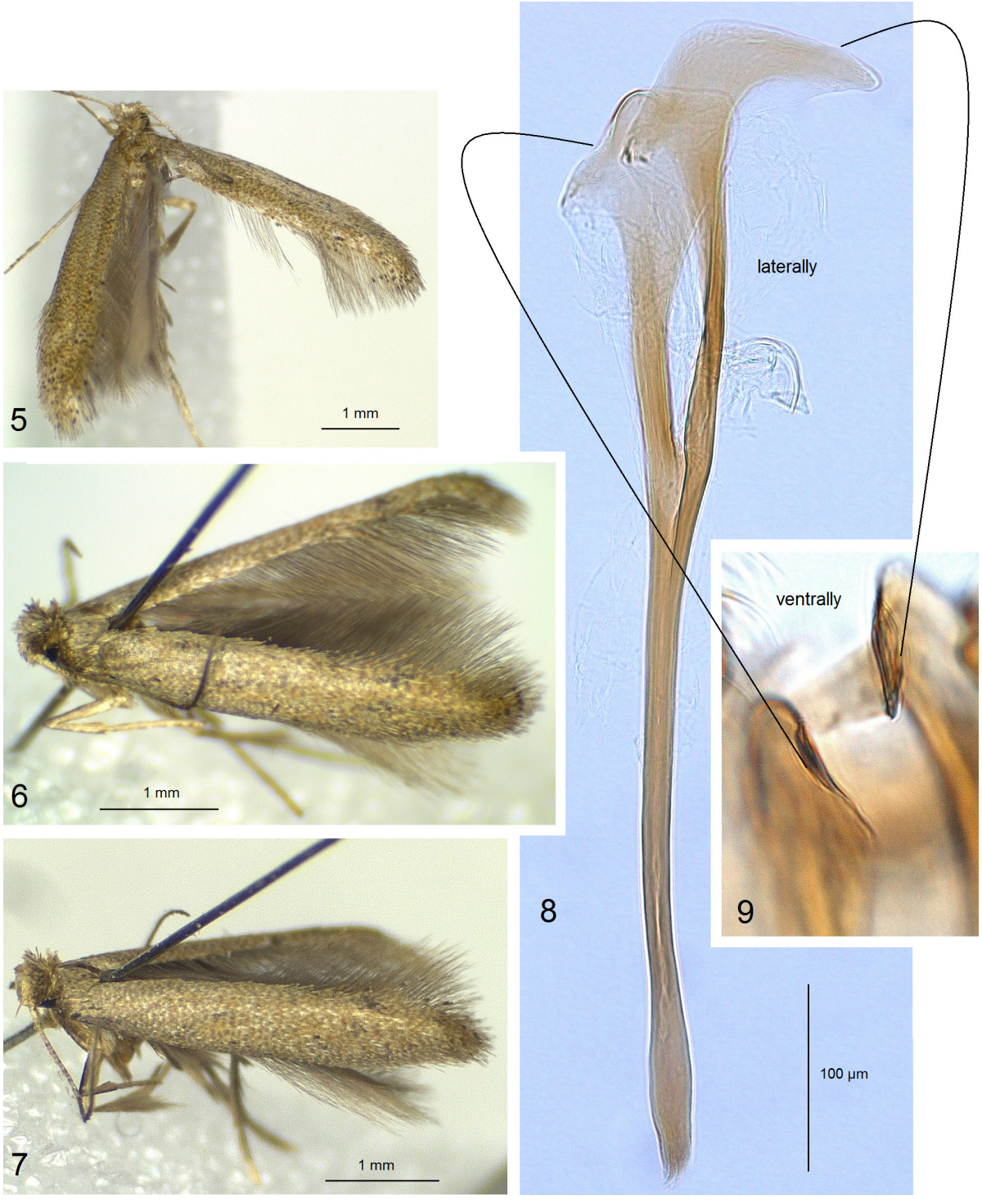
Female. Unknown.

Bionomics (Figs 1–3, 19). The host plant is unknown; probably *Baccharis* L., Asteraceae (see Remarks). Adults fly in February. Otherwise, the biology is unknown.

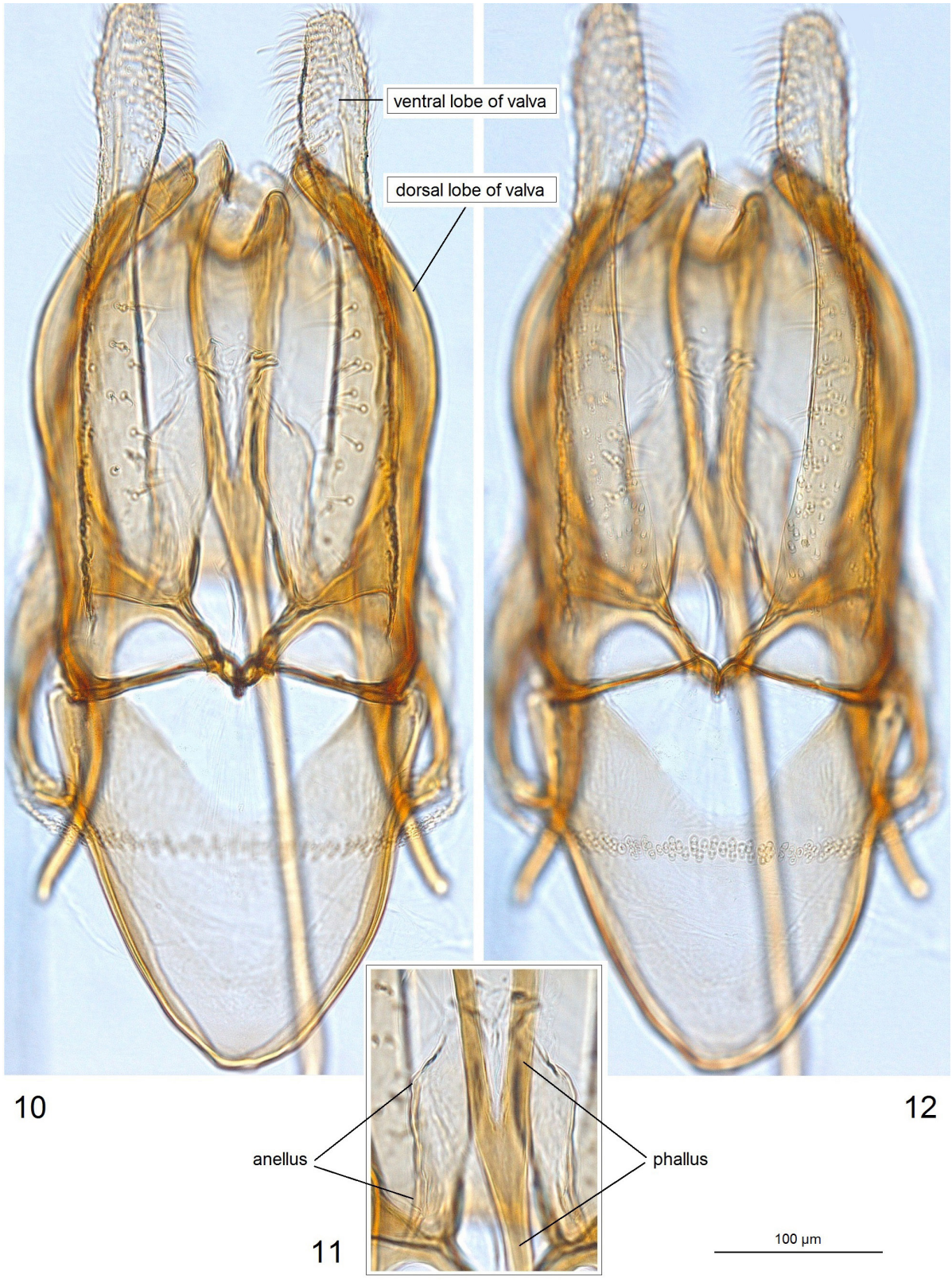
Distribution. The species is known from the subtropical habitats of western Colombia at an elevation of about 1750–1900 m.

Etymology. The species name is derived from the Latin *rectus* (straight, upright, correct) in the reference of the long and relatively straight dorsal processes of the valva and relatively long and typical *Astrotischeria* genital capsule.

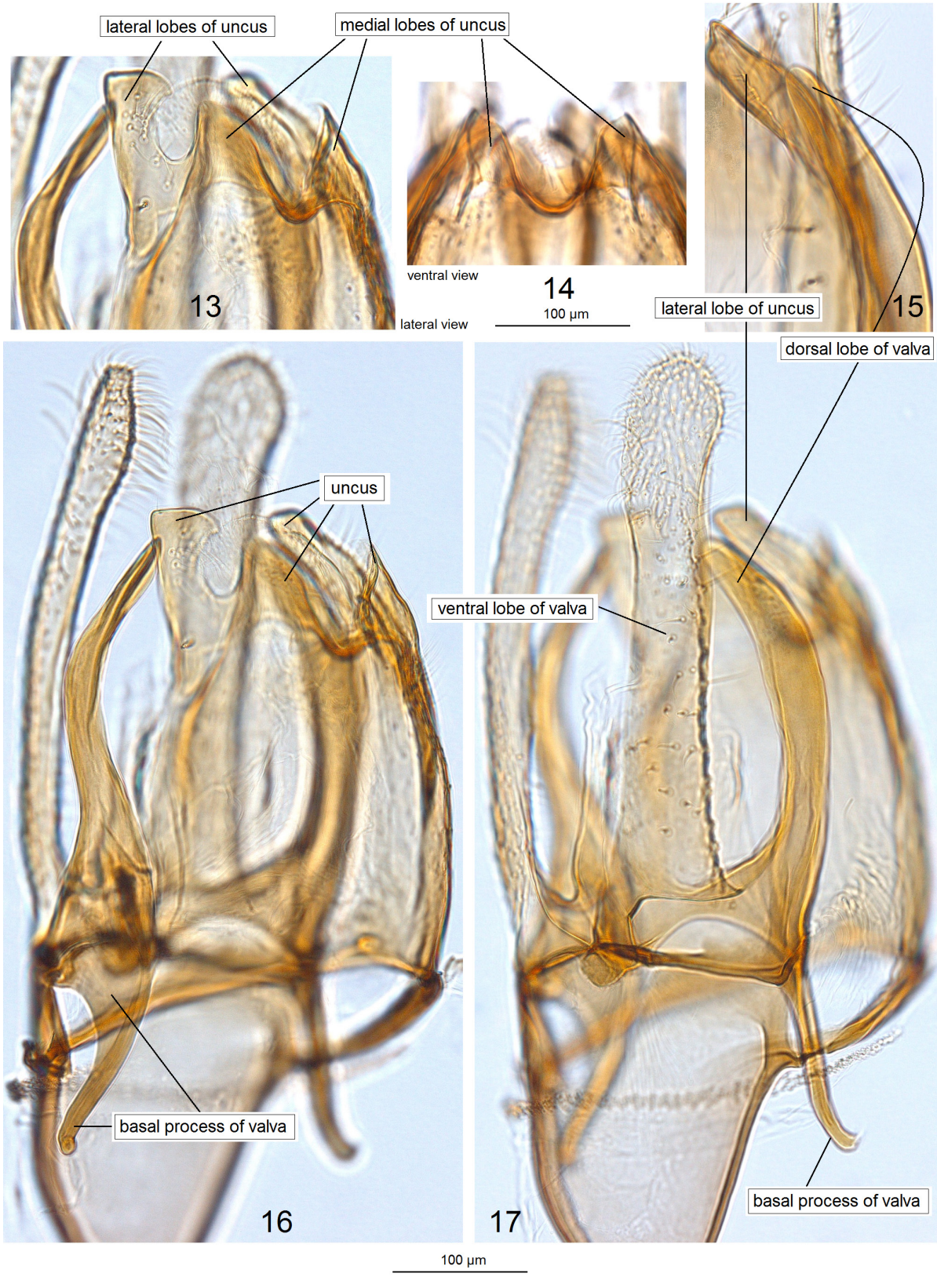
Remarks. The host plant of *Astrotischeria recta* sp. nov. is unknown, but all the most similar (and, supposedly, phylogenetically related) species are trophically associated exclusively with various plants of the genus *Baccharis* L. (Asteraceae). Therefore, it can be assumed that *A. recta* is also a *Baccharis*-feeding species.



Figs 5–9. *Astrotischeria recta* Diškus, Mey & Stonis sp. nov. 5 – male adult, holotype; 6, 7 – same, paratypes; 8 – phallus, lateral view, paratype, genitalia slide no. AD1121; 9 – same, ventral view of the apex, holotype, genitalia slide no. AD1122 (MfN)



Figs 10–12. *Astrotischeria recta* Diškus, Mey & Stonis sp. nov., holotype, genitalia slide no. AD1122 (MfN). 10, 12 – ventral view of capsule with phallus inside; 11 – anellus



Figs 13–17. *Astrotischeria recta* Diškus, Mey & Stonis sp. nov., paratype, genitalia slide no. AD1121 (MfN). 13–15 – uncus; 16, 17 – lateral view of capsule with phallus removed

DISCUSSION

Someone may be surprised to learn that Tischeriidae are rather poorly presented in many scientific collections. The documentation of these tiny but ecologically and phylogenetically interesting leaf-mining insects is usually hampered by the lack of qualified specialists and probably by the small size of the study object, the micro moths (Stonis et al., 2019a).

The total number of Tischeriidae of the Neotropics now amounts to 28 described species, including the newly discovered species described in this paper. Here, we present an updated account of the described Tischeriidae species by area or country: Caribbean countries (three species), Mexico (two species), Guatemala (11 species), Belize (14 species), Honduras (three species) Guyana (one species), Colombia (four species), Ecuador (ten species), Peru (13 species), Brazil (two species), Bolivia (seven species), Paraguay (one species), Uruguay (one species), Argentina (three species), and Chile (one species) (Fig. 18). Some species occur in more than one country, which explains some overlap, and the total (76) does not coincide with the total 64 species known from the region. We did not list countries which have no published Tischeriidae records.

Colombia is widely regarded as one of the world's 'megadiverse' countries possessing a great complexity of ecological, climatic, biological, and ecosystemic components and hosting extraordinary biodiversity that accounts for a significantly large proportion of the Earth's total biodiversity. Meanwhile, the current list of the Colombian Tischeriidae comprises only about 2% of the world's Tischeriidae. Do the four currently known Tischeriidae species (Fig. 20) already reflect the full picture of the actual diversity of the Colombian Tischeriidae?

The Tischeriidae issue is related not to 'a lack of species' but the lack of effort and insufficient sampling throughout Central and South America, particularly in Colombia. We can roughly speculate about 25–30 or even more species of Tischeriidae in Colombia awaiting their discovery.

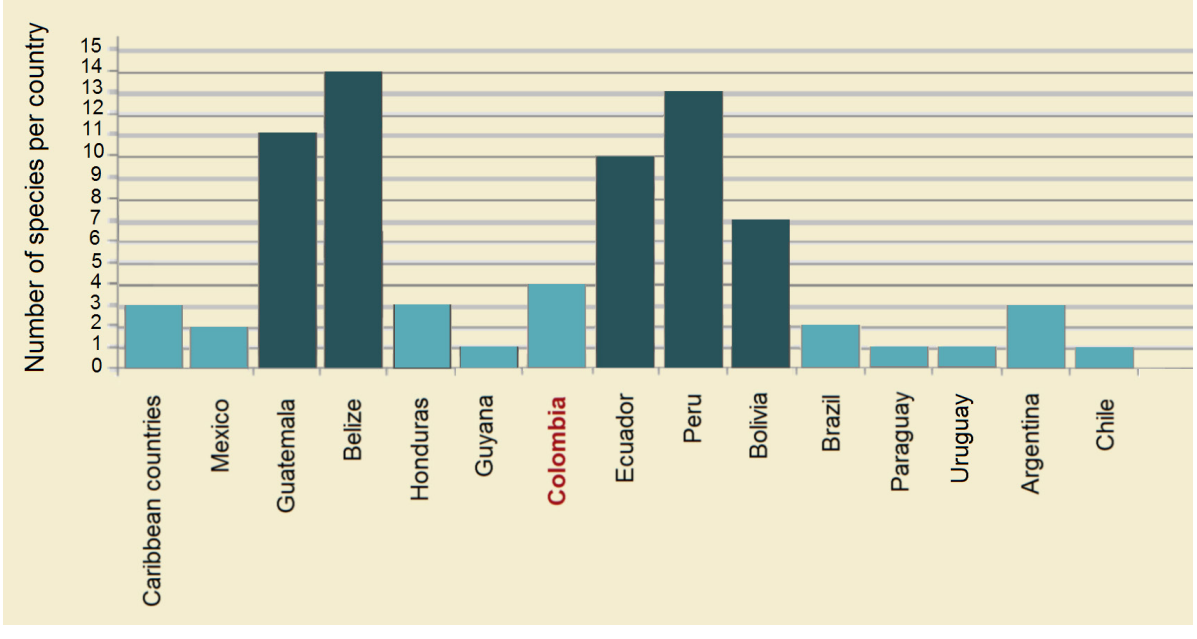
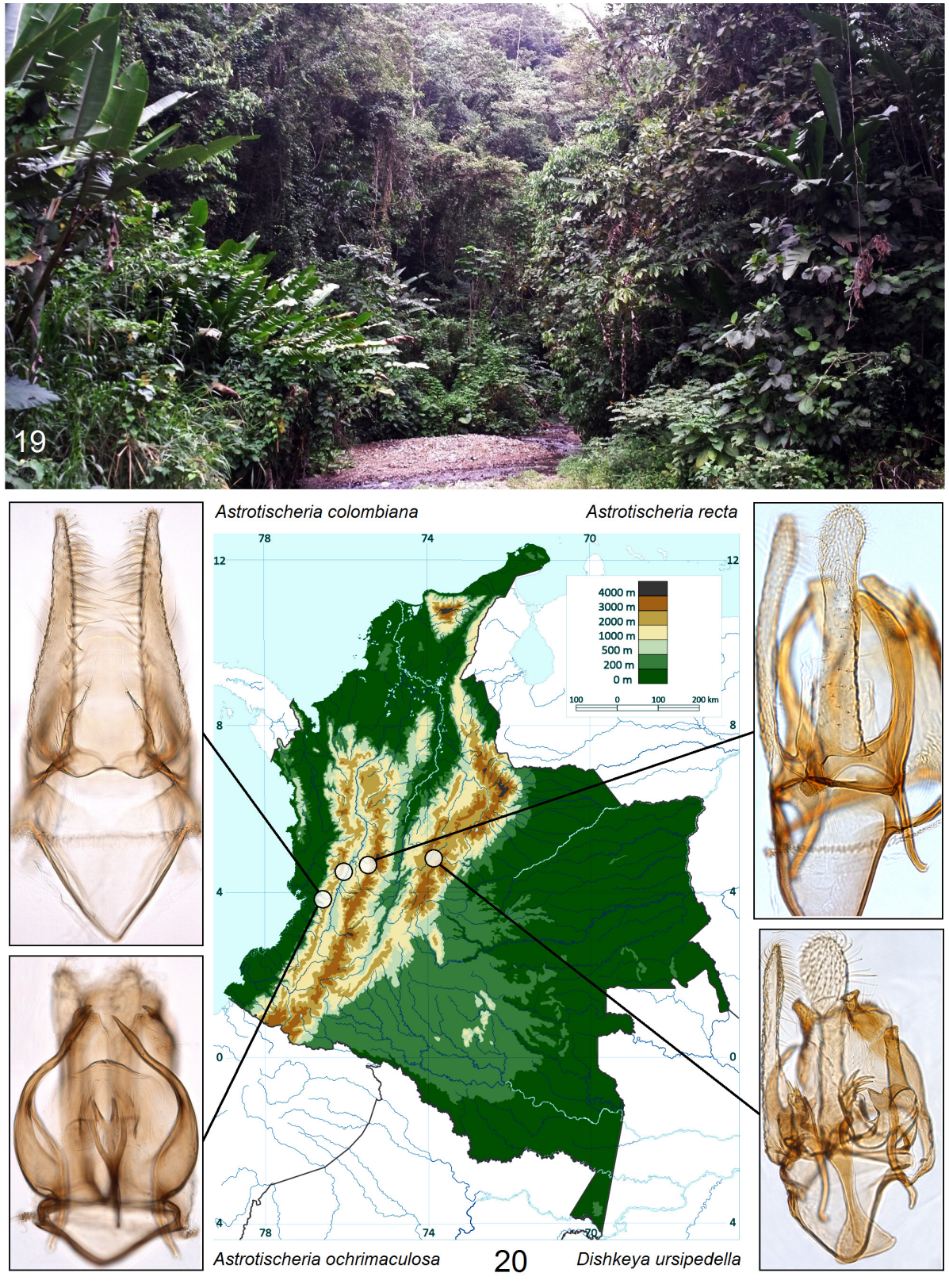


Fig. 18. An updated account of the described Tischeriidae species by country or area. Note that some species occur in more than one country, which accounts for some overlap, and the total (76) does not coincide with the total of 64 species known from the Neotropical region (countries with no published Tischeriidae records were not listed)



Figs 19–20. Colombian Tischeriidae. 19 – Risaralda Sanctuario de Flora y Fauna, habitat of *Astrotischeria recta* Diškus, Mey & Stonis sp. nov.; 20 – distribution map of all currently known Tischeriidae species from Colombia (map base, courtesy of Virgilijus Gerulaitis)

Recently, 14 Tischeriidae species were reported to have been recorded from a single tropical forest locality in Belize in Central America (Stonis et al., 2020a). To date, this is the highest number of Tischeriidae species recorded from a single locality worldwide and it exhibits a remarkable range of morphological structures. In its species numbers, the identified fauna from a single site in Belize (Las Cuevas) exceeds the entire European fauna and represents nearly one-fourth of the Tischeriidae fauna of the Neotropics (Stonis et al., 2020a).

As stated earlier (Stonis et al., 2015), the current situation with the Colombian Tischeriidae is still rather disconcerting and requires urgent action in planning and extensive taxonomic investigation of Tischeriidae in different ecosystems and habitats of this amazing country.

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Jonas Rimantas Stonis, Arūnas Diškus, Wolfram Mey

KETURIOS TISCHERIIDAE RŪŠYS KOLUMBIJOJE, TARP JŲ VIENA NAUJA *ASTROTISCHERIA*: AR NE PER MAŽAI TOKIAI BIOLOGINE ĮVAIROVE GARSIAI ŠALIAI?

Santrauka

Straipsnyje aprašoma nauja mokslui mažųjų šeriuotaūsių (Tischeriidae) rūšis – *Astrotischeria recta* sp. nov. Pateikiami naujausi, gerokai papildyti duomenys apie Tischeriidae rūšių skaičių kitose neotropinio regiono šalyse.

Raktažodžiai: *Astrotischeria*, minuotojai, naujos rūšys, mažieji šeriuotaūsiai