



Montana tomorri and *Montana dani* (Orthoptera: Tettigoniidae), two new species of bush-crickets from the mountains of south Albania

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Abstract

Two new taxa of Platycleidini have been discovered in southern Albania, with one of them extending its range to the Greek border. In this paper, we analyse their morphological features, the characteristics of their acoustic signals, and phylogenetic relationships. These taxa clearly belong to the cluster of species comprising the four genera *Montana*, *Amedegnatiana*, *Parnassiana*, and *Metrioptera* s. str. The results of this study suggest their placement within the genus *Montana*, and we describe two new species: *Montana tomorri* **sp. nov.** and *Montana dani* **sp. nov.** Our findings highlight the urgent need for a reassessment of the tribe Platycleidini using integrative approaches that incorporate molecular and bioacoustic data, in order to better understand monophyletic groups and evaluate the consistency of current generic classifications.

Key words: Balkans, mountain endemism, Platycleidini, bioacoustics, phylogeny

Introduction

For Orthoptera in Europe, the Balkan Peninsula is one of the hotspots of biodiversity and endemism (Kenyeres *et al.* 2009; Hochkirch *et al.* 2016). The southern location and mild winters in this area, as well as its fragmented geography and proximity to Anatolia, have helped its biodiversity to flourish. A notable percentage of endemic species are found in mountain ranges. Endemic genera are also present, such as *Oropodisma* Uvarov, with 12 described species, and *Parnassiana* Zeuner, with 13 described species (Cigliano *et al.* 2025), and several species still awaiting formal description (Willemse *et al.* 2018).

Much of the 20th century Albania was inaccessible to foreign zoologists due to the country's isolation. Consequently, biodiversity studies almost ceased during this period. Following the political transition, enthusiastic researchers from the Hungarian Natural History Museum (HNHM) began an intensive exploration of Albanian fauna in 1992 (Fehér *et al.* 2004). The expeditions continued for over two decades (Murányi *et al.* 2011).

During a trip to Mt. Tomorr in 2006, Gastropoda and Plecoptera specialists collected a single specimen of mountain bush-cricket. The specimen was sent to the late Fer and Luc Willemsse for identification, along with other Albanian Orthoptera material from the HNHM. Fer and Luc Willemsse recognised it as an undescribed species of the tribe Platycleidini but it has not been formally described due to a lack of additional material. In 2013, another mountain bush-cricket, closely related, was collected in Mt. Trebeshina as part of a nutritional study of the Greek meadow viper (*Vipera graeca* Nilson & Andrén); the body parts of this species were also identified in the excrements of vipers (Mizsei *et al.* 2019). Since 2014, several co-authors of this paper have collected specimens belonging to these two species on several mountains of south Albania, and one locality across the border with Greece (Fig. 1).

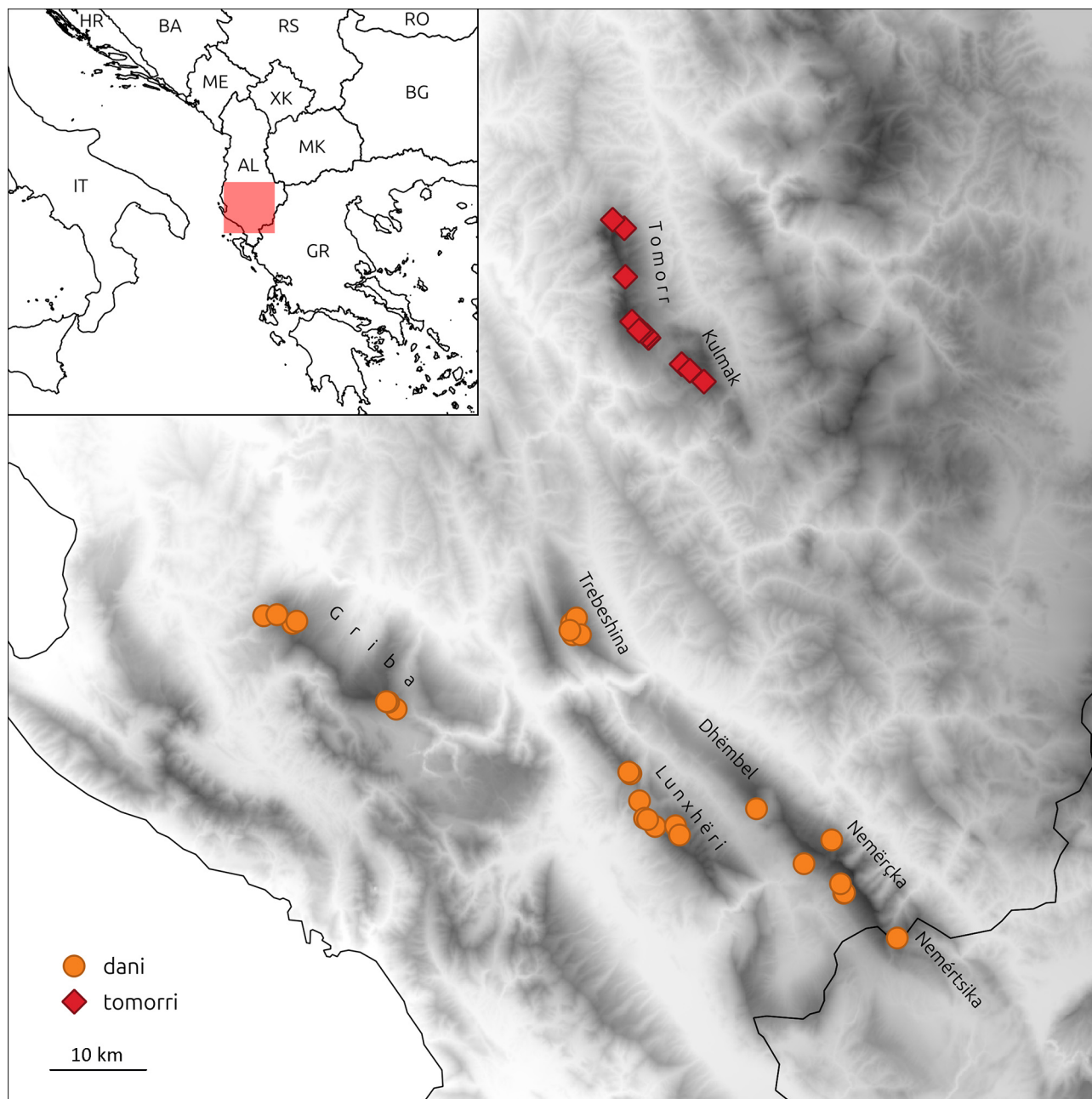


FIGURE 1. Map of localities studied where the new species have been found.

The two new species belong to the tribe Platycleidini, which includes 25 genera with over 200 species (Cigliano *et al.* 2025) distributed across the northern hemisphere and Australia, most species being found in the Palearctic region. Excluding genera that show clear differences in the shape of the pronotum, prosternum, ovipositor or cercus, there are four genera left that superficially resemble the new Albanian species: *Amedegnati* Massa & Fontana, with a single species found in southern France; *Montana* Zeuner, with 23 species ranging from the island of Madeira

in the west to Mongolia and western China in the east; *Parnassiana* Zeuner, currently with 13 species restricted to Greece; and *Metrioptera* s.str. Wesmaël, with 10 species, distributed across the Palearctic region including three mountain species found in Bosnia and Herzegovina and Montenegro.

In this study, we examined and described these bush-crickets based on morphology and acoustic traits as new species to science, study their relationships based on a partial sample of taxa from tribus Platycleidini using a nuclear marker, and discuss their phylogenetic position in the tribus.

Material and methods

Collecting and preservation

Most of the specimens were preserved in 70% alcohol, some were preserved in 96% ethanol, while others were pinned. In some cases, nymphs were collected in the field and reared in the laboratory until they reached the adult stage. The information about the studied samples is provided in Tables 1 and 2.

Depositories

HNHM—Hungarian Natural History Museum, Budapest, Hungary

RMNH—Naturalis Biodiversity Center, Leiden, Netherlands

CCh—Institute of Biodiversity and Ecosystem Research, Sofia, Bulgaria (Collection Chobanov)

CLD—Collection Lemonnier-Darcemont, Parga, Greece

CSz—Collection Szövényi, Budapest, Hungary

Measurements and photographing

For the measurements, we used a stereomicroscope with ocular micrometer. As the preservation modes of specimens were different (70% or 96% ethanol, or dry preparation) we performed statistical analysis on chitinized parts (such as hind femur length, pronotum, ovipositor), not impacted by the preservation (checked with ANOVA analysis). For the other cases, the preservation mode is indicated.

Focus stacking photos were taken with stereomicroscopes equipped with digital cameras; some individual images were combined with Zerene Stacker software.

In the nomenclature of wing veins, we followed Béthoux & Nel (2001).

Bioacoustics

Song recordings were made in captivity with the following equipment: M-Audio MicroTrack II digital voice recorder with its own stereo “T” microphone (24 bit/96 kHz); Zoom H4n digital audio recorder (24 bit/96 kHz); Casio EXILIM EX-ZR200; ZOOM H2 (96kHz/24 bit) using embedded or Pettersson D500 microphone; Tascam DR-680MKII (192 kHz/24 bit) with Pettersson D500 microphone. The singers were caged in plastic tubes or gauze cages with the microphone fixed or handheld at distances between 5 and 60 cm. The list of specimens recorded is given in Table 3.

The recordings were analysed in *Audacity* (<https://www.audacityteam.org/>), a free and open-source digital audio editor and recording application software. For the bioacoustic investigations, shorter sections of the recordings were selected. Temporal data are given as mean \pm standard deviation (SD) with n=10 except otherwise stated. For the frequency measurements, recordings were evaluated using Fast Fourier Transformation (FFT) analysis with Hanning window, 512 points per frame, from the mean of several overlapping frames of a closing hemisyllable.

TABLE 1. Collection data for specimens from Tomorr and Kulmak Mts.

Collector	Date	Latitude	Longitude	Altitude	Material	Col. adult or nymph (reared)	Depository	Col. ID	Mt
Z. Fehér, A. Hunyadi, T. Huszár & D. Murányi	2006.08.25	40.71640	20.15670	1950	1♂ dry	Adult	RMNH		Tomorr
G. Csorba, D. Czabán, E. Mizsei	2014.09.18	40.61590	20.18610	1860	1♂ 1♀ in alcohol	Adult	HNHM	OrP 1843	Tomorr
D. Chobanov	2015.07.03	40.61618	20.18578	1880	1♂ 1♀ dry	Nymph reared	CCh		Tomorr
M. Lemonnier-Darcemont	2015.07.23	40.62225	20.17792	2029	1♂ 1♀ dry, 2♂ in alcohol	Adult	CLD		Tomorr
M. Lemonnier-Darcemont	2015.07.23	40.61831	20.18383	1923	4♂ dry	Adult	CLD		Tomorr
M. Lemonnier-Darcemont	2015.07.24	40.72422	20.14269	1707	2♂ 2♀ dry, 2♂ 2♀ in alcohol	Adult	CLD		Tomorr
G. Puskás, M. Szabolcs, J. Ujszegi & B. Vági	2015.09.21	40.62200	20.17800	2000	3♂ 9♀ dry, 11♂ 19♀ in alcohol	Adult	HNHM	OrP 1840	Tomorr
G. Puskás	2015.09.22	40.67200	20.15800	2100–2200	4♂ 5♀ in alcohol	Adult	HNHM	OrP 1841	Tomorr
G. Puskás	2015.09.23	40.63100	20.16600	2270	14♂ 5♀ in alcohol	Adult	HNHM	OrP 1842	Tomorr
G. Puskás, M. Szabolcs, J. Ujszegi & B. Vági	2015.09.24	40.59200	20.22600	1780	1♀ in alcohol	Adult	HNHM	OrP 1844	Kulmak
G. Puskás	2015.09.24	40.58600	20.23600	2000–2140	9♂ 10♀ in alcohol	Adult	HNHM	OrP 1845	Kulmak
G. Puskás	2015.09.24	40.57600	20.25300	1950–2150	3♂ 3♀ in alcohol	Adult	HNHM	OrP 1846	Kulmak
D. Chobanov	2022.07.24	40.62280	20.17460	2000–2100	9♂ 6♀ in alcohol	Adult and nymph	CCh		Tomorr

TABLE 2. Collection data for specimens from Griba, Lunxhëri, Nemërçka, Dhëmbel and Trebeshina Mts.

Collector	Date	Latitude	Longitude	Altitude	Material	Col. adult or nymph (reared)	Depository	Col. ID	Mountain
E. Mizsei, J. Ujszegi, Z. Gál, M. Szabolcs, Cs. Szepesváry & Á. Lovas-Kiss	2013.07.25	40.35400	20.09300	1880	1♂ 1♀ in alcohol	Adult	HNHM	OrP 1849	Trebeshina
G. Puskás	2014.06.23	40.35400	20.09300	1880	2♂ 2♀ in alcohol	Nymph reared	HNHM	OrP 1847	Trebeshina
G. Puskás	2014.07.03	40.35400	19.75600	1850	1♂ 3♀ in alcohol	Nymph reared	HNHM	OrP 1851	Griba
G. Puskás	2014.07.03	40.35600	19.72100	1630	5♂ in alcohol	Nymph reared	HNHM	OrP 1852	Griba
M. Lemonnier-Darcemont	2014.07.25	40.21572	20.16467	1725	1♂ dry	Adult	CLD		Lunxhëri
Cs. Barkóczy, E. Loçe, E. Mizsei, G. Puskás & M. Szabolcs	2014.08.21	40.35400	20.09300	1880	21♂ 17♀ in alcohol, 1♂ 5♀ dry	Adult	HNHM	OrP 1848	Trebeshina
Cs. Barkóczy & G. Puskás	2014.08.23	40.35900	20.09900	1400–1750	2♂ 2♀ dry	Adult	HNHM	OrP 1850	Trebeshina
D. Chobanov	2015.07.04	40.34354	20.09426	1250–1560	8♂ 1♀ in alcohol	Adult	CCh		Trebeshina
D. Chobanov	2015.07.05	40.13211	20.39709	1850	2♀ in alcohol	Adult	CCh		Nemërçka
P. Badić, G. Puskás & G. Szövényi	2015.07.24	40.36100	19.72100	1300–1600	1♂ 4♀ in alcohol, 2♂ dry	Adult	HNHM	OrP 1853	Griba
P. Badić, G. Puskás & G. Szövényi	2015.07.24	40.36100	19.72100	1300–1600	3♂ 4♀ in alcohol	Adult	CSz		Griba
P. Badić, G. Puskás & G. Szövényi	2015.07.24	40.36200	19.73700	1700–1900	1♂ 1♀ in alcohol	Adult	HNHM	OrP 1854	Griba
P. Badić, G. Puskás & G. Szövényi	2015.07.24	40.36200	19.73700	1700–1900	1♂ 1♀ in alcohol	Adult	CSz		Griba
G. Puskás & G. Szövényi	2015.07.25	40.16700	20.19400	1730	2♂ 1♀ dry, 1♂ in alcohol	Adult	HNHM	OrP 1855	Lunxhëri
G. Puskás & G. Szövényi	2015.07.25	40.16700	20.19400	1730	3♂ 3♀ in alcohol	Adult	CSz		Lunxhëri
M. Lemonnier-Darcemont	2015.07.30	40.10528	20.42194	1737	3♀ dry	Adult	CLD		Nemërçka

.....continued on the next page

TABLE 2. (Continued)

Collector	Date	Latitude	Longitude	Altitude	Material	Col. adult or nymph (reared)	Depository	Col. ID	Mountain
M. Lemonnier-Darcemont	2015.07.30	40.10583	20.42278	1792	3♂ 2♀ dry, 1♂ in alcohol	Adult	CLD		Nemërçka
M. Lemonnier-Darcemont	2015.07.31	40.19056	20.17508	1506	1♀ in alcohol	Adult	CLD		Lunxhëri
M. Lemonnier-Darcemont	2015.08.01	40.16758	20.21864	1729	2♀ dry, 1♀ in alcohol	Adult	CLD		Lunxhëri
M. Lemonnier-Darcemont	2015.08.01	40.15906	20.22353	1843	1♂ dry	Adult	CLD		Lunxhëri
M. Lemonnier-Darcemont	2015.08.02	40.21539	20.16414	1753	4♂ 4♀ dry, 1♂ in alcohol	Adult	CLD		Lunxhëri
M. Szabolcs, Zs. Tóth, Z. Rádai & F. Báthori	2015.08.19	40.15450	20.40740	1720	1♂ dry	Adult	HNHM	OrP 1857	Nemërçka
Z. Barina, M. Mahilaj, G. Puskás & L. M. Tálas	2021.07.06	40.13260	20.37390	1450	2♂ in alcohol	Adult	HNHM	OrP 1858	Nemërçka
Z. Barina, M. Mahilaj, G. Puskás & L. M. Tálas	2021.07.07	40.18330	20.31650	1800	1♂ 2♀ in alcohol	Adult	HNHM	OrP 1856	Dhëmbel
L. Willemse	2021.08.21	40.06400	20.48660	1850	2♂ 1♀ dry	Adult	RMNH	1452567,68,73	Nemërçka→GR
D. Chobanov	2022.07.22	40.11410	20.41800	1800–2000	4♂ 2♀ in alcohol	Adult	CCh		Nemërçka
D. Chobanov	2022.07.23	40.17446	20.18118	1560	1♂ in alcohol	Adult	CCh		Lunxhëri
D. Chobanov	2022.07.23	40.17326	20.18489	1720	1♂ in alcohol	Adult	CCh		Lunxhëri
D. Chobanov	2022.07.25	40.27509	19.88113	1620–1850	3♂ 4♀ in alcohol	Adult	CCh		Griba
D. Chobanov	2022.07.26	40.34758	20.09102	1600–1700	5♂ 10♀ in alcohol	Adult	CCh		Trebesina
R. Kleukers, B. Ode, R. Felix, L. Willemse	2023.07.24	40.21710	20.16210	1550	3♂ 2♀ dry	Adult	RMNH	1571661,662,704,706,709	Lunxhëri

TABLE 3. Specimens and conditions used for audio recordings.

Species	Recorder	Audio recording date	Collecting date	Number of specimens	Mountain	Col. ID	Sampling	T°C	Hardware used
<i>tomorri</i>	D. Chobanov	2015.08.02	2015.07.03	1♂	Tomorr		96kHz/24 bit	26	Zoom H2 + Pettersson D500
<i>tomorri</i>	C. Darceumont	2015.07.23	2015.07.23	1♂	Tomorr		96kHz/24 bit	26 & 27,5	Zoom H2
<i>tomorri</i>	G. Puskás	2015.09.28	2015.09.21	5♂	Tomorr	OrP 1840	96kHz/24 bit	21	Zoom H4n
<i>tomorri</i>	G. Puskás	2015.09.30	2015.09.22	1♂	Tomorr	OrP 1841	96kHz/24 bit	21	Zoom H4n
<i>tomorri</i>	G. Puskás	2015.09.28	2015.09.23	5♂	Tomorr	OrP 1842	96kHz/24 bit	21	Zoom H4n
<i>tomorri</i>	G. Puskás	2015.09.29	2015.09.24	2♂	Kulmak	OrP 1845	96kHz/24 bit	21	Zoom H4n
<i>tomorri</i>	G. Puskás	2015.09.28	2015.09.24	1♂	Kulmak	OrP 1846	96kHz/24 bit	21	Zoom H4n
<i>tomorri</i>	D. Chobanov	2022.07.25	2022.07.24	2♂	Tomorr		192kHz/24 bit	28	Tascam DR-680MKII + Pettersson D500
<i>dani</i>	G. Puskás	2014.08.04	2014.06.23	2♂	Trebeshtina	OrP 1847	96kHz/24 bit	25 & 26	MicroTrack-II
<i>dani</i>	G. Puskás	2014.09.04	2014	1♂	Trebeshtina or Griba		96kHz/24 bit	23	MicroTrack-II
<i>dani</i>	G. Puskás	2014.08.12	2014.07.03	1♂	Griba	OrP 1851	96kHz/24 bit	25 & 26	MicroTrack-II
<i>dani</i>	G. Puskás	2014.08.17	2014.07.03	1♂	Griba	OrP 1852	96kHz/24 bit	25	MicroTrack-II
<i>dani</i>	G. Puskás	2014.09.04	2014.08.23	1♂	Trebeshtina	OrP 1850	96kHz/24 bit	23 & 24	MicroTrack-II
<i>dani</i>	D. Chobanov	2015.08.17	2015.07.04	1♂ (+ rival)	Trebeshtina		96kHz/24 bit	24,5	Zoom H2 + Pettersson D500
<i>dani</i>	G. Puskás	2015.08.01	2015.07.25	1♂	Lunxhëri	OrP 1855	96kHz/24 bit	24	Zoom H4n
<i>dani</i>	C. Darceumont	2015.07.30	2015.07.30	1♂	Nemërçka		96kHz/24 bit	27	Zoom H2
<i>dani</i>	G. Puskás	2021.07.20	2021.07.07	1♂	Dhëmbel	OrP 1856	96kHz/24 bit	25	Zoom H4n
<i>dani</i>	D. Chobanov	2022.07.26	2022.07.22	1♂	Nemërçka		192kHz/24 bit	26,5	Tascam DR-680MKII + Pettersson D500
<i>dani</i>	D. Chobanov	2022.07.25	2022.07.23	1♂	Lunxhëri		192kHz/24 bit	28	Tascam DR-680MKII + Pettersson D500
<i>dani</i>	D. Chobanov	2022.07.26	2022.07.25	1♂ (+ rival)	Griba		192kHz/24 bit	27	Tascam DR-680MKII + Pettersson D500
<i>dani</i>	D. Chobanov	2022.07.31	2022.07.26	2♂	Trebeshtina		192kHz/24 bit	25,5	Tascam DR-680MKII + Pettersson D500

In the bioacoustics we follow the terminology of Heller (1988), Chobanov *et al.* (2014) and Ivković *et al.* (2017). **Calling song** is the song produced by an isolated male; **syllable** is the sound produced during one cycle of movements, generated by opening and closing of the tegmina (each uni-directional movement generating a hemisyllable); based on its length, a syllable can be very short—called microsyllable—or normal—for distinction then called macrosyllable; **syllable period** is the time period measured from the first impulse to the first impulse of the next syllable (reciprocal value: **syllable repetition rate [SRR]**); **impulse** is a simple, undivided transient train of sound waves (here the damped sound impulse arising as the effect of one tooth of the stridulatory file being struck by the scraper; a first-order assemblage of syllables is called **echeme** (=chirp; short series of syllables, its length typically given in number of syllables); **echeme period** is the time period measured from the first impulse to the first impulse of the next echeme (reciprocal value: **echeme repetition rate [ERR]**).

DNA sampling and phylogenetic analyses

Total genomic DNA was extracted from muscles of the hind femora using the Invitrogen PureLink Genomic DNA Mini Kit (Thermo Fisher Scientific 2024) from five specimens of the studied taxa and 18 outgroup taxa from the tribus Platycleidini with focus on the related genera. Protocol followed the manufacturer's instructions.

We amplified the internal transcribed spacers 1 and 2, together with the 5.8 S ribosomal RNA between them (ITS1–5.8S–ITS2, further in the text mentioned as ITS), with the primers WeekF TAGAGGAAGTAAAAGTCG (forward) and WeekR GCTTAAATTCAGCGG (reverse), resulting in one fragment (Weekers *et al.* 2001). Polymerase chain reactions were carried out in 25 µl volume using Thermo Scientific DreamTaq Hot Start Master Mix according to manufacturer's instructions following the protocol by Ullrich *et al.* (2010). Purification of PCR products and Sanger sequencing from both 5' and 3' ends were performed by Macrogen Europe (Macrogen, Inc., Amsterdam, the Netherlands).

Chromatograms were processed, trimmed and assembled using CodonCode Aligner v.8.0.2 (CodonCode, Dedham, MA, USA). Sequence alignments were performed in MEGA12 v.11.0.13 (Tamura *et al.* 2004; Kumar *et al.* 2024) using the MUSCLE algorithm. Best models were selected under the corrected Akaike Information Criterion (AICc) using the jModeltest (Darriba *et al.* 2012) and IQ-TREE (Nguyen *et al.* 2015). Phylogenetic analyses were performed using Bayesian Inference (BI) and Maximum likelihood (ML). The ML analysis was performed, applying the calculated models in IQ-TREE and bootstrap support was obtained through ultrafast bootstrap with 1000 replicates (Hoang *et al.* 2018). The BI analysis was performed with MrBayes v. 3.2.7 (Ronquist *et al.* 2012) were the closest available approximations of the models suggested by jModeltest. Parameters for the Bayesian Inference analyses include four simulations of Markov chains and 2×10^6 generations sampling each 100^{th} tree. Stationary distribution of the MCMC parameters was checked with Tracer (Rambaut *et al.* 2018). The first 25% of trees were excluded as burnin. Resulting trees were visualized in FigTree v.1.4.4 (Rambaut 2006; <http://tree.bio.ed.ac.uk/software/figtree/>).

Results

Taxonomy and systematics based on phenotype

Family Tettigoniidae Krauss

Subfamily Tettigoniinae Krauss

Tribe Platycleidini Brunner von Wattenwyl

The new Albanian species clearly belong to the cluster of species of the four genera *Amedegnatianna*, *Montana*, *Parnassiana* and *Metrioptera* s. str. Species in the latter genera show general resemblance in the shape of pronotum, male cerci, ovipositor, tegmina (if reduced), epiphallus, as well as in coloration having two colour variants—brownish ones and specimens in which the pronotum and vertex are deep green.

Amedegnatiana was described by Massa & Fontana (2011) for a single species, *A. vicheti* (Delmas & Rambier), found in a small region in southern France. Morphological characters mentioned in the description to separate this genus from *Parnassiana*, in which it was originally placed, are the shape of pronotum, male anal tergite, female subgenital plate and ovipositor. The two Albanian species quite closely resemble *Amedegnatiana*, but they differ in the pronotum (pronotal disc more flattened in *Amedegnatiana*) and the hind femur (wider in *Amedegnatiana*). Besides, in male *Amedegnatiana* the cercus is slimmer, with a small side tooth in the apical third, whereas, in the Albanian species the cercus is wider, the side tooth bigger and placed in the medial third. Females differ in the subgenital plate with the hind margin being straight in *Amedegnatiana*, excised in the middle in the new Albanian species, and in the ovipositor, which is slimmer in the Albanian species.

Montana was described by Zeuner (1941) for species in which the ovipositor is regularly curved, narrow, light coloured with a dark coloured tip, having relatively slender hind femora (opposed to *Parnassiana* with stout hind femora), and flattened pronotal disc (opposed to rounded as in *Sepiana* Zeuner). *Montana* consists of a rather heterogeneous group of species with considerable variation in the shape of pronotum, length of the fore wings, shape of the hind femur, male anal tergite, cercus and titillator, as well as the female subgenital plate and ovipositor. The characters displayed by the new Albanian species do not differ from character states found across species assigned to *Montana* albeit some are only found in one or two species.

Parnassiana was erected by Zeuner (1941) for a rather uniform group of species with stout hind femora, and relatively short fore wings. The new Albanian species share the stout hind femora, shortened wings, the shape of the male 10th tergite and the rounded edges of the pronotum with *Parnassiana*. However, they differ from *Parnassiana* in the fore wings being slightly wider and longer (especially in females), the female subgenital plate being rectangular, without deep emargination and a slightly longer pronotum. Besides, the new Albanian species carry the distinct dark and light spots in the fore wings, typical of *Platycleis* sensu lato, but these spots are lacking in the fore wings of most species of *Parnassiana*.

Metrioptera s. str. was redefined by Zeuner (1941) for species with shortened wings in which the female subgenital plate is bilobate, the 7th sternite unmodified, the ovipositor is regularly curved and compressed, and the hind femora are slender. Like *Montana*, the species of *Metrioptera* show variation in pronotum shape, wing length, absence or presence of black spots in the fore wing, shape of the hind femur, the male anal tergite and the ovipositor. In addition to the black spots on the fore wings, which are lacking in most species of *Metrioptera* (but present in *M. hoermanni* and *M. karnyana*), the new Albanian species have a more convex pronotum, shorter fore wings, and the hind femur is more compact. Males also differ in the titillator, which in the new Albanian species has spines on both apical and basal arms, whereas in *Metrioptera* spines are only present on the apical arm. Females differ in the ovipositor being wider and more curved in *Metrioptera* but again this is less so in *M. hoermanni* and *M. karnyana*.

In song pattern, both new species differ clearly from all other *Montana* and *Metrioptera* s.str. species with known song (see Heller 1988; Ingrisch & Pavićević 2012; Ivković *et al.* 2017). They are also easily distinguished from *Parnassiana* species, which all have complex echemes (phrases) consisting of microsyllable and macrosyllable part, both composed of pairs of syllables (Heller 1988; Willemse *et al.* 2018). *Amedegnatiana vicheti*, however, seems to have a quite variable song with different patterns during day and night (Barataud 2025). Here more research is necessary to achieve safe conclusions.

Overall, the new taxa considered here fit less well into *Amedegnatiana*, *Parnassiana* and *Metrioptera*, while showing a good match with *Montana*. Because differences with *Montana* are small, the erection of a new genus is not required, and thus the new species have been assigned to *Montana*.

Phylogenetic relationships

Details of the sampled specimens and GenBank accession numbers are given in Table 4. The ITS aligned matrix consisted of 23 taxa and contained 912 sites including gaps. Of these, 236 sites were variable and 142 sites were parsimony informative. Pairwise genetic distances varied from 0.000 to 0.086 (Table 5). Both ML and BI analyses revealed similar topology, which differed in the position of *Platycleis intermedia* (Serville) (Fig. 2). The analyses supported with high probability the monophyly of a group (hereafter Group 1) of genera including *Montana*, *Amedegnatiana*, *Roeseliana*, *Broughtonia*, *Vichetia*, *Bicolorana*, *Modestana*, *Semenoviana*, *Platycleis* and *Parnassiana*, failing to resolve their relationships with *Zeuneriana* and *Anterastes*. Within the above group

of Platycleidini, two groups of taxa were strongly supported—a clade formed of *Modestana* and four genera of *Metrioptera* s.l. (*Roeseliana*, *Broughtonia*, *Vichetia*, *Bicolorana*) excluding *Zeuneriana* (hereafter, Group 2a). The highest support (full consensus) received a clade consisting of the two Albanian taxa, grouping with *Amedegnatiana vicheti* and *Montana dectificiformis* (Stshelkanovtzev) (Group 2b). Apart from the clades formed by Groups 2a and 2b, relationships within the sampled Platycleidini were poorly resolved. Within Group 2b, we found strong support to classify the Albanian samples within two distinct unnamed species. The samples from the mountains of Lunxhëri, Nemërçka, and Trebeshina, form a fully supported clade with genetic distances among samples between 0.002 and 0.011 (Table 5), while the latter group with the sample from Tomorr with slightly lower support and express genetic distances between pairs in the range 0.040–0.042.

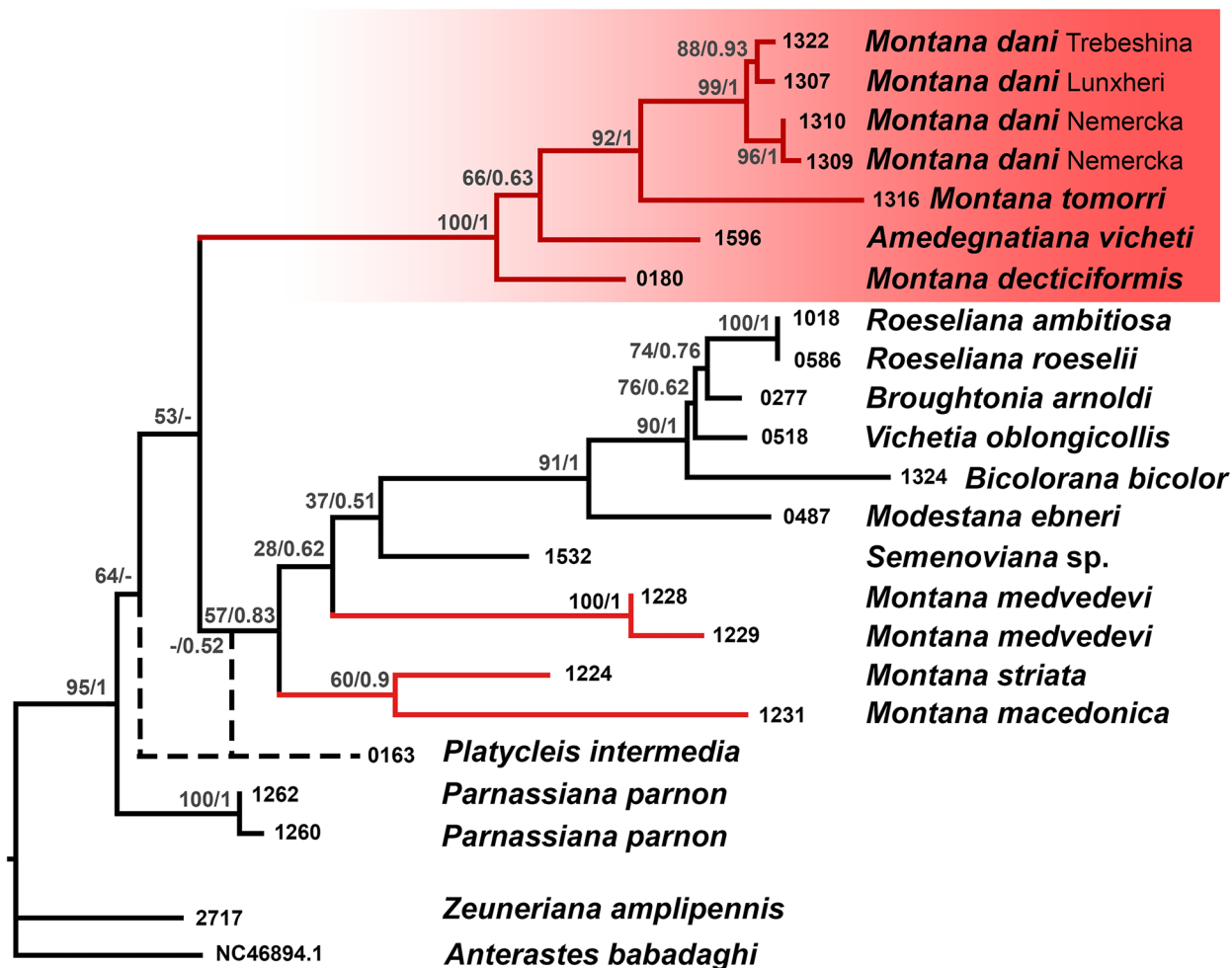


FIGURE 2. Reconstruction of phylogenetic relationships of sampled Platycleidini based on a ITS1–5.8S–ITS2 DNA fragment using Maximum Likelihood and Bayesian Inference analyses. Numbers before nodes correspond to ultrafast bootstrap support (%) (ML) and posterior probabilities (BI), to the left and to the right of the slash line, respectively. Numbers before the names of taxa indicate the DNA sample code. Red-colored branches mark lineages belonging to the genera *Montana* and *Amedegnatiana*. Dotted line marks the different topology of the ML and BI trees concerning *Platycleis intermedia*. The red highlighted area marks the highly supported clade containing the new species.

Description of new taxa

Based on the above results, we outline and describe two new species to science, as follows.

TABLE 4. Details on samples used in the phylogenetic reconstruction using the ITS1–5.8S–ITS2.

DNA extract ID	Species name	Country	Locality	Altitude (m)	Latitude	Longitude	Leg.	Collection date	Original Collection	GenBank Accession Number
1316	<i>Montana tomorri</i>	Albania	Tomor mt.	2000–2200	40.62280	20.17460	Chobanov D.	7/24/2022	IBER-BAS	PX946109
1307	<i>Montana dani</i>	Albania	Lunxhëri mt.	1700	40.17326	20.18490	Chobanov D.	7/23/2022	IBER-BAS	PX946103
1309	<i>Montana dani</i>	Albania	Nemërçka mt.	1800–2000	40.11410	20.41800	Chobanov D.	7/22/2022	IBER-BAS	PX946104
1310	<i>Montana dani</i>	Albania	Nemërçka mt.	1800	40.11410	20.41800	Chobanov D.	7/22/2022	IBER-BAS	PX946105
1322	<i>Montana dani</i>	Albania	Trebeshtina mt.	1600–1700	40.34760	20.09100	Chobanov D.	7/26/2022	IBER-BAS	PX946108
1596	<i>Amedegnatiana vicheti</i>	France	Herault	NA	NA	NA	Foucart A.	8/1/1994	Naturalis Collection RMNH. INS.1724659	PZ024143
180	<i>Montana dectiformis</i>	Kazakhstan	Shatpe	160–190	44.20957	52.08589	Chobanov D.	6/13/2016	IBER-BAS	PX946042
1018	<i>Roeseliana ambitiosa</i>	Bulgaria	Black Sea coast, Kraymorie village	1	42.45198	27.47848	Chobanov D.	6/19/2020	IBER-BAS	PX946120
586	<i>Roeseliana roeselii</i>	Bulgaria	Danubian Plain, Vidin-Topolovets stream	35	43.94174	22.83769	Chobanov D.	7/16/2020	IBER-BAS	PX946121
277	<i>Broughtonia arnoldi</i>	Bulgaria	Pirin Mts, Predela pass	1100	41.88780	23.33550	Chobanov D.	8/3/2016	IBER-BAS	PX946038
518	<i>Vichetia oblongicollis</i>	North Macedonia	Bistra Mts, Drstila-Golem Lopushnik	1350	41.51030	20.75460	Chobanov D.	7/30/2019	IBER-BAS	PX946039
1324	<i>Bicolorana bicolor</i>	Bulgaria	W Predbalkan Range, Pustrina hill	570	43.42677	23.30433	Chobanov D.	5/27/2020	IBER-BAS	PX946037
487	<i>Modestana ebneri</i>	North Macedonia	Shar Mts, under Rudoka, 2000 m	2000	41.92460	20.79800	Chobanov D.	8/24/2018	IBER-BAS	PX946040

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TABLE 4. (Continued)

DNA extract ID	Species name	Country	Locality	Altitude (m)	Latitude	Longitude	Leg.	Collection date	Original Collection	GenBank Accession Number
1228	<i>Montana medvedevi</i>	Bulgaria	Danubian Plain, Muselievo - Vubel	150	43.64838	24.87630	Chobanov D.	5/29/2020	IBER-BAS	PX946043
1229	<i>Montana medvedevi</i>	Bulgaria	Danubian Plain, Muselievo - Vubel	150	43.64838	24.87630	Chobanov D.	5/29/2020	IBER-BAS	PX946044
1532	<i>Semenoviana</i> sp.	Kazakhstan	Teke	200	43.12757	68.02047	Chobanov D.	6/21/2016	IBER-BAS	PZ024142
1224	<i>Montana striata</i>	Bulgaria	Danubian Plain, Alvanovo	135	43.28658	26.68968	Chobanov D.	6/22/2020	IBER-BAS	PX946045
1231	<i>Montana macedonica</i>	Bulgaria	Strouma Valley, Ploski vill.	200	41.60634	23.23350	Chobanov D.	6/29/2018	IBER-BAS	PZ024141
163	<i>Platycleis intermedia</i>	Kazakhstan	Buratchkan	560–700	43.58936	68.50527	Chobanov D.	6/20/2016	IBER-BAS	PZ024144
1260	<i>Parnassiana parnon</i>	Greece	Parnon mt.	1860	37.27980	22.61300	Chobanov D. & Kotitsa N.	8/11/2022	IBER-BAS	PX946073
1262	<i>Parnassiana parnon</i>	Greece	Parnon mt.	1860	37.27980	22.61300	Chobanov D. & Kotitsa N.	8/11/2022	IBER-BAS	PX946074
271	<i>Zeumeriana amplipennis</i>	Bulgaria	Danubian Plain, Belene island	20	43.68204	25.19661	Chobanov D.	8/4/2016	IBER-BAS	PZ024145
GenBank NC46894.1	<i>Anterastes babadaghi</i>	Turkey	NA	NA	NA	NA	Karsi U. & Ciplak B.	NA	Downloaded from Genbank	NC46894.1

***Montana tomorri* Chobanov, Lemonnier-Darcemont, Puskás sp. nov.**

Genus aff. *Parnassiana* sp. 1 GRZYWACZ *et al.* (2017): 2 (cytogenetical studies).

Holotype male: ALBANIA, TOMORR Mt.: 03.VII.2015, N40.61618° E20.18578°, 1880 m, CCh; dry prepared, pinned, left hind leg and right antenna missing. **Allotype** female: same locality, CCh; dry prepared, pinned, left hind leg and the apical half of right front tibia with the tarsal segments missing. **Paratypes**: Table 1.

Description of holotype male (Fig. 3): Medium-sized (Body length 22.5 mm but enlarged due to the pulled out titillators). General coloration ochre-brown, frons and lower side of body ochre; dorsal side of fastigium, vertex and pronotum disc greenish; vertex, lateral from the green color, with two lateral dark areas cut by a thin light stripe; lateral sides of pronotum disk bordered with incurved ochre line; pronotum paranota dark brown becoming blackish posteriorly, bordered with wide whitish band at their ventral and posterior margins (except for the posterior-dorsal corner); tegmina reaching the third abdominal tergite; subcostal, radial and medial veins light ochre in the basal area, stridulatory field ochre-brown with darker spots and veins, the rest of tegmina darker with dark veins and dark spots in the apical area outside the stridulatory area; abdominal tergites light brown, with two light bands laterally at the dorsal side, lateral side of terga with a wide vertical black spot at their posterior area; cercus ochre colored, armed with a long sinuated spine located at its apical third to fourth, the spine rusty colored; titillators rusty-brown, robust, with the apical arms outcurved and retro-laterally arcuate, apical arms and small area of the basal arms covered with spines at their anterior parts; legs ochre-brown with dark spots dorso-laterally, hind femora with thin longitudinal dark band on the outer side and a wide dark spot on the inner side.

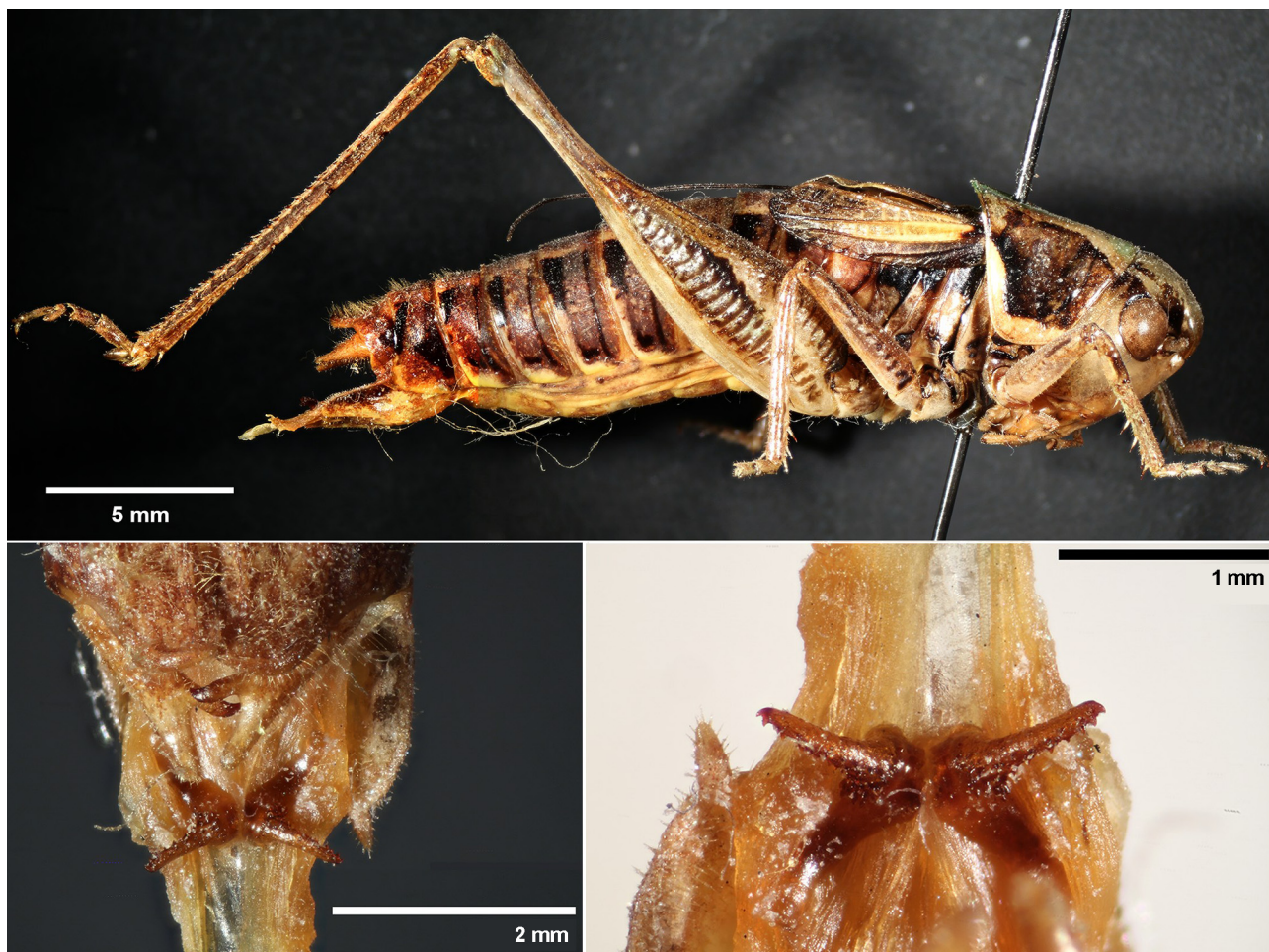


FIGURE 3. Holotype male of *Montana tomorri* sp. nov.

Description of allotype female (Fig. 4): Medium-sized (Body length 19.8 mm). Coloration as in male with the following specifics. Dorsal side of fastigium, vertex and pronotum disc dark green; tegmina with the base of the radial and medial veins of ochre coloration, the rest of tegmen brownish with darker veins and spots in between; ovipositor ochre-brown, with a blackish base and dorsal side of the upper valve; both outer valves darkened and slightly greenish at the tips.

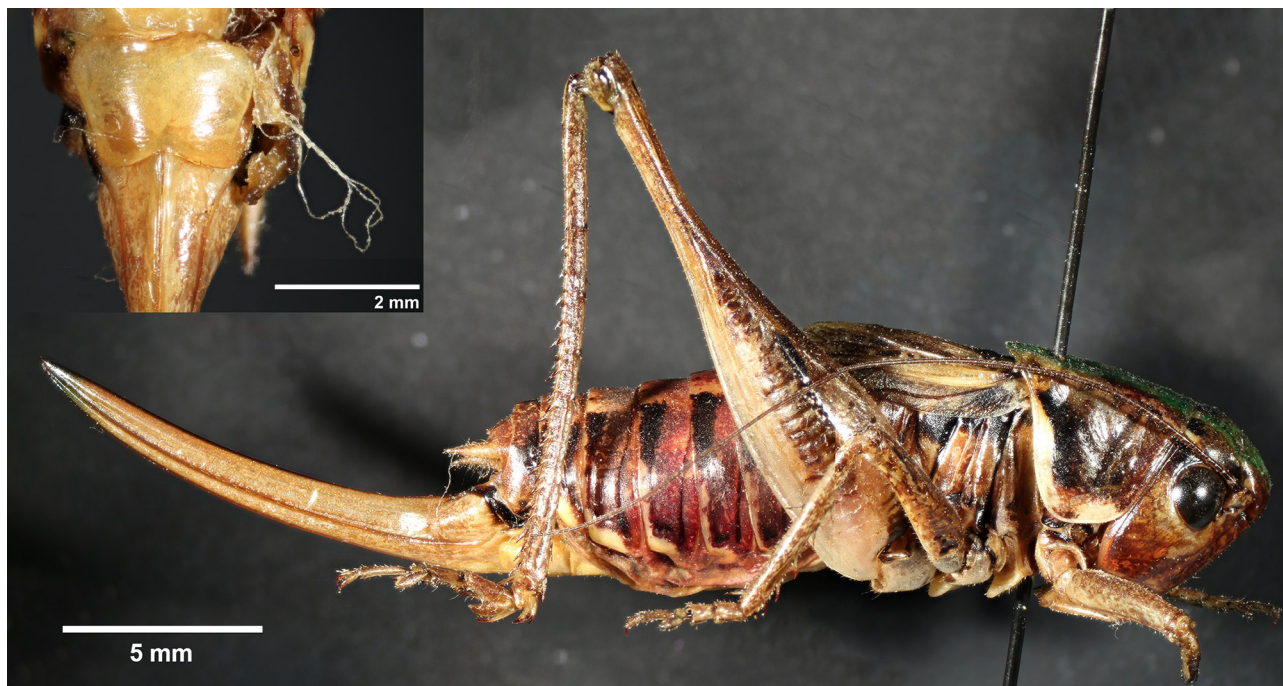


FIGURE 4. Allotype female of *Montana tomorri* **sp. nov.**

General description (see also Supplementary Figures 1–7). **Male.** Head not wider than pronotum, fastigium verticis very wide, 2.1–2.5 times wider than scapus. Pronotum rounded, almost cylindrical, without evident lateral edges; widening backwards, hind margin just exceeding mesonotum. Dorsal disc rounded in the prozona, metazona flat, slightly depressed in the middle, with wide median carina. Paranota stretch widely ventrally, hind margin slightly concave (humeral excision indistinct). Tegmina wide, in natural position overlapping, exceeding 2nd abdominal tergite, apex broadly rounded. Tegmina light at the medial part (the stridulatory area and the triangle projecting backwards from it), usually contrasting with the darker apical part. The distal section (from the end of the mirror to the apex) about the same length as the proximal section. The distal part of the longitudinal veins (Sc, R, M) curving towards the middle, so that the apex of the tegmen high and convex (tips of the tegmina meet, radial and medial areas are vertical rather than horizontal). Hind wings exist but rudimentary. Fore tibiae with 3 outer and 6 inner spines. Postfemora stocky, the evenly thin apical part is shorter than one third of the total length (i.e. the dorsal and ventral edges of the femur are not parallel in the apical third of its length). Posttibiae with four apical spurs, two outer ones much longer than inner ones. Plantulae shorter than basal segment of hind tarsi. Anal tergite wide, deeply depressed, with two crescent lobes regularly bending to the middle (to each other), often forming a round excision between them. The last 3–4 (depending on the specimen) tergites with dense, long hairs in the median part; the cuticle here softer, leathery. The hairy and leathery medial part of the anal tergites different in colour from the adjacent area. The subgenital plate long, with the widest part in the basal third, with a short triangular emargination between styli. Cerci long, the apical part slightly outward bent, slightly thinning backwards on both the thick basal part and the thin apical part; the apical part straight with slightly outward facing central axis (in relation to the axis of the basal part). The inner tooth thin; located in the distal third of the cerci; about twice as long as wide at the base; with an abrupt thinning that results a wave at the inner edge. The apical arm of the titillator robust, moderately long, downwards curving, with a thin base and straight apical part, strongly spinulose at the dorsal and lateral side; the basal arm without spines (at least at the junction with the apical arm).

Female. As in male with the following characteristics. Subgenital plate smooth, wide rectangular, without deep

emargination, at most slightly concave at hind margin, V-shaped in caudal view (therefore, appears to be excised in caudoventral view). Sternites without any modifications. Anal tergite with two terminal lobes concave on their outer margin, giving the hind borderline of the tergite a semicircular shape. Ovipositor more than twice as long as pronotum, slightly and evenly upcurved, less compressed laterally, the ventral margin finely serrate apically, light in colour including the upper margin. Hind margin of pronotum widely rounded, medial carina at the metazona moderately wide. Cubital veins of the left tegmen generally light coloured, CuPb curved, more or less closer to the inner margin of the tegmen than to CuA. The tip of the tegmina convex. Longitudinal black spot at the outer side of hind femora distinct, with sharp borders, on a pale background; transverse stripes absent.

Bioacoustics: The calling song (Fig. 5) consists of repeated echemes with a duration of less than one second, often less than half a second. In an echeme there are typically 10–30 syllables, each consisting of a quiet opening and a loud closing hemisyllable. The amplitude of the syllables typically increases at the beginning, but sometimes an echeme starts also with one or two loud syllables. The mean syllable repetition rate varied between around 23 Hz (in 21°C) and 39 Hz (at 27.5°C). The repetition rate of the echemes is quite variable, measured between 0.2 and 70 echemes per minute. The males stridulate in the night and in the morning.

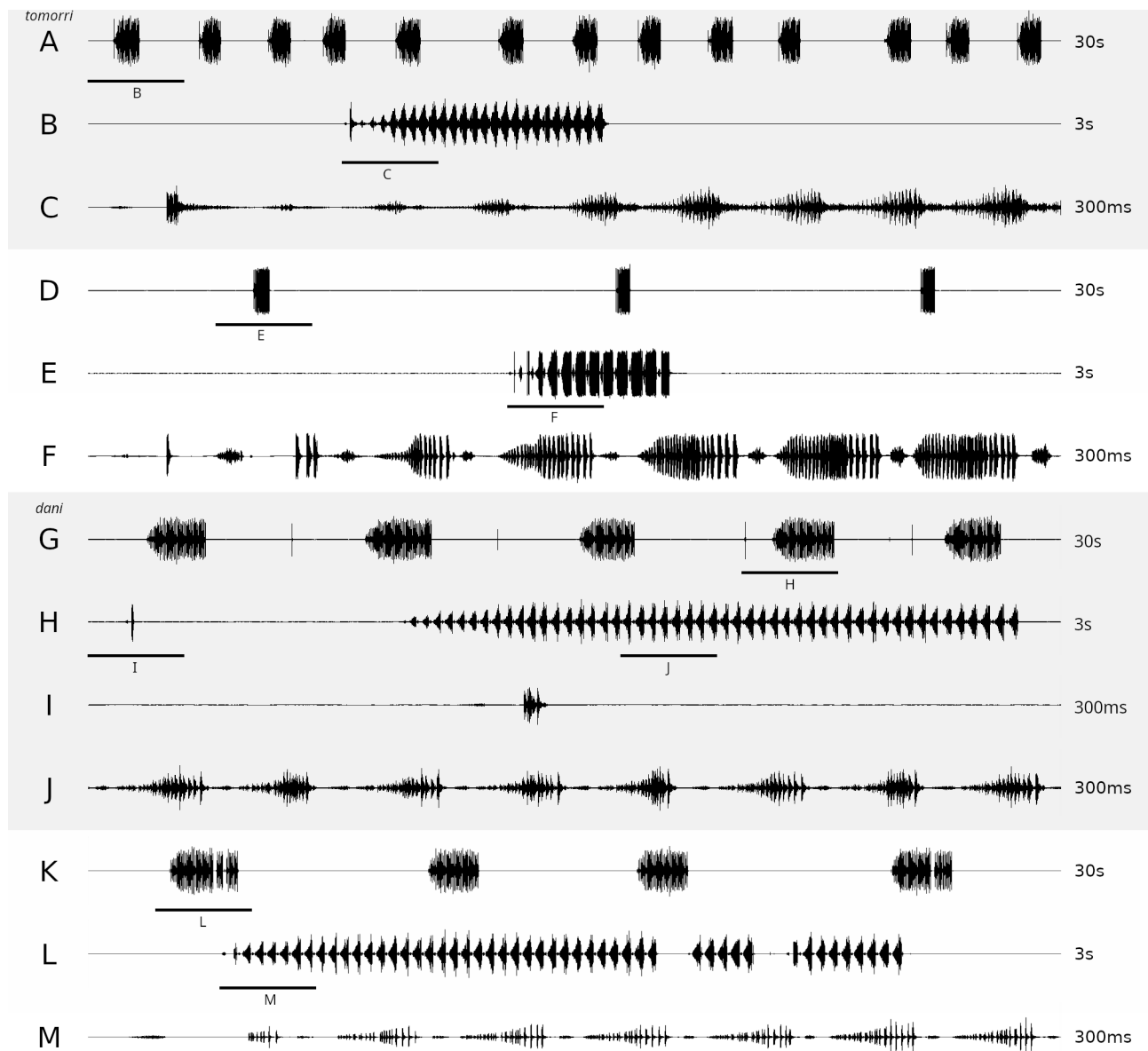


FIGURE 5. Oscillograms of the male calling songs. A–F: *Montana tomorri* sp. nov. (A–C Tomorr Mts, 28°C; D–F Kulmak Mts, 21°C); G–L: *Montana dani* sp. nov. (G–I Griba Mts, 26°C; J–L Trebeshina Mts, 26°C).

The frequency spectrum shows a broad peak in the near-ultrasound: peak 18–23 kHz; 6 specimens (Fig. 6).

Measurements: Measurements performed on holotype and paratypes are provided in Table 6.

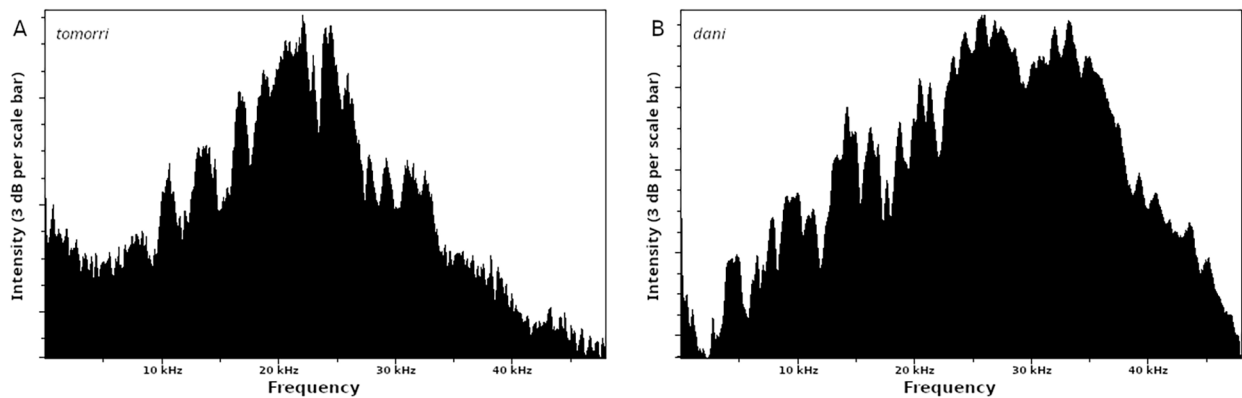


FIGURE 6. Power spectra of the calling songs. A: *Montana tomorri* sp. nov. (Kulmak Mts, 21°C); B: *Montana dani* sp. nov. (Trebeshina Mts, 26°C).

TABLE 6. Measurements of *M. tomorri* sp. nov. paratypes.

Measurement (mm)	Mean	Min(95%)	Max(95%)	n	Holotype♂ & allotype♀
♂					
Body length	18.6	16.7	20.5	14	22.5
Pronotum length	4.8	4.4	5.3	35	4.7
Tegmina length	6.4	5.6	7.3	34	6.0
Hind femur length	13.9	12.7	15.1	35	13.5
Hind femur width	3.2	2.8	3.6	35	3.2
♀					
Body length	20.3	16.9	23.7	9	19.8
Pronotum length	5.5	5.0	5.9	29	5.0
Tegmina length	6.8	6.0	7.6	29	6.3
Hind femur length	16.0	15.0	17.0	28	14.6
Hind femur width	3.7	3.3	4.1	28	3.5
Ovipositor length	14.0	12.6	15.5	29	13.2

Differential diagnosis: *Montana tomorri* belongs to the short-winged morpho-type in the genus (Table 7). Among short-winged taxa, *M. tomorri* can be differentiated by the following combination of characters: pronotal disc flat or slightly convex, lateral edges rounded, tegmina about the length of pronotum, stocky wide hind femora, semicircular lobes of the male 10th tergite with a very narrow incision between them, cerci with a large long tooth positioned in the proximal 1/3 of cercus, square female subgenital plate without clear incision, pronotum length in the range 4.4–6.0 mm. The most similar taxon seems to be *M. heinrichi* (Ramme), known from northern Iran (Elburs), though this species has narrower lobes and wider incision of the male 10th abdominal tergum and larger size (pronotum 8.2–9.7 mm). *M. richteri* (Bey-Bienko) may be related to *M. tomorri* but this species is known only by female. The song of *M. tomorri* is similar to that of *M. helleri* (Çıplak & Taylan) (compare Ivković *et al.* 2017: Fig. 7K) but morphologically both taxa are well distinguished by male cerci and 10th abdominal tergite.

Distribution: Endemic in the Tomorr (2416 m) and Kulmak (2174 m) Mts., above 1700 m.

Habitat: Grasslands with some bushes such as subalpine grasslands with *Juniperus* sp., rocky grasslands with stone screens in edge of pine forest but mostly above the tree line.

Etymology: In the central Albanian mythology, Baba Tomorri (Father Tomorr) is the personification of Tomorr Mountain. Used as a noun, gender masculine.

TABLE 7. Species currently classified in the genus *Montana* and some of their characteristics.

Species	Author, year	Pronotum length (mm)	Hind femur	hind femur length (mm)	Tooth of cercus	Lobes of male anal tergite	Female subgenital plate	Distribution	Song type (from Ivković <i>et al.</i> 2017)	Wing length
<i>M. tomorri</i>	sp. nov.	♂ 4.4–5.4 ♀ 4.9–6.0	robust	♂ 12.8–15.1 ♀ 14.6–17.0	distal 1/3	semicircular, incision very narrow	wide rectangular, not or a little emarginated	Balkan	(3?)	short
<i>M. dani</i>	sp. nov.	♂ 5.1–6.5 ♀ 5.3–7.0	robust	♂ 14.8–18.0 ♀ 15.9–19.7	middle or somewhat distal from it	semicircular, incision very narrow	wide rectangular, not or a little emarginated	Balkan	(3a)	short
<i>M. armeniacae</i>	(Ramme, 1930)	♂ 5 ♀ 5–5.5	slender	♂ 18 ♀ 19	middle or just proximal from it	semicircular	wide rectangular, simple	Caucasus	3a	medium
<i>M. barretti</i>	(Burr, 1912)	5	slender	♂ 15 ♀ 16	distal to middle	short rounded	with rounded emargination	Madeira	2	medium
<i>M. carpetana</i>	(Bolivar, 1887)	♂ 4.5–6.5 ♀ 5.5–6.5	robust	♂ 16–20.5 ♀ 16.5–21.5	distal 1/3	pointed, ~ straight	rounded, with narrow incision	Iberia	2	long
<i>M. daghestanica</i>	(Uvarov, 1917)	♂ 5 ♀ 5.5	robust	♂ 15 ♀ 16.5	slightly distal to middle	short, pointed	apically narrowed, with tucked in lateral edges	Caucasus	3a	medium
<i>M. dectiformis</i>	(Stshelkanovtzev, 1914)	♂ 6–7 ♀ 6–8	robust	♂ 20–23 ♀ 24–27	distal 1/4	semicircular, incision narrow	wide rectangular, slightly emarginated	Caucasus, Central Asia	1, 3b	long to medium
<i>M. elegans</i>	(Uvarov, 1934)	♂ 3.7 ♀ 4	slender	♂ 17 ♀ 19	distal 1/3	pointed, ~ straight	bilobate, ca. as long as wide	Anatolia	-	long
<i>M. eversmanni</i>	(Kittary, 1849)	♂ 4–5 ♀ 4.5–5	slender	♂ 17–19 ♀ 18–20	at the base	semicircular, incision wide	wide rectangular, slightly emarginated	E–Europe–Siberia	1, 3b	long
<i>M. gaskoi</i>	Garai, 2011	♀ 8	slender	♀ 21	not known	not known	wide, with broad shallow triangular incision (as in <i>zanjanica</i>)	Iran	-	short
<i>M. heinrichi</i>	(Ramme, 1929)	♂ 8.2 ♀ 9.7	robust	♂ 23.4 ♀ 24.8	distal 1/3	semicircular, incision wider		Iran	-	short
<i>M. helleri</i>	(Çıplak & Tavlan, 2006)	♂ 3.1–3.3 ♀ 3.0–3.2	robust	♂ 11.8–12.5 ♀ 11.5–12.2	distal 1/4	pointed, ~ straight	narrowing backwards, with two triangular lobes	Anatolia	3b	short
<i>M. kure</i>	(Ünal, 2006)	♂ 5–5.4 ♀ 5.5–5.8	robust	♂ 17.9–18 ♀ 20.6–20.7	proximal from the middle	long and broad	square, with a distinct median keel	Anatolia	-	medium
<i>M. macedonica</i>	(Berland & Chopard, 1922)	3.5–4	slender	♂ 12–13.5 ♀ 15–17	at the middle; cercus short	long pointed, incision narrow	bilobate, ca. as long as wide	Balkan	2	short

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TABLE 7. (Continued)

Species	Author, year	Pronotum length (mm)	Hind femur	hind femur length (mm)	Tooth of cercus	Lobes of male anal tergite	Female subgenital plate	Distribution	Song type (from Ivković <i>et al.</i> 2017)	Wing length
<i>M. medvedevi</i>	(Miram, 1927)	3.2–4	slender	♂ 12.5–14 ♀ 14–16	distal 1/4	narrow, incurved, incision wide	elongated, triangularly incised	E-Europe–Central Asia	1	short
<i>M. montana</i>	(Kollar, 1833)	♂ 4.0–5.2 ♀ 4.5–5.5	slender	♂ 14.5–19.0 ♀ 17.0–20.8	at the base	rounded	not or a little emarginate	Central Europe–Siberia	3a	long
<i>M. richteri</i>	(Bey-Bienko, 1958)	♀ 5.9	more slender	♀ 16	not known	not known	not or a little emarginate	Iran	-	short
<i>M. schereri</i>	(Werner, 1901)	♂ 7 ♀ 8	robust	♂ 18 ♀ 24	distal 1/4	pointed, ~ straight	almost square, with two distal foveolae	Anatolia	-	short
<i>M. striata</i>	(Thunberg, 1815)	4–4.5	slender	♂ 14.5–18 ♀ 17–18	at the base	long pointed	wide rectangular	Balkan–Siberia	1	short
<i>M. stricta</i>	(Zeller, 1849)	♂ 3.5–4.5 ♀ 4.5–5	slender	♂ 13.5–16 ♀ 16–18	slightly proximal to middle	short, pointed, incision shallow and broad	bilobate	S-Europe	2	long
<i>M. taurica</i>	(Bolivar, 1899)	♂ 5 ♀ 7	robust	♂ 19 ♀ 22	just distal to the middle	long, rounded edge, slightly incurved	wide rectangular, with median keel	Anatolia	1	medium
<i>M. tianshanica</i>	(Uvarov, 1933)	♂ 6 ♀ 5.5	robust	♂ 17–18 ♀ 18	distal 1/3	pointed	deeply emarginated	Central Asia, Mongolia	3b	short
<i>M. tomini</i>	(Pylnov, 1916)	♂ 4.4 ♀ 4.4–5.2	more slender	♂ 16.2 ♀ 18.2–19.6	distal 1/3	pointed, incurved	~round, slightly emarginate, with median keel	Central Asia, Mongolia, S-Siberia	3b	short
<i>M. uvarovi</i>	Karabag, 1950	♂ 6.6 ♀ 7.2	? robust	♂ 19	basal 1/4	semicircular, strongly incurved	square, simple	Anatolia, Caucasus	-	medium
<i>M. zanjantica</i>	Garai, 2011	7	slender	♂ 20 ♀ 21.3	distal 1/4	broad, semicircular, incision wide	wide, with broad shallow triangular incision	Iran	-	short

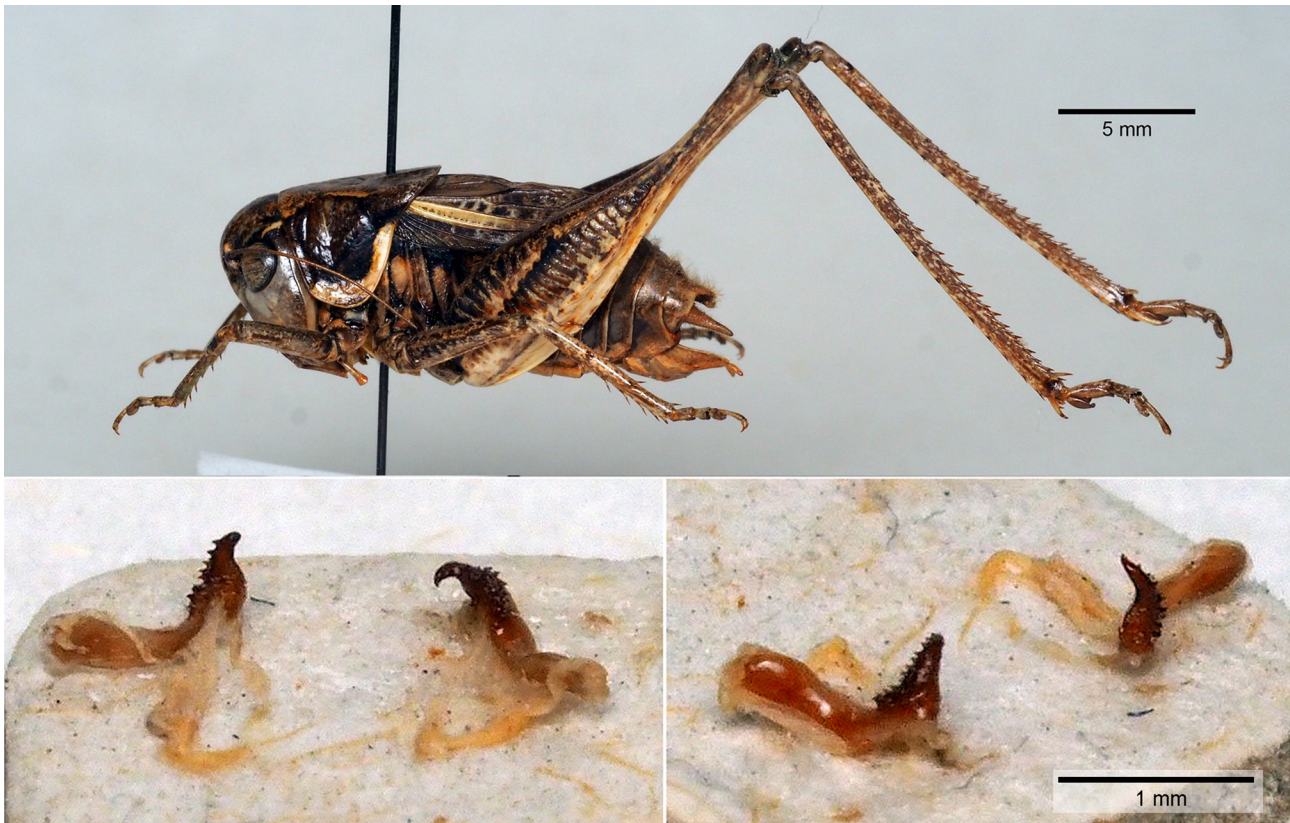


FIGURE 7. Holotype male of *Montana dani* sp. nov.

***Montana dani* Puskás, Lemonnier-Darcemont, Chobanov, Szövényi, Willemse sp. nov.**

Platycleis (*s.l.*) *n.sp.* LEMONNIER-DARCEMONT *et al.* (2015): 67 (faunistical records).

Genus aff. *Parnassiana* sp. 2 GRZYWACZ *et al.* (2017): 2 (cytogenetical studies).

Genus aff. *Parnassiana* sp. MIZSEI *et al.* (2019): 2362 (prey of *Vipera graeca*).

Holotype (male): Albania, Përmet District, Mt. Trebeshinë above Podgoran, rocky grasslands, 1400–1750 m, N40.359°E20.099°–N40.362°E20.110°, leg. Cs. Barkóczy & G. Puskás 23.VIII.2014, HNHM (OrP1850a), dry prepared and pinned. Dimensions: body length 18.8 mm, pronotum length 6.1 mm, hind femur length 16.1 mm, width 4.2 mm, tegmen length 7.4 mm. **Allotype** (female): Albania, Përmet District, Mt. Trebeshinë above Podgoran, grazed mountain grasslands, 1880 m, N40.354° E20.093°, leg. Cs. Barkóczy, E. Loçe, E. Mizsei, G. Puskás & M. Szabolcs 21–22.VIII.2014, HNHM (OrP1848b), dry prepared and pinned. **Paratypes**: Table 2.

Description of holotype male (Fig. 7): Medium-sized (Body length 18.8 mm). General coloration ochre-brown, lower side of body and legs ochre; frons and genae ochre marbled with brown; dorsal site of fastigium, vertex and pronotum disc densely dotted with dark brown spots on a light brown background, with a light, thin longitudinal line in the middle; lateral sides of vertex and pronotal disk bordered with incurved ochre line (not entirely connected spots), disappearing in the metazona; paranota dark brown becoming blackish posteriorly, bordered with wide whitish band at their ventral and posterior margins (except for the posterior-dorsal corner); tegmina reaching the sixth abdominal tergite; subcostal and radial veins light ochre in their basal half, stridulatory area medium brown, the rest of tegmina darker with dark veins and dark spots in the apical area outside the stridulatory area; legs ochre-brown with dark spots dorso-laterally, hind femora with longitudinal dark band on the outer side and a wide dark spot on the inner side; abdominal tergites brown, with paler hind margin, lateral side of terga increasingly darker downward, with a wide vertical ochre band at the ventral edge; cerci light brown with a bit darker distal part, armed with a strong, reverse-curving spine located in middle, apical part of the spine blackish; titillators robust, with pale ochre basal arm and brown apical arm, apical arm narrowing distally, with downward and outcurving apex, apical arms and small area of the basal arms covered with spines at their dorsal and outer parts.

Description of allotype female (Fig. 8): Medium-sized (Body length 18.1 mm). Coloration as in male with the following specifics. Dorsal side of fastigium, vertex and pronotum disc pale with two blackish spot on the occiput; tegmina reaching the fourth abdominal tergite, with the base of the subcostal, radial and medial veins of ochre coloration, the rest of tegmen brownish with darker veins and spots in between; ovipositor ochre-brown and darkening at the tip, with a blackish stripe at the base and at the whole upper margin.

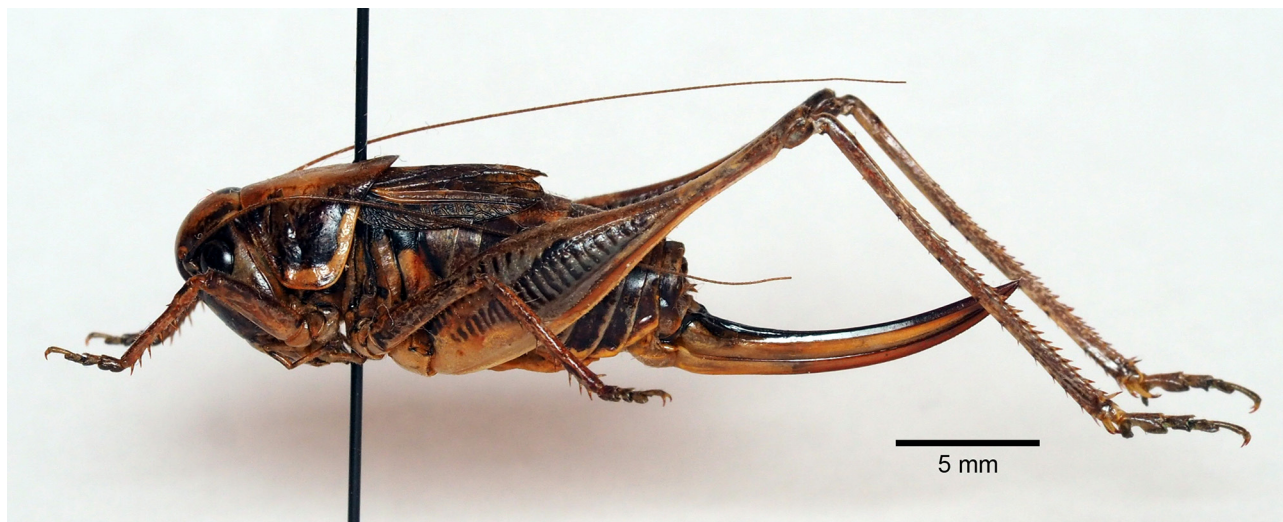


FIGURE 8. Allotype female of *Montana dani* sp. nov.

General description (see also Supplementary Figures 1–7). Medium-sized, brachypterous bush-crickets. Head not wider than pronotum, fastigium verticis about 2.5 times wider than scapus. Pronotum convex, almost cylindrical, without evident lateral edges; widening backwards, hind margin just exceeding mesonotum. Dorsal disc rounded in the prozona, metazona flat, slightly depressed in the middle, with wide median carina. Paranota stretch widely ventrally (in dry prepared specimens somewhat narrower), hind margin slightly concave (humeral excision indistinct). Prosternum without spines. Tegmina wide, in natural position overlapping in both sexes, always exceeding 2nd abdominal tergite (usually longer), apex broadly rounded. Hind wings exist but rudimentary. Fore tibiae with 3 outer and 6 inner spines. Postfemora robust, the evenly thin apical part is shorter than one third of the total length (i.e. the dorsal and ventral edges of the femur are not parallel in the apical third of its length); ratio length of hind femur: pronotum: 2,5–3,2. Posttibiae with four apical spurs, two outer ones much longer than inner ones. Plantulae shorter than basal segment of hind tarsi. The colour is quite uniform (as presented in the description of the holotype and the allotype), except of the vertex and the dorsal disc of pronotum which can vary from light cream to brown or grey but never green; usually unicolored but sometimes with a dark longitudinal stripe.

Male. Tegmina at the apical part flat or only slightly convex, rather fitting to the abdomen (ca. 45°). The distal part of the longitudinal veins (Sc, R, M) straight, the tips of the tegmina far from each other. The distal section of the tegmina (from the end of the mirror to the apex) distinctly longer than the proximal section. Stridulatory file consist of 78–104 pegs. The last 3–4 abdominal tergites with dense, long hairs in the median part; the cuticle here softer, leathery; this hairy and leathery medial part of tergites usually not separated in colour from the adjacent area. Anal tergite wide, deeply depressed, with two crescent lobes regularly bending to the middle (to each other), often forming a round excision between them, in dry prepared specimens the lobes usually overlap or cross each other. The subgenital plate long, with the widest part in the basal third, with a short triangular emargination between styli. Cerci long, cylindrical and almost uniform in thickness on both the thick basal part and the thin apical part; the apical part bending slightly outwards and has an individual variability in length and width. The inner tooth strong; located nearly in the middle of the cercus or somewhat distal from it (depending on the length of the apical part of the cercus); the base of the tooth wide (as wide or almost as wide as its length). Axis of the inner tooth forms a right or obtuse angle with the axis of the apical part of the cercus. Titillator with spines with both the apical and basal arm; basal arm long (ratio length of apical and basal arm below 0.6); apical arm robust, moderately long, downwards curving and strongly spinulose at the dorsal and lateral side; ends in a pointed apex curving outward and slightly downward.

Female. Tip of the tegmina flat or slightly convex. Cubital veins usually brown, more or less parallel, CuPb often closer to CuA than the inner margin of the tegmen. Anal tergite with two triangular terminal lobes, the tips of which extend backwards (less visible in dry specimens). Subgenital plate smooth, wide rectangular, without deep emargination, at most slightly concave at hind margin, V-shaped in caudal view (therefore appears to be excised in caudoventral view). Sternites without any modifications. Ovipositor more than twice as long as pronotum, slightly and evenly upcurved, less compressed laterally, the ventral margin finely serrate apically; dark coloured at the upper margin.

Bioacoustics: The calling song (Fig. 5) consists of repeated series of syllables (echemes) with a duration of 1–2 seconds (839–2449 ms). These echemes consist of 19–54 syllables, with a SRR of 20–28 Hz (25–28°C). However, there is some variability in the song. In some specimens occasionally a few additional syllables follow directly behind an echeme after a short break (Fig. 5K–L). Clearly separated from the echemes also isolated (or pairs of) microsyllables can be observed in many specimens, with 0 to 28 echemes between these short elements (Fig. 5G–H). As an individual variation, one animal showed a few microsyllable-like elements near the beginning of an echeme.

The frequency spectrum shows a broad peak in the near-ultrasound: peak 21–29 kHz; 7 specimens (Fig. 6).

Measurements: Measurements performed on holotype and paratypes are provided in Table 8.

TABLE 8. Measurements of *M. dani* sp. nov. paratypes.

Measurement (mm)	Mean	Min (95%)	Max (95 %)	n	Holotype ♂ & allotype ♀
♂					
Body length	21.1	18.4	23.8	20	18.8
Pronotum length	5.9	5.2	6.6	32	6.1
Tegmina length	7.5	6.3	8.7	31	7.4
Hind femur length	16.6	14.9	18.3	30	16.1
Hind femur width	3.8	3.0	4.7	30	4.2
♀					
Body length	20.5	16.5	24.4	19	18.2
Pronotum length	6.1	5.4	6.8	36	5.8
Tegmina length	7.5	6.2	8.9	36	6.8
Hind femur length	17.7	16.0	19.3	36	16.4
Hind femur width	4.1	3.2	5.0	36	3.9
Ovipositor length	13.9	11.7	16.0	36	13.0

Differential diagnosis: *Montana dani* belongs to the short-winged morpho-type in the genus (Table 7). Among short-winged taxa, *M. dani* can be differentiated by the following combination of characters: pronotal disc flat or slightly convex, lateral edges rounded, tegmina about the length of pronotum, stocky wide hind femora, semicircular lobes of the male 10th tergite with a very narrow incision between them, cerci with a large long tooth positioned between the middle and the proximal 1/3 of cercus, square female subgenital plate without clear incision, pronotum length in the range 5.1–7.0 mm. The most similar taxon seems to be *M. heinrichi* (Ramme), known from northern Iran (Elburs), though this species has narrower lobes and wider incision of the male 10th abdominal tergum and larger size (pronotum 8.2–9.7 mm). Cercus shape resembles *M. taurica* but 10th tergum in the latter species has longer lobes and wide deep incision between them. From *M. tomorri* this species differs mostly by the shape of male tegmina, cerci and titillator (see Table 9 and the key to brachypterous species of genus *Montana* in the Balkans below).

Distribution: Known from a few mountains of the Albanian Epirus above 1400 m: Griba (2122 m), Trebeshina (1923 m), Lunxhëri (2155 m), Dhëmbel (2050 m) and Nemërçka (2482 m), reaching the Greek border of the latter chain.

Habitat: Grasslands with some bushes such as grassland more or less dense with *Juniperus* sp., *Astragalus* sp., scratched grassland with *Astragalus* sp., grassland with *Arctostaphylos uva-ursi* and *Eryngium* sp., stony grassland with *Arctostaphylos uva-ursi* and *Astragalus* sp., stony pastured grassland with *Astragalus* sp. and *Juniperus* sp.

TABLE 9. Differential characters between *M. tomorri* sp. nov. and *M. dani* sp. nov.

Character	<i>Montana tomorri</i> sp. nov.	<i>Montana dani</i> sp. nov.
Size (Tables 6 and 8)	Generally smaller, hind femur length usually up to 15 mm in males and 17 mm in females.	Generally bigger, hind femur usually longer than 15 mm in males and 16 mm in females.
Coloration of vertex and pronotal disc (Fig. 10)	Green, brown or grey.	Never green.
Male tegmina (Fig. 3 and 7, Annex 2)	High and convex, at the distal end vertical and bending inward, hind tips usually meet. Distal part, behind the mirror, about equal length with the proximal part.	Less convex, distal part flatter and more vertical (ca. 45°), hind tips farther from each other. Distal part, behind the mirror, significantly longer than the proximal part.
Inner tooth of the male cercus (Fig. 12)	Thin, located on the distal third of the cercus. Length about twice of the basal width. Axis forms an acute angle with the apical part of the cercus.	Strong, located at the middle of the cercus or somewhat distal from it. Length roughly equal to the basal width. Axis forms a right or obtuse angle with the apical part of the cercus.
Male titillator (Fig. 13, Annex 6)	Basal arm shorter, ratio length of apical : basal arm > 0,6. Apical arm with a less pointed and more or less straight apex.	Basal arm longer, ratio length of apical : basal arm < 0,6. Apex of the apical arm pointed, bending outward and slightly downward.
Female tegmen (Annex 2)	More convex, cubital veins light.	More flat, cubital veins usually brown.
Female anal tergite (Annex 4, less visible in dry specimens)	Semicircular, terminal lobes bending inward.	Terminal lobes triangular, extending backwards.
Ovipositor (Fig. 4 and 8, Annex 7)	Upper margin light.	Upper margin dark.
Male calling song (Fig. 5)	Consists of short echemes (usually less than 0.5 s).	Consists of 1-2 s long echemes.

Etymology: Dedicated to the memory of Dániel Pifkó (1976–2023), Hungarian botanist, science historian and Balkan researcher. By this species name, Dani is symbolically still in the Albanian mountains he loved so much. Used as a noun in apposition, gender masculine.

Analysis of the variability of the measurements of paratypes of the two species and differential diagnosis between them

M. tomorri is smaller on average compared to *M. dani*. We have analysed and demonstrated statistically that the difference in altitude of their localities on average (*M. dani* occurs at lower altitude) cannot explain the size differences. As the variances appear to be relatively high, we performed statistical analysis on some measurements less impacted by the preservation mode of the exemplars.

For males, we first analysed the specimens in alcohol (47 set of data), excluding dry specimens, because a higher number of variables is associated. Most of the variables appeared to be highly correlated (two excepted), so we decreased this number in order to increase the number of set of data by adding the measurements on dry exemplars (on rigid parts only). The accuracy increased by using 65 set of data and three variables (pronotum length, femur width, femur length). We have also analysed the structure of the titillators of the specimens of various mountains and tried to characterise it by the relative shape and size of the two arms (basal and apical) and the shape of the apical arm, particularly in its basal part. We performed statistics with relative measurements (ratio on measurements and angles), with a total of 10 variables. We analysed 26 titillators, re-grouped when paired, from 15 specimens. For females, we first analysed specimens in alcohol only (52 set of data, 8 variables), then reduced the number of variables to four (pronotum length, femur width, femur length, ovipositor length) and adding set of data for dry specimens, for a total of 64 set of data. Resulting PCAs are shown in Figure 9. The species are clearly separated but the ellipses of confidence (95%) slightly overlap, especially for females.

Figure 10 shows the variability of colours of specimens in-natura.

In song pattern, both species are similar, but differ slightly in SRR and more clearly in the number of syllables per echeme (Fig. 11).

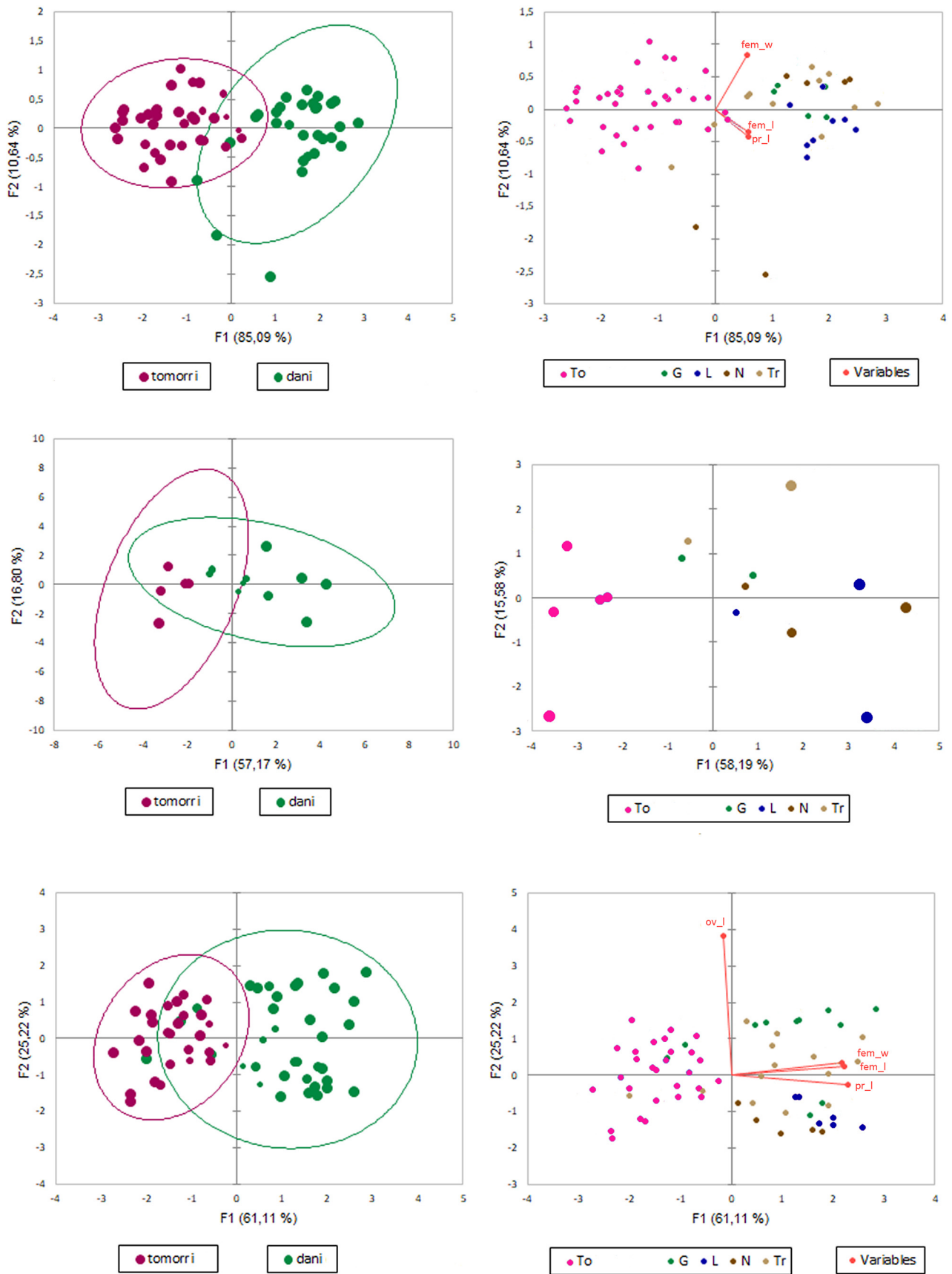


FIGURE 9. PCA of measurements. Per species on the left, per mountain range on the right. Upper row, external measurements of males. Central row, titillators. Lower row, external measurements of females. To—Tomorr & Kulmak Mt., G—Griaba Mt., L—Lunxhëri Mt., N—Nemërçka & Dhëmbel Mts., T—Treshishina Mt.

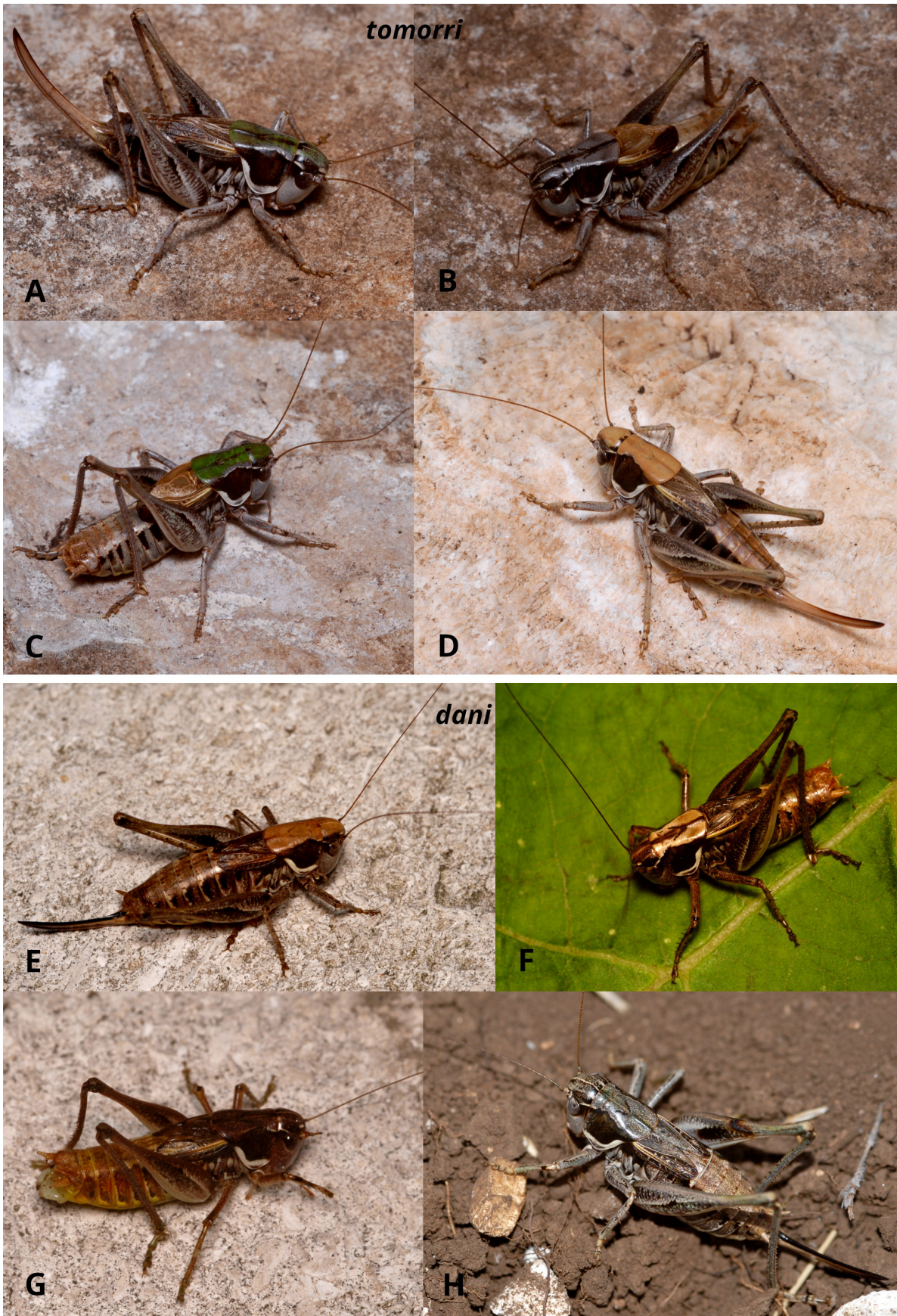


FIGURE 10. Habitus and colour variation of *Montana tomorri* sp. nov. from Tomorr Mt. (A–D) and *M. dani* sp. nov. from Trebeshina Mt. (E–H).

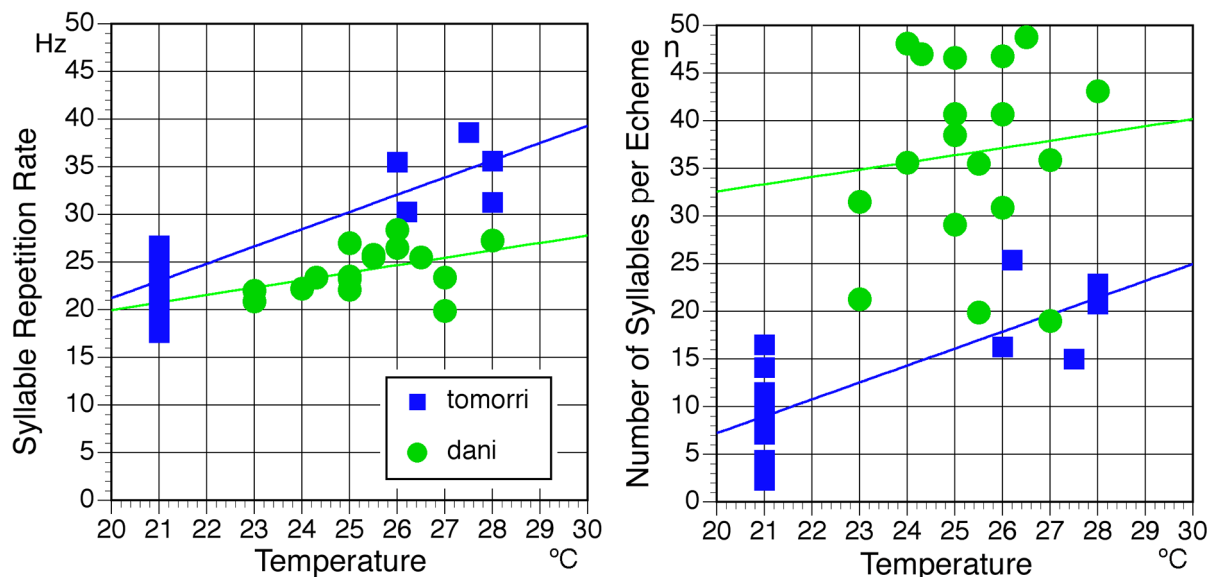


FIGURE 11. Comparison of song patterns.

Key to brachypterous species of genus *Montana* occurring in the Balkan Peninsula

Note: Between *M. tomorri* and *M. dani*, the analysis of males provides a better reliability of identification compared to the females due to fewer distinctive characters of the latter.

Males

1. Internal tooth of cerci close to the base *M. striata* (Thunberg, 1815)
- Internal tooth of cerci located between the half to the tip of the cerci. 2
2. Internal tooth of cerci close to the tip, within $\frac{1}{4}$ of the length of the cerci *M. medvedevi* (Miram, 1927)
- Internal tooth of cerci located between $\frac{1}{2}$ to $\frac{3}{4}$ of the length of the cerci from the base. 3
3. 10th tergite with two spiniform processes. *M. macedonica* (Berland & Chopard, 1922)
- 10th tergite with no spiniform processes. 4
4. Cerci (Fig. 12) with thin and long inner tooth at the distal third; ratio of apical to basal arms length of titillators over 0.6 (Fig. 13); hind femur length shorter than 15,1 mm (conf. 95%) *M. tomorri*
- Cerci (Fig. 12) with a strong and short inner tooth between the middle to the distal third; ratio of apical to basal arm's length of titillators less than 0.6 (Fig. 13); hind femur length longer than 15,0 mm (conf. 95%) *M. dani*

Females

1. Tegmina length less than 3.5 mm; side sclerite of subgenital plate outstandingly large *M. medvedevi*
- Tegmina length longer than 3.5 mm; side sclerite of subgenital plate not outstandingly large. 2
2. Subgenital plate conical with the apex shortly emarginated, almost as long as wide at the base *M. macedonica*
- Subgenital plate more or less transverse (rectangular) with the hind margin truncated or emarginated. 3
3. Hind margin of subgenital plate more or less as wide as at the base; side sclerites with gentle concavities *M. striata*
- Hind margin of subgenital plate narrower compared to the base. 4
4. Upper margin of the ovipositor light *M. tomorri*
- Upper margin of the ovipositor dark *M. dani*

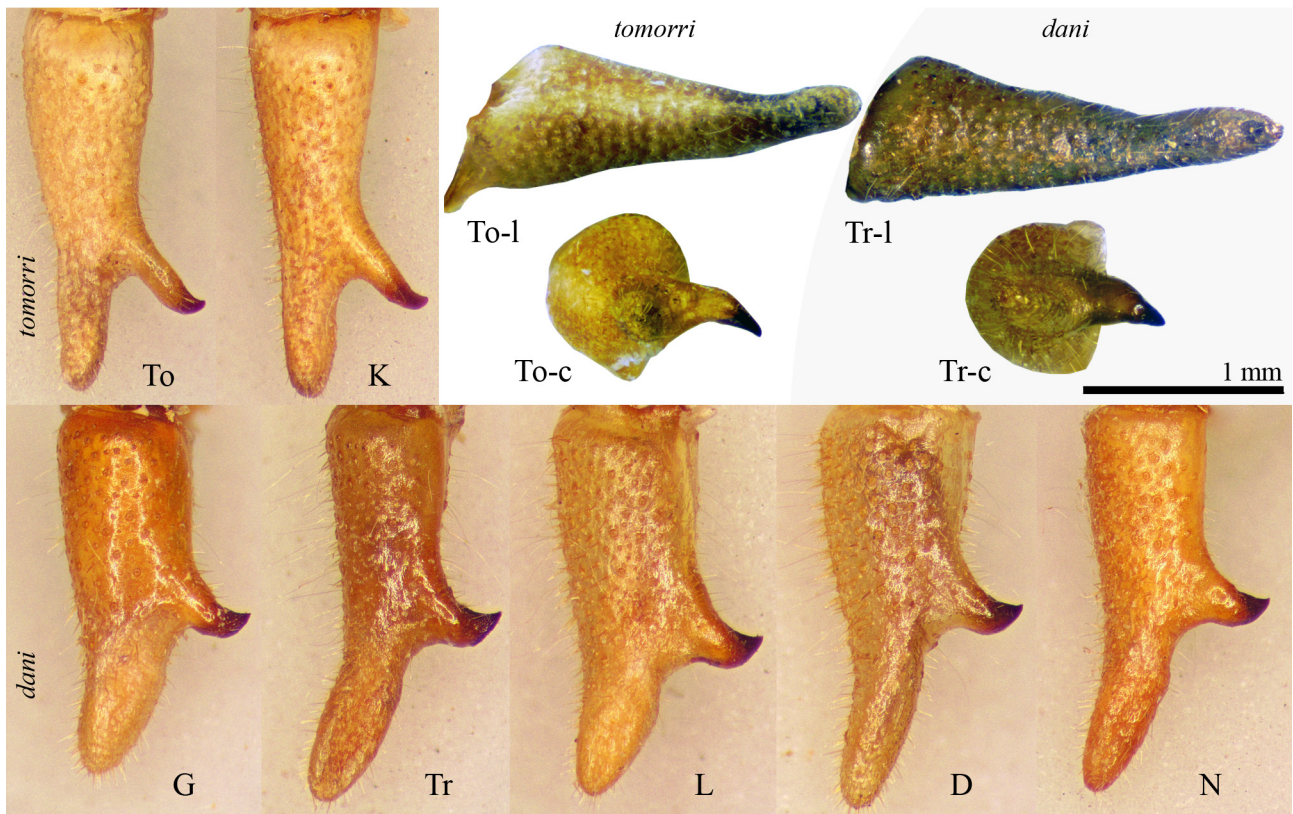


FIGURE 12. Male left cercus of *Montana tomorri* sp. nov. from Tomorr (To), Kulmak (K) and *M. dani* sp. nov. from Griba (G), Trebeshina (Tr), Lunxeri (L), Dhëmbel (D), Nemërçka (N) Mountains; dorsal view (not marked), lateral view (-l), caudal view (-c).

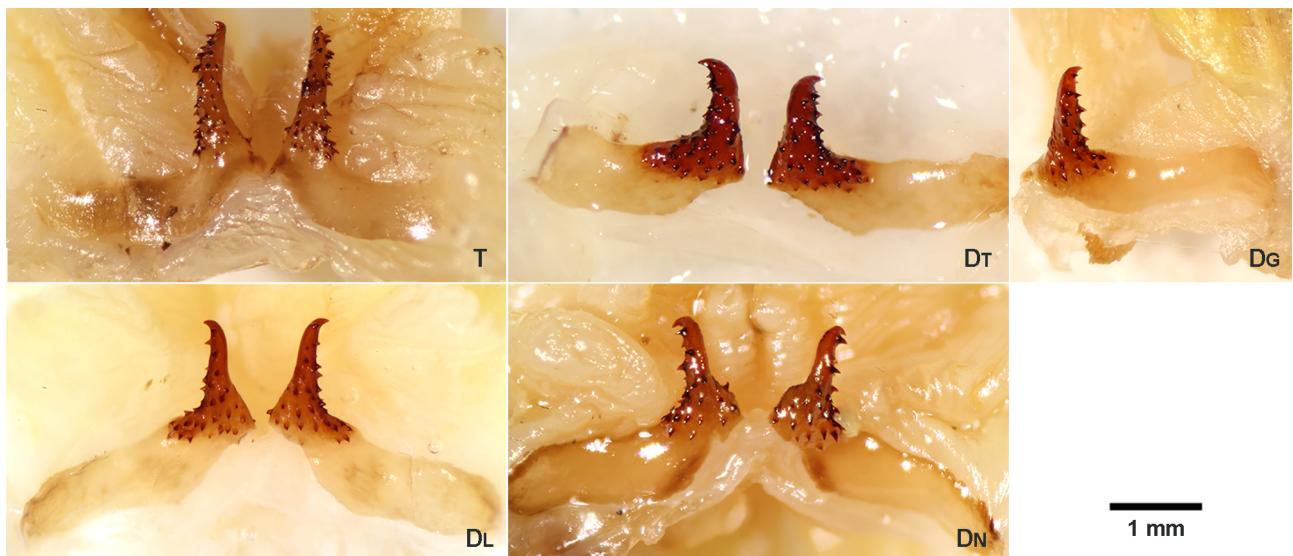


FIGURE 13. Titillators from each mountain range. T: *M. tomorri* from Tomorr. DT, DG, DL, DN: *M. dani* from Trebeshina (DT), Griba (DG), Lunxhëri (DL), Nemërçka (DN).

Discussion

The exceptionally rich and complex fauna of the Balkan Peninsula hosting the highest number of Orthoptera species in Europe (Hochkirch *et al.* 2016; Ivković *et al.* 2024) yet proves to hide undiscovered diversity (e.g., Willems *et al.* 2023, 2025; Trillo & Ortego 2025) as we show in the present paper. In the present study, we describe two new

species from the Balkan fauna, *Montana tomorri* and *M. dani*. An extensive sample provides a clear view on the spatial distribution and phenology of these local endemics and a basis for future assessments of their threatened status and for possible conservation strategies. The general knowledge concerning *M. tomorri* and *M. dani* has to be improved in the future, concerning their biology and ecology. Some experiments of rearing have been started but not yet on a full cycle (unpublished data). Concerning their habitat, we noticed that the presence of bushes in the grasslands appears as a positive factor (used as shelters or for other reason). Their ecology seems to be relatively similar to that of *Parnassiana* but more studies are necessary to better understand it.

In addition to the two new descriptions, we provide further insights into the systematics of tribe Platycleidini and the genus *Montana*, based on a modest sample of nuclear DNA data and on a general evaluation of morphology and acoustic characters of *Montana*. We show that a reassessment of the tribe with focus on certain genus groups like *Metrioptera* s.l. and *Platycleis* s.l., as well as specifically on genus *Montana*, not only based on morphology but also including molecular and bioacoustic information, is urgently required to get a better understanding of monophyletic groups and how these match the current generic grouping.

The ITS nuclear marker was recently used to study phylogenetic relationships at intrageneric level in Orthoptera (e.g., Ullrich *et al.* 2010; Çiplak *et al.* 2015, 2020; Chobanov *et al.* 2017; Borissov *et al.* 2023) having an evolutionary rate faster than the protein coding nuclear markers and slower than most mitochondrial markers (Bargues *et al.* 2000, 2006; Papadopoulou *et al.* 2010). As ITS proved to provide robust phylogenies within certain orthopteran genera (see above citations) current results may be considered decisive concerning the terminal nodes in the produced tree but are precarious concerning the basal relationships. Our preliminary conclusions based on the ITS revealed two strongly supported monophyletic lineages including a crown clade consisting of *M. tomorri*, *M. dani*, *M. dectiformis* and *Amedegnatiana vicheti*. The latter result, together with the polytomy at the root of the tree including other species of *Montana*, point to a possible polyphyly of that genus. A future review of the Platycleidini involving a wider set of DNA markers may very well find arguments to split *Montana* into several species groups. Such a review will hopefully also clarify the position of atypical species like *M. macedonica*, *M. schereri* or *M. dectiformis*, confirm the status of geographical outliers from Spain and Madeira, shed some more light on the position of *Amedegnatiana* in relation to *Montana*, and help to get a better understanding of the relationship of species currently assigned to *Metrioptera* s.str.

Acknowledgements

We would like to thank all colleagues (most of them working on other groups), who contributed to the collection of material in-situ, or who provided help: Z. Barina, F. Báthori, Cs. Barkóczi, G. Csorba, D. Czabán, Z. Fehér, R. Felix, Z. Gál, G. Hristov, A. Hunyadi, T. Huszár, R. Kleukers, E. Loçe, Á. Lovas-Kiss, M. Mahilaj, E. Mizsei, D. Murányi, B. Odé, P. Ponel, Z. Rádai, M. Szabolcs, Cs. Szepesváry, L. M. Tálás, Zs. Tóth, J. Ujszegi, B. Vági and B. Zlatkov. A particular thought to Fer Willemse, who was the first to examine one of the two species.

This study was supported by grant KP-06-N81/5–04.12.2024 from the National Science Fund (MES) of Bulgaria to Dragan Chobanov. Genetic samples were collected with respective permissions during fields trips funded by the Theodore J. Cohn Research Fund (The Orthopterists' Society; to Nefeli Kotitsa) and grants supporting the Orthoptera Species File (to Dragan Chobanov). The Fonds Pontium fund from Naturalis Biodiversity Center, Leiden (to Nefeli Kotitsa), provided material of *Amedegnatiana vicheti*.

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Supplementary Materials. The following supporting information can be downloaded at the DOI landing page of this paper.

Supplementary Figure 1. Head, pronotum and tegmina of *Montana tomorri* **sp. nov.** from Tomorr Mt. (A–D) and *M. dani* **sp. nov.** from Trebeshina Mt. (E–H). A, C, E, G: males; B, D, F, H: females; A, B, E, F: dorsal view; C, D, G, H: lateral view.

Supplementary Figure 2. Tegmina of *Montana tomorri* **sp. nov.** from Tomorr Mt. (A, C) and *M. dani* **sp. nov.** from Griba Mt. (B, D), dorsal view. A, B: males, C, D: females.

Supplementary Figure 3. Stridulatory file of *Montana tomorri* **sp. nov.** from Tomorr Mt. (focus stack image) and *M. dani* **sp. nov.** from Trebeshina Mt. (SEM photo).

Supplementary Figure 4. Terminal abdominal segments of *Montana tomorri* **sp. nov.** from Tomorr Mt. (A, C) and *M. dani* **sp. nov.** from Trebeshina Mt. (B, D) in dorsal view. A, B: males; C, D: females.

Supplementary Figure 5. Subgenital plate of *Montana tomorri* **sp. nov.** from Tomorr Mt. (A–D) and *M. dani* **sp. nov.** from Trebeshina Mt. (E–H). A, B, E, F: males; C, D, G, H: females; A, C, E, G: ventral view; B, D, F, H: lateral view.

Supplementary Figure 6. Left titillator of *Montana tomorri* **sp. nov.** from Tomorr Mt. (A–C) and *M. dani* **sp. nov.** from Trebeshina Mt. (D–F). A, D: dorsal view; B, E: lateral view; C, F: caudal view.

Supplementary Figure 7. Ovipositor of *Montana tomorri* **sp. nov.** from Tomorr Mt. (A, B) and *M. dani* **sp. nov.** from Griba Mt. (C, D). A, C: lateral view; B, D: dorsal view.