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RESEARCH PAPER

Megacraspedus (Lepidoptera: Gelechiidae) of the Altai Mountains with description of a new species belonging to the *M. majorella* group

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Abstract. The paper summarises the records of *Megacraspedus* Zeller, 1839 (Lepidoptera: Gelechiidae) species collected during the author's four trips to the Russian Altai in 2014–2019. A total of four species belonging to this genus were recorded here, of which one was found to be undescribed and two other species, namely *Megacraspedus dolosellus* (Zeller, 1839) and *Megacraspedus podolicus* (Toll, 1942), were new species for the area at the time. *Megacraspedus bidzilyai* sp. nov. is described here as a new species for science and is assigned to the *Megacraspedus majorella* species group. Its adults and genitalia of both sexes are figured in detail. *Megacraspedus latiuncus* Huemer & Karsholt, 2018 belonging to the same species group is recorded from Kyrgyzstan for the first time. Barcode data of all Altaic *Megacraspedus* species and *Megacraspedus latiuncus* are given.

Key words. Lepidoptera, Gelechiidae, *Megacraspedus bidzilyai*, *Megacraspedus latiuncus*, DNA barcoding, new species, taxonomy, Altai Republic, Kyrgyzstan, Russia, Palaearctic Region

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Introduction

Until recently, the genus *Megacraspedus* Zeller, 1839 was among the most neglected genera within the Gelechiidae family. It was only recently revised by Huemer & Karsholt (2018) which resulted in a number of taxonomic changes, including the descriptions of 44 new species. The author of this paper contributed a rich *Megacraspedus* material to the authors of the revision; however, most of the Altaic material was kept in the freezer and had not yet been processed at the time of preparation of that extensive work. This is the reason why the overview of the Altaic records and especially the description of the new species is presented separately in this contribution. The aim of this paper is to provide an overview of the *Megacraspedus* species occurring in the Altai Mts, describe a new species and add new knowledge about another little-known species from the *Megacraspedus majorella* species group.

Material and methods

Specimens and photographic documentation. The material presented was collected by the author using portable light traps with ultraviolet 8W/12V tubes. Preparations of genitalia slides followed standard methods described e.g., by Huemer & Karsholt (1999). Pinned specimens were photographed with a Canon 750D camera with a Canon MP-E-65 mm lens. Preparations of genitalia (in glycerol) were photographed with a Canon EOS 200D camera mounted on an Olympus CX31 stereomicroscope. All of the photos were edited in Helicon Focus 6.3.5 Pro and Adobe Photoshop CC. Photographs contain the numbers of genitalia preparations or photographed specimens according to what is possible to find of these specimens in Lepidoptera collections, various databases or other papers of the author.

The present contribution is based on material deposited in the following collections:

NMPC National Museum, Prague, Czech Republic;
ZMKU Zoological Museum Kiev, Taras Shevchenko National University, Kiev, Ukraine.

DNA barcoding. The selected eight specimens of *Megacraspedus* species presented in this study were barcoded at the Canadian Centre for DNA Barcoding (CCDB, Biodiversity Institute of Ontario, University of Guelph). Dry legs were used for DNA isolation. Barcode sequences of the mitochondrial COI gene were obtained (592–658 base-pair long segments of the 5' terminus of cytochrome c

oxidase I). Details of the sequenced specimens, comprising faunistic data and images, were uploaded to the Barcode of Life Data Systems (BOLD; Ratnasingham & Hebert 2007), and they are becoming public now. All sequences were subsequently calculated under the Kimura 2-parameter model using analytical tools of BOLD Systems v. 4.0. (http://www.boldsystems.org). A neighbor-joining tree of DNA barcode data was constructed using MEGA X software (Kumar et al. 2018) under the Kimura 2-parameter model for nucleotide substitutions. For each species I present the Barcode Index Numbers (BIN) (Ratnasingham & Hebert 2013) and compare the results obtained from Altaic moths with public and partly private data from other regions stored in the BOLD database.

Results

Family Gelechiidae Stainton, 1854
Subfamily Anomologinae Meyrick, 1926

Megacraspedus bidzilyai sp. nov.

(Figs 1–7, 19)

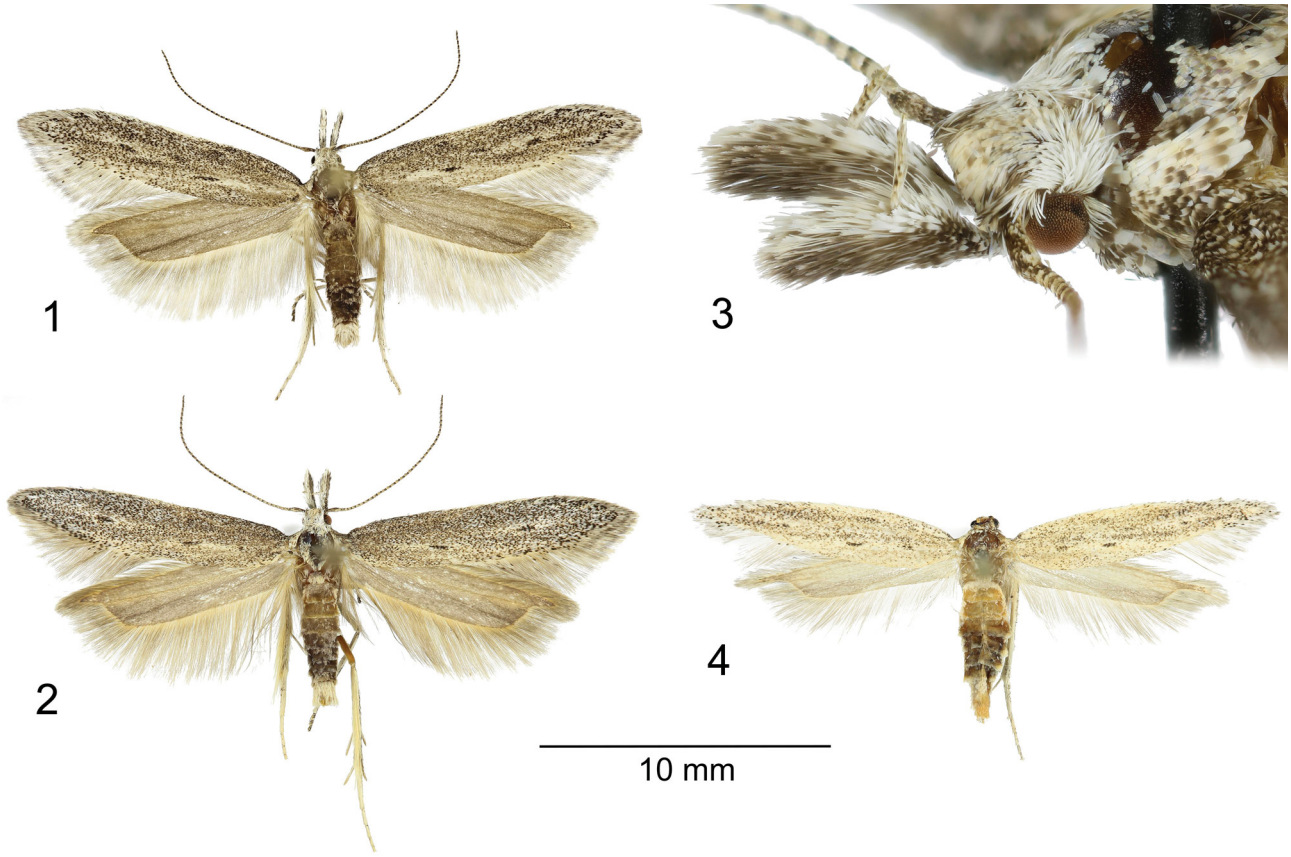
Type material. Holotype: ♂ (NMPC): **RUSSIA: Altai Republic:** Belyashi (Dzhazator) env. (25 km NW), confluence of Argut and Karagem rivers, 49°51′56″N, 87°10′22″E, rocky steppe, 1400 m a.s.l., 27.–28. vii.2017 (Barcode NMPC-LEP-0381), J. Šumpich leg. Paratypes: 51 ♂♂ 1 ♀ (49 ♂♂ 1 ♀ NMPC, 2 ♂♂ ZMKU): the same collecting data as holotype, gen. prep. Šumpich 18239, 21353, 21357.

Description. ***Adult.*** *Male* (Figs 1–3). Wingspan 17–21 mm (on average 20 mm). Segment 2 of labial palpus comparatively long, at upper border of outer surface white dusted with brown scales, lower part densely dusted with brown scales, exceptionally almost brown (Fig. 3), inner surface similarly coloured. Segment 3 white, mottled with brown scales, especially near top. Antennal scape with several long pecten scales. Flagellum brown, distinctly ringed with creamy ochre to whitish. Head, thorax and tegula creamy whitish, weakly mottled with brown scales. Forewing grey, slightly darker near costa, two small blackish dots at 1/3 and 2/3 of wing, fringes light grey. Hindwing dark grey with grey fringes.

Female (Fig. 4). Wingspan 19.5 mm. Similar to male but generally lighter, hindwings whitish. Head of the only available female is lost.

Variation. The degree of variability is very low. Fresh specimens appear darker and more contrasting.

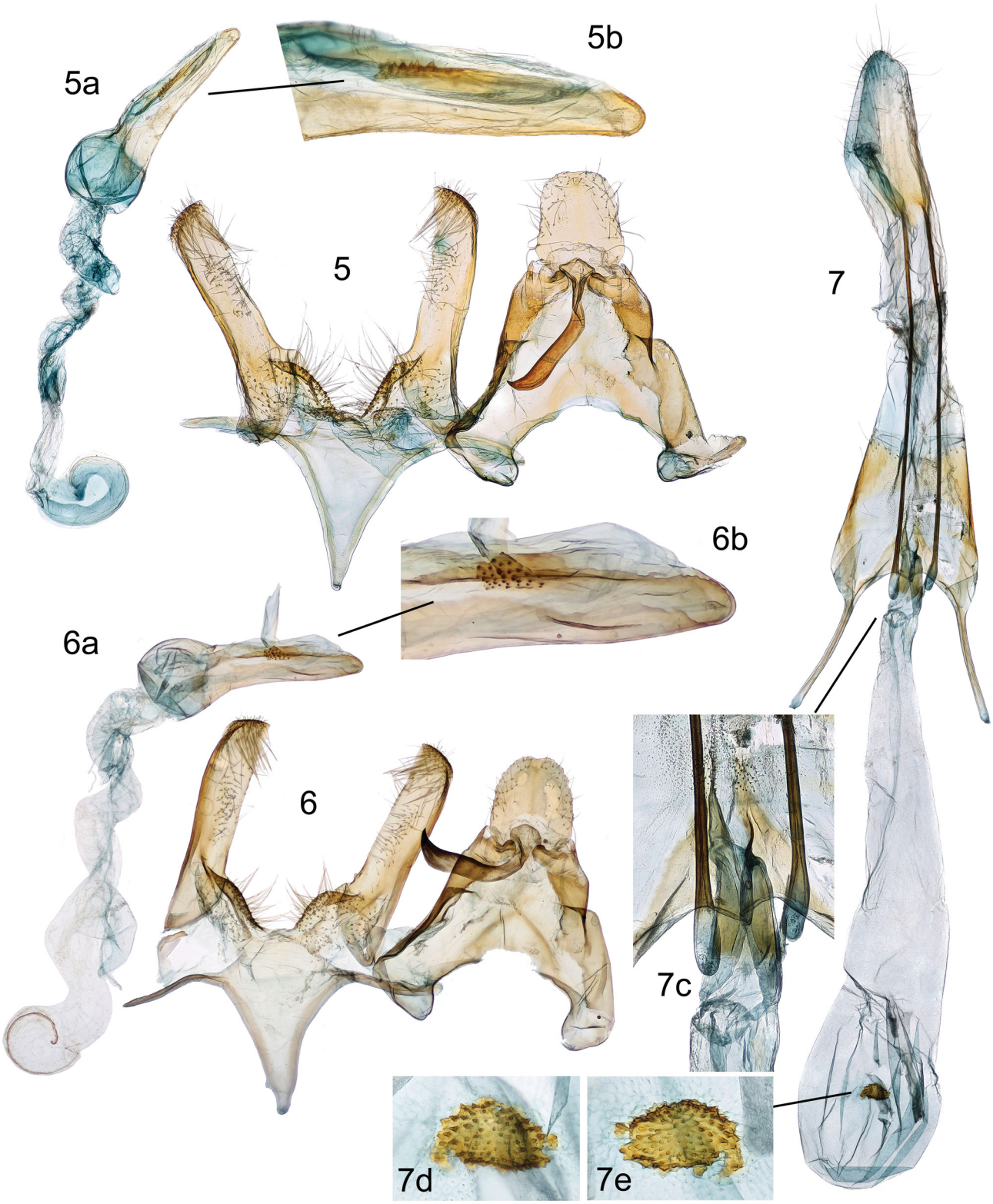
Male genitalia (Figs 5–6). Uncus broad, almost square, slightly rounded in corners of apical part. Gnathos stout, broad, slightly longer than uncus, middle part is straight, at end curved and sharply pointed. Tegumen broad, in shape of isosceles triangle, pedunculi broadly oval. Valva broad, regularly equal, extending to near top of uncus, apex distinctly rounded laterally and inwardly ended sharply, covered with setae, more densely in apex area. Separated sacculus not developed. Posterior margin of vinculum with comparatively deeper medial emargination. Saccus sub-triangular with weakly pointed apex, ratio maximum width to length approximately 0.7, lateral sclerites approximately 0.7 times maximum width of saccus. Phallus straight, bulbous coecum, in middle of phallus small sclerotised microplate



Figs 1–4. Adults of *Megacraspedus bidzilyai* sp. nov., Russia, Altai Mts., details in text. 1–3 – males: 1 – holotype (barcoded); 2 – paratype; 3 – head (enlarged); 4 – female, paratype.

with minute spines, ductus ejaculatorius twisted several times, apically with short interior sclerotisation.

Female genitalia (Fig. 7). Papilla analis large, elongated, apically rounded. Anterior apophysis very short, posterior apophysis 3.5 times longer than anterior apophysis. Segment VIII distinct, slightly sclerotized distally. Subgenital plate with triangular subostial sclerotisation, distally pointed, anteriorly delimiting oblong ostium bursae, anterior margin smooth, slightly concave, connecting with anterior apophysis. Colliculum comparatively short, tube-shaped, sclerotised, slightly expanding anteriorly. Ductus bursae gradually widening to weakly delimited, comparatively broad corpus bursae, entire length of ductus and corpus bursae only slightly longer than entire length



Figs 5–7. Genitalia of *Megacraspedus bidzilyai* sp. nov., Russia, Altai Mts., details in text. 5–6 – male genitalia, paratypes: a – phallus; b – detail of apical part of phallus. 7 – female genitalia: c – detail of ostium; d – signum; e – oposite view of signum.

of papilla analis and posterior apophysis. Signum small, in shape of rounded spiny plate.

Differential diagnosis. *Megacraspedus bidzilyai* sp. nov. is characterised by grey coloration and two small black dots on the forewings in combination with a fairly large wingspan. It is most similar to *M. majorella* Caradja, 1920, but *M. bidzilyai* sp. nov. is overall darker, a particularly distinct difference is in the hindwing, which is very light in *M. majorella*. Moreover, in M. *bidzilyai* sp. nov., the forewing is densely dusted with darker scales and appears finely speckled, while in *M. majorella* the overall coloring gives a solid plain impression. Male genitalia of *M. bidzilyai* sp. nov. are unique within the genus due to broadly sub-rectangular uncus, stout gnathos and a small sclerotised spined patch on the phallus. Similarity is evident only with species from the *M. majorella* group, but *M. majorella* has distinctly thinner valvae and broader saccus while *M. latiuncus* Huemer & Karsholt, 2018 has a less stout gnathos, posteriorly tapering valves and differently shaped spined patch on the phallus.

Molecular data. BIN: BOLD:ADR7289. The average intraspecific distance of the barcode region is unknown (n = 1). The minimum distance to the nearest neighbour, *Megacraspedus latiuncus* (BIN: BOLD:AEK4287), is 5.93% (p-dist) (Fig. 18).

Etymology. The species name is dedicated to the excellent Ukrainian lepidopterologist Oleksiy Bidzilya (Institute for Evolutionary Ecology of the National Academy of Sciences of Ukraine, Kyiv, Ukraine), who has made an exceptionally significant contribution to the knowledge of the gelechiids of Siberia including the Russian Altai Mountains.

Biology. Host plant and early stages are unknown. The adults were collected at an altitude of 1400 m at the end of July. The type locality is extremely low-lying in the geomorphological conditions of the high parts of the Russian Altai, surrounded by several high mountain ridges with glacier-covered peaks, difficult to reach and substantially isolated from places with comparable natural conditions (Figs 19–20).

Distribution. Russia: Altai Republic.

Remarks. Based on male genitalia characters, *Megacraspedus bidzilyai* sp. nov. belongs to the *Megacraspedus majorella* species group, which was established by Huemer & Karsholt (2018). This group comprised only two species so far, and no female is known from either of them. Huemer & Karsholt (2018) point to the uncertain systematic position of this species group due to the absence of supportive molecular data. However, since molecular data have been obtained for two species of this group, an updated annotated checklist of the *M. majorella* group is attached. Specific structures in the male genitalia of all three species and the close genetic relationship between *M. latiuncus* and *M. bidzilyai* sp. nov. confirm the correctness of establishing a separate species group. The description of the female of *M. bidzilyai* sp. nov. can be considered as the initial basis for the characteristics of the females of *M. majorella* group.

Checklist of *Megacraspedus majorella* species group

Megacraspedus majorella Caradja, 1920

Type locality. Kyrgyzstan (Alai Mountains).

Distribution. Kyrgyzstan, probably endemic to the Alai Mountains (Caradja 1920, Huemer & Karsholt 2018).

Megacraspedus latiuncus Huemer & Karsholt, 2018

(Figs 15–17)

Type locality. Kazahkstan (Zailiskiy Alatau).

Material examined. Kyrgyzstan: North Tian-Shan Mts, Issyk-Kul Region, Kungei Ala-Too range, 13 km NW of Balykchy, 42°32.5′N, 76°4.0′E, 3050 m, 24.vii.2019, 1 ♂ (gen. prep. 21351 Šumpich), (Barcode NMPC-LEP-0664), I. Dvořák leg. (NMPC).

Molecular data. BIN BOLD:AEK4287. The average intraspecific distance of the barcode region is unknown (n = 1). The distance to the nearest neighbour, *M. bidzilyai* sp. nov. (BIN: BOLD:ADR7289), is 5.93% (p-dist) (Fig. 18).

Biology. In Kyrgyzstan, it was collected in a grassy steppe slope at an altitude of 3050 m (Fig. 21).

Distribution. Northern Tian-Shan Mts in south-eastern Kazahkstan (Huemer & Karsholt 2018) and northern Kyrgyzstan (this paper).

Megacraspedus bidzilyai sp. nov.

Type locality. Russia (Altai Mountains).

Distribution. Russia, probably endemic to the Altai Mountains (this paper).

Faunistic records from Russian Altai

Megacraspedus dolosellus (Zeller, 1839)

(Figs 8–9)

Ypsolophus dolosellus Zeller, 1839. Type locality: Austria.

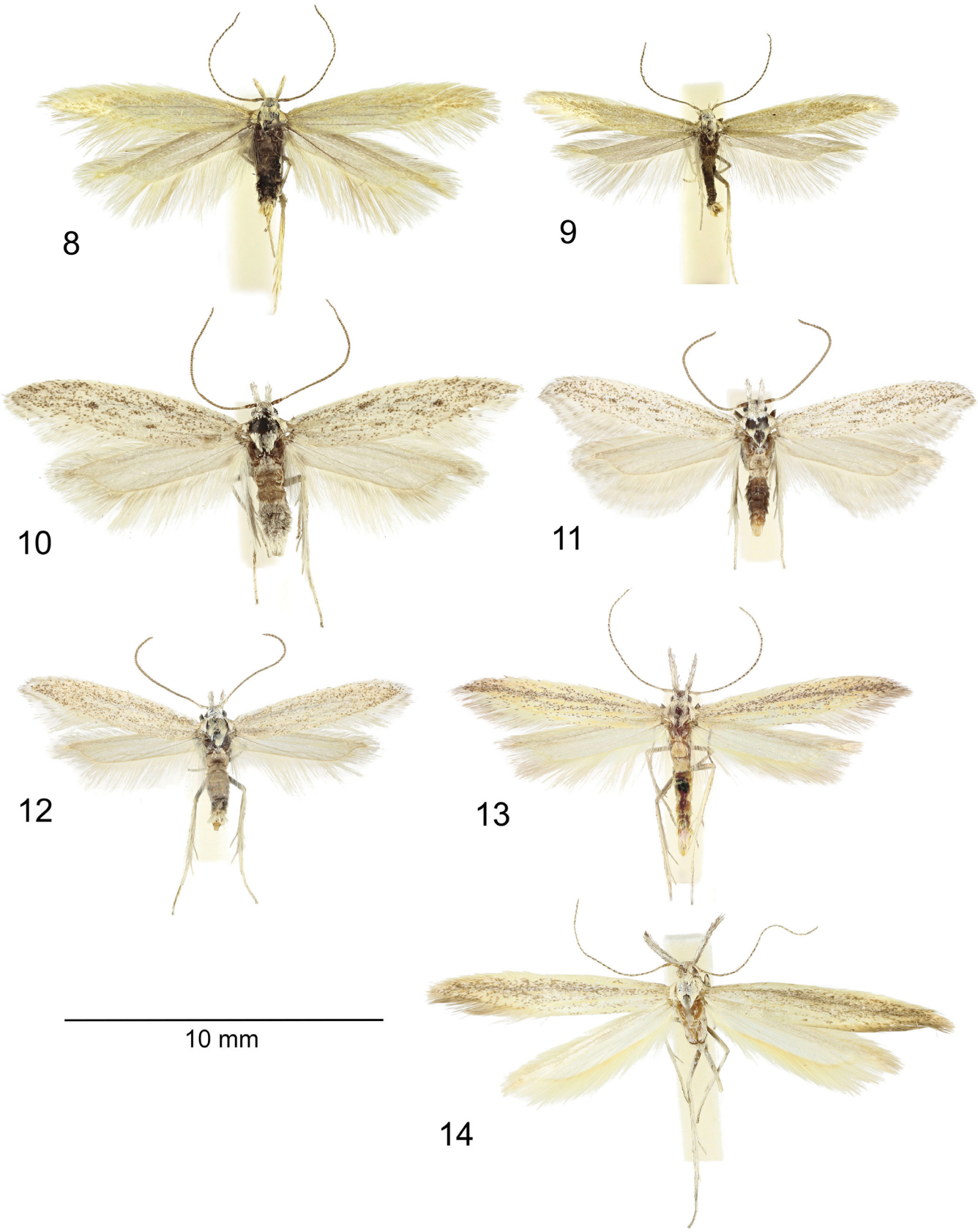
= *Ypsolophus separatellus* Fischer von Röslerstamm, 1843. Type locality: Austria.

= *Megacraspedus incertellus* Rebel, 1930. Type locality: Bulgaria.

Records. Huemer & Karsholt (2018): Katun valley near Katanda village, environs of Aktash village, Kuraisky khrebet; Ponomarenko (2019) (checklist).

Material examined. RUSSIA: Altai Republic: Aktash vill., 50°19′12″N, 87°36′00″E, grassy steppe, rocks, 1400 m, 11.vii.2014, 1 ♂ (Barcode NMPC-LEP-0383), J. Šumpich leg. (NMPC); the same locality but 21.vi.2015, 1 ♂, J. Šumpich leg. (NMPC); the same locality but 24.vi.2019, 8 ♂♂, J. Šumpich leg. (NMPC); Kosh-Agach Distr., Kurai env. (15 km SW), Dzhangyskol lake, 50°10′49″N; 87°44′19″E, coniferous forest/steppe, 1830 m, 24.–25.vi.2015, 1 ♂ (Barcode NMPC-LEP-0384), J. Šumpich leg. (NMPC); the same locality but 29.–30. vi.2019, 6 ♂♂, J. Šumpich leg. (NMPC); Shebalino Distr., Cherga vill. (8 km W), 51°34′04″N; 85°28′33″E, rocky slopes, steppe, 580 m, 4 ♂♂ (Barcode NMPC-LEP-0615), J. Šumpich leg. (NMPC).

Molecular data. A genetically extremely variable species resulted in 23 BINs (Huemer & Karsholt 2018), which is a unique phenomenon within the Gelechiidae (Huemer et al. 2020). The mean intraspecific divergence of the barcode region is 7.5% and the maximum is 13.8% (Huemer & Karsholt 2018). Altaic specimens are clustered in two branches with different BINs: BOLD:ACB3319 (n = 2; 2 public, both from Altai) [as "BIN dolo20" in Huemer & Karsholt 2018], where the average intraspecific



Figs 8–14. Adults of *Megacraspedus* taxa recorded in Altai Mts. (Russia). 8–9 – *M. dolosellus* (Zeller, 1839): 8 – Aktash (barcoded); 9 – surroundings of Dzhangyskol lake (barcoded). 10–12 – *M. leuca* (Filipjev, 1929): 10–11 – Karagem valley; 12 – Kurai. 13–14 – *M. podolicus* (Toll, 1942): 13 – Chulyshman valley; 14 – Aktash.

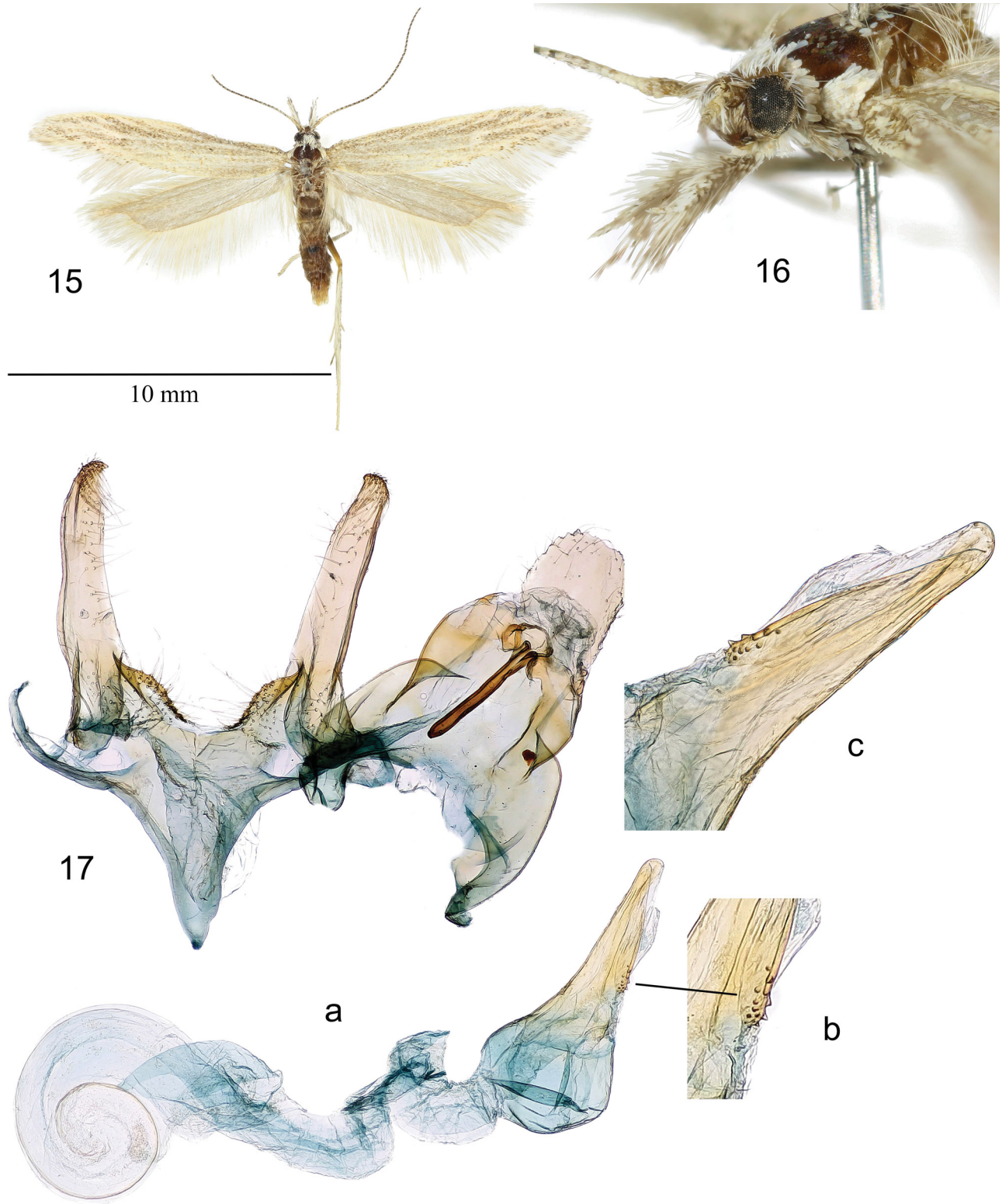
divergence of the barcode region is 0.96% (p-dist), and BOLD:ACZ3530 (n = 8, 8 public, all from Altai) [as "BIN dolo21" in Huemer & Karsholt 2018], where the average intraspecific divergence of the barcode region is 0.03% (p-dist) (maximum distance 0.16% (p-dist)). Distance between these clusters is 1.38% (p-dist).

Distribution. From Europe (not recorded in northern parts of the continent) to Central Asia (Huemer & Karsholt 2018, Gastón & Vives Moreno 2021). Based on the current knowledge, the Altai Mountains seem to be the easternmost area of its occurrence.

Megacraspedus leuca (Filipjev, 1929)

(Figs 10–12)

Nothris leuca Filipjev, 1929. Type locality: Russia (Sajan Mts).
= *Megacraspedus kaszabianus* Povolný, 1982. Type locality: Mongolia.



Figs 15–17. *Megacraspedus latiuncus* Huemer & Karsholt, 2018, Kyrgyzstan, Issyk-Kul (barcoded). 15 – adult. 16 – head (enlarged). 17 – male genitalia: a – phallus; b – detail of spines; c – detail of apical part of phallus.

Records. Ponomarenko (2008) (checklist); Huemer et al. (2017): Sajlyugem River valley near Kokorya village, Tabozhok River valley near Kosh-Agach village; Huemer & Karsholt (2018): environs of Kosh-Agach village, environs of Kurai village, Tabozhok River valley near Kosh-Agach, Sajlyugem River valley near Kokorya village, Aktash village; Ponomarenko (2019) (checklist).

Material examined. RUSSIA: Altai Republic: Aktash vill., 50°19′12″N; 87°36′00 ″E, grassy steppe, rocks, 1400 m, 11.vii.2014, 1 ♂, J. Šumpich leg. (NMPC); Kosh-Agach Distr., Kurai env. (6.5 km SW), 50°10′35 ″N; 87°53′55 ″E, grassy steppe, 1550 m, 9.–10.vii.2014, 19 ♂♂, J. Šumpich leg. (NMPC); the same locality but 30.vii.2017, 9 ♂♂ (Barcode NMPC-LEP-0385), J. Šumpich leg.; Belyashi (Dzhazator) env. (25 km NW), confluence of Argut and Karagem rivers, 49°51′56 ″N, 87°10′22 ″E, rocky steppe, 1400 m, 27.–28.vii.2017, 101 ♂♂ (Barcode NMPC-LEP-0386), J. Šumpich leg.; Kosh-Agach Distr., Chagan-Uzun env., Krasnaya Gorka hill, 50°05′00 ″N; 88°25′15 ″E, rocky steppe, 1870 m, 29.vi.2015, 1 ♂, J. Šumpich leg.; the same locality but 1.–3.vii.2019, 5 ♂♂, J. Šumpich leg.; Belyashi env. (56 km SE), 49°38′N; 88°12′E Dzhazator valley, mountain meadows near Tara river, 2300 m, 25.–26. vii.2017, 1 ♂, J. Šumpich leg.; Kosh-Agach Distr., Zhana-Aul env., 49°48′28 ″N, 88°56′17 ″E, steppe, rocky steppe, 2000 m, 24.vii.2017, 17 ♂♂, J. Šumpich leg. (all NMPC).

Molecular data. BIN BOLD:ACB3260 (n = 12; 10 public, 10 from Altai). The average intraspecific divergence of the barcode region is 0.05% (maximum 0.32%). The distance to the nearest neighbours, *M. attritellus* Staudinger, 1871 (BIN: BOLD:ACE2700) and *M. skulei* Huemer & Karsholt, 2018 (BIN: BOLD:ACM0982), is 6.6% (p-dist).

Distribution. Russia (Altai Republic, Buryatia, Chitin Region, Tuva) (Ponomarenko 2019), Mongolia (Povolný 1982).

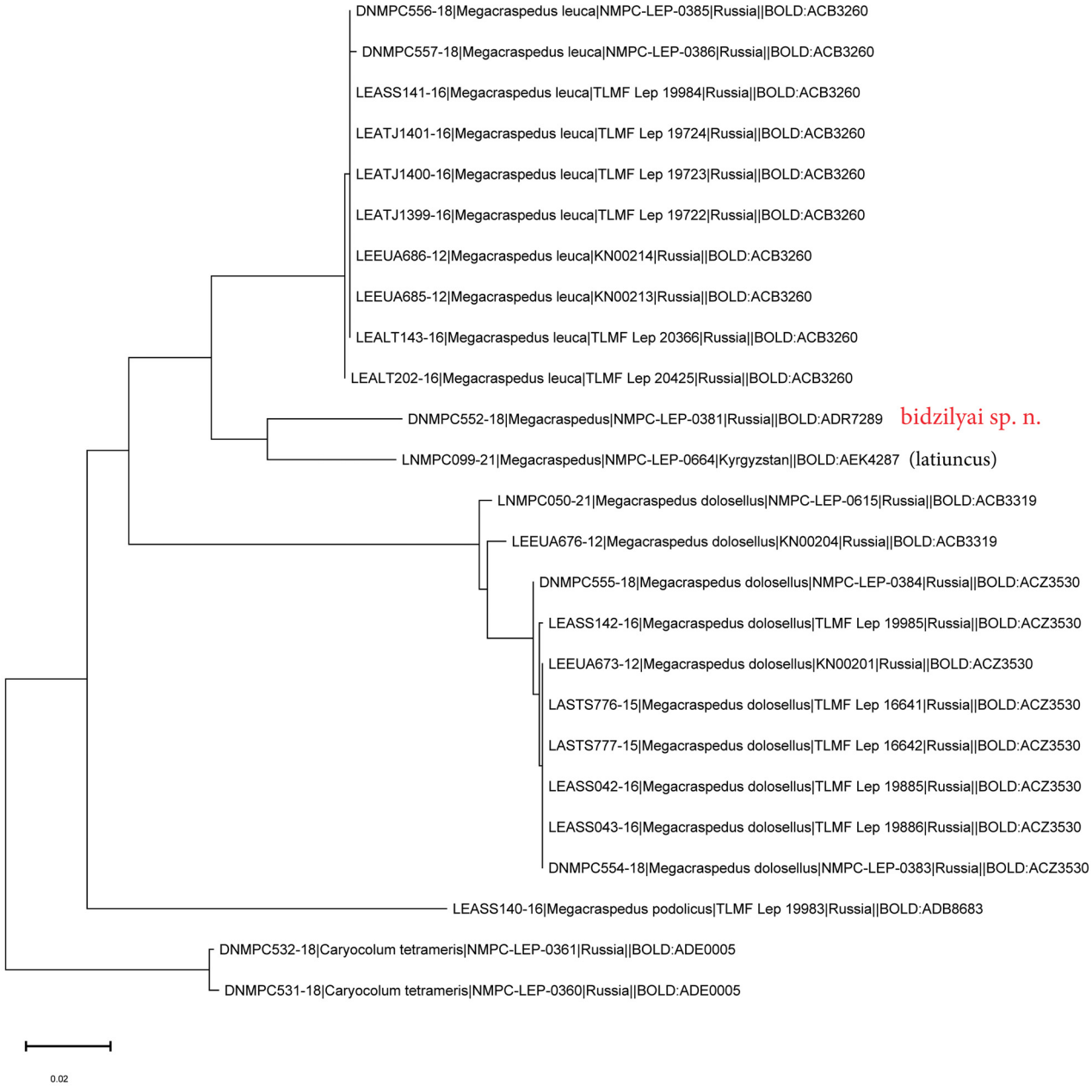


Fig. 18. Neighbor-joining tree of *Megacraspedus* species recorded in Altai Mts., *M. latiuncus* Huemer & Karsholt, 2018, and *Caryocolum tetrameris* (Meyrick, 1926) as an outgroup. Source: Barcode of Life Database, cf. Ratnasingham & Hebert (2007).

Remark. The species is widely distributed in the Altai Mountains and is the most common gelechiid species there.

Megacraspedus podolicus (Toll, 1942)

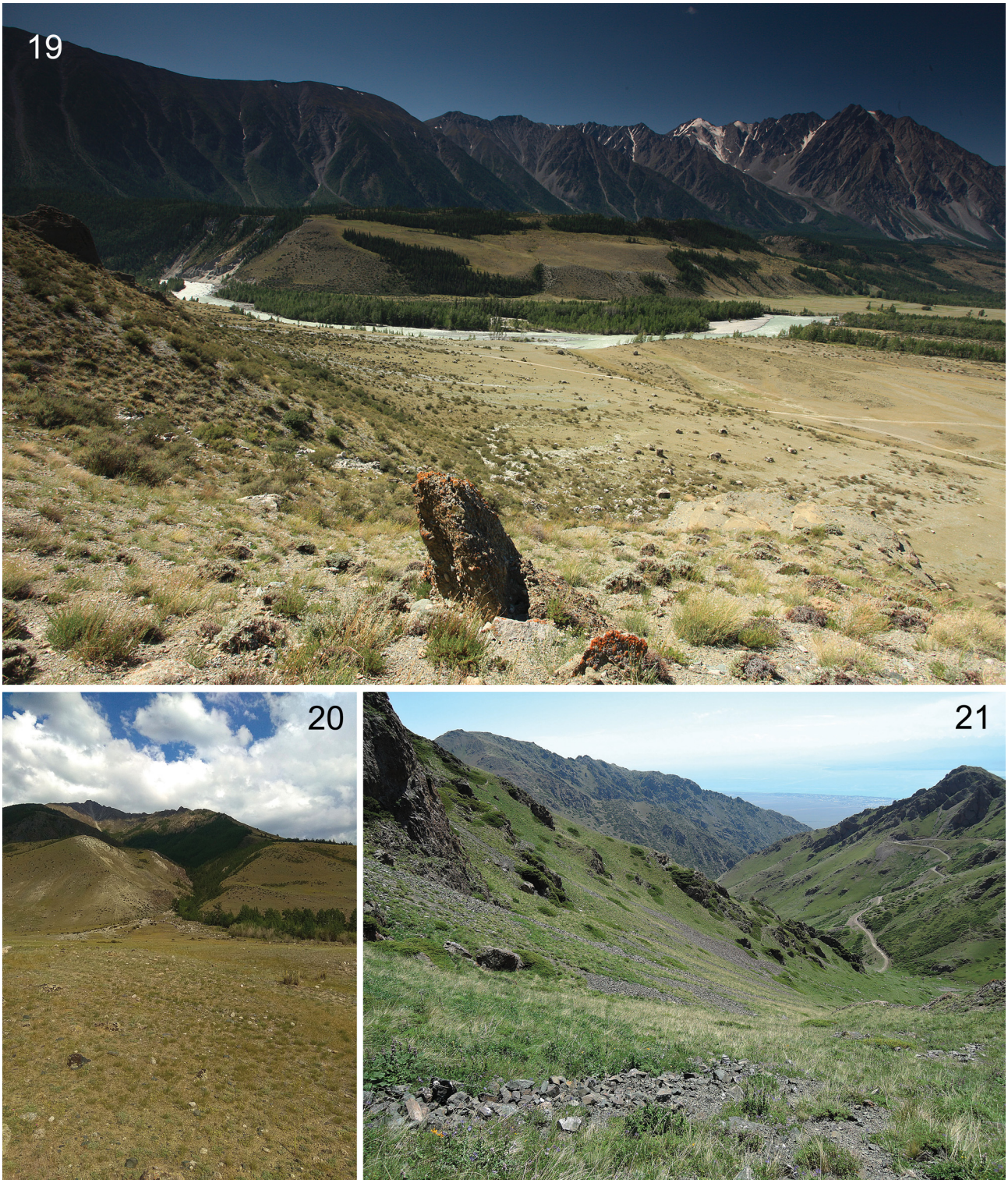
(Figs 13–14)

Chilopselaphus podolicus Toll, 1942. Type locality: western Ukraine.

Records. Huemer & Karsholt (2018): Aktash; Ponomarenko (2019) (checklist); Huemer & Tokár (2021): Altai Mts.

Material examined. RUSSIA: Altai Republic: Aktash vill., 50°19′12″N; 87°36′00″E, grassy steppe, rocks, 1400 m, 11.vii.2014, 1 ♂ (Barcode TLMF Lep 19983) (gen. prep. GU16/1459 P. Huemer), J. Šumpich leg. (NMPC); 45 km N of Ulagan vill., Chulyshman valley, 51°01′03″N; 88°00′39″E, grassy steppe, rocks, 600 m, 26.–27.vi.2019, 2 ♂♂, J. Šumpich leg. (NMPC); the same locality but 4.–5.vii.2019, 3 ♂♂ (gen. prep. Šumpich 21379), J. Šumpich leg. (NMPC).

Molecular data. BIN BOLD:ADB8683 (n = 5; 1 public, 1 from Altai). The average intraspecific divergence of the



Figs 19–21. Habitats of *Megacraspedus* species. 19–20 – *M. bidzilyai* sp. nov., Russia, Altai Mts. 21 – *M. latiuncus* Huemer & Karsholt, 2018, Kyrgyzstan, North Tian-Shan Mts. (19 – photographed by Z. Růžičková, 21 – photographed by I. Dvořák).

barcode region is 0.33% (maximum 0.88%). The distance to the nearest neighbour, a specimen from Croatia, in BOLD currently identified as *M. balneariellus* (Chrétien, 1907) (BIN: AEC7522, n = 1), is 2.24% (p-dist). The distance to the second nearest neighbour, *M. balneariellus* (BIN: ADR2637, n = 2), is 6.3% (p-dist).

Distribution. Austria, Hungary, Romania, Russia (S Ural, Altai Mts), Ukraine (Huemer & Karsholt 2018).

Remark. The first report from the Altai Mountains (Huemer & Karsholt 2018) was based on the above presented record from Aktash in 2014.

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