



An integrative taxonomic revision of the genus *Triphosa* Stephens, 1829 (Geometridae: Larentiinae) in the Middle East and Central Asia, with description of two new species

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Abstract

Western Palaearctic species of the genus *Triphosa* Stephens, 1829 are revised with focus on the Middle East and Central Asia. The analysis is based on the morphological examination (wing pattern and genitalia) of the type series of most species, as well as of large series of additional material. Additionally, DNA barcode data were used as an extra line of information. As result, *Triphosa agnata* Le Cerf, 1918 **syn. n.** is synonymized with *T. sabaudiata* (Duponchel, 1830), the taxonomy of the enigmatic *Triphosa taochata* Lederer, 1870 is clarified, and two species are described as new to science: *T. silviae* **sp. n.** and *T. lecerfi* **sp. n.** *Hydria ravulata* (Staudinger, 1892) **comb. rev.**, is transferred from *Triphosa* to the genus *Hydria*. Lectotypes are designated for *Triphosa taochata* and *Hydria ravulata*. Wing pattern, genitalia and diagnostic characters of all examined species are illustrated and the distribution data shown on the map.

Key words: *Hydria*, lectotype designation, new combinations, new synonyms, Triphosini

Introduction

The genus *Triphosa* Stephens, 1829 belongs to the tribe Triphosini Tutt, 1896 (Viidalepp 2011; Schmidt 2017). Herbulot (1962) regarded the tribe Triphosini as a synonym of the tribe Rheumapterini Herbulot, 1962, without any declaration. However, genitalia structures confirmed the separation of these tribes (Viidalepp 2011, Schmidt 2017), which is supported by molecular data (Öunap *et al.* 2016). Up to now the tribe Triphosini comprises two genera, *Triphosa* and *Pareulype* Herbulot, 1951 (Schmidt 2017).

Scoble (1999) listed 50 species (and 6 subspecies) in the genus *Triphosa*, which was supplemented later by further two species (Scoble & Hausmann 2007). With description of *T. tauteli* Leraut, 2008, the actual number of *Triphosa* taxa increased to 53 species. *Triphosa* species occur almost in all biogeographical regions, except Australia and Antarctica (45 species in the Palaearctic and Indo-Pacific, three species in the Nearctic, ten in the Neotropical and one in Afrotropical region) (Scoble & Hausmann 2007, Leraut 2008).

The genus is characterized by weakly developed socii, setose labides (separated or fused lobes), the furcate sacculus projection in male genitalia and by the heavily sclerotized posterior part of the corpus bursae in female genitalia (Hausmann & Viidalepp 2012).

The delimitation of most *Triphosa* species based on the wing pattern only can be challenging. In this regard, many specimens collected from the Middle East and Central Asia, where no taxonomic revision on this genus has been published, are uncertainly identified. The aim of this study is to shed light on the species occurring in these areas. To achieve this, we mainly focused on the characters of male and female genitalia and the data obtained by DNA barcoding. The type series of most species were investigated, and large series of additional material were studied to explore the actual geographic distribution of each species.

Material and methods

Type material and additional specimens examined in this study were borrowed from the following collections (acronyms after Evenhuis 2007, as far as included):

BMNH—Natural History Museum, London, England; HMIM—Hyke Mirzayans Insect Museum, Tehran, Iran; HPM—Hrvatski Prirodoslovni Musej, Zagreb, Croatia; MCIZ—Museo Cambria, Istituto di Zoologia dell'Università, Messina, Italy; MNHM—Muséum National d'Histoire Naturelle, Paris, France; MNHU—Museum für Naturkunde der Humboldt-Universität, Berlin, Germany; MKU—Mustafa Kemal University, Agriculture Faculty, Plant Protection Department, Antakya, Turkey; PCBM—Private collection of Bernd Müller, Berlin, Germany; PCDB—Private collection of Daniel Bolt, Schiers, Switzerland; PCDS—Private collection of Dirk Stadie, Eisleben, Germany; PCJG—Private collection of Jörg Gelbrecht, Berlin, Germany; PCPS—Private collection of Peder Skou, Vester Skerninge, Denmark; SMNK—Staatliches Museum für Naturkunde Karlsruhe, Germany; SMNS—Staatliches Museum für Naturkunde Stuttgart, Germany; ZSM—Zoologische Staatssammlung München (Munich), Germany.

Morphological examination. For the identification and comparison of specimens we used, original descriptions and type material, if available. Specimens were externally photographed with Visionary Digital photography system (LK Imaging System, Dun.Inc.) and Olympus E3 digital camera. Genital preparations were made using standard methods (Robinson 1976). Genitalia were first photographed in their natural form following the methods described by Su (2016) and Wanke & Rajaei (2018) using a Keyence VHX-5000 and Visionary Digital photography system (LK Imaging System, Dun.Inc.). Genitalia were embedded in Euparal as permanent slides. All slides were photographed with a Leica digital microscope (Z16 APO) and a Keyence VHX-5000.

Geographical coordinates were traced using 'Google Earth Pro' (vers 7.3.1.4507 for Mac) and distribution maps were prepared using QGIS (vers 2.18.15). For the elevation profile in QGIS, Global Multi-resolution Terrain Elevation Data 2010 (GMTED2010) were downloaded from <https://earthexplorer.usgs.gov>.

DNA barcoding. DNA extraction and amplification of the "barcode" fragment (658 base-pairs of the 5' terminus) of the mitochondrial Cytochrome-C Oxidase I gene were carried out using standard protocols (Ivanova *et al.* 2006) and sent to Macrogen for sequencing. As reference data, we used the sequences from BOLD (Barcode of Life Datasystems). Amplification and sequencing of the "barcode" fragment of the syntypes of *Triphosa taochata* were carried out at the Canadian Centre for DNA barcoding (CCDB, Guelph), in the framework of the Lepidoptera Campaign of the international Barcode of Life program (iBOL; www.lepbarcoding.org), following a special protocol for old museum specimens based on Next-Generation-Sequencing (Prosser *et al.* 2016, Hausmann *et al.* 2016).

A list of all specimens used for DNA analysis is presented in the Appendix along with their label data and process ID numbers. All sequence and metadata are accessible in a public dataset on BOLD (DS-TRIPHOSA; doi: dx.doi.org/10.5883/DS-TRIPHOSA). Reconstruction of a neighbour-joining (NJ) tree (Using K2P model: Kimura 1980) and calculation of genetic distances was carried out in MEGA7 (Kumar *et al.* 2016). Genetic similarities and exact interspecific distances are shown in the neighbour-joining tree (fig. 54) and exact distances are listed in table 2.

Results and discussion

Triphosa Stephens, 1829

Triphosa Stephens, 1829, *The nomenclature of British insects; being a compendious list of such species as are contained in the Systematic Catalog of British insects*, 44. Type species: *Phalaena dubitata* Linnaeus, 1758.

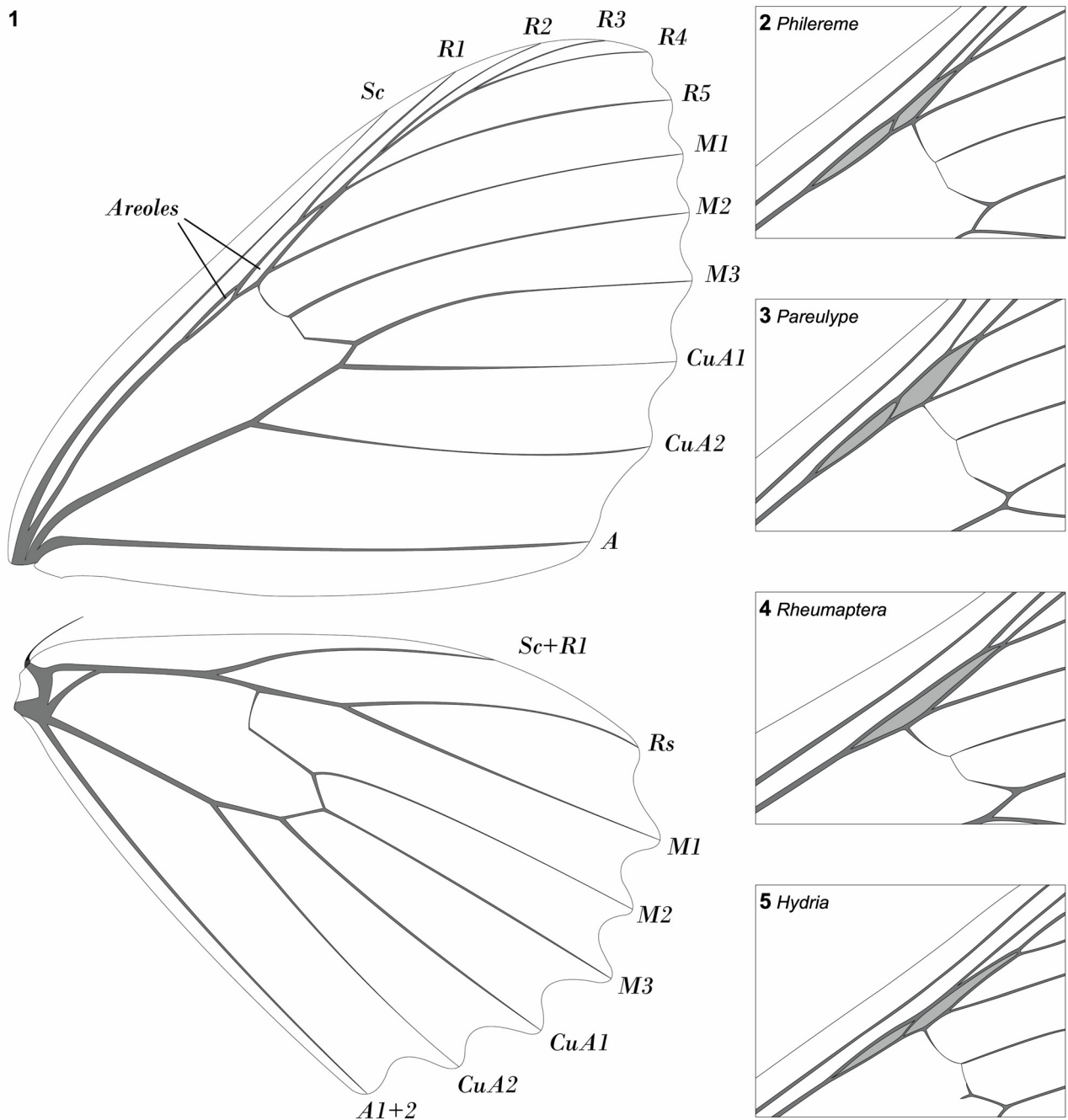
Umbrosina Bruand, 1847, *Mémoires de la Société d'émulation du Doubs*, (1) 2 (3, livr. 5, 6), 105. Type species: *Phalaena dubitata* Linnaeus, 1758.

Speluncaris Bruand, 1847, *Mémoires de la Société d'émulation du Doubs*, (1) 2 (3, livr. 5, 6), 105. Type species: *Larentia sabaudiata* Duponchel, 1830.

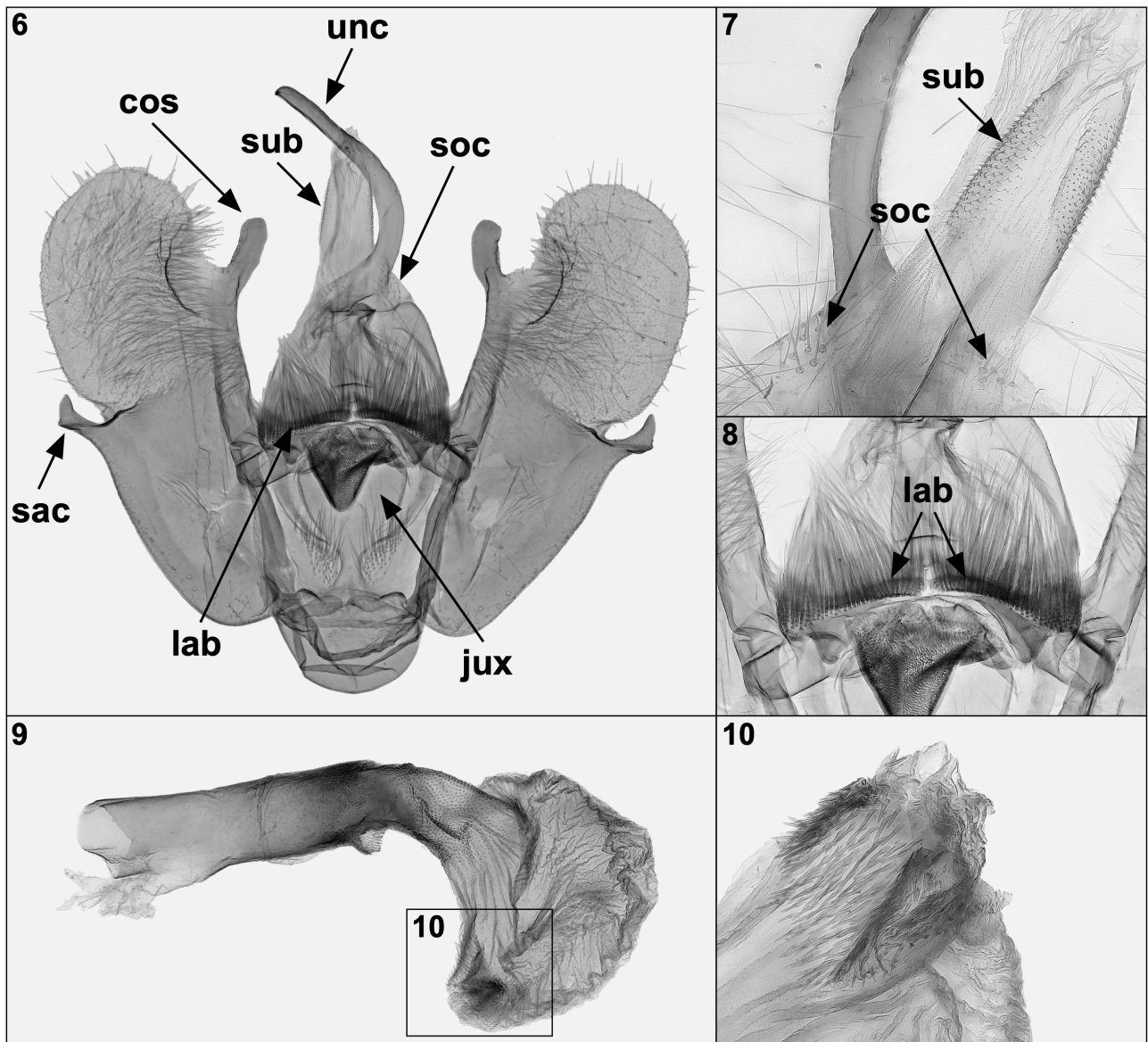
Strepsizuga Warren, 1908, *Proceedings of the United States National Museum*, 34, 101. Type species: *Strepsizuga aberrans* Warren, 1908.

Re-description of genus. Medium to large moths (wingspan between 33–57 mm). Antennae filiform, in males very shortly ciliated-setose. Frons slightly convex. Palpi long, about twice the diameter of the eye (Hausmann &

Viidalepp 2012). Proboscis well developed. Chaetosemata consisting of two patches of setae, not connected to each other. Ground colour varies from yellow to beige, or brown with slight greyish or rarely reddish tinge. Tergites of both wings wavy, more conspicuous on the hindwings. Forewing with two areoles, vein R1 arising separately from the second areole, R2-5 on a common stalk, M1 arising from the second areole (fig. 1). In hindwing Sc+R1 fused with Rs, basally bifurcate, Rs and M1 stalked, A1+2 originating separately. Epiphysis short (one third of the tibia). Midtibia with one, hindtibia with two pairs of spurs.



FIGURES 1–5. Wing venation in genus *Triphosa* and its closely related genera. 1: *Triphosa dubitata*, with two areoles. 2: *Philereme transversata*; 3: *Pareulype berberata*; 4: *Rheumaptera hastata*; 5: *Hydria cervinalis*. Areoles marked with grey in 2–5. Only one areole is present in *Rheumaptera*.



FIGURES 6–10. Terminology of male genitalia used in this paper. 6: genitalia capsule. 7: subscaphium and socii. 8: labides. 9: aedeagus. 10: microcornuti on vesica. Abbreviations as follows (after Schmidt 2017): *cos*—costa of valva, *jux*—juxta, *lab*—labides, *sac*—sacculus projection, *soc*—socii, *sub*—subscaphium, *unc*—uncus. (Photos of *Triphosa lecerfi* sp. n.)

Male genitalia (fig. 6–10). Uncus long, thin, tapered, sub-medially curved and heavily sclerotized. Socii present, weakly developed (Schmidt 2017, also see fig. 6, 7). Subscaphium developed as a flat spatulate sclerite (Hausmann & Viidalepp 2012), sclerotized and strewn with plenty of little spines on both sides (fig. 7). Valva apically rounded, its apical half weakly sclerotized; costa of valva and sacculus projection heavily sclerotized, the latter distally forked (fig. 6). Labides variable, but diagnostic to species, differing from two flattened structures (fig. 8) to a spoon-shaped structure. Saccus short, broad. Aedeagus medium-sized, broad, heavily sclerotized (fig. 9). Vesica membranous, partially covered with a patch of microcornuti (fig. 10).

Female genitalia (fig. 11, 12). Ovipositor short, broad. Apophyses posteriores approximately twice the length of apophyses anteriores. Antrum short, broad, funnel-shaped. Ductus bursae extremely short, arched, flat, wide on the ventral view, but narrow on the lateral view. Corpus bursae with heavily sclerotized posterior part and membranous anterior part. Signum absent.

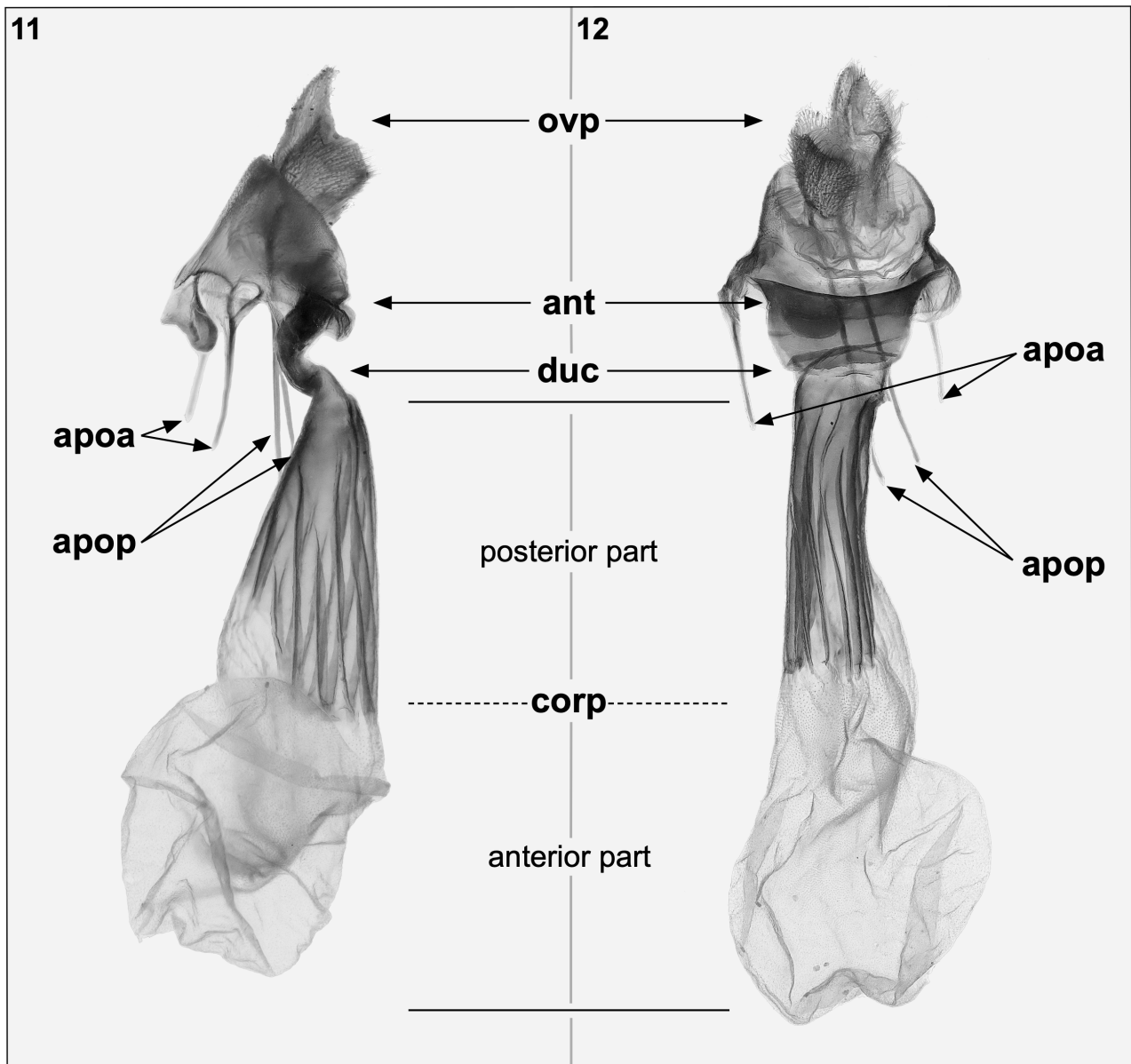
Diagnosis. (data are summarized in table 1). Forewing of *Triphosa*, *Pareulype*, *Hydria*, *Philereme* and *Hospitalia* is characterized by the presence of two areoles (only one areole in *Rheumaptera*) (see detailed drawings in figs 1–5). The two genera *Triphosa* and *Pareulype* could be easily diagnosed based on their heavily sclerotized, long and strongly curved uncus (short, broader at the base, slightly curved in *Rheumaptera* and *Hydria*; vestigial in

Hospitalia; thin and needle-shaped in *Philereme*). Valva medium size (not exceeding the tip of the uncus) in *Triphosa*, *Pareulype*, *Rheumaptera*, *Hydria* and *Hospitalia* (valva very large, exceeding tip of uncus in *Philereme*). Costa of valva strongly sclerotized, distally rounded and separated from centre of valva in *Triphosa* (distally rounded, fused to valva, medially projecting in *Pareulype*; distally broadened, and covering apex of valva in *Hospitalia*; weakly sclerotized in *Rheumaptera*, *Hydria* and *Philereme*). Labides setose, with separated or fused lobes, variable in shape (flat, hump-, stick- or spoon-shaped) in *Triphosa* (relatively small, partly fused in *Pareulype* (Choi 2006) and *Hospitalia*; long, apically dilated, reaching uncus in *Rheumaptera* and *Hydria*; short in *Philereme* (Schmidt 2017)). Sacculus projection furcate in most species of *Triphosa* (with distal process in *Pareulype* (Choi 2006, Hausmann & Viidalepp 2012); elongated, distally tapered or round, sometimes curved in *Rheumaptera*, *Hydria* [sometimes furcate], *Hospitalia* and *Philereme* (Hausmann & Viidalepp 2012)). Vesica membranous, partially covered with patch of microcornuti in *Triphosa* (patches of spinose cornuti in *Pareulype* (Choi 2006); long, rod-shaped cornuti present in *Rheumaptera* and *Hydria*; one cornutus in *Hospitalia* (Hausmann & Viidalepp 2012); tiny cornuti in *Philereme* (Viidalepp 2011)) (see tab. 1).

In the female genitalia of *Triphosa* (figs 11–12), anterior part of corpus bursae membranous, its posterior part sclerotized with several longitudinal folds, signum absent (same condition, but longitudinal folds absent, signum present in *Pareulype*; signum in *Hydria*, if present, more complicated and diverse; anterior and posterior parts not well separated, but signum present in *Rheumaptera*; signum absent in *Hospitalia* and *Philereme* (see Choi 2006, Hausmann & Viidalepp 2012) (for further details, see tab. 1).

TABLE 1. Summary of diagnostic characters of genitalia in *Triphosa* and genera closely related to it. For more information see: Xue & Zhu (1999), Choi (2006), Hausmann & Viidalepp (2012), Schmidt (2017) and Viidalepp (2011).

	<i>Triphosa</i>	<i>Pareulype</i>	<i>Rheumaptera</i>	<i>Hydria</i>	<i>Hospitalia</i>	<i>Philereme</i>
uncus	long, curved sclerotized		short, broad at base, slightly curved		vestigial	thin, needle-shaped
costa of valva	sclerotized, distally rounded tip free	distally rounded, fused to valva, medially projecting	weakly sclerotized		distally broadened, covering apex of valva	weakly sclerotized
valva	not exceeding tip of uncus					exceeding tip of uncus
labides	flat, hump-, stick-, spoon-shaped	relatively small, partly fused	long, apically dilated, reaching uncus		small, partly fused	short, curved
sacculus projection	mostly furcate	distal process	elongated tapering	slender, distally round, sometimes furcate	distally thin, elongated	distally finger-shaped
cornuti	weakly developed microcornuti	patch, spinulose	usually long tapered		one cornutus 1/3 aedeagus length	tiny
ovipositor	usually broad rarely thin, tapered	ventrally with sclerotized stripe	thin, tapered		broad	telescopic
corpus bursae	posteriorly sclerotized, anteriorly membranous	large	sclerotized	posterior part sclerotized	latero-posterior sclerotization	simple
signum	absent	horizontally oriented, band-shaped	comb-shaped	if present: comb-, star-shaped ridge of spinules	absent	



FIGURES 11–12. Terminology of female genitalia of *Triphosa* used in this paper. Structures showed in both lateral (fig. 11) and ventral (fig. 12) view. Abbreviations as follows: *ovp*—ovipositor, *ant*—antrum, *duc*—ductus bursae, *corp*—corpus bursae, *apoa*—apophyses anteriores, *apop*—apophyses posteriores.

Species accounts

Triphosa dubitata (Linnaeus, 1758)

(figs 13, 22, 38, 46; map)

Phalaena Geometra dubitata Linnaeus, 1758. *Systema naturae* (Ed. 10) 1, 524. Syntypes (Europe). Deposited in the Linnean Society of London, UK.

Phalaena dubia Brez, 1791. *La flore des insectophiles, précédée d'un discours sur l'utilité des insectes et de l'étude de l'insectologie*, 174. Incorrect subsequent spelling.

Phalaena Geometra dimidiata Stewart, 1802. *Elements of natural history*, 2, 162. Syntypes (England).

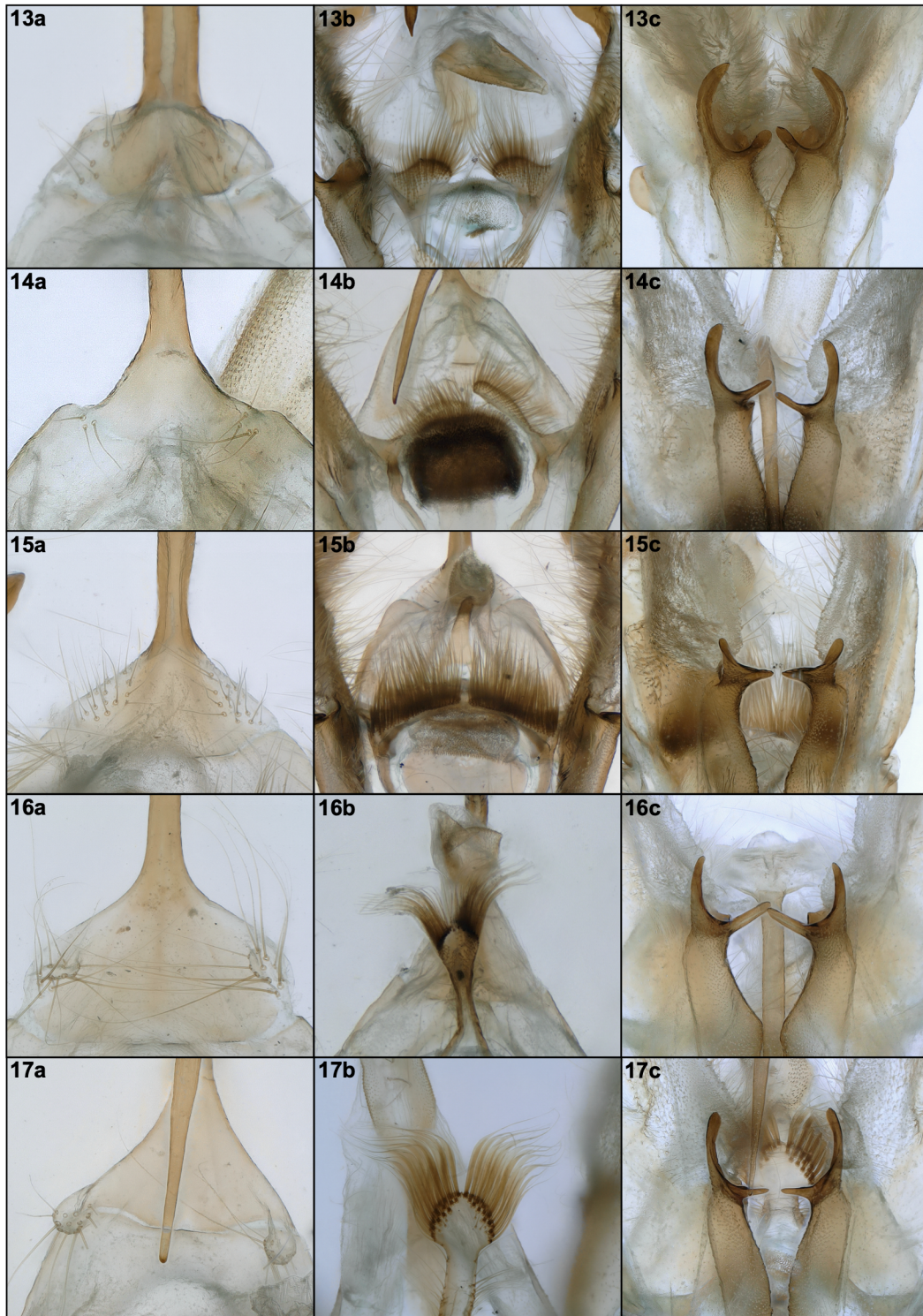
Triphosa cinerata Stephens, 1829. *Illustrations of British entomology (Haustellata)*, 3, 263. Syntypes (England).

Triphosa dubitata amblychiles Prout, 1937. In: Seitz, *The Macrolepidoptera of the World*, 4, Supplement, 99. Holotype ♂ (China, Kwei-chou). Deposited in Natural History Museum, London, UK.

Material examined. 1 ♂, Türkei, Prov. Erzurum, 05.vii.[20]00, ca. 2400 m, 1 km E Gölyurt Gecidi im Mescit Daglari, leg. Bernd Schacht, BC Lep DS 0020, g. prep 0031/2018; in PCDS. 6 ♂, 6 ♀, Hispania, Leon, Pto. Pandtrave, 1500 m, 18.vii.1976, leg. Aistleitner, coll. W. Schäfer, Stuttgart, SMNS-Lep.1997-11, g. prep (♂) 0014/2018 D. Wanke; 1 ♂, 4 ♀, Gr. Ballon Ht.-R, France, 11.viii.[19]62, coll. E. Wenck; 1 ♂, 1 ♀, Gr. Ballon Ht.-R, France, 4.viii.[19]61, coll. E. Wenck; 1 ♂, Gr. Ballon Ht.-R, France, 10.vii.[19]61, coll. E. Wenck; 1 ♂, Gr. Ballon Ht.-R, France, 10.vii.[19]69, coll. E. Wenck; 1 ♀, Gr. Ballon Ht.-R, France, 10.vii.[19]59, coll. E. Wenck; 1 ♂, Valle du Miroux, Digue, B.-Alpes, France, 4.-21.vii.[19]64, leg. E. Wenck; 1 ♂, Haut-Rhin, 14.vii.[19]53, coll. E. Wenck; 1 ♂, F: Dept. Isère, Chatreuse, Grotte de Gulers Mort, 1350 m, 6.x.1984, leg. Schawaller; 2 ♀, F: Dept. Isère, Chatreuse, Grotte de Gulers Mort, 1350 m, 6.x.1984, leg. Bretzendorfer; 1 ♂, Schweiz, Kanton Uri, Steinalper Jochli, b. Isenthal, 2150 m, 30.vii.1992, leg. H. Hoppe; 1 ♂, Hispania, Burgos, Sierra Mencia, 1650 m, 2.viii.1976, Li. leg. Aistleitner, coll. W. Schäfer, Stuttgart, SMNS-Lep.1997-11; 1 ♂, Schweiz, Strelapass, 6.viii.[19]62, L. Settele; 1 ♀, Davos, Strelapass, 4.viii.[19]64, L. Settele; 1 ♀, Graubuenden, Strelapass, 7.viii.[19]62, L. Settele; 1 ♀, Gempenhöhle, 29.xii.[19]47; 1 ♀, Zürich, 18.iv.1909; 1 ♂, Italy, Piemonte, Prov. Cuneo, Parco Naturale Alpi, Marittime: N Lago della, NW Gias della Beurra, old road, 1575 m, 44°11'03.47"N 7°20'37.15"E, 2.ix.2008, 20:30-23:30 h, at light, leg. C. Häuser, Record ID: EDIT ATBI 01 CH 2008-23A-001-0252; 1 ♂, Italy, Piemonte, Prov. Cuneo, Parco Naturale Alpi, Marittime: Sant' Anna di Valdieri, 975-990 m, at light, N 44.2435°, E 7.32161°, 1.ix.2008, 21.45-22.30h, leg. D. Bartsch & C. Häuser, Record ID: EDIT ATBI 01 CH 2008-22-001-0007, SMNS - Lep. 2008 - 01; 1 ♂, Südtirol, 2000 m, Stilfser Joch, 1.viii.-8.viii.1958, leg. H. Jüngling; 1 ♂, Italia, Prov. Friaul, 400 m, 19.vii.1961, leg. H. u. G. Reiß; 2 ♂, 2 ♀, Trafoi, 15.vii.1927, A. Langheinrich, g. prep (♀) 0013/2018 D. Wanke; 1 ♂, Stilfser Joch, Südtirol, Trafoi, 1600 m, 1.-8.viii.1959, leg. H. Jüngling; 1 ♂, Italien, Schnalstal, 900 m, 19.v.[19]79, R. Probst; 1 ♀, Naturns, 6.84 Rp., Berberitze, e.p. 11.v.[19]85, Sammlung Langer, SMNS 1986; 1 ♀, Pitztal-Tirol, 1400-1700 m 8.-22.vii.1961, L. Settele; 1 ♂, S. Fedele d'Intelvi, 1.viii.1907; 1 ♂, S. Fedele d'Intelvi, 20.vii.1907; 1 ♂, S. Fedele d'Intelvi, 17.viii.1907; 1 ♂, S. Fedele d'Intelvi, 19.viii.1907; 1 ♀, S. Fedele d'Intelvi, 22.viii.1907; 1 ♂, Austria, Lechtal, Häselgehr, 4.viii.1965, leg. W. Rohm; 2 ♂, Austria, Steiermark, Radmer, 17.vii.1959, leg. Achtelig; 1 ♂, Wien, vii.[19]30; 1 ♂, Oberösterreich, Hochburg, 27.vii. [19]57, Sauer; 1 ♂, Oberösterreich, Hochburg, 5.vii.[19]56, e.l, Sauer; 1 ♂, Oberösterreich, Hochburg, 6.v.[19]59, Sauer; 1 ♂, Oberösterreich, Hochburg, 18.vii.[19]56, Sauer; 1 ♀, Oberösterreich, Hochburg, 15.vii.[19]56, e.l, Sauer; 1 ♀, O. Öst., Hochburg, 3.iv.[19]53, Lichtfg., Sauer; 1 ♀, O. Öst., Hochburg, 3.iv.[19]53, Sauer; 1 ♀, O. Öst., Hochburg, 28.iv.[19]53, Lichtfg., Sauer; 1 ♂, 1 ♀, Ungarn, Bakony-Wald, 9.viii.[19]80 Li, Sammlung Langer SMNS 1986; 1 ♀, Oberbayern, München-Allach, 10.v.1979, W. Sauer; 1 ♂, Jugoslawien, Porec, LF, 28.vi.[19]86, H. Popp, coll. H. Popp, Rottenburg/Laaber, SMNS - Lep. 2003 - 05; 1 ♂, Iran, Elburs, vic. Kendevan, 2500–3000 m, 7.-9.viii.1977, leg. W. Thomas, coll. W. Schäfer, Stuttgart, SMNS - Lep., 1997 - 11, g. prep 0015/2018 D. Wanke; 2 ♂, Georgia: Borjomi Kharaguali NP, Borjomi District, vic. Likani, trail 1 near ranger shelter, 1850 m, 22.vii.2006, 41°51'01.6", 43°15'39.1"E, at light, leg. C. Häuser, D. Bartsch, SMNS - Lep 2006 - 03, g. prep 0016/2018 D. Wanke; all in SMNS.

Diagnosis. Wingspan 34–43 mm, but in rare cases smaller specimens with wingspan of 28–33 mm (length of forewing 17–23 mm). Ground colour greyish brown, with red shimmer (beige, sandy coloured in *T. silviae* sp. n.; beige, sandy-coloured to very bright brown in *T. lecerfi* sp. n.; pale grey to bright yellow-white, with some grey shine in *T. sabaudiata*; sandy-yellow covered with a slate-coloured shroud in *T. taochata*). Transversal lines on the forewing darkened, clearly visible, on the hindwing faint. Terminal line black. Fringes clearly visible, not differing in colour from wings.

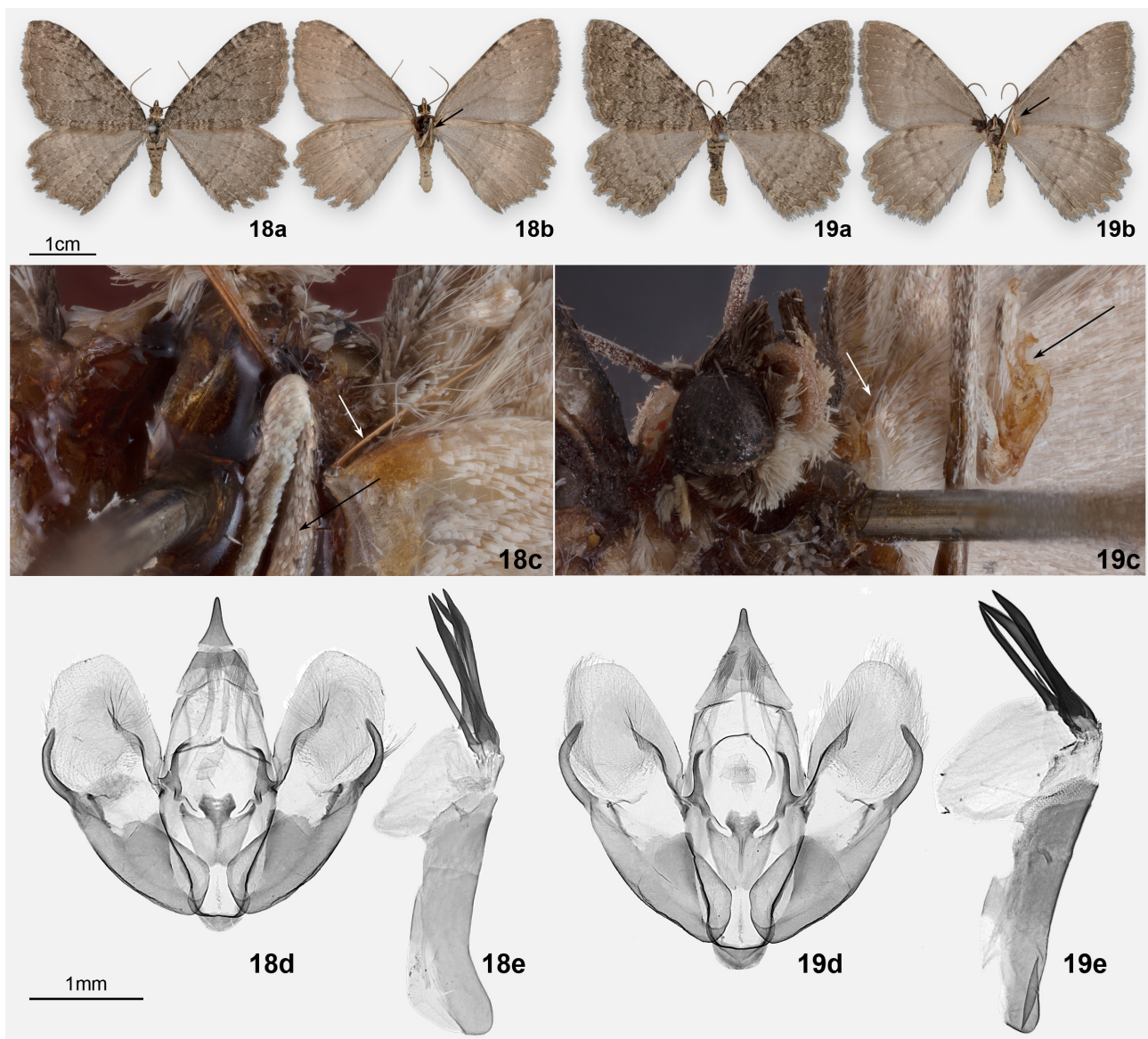
Male genitalia (figs 13, 38). Socii weakly developed, consisting of few setae at the base of the uncus (fewer setae located at base of uncus in *T. silviae* sp. n.; more setae at the uncus base in *T. lecerfi* sp. n.; setae located on protrusions in *T. sabaudiata* and *T. taochata*) (figs 13a–17a). Labides on the ventral view hump-shaped, not touching each other, equipped with setae (flat, thickened to the centre and setose in *T. silviae* sp. n.; thin, flat, strongly and dense setose in *T. lecerfi* sp. n.; labides stick-like fused in *T. sabaudiata*; spoon-shaped, fused, tip strongly setose in *T. taochata*) (figs 13b–17b). Juxta three-lobed. Sacculus projection heavily sclerotized, distally forked; lower prong shorter than upper one, upper prong curved. Both arranged in less than 90° (prongs of sacculus projection tip slightly different, with the upper prong longer and broader, both arranged in less than 90° in *T. silviae* sp. n.; both prongs blunt and short, arranged in more than 90° in *T. lecerfi* sp. n.; two identical prongs, arranged in ~45° in *T. sabaudiata*; upper prong long, lower prong shortened, arranged in ~90° in *T. taochata*) (figs 13c–17c).



FIGURES 13–17. Diagnostic characters of the genitalia of *Triphosa* species (ventral view). 13: *Triphosa dubitata*; 14: *Triphosa silviae* sp. n.; 15: *Triphosa lecerfi* sp. n.; 16: *Triphosa sabaudiata*; 17: *Triphosa taochata*; a = socii; b = labides; c = saccus projections (unspread, in natural position).

Female genitalia (fig. 46). 'Guitar-shaped'. Ovipositor slim. Ductus bursae sclerotized, arched-folded, flat, wide on the ventral view, but narrow on the lateral view. Posterior part of corpus bursae tubular, heavily sclerotized with few longitudinal folds; anterior part membranous (corpus bursae pyriform; posterior part strongly sclerotized, with longitudinal folds, funnel-shaped in *T. silviae* sp. n., *T. lecerfi* sp. n., *T. sabaudiata* and *T. taochata*).

Phenology. Univoltine. One very long generation, emerging early July, both sexes hibernating, in spring flying from March to early June (Ebert 2001; Hausmann & Viidalepp 2012).



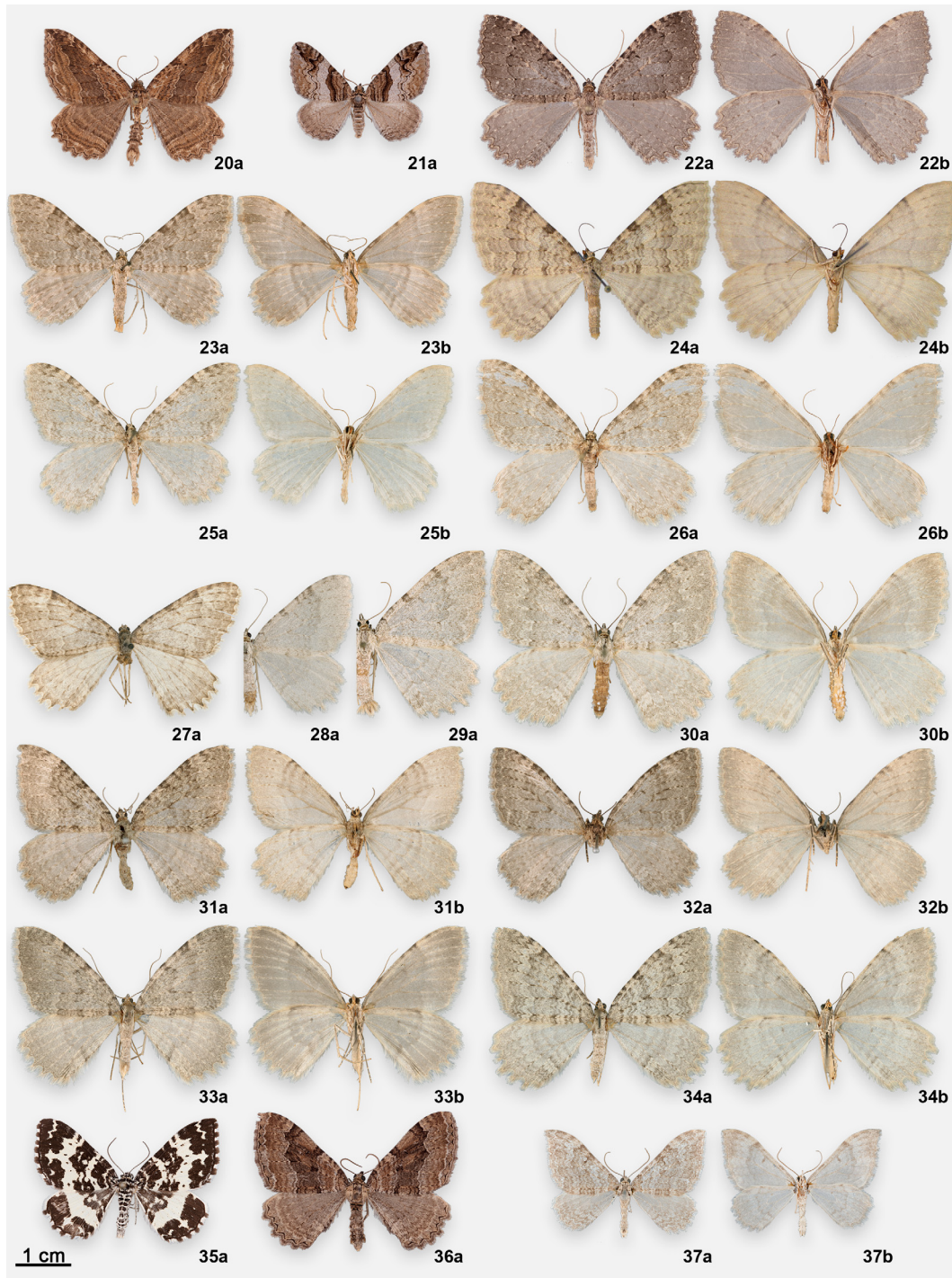
FIGURES 18–19. Wing pattern, frenulum and genitalia structures of the two ‘male’ syntypes of *Triphosa taochata* with secondarily glued abdomens. a = upperside; b = underside; c = close up photography on the underside; d = genitalia capsule; e, aedeagus. Black arrows indicate on the awfully glued legs of the specimens; white arrows indicate the frenulum.

Biology. Larva oligophagous on Rhamnaceae (*Rhamnus cathartica*, *Frangula alnus*) and Rosaceae (*Prunus spinosa*, *Crataegus*), adults on catkins of *Salix* and *Buddleja* (Heinicke & Müller 1976; Ebert 2001; Hausmann & Viidalepp 2012).

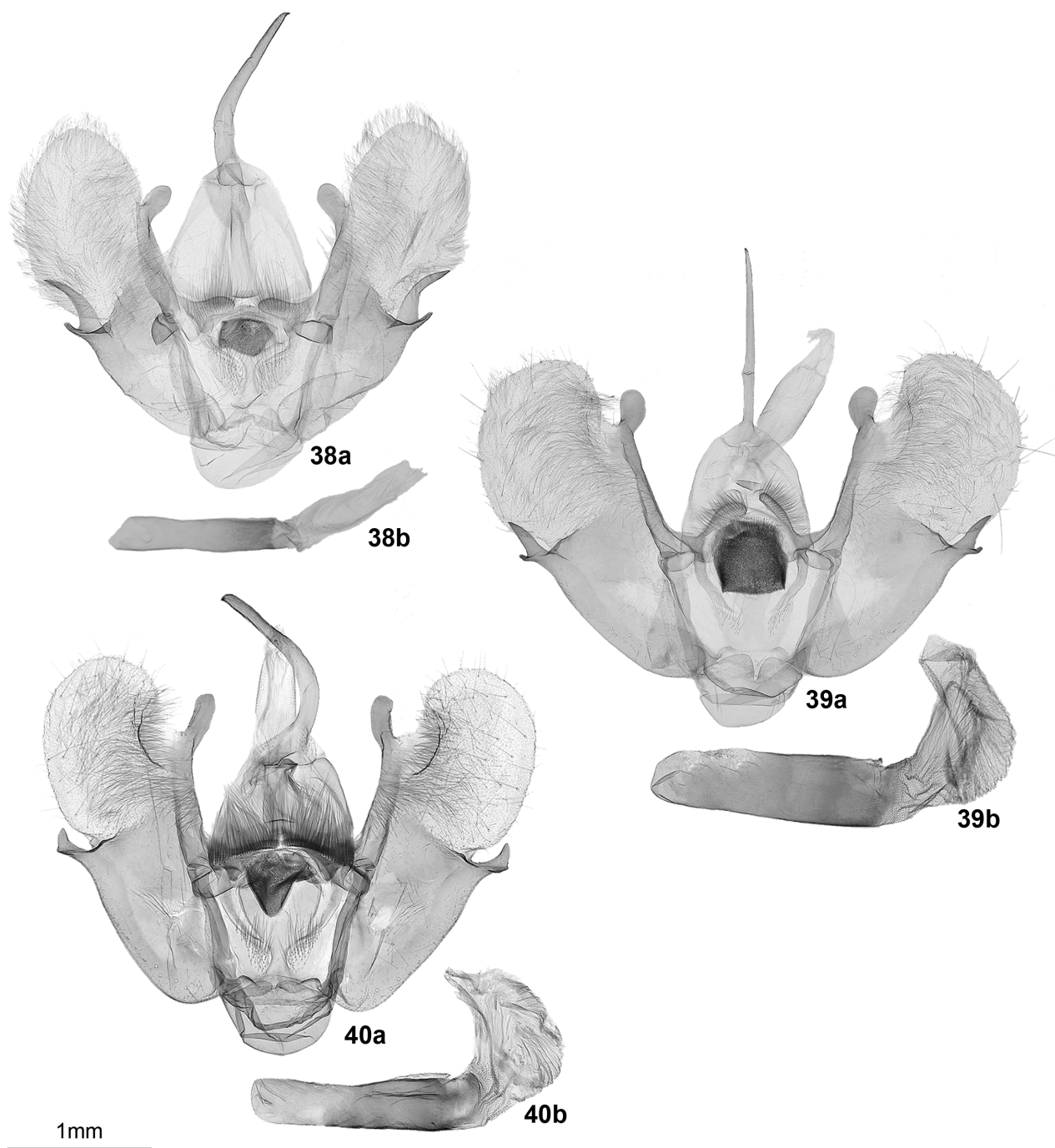
Habitat. Silvicolous, warm hillsides, gardens, parks, hedges, cemeteries. Hibernating in caves, under bridges, buildings, between rocks and boards (Heinicke & Müller 1976; Ebert 2001; Hausmann & Viidalepp 2012). Occurring at almost all altitudes up to the subalpine level (Ebert 2001).

Distribution. Palaearctic. Widely distributed from Europe to southern Siberia (with a gap between Urals and Russian Far East (Sinev 2008)), northern Turkey to Caucasus, western and northern China to Japan (Hausmann & Viidalepp 2012).

DNA barcoding. Clusters separately from all the other examined *Triphosa* species at a distance of more than 4% (tab. 2). Populations from Iran, Turkey and Georgia separated from the European populations in the NJ tree (2.5%), but there is no morphological difference between these populations. It might be regarded as a separated subspecies but this hypothesis needs further investigation (fig. 54).



FIGURES 20–37. Wing pattern. 20: *Philereme transversata* (Germany, Augsburg, 12.vii.1970; SMNS); 21: *Pareulype berberata* (Germany, Mannheim, 13.vii.1933; SMNS); 22: *Triphosa dubitata* (Georgia, Borjomi, 22.vii.2006, g. prep. 0016/2018 D. Wanke); 23–24: *Triphosa silviae* sp. n. (23: holotype, Iran, Fars, v.1937, g. prep. 0059/2018 D. Wanke; 24: paratype, Iran, Fars, Tange Surkh, g. prep. 755/2009 H. Rajaei); 25–26: *Triphosa lecerfi* sp. n. (25: holotype, Alai, Dugoba, 27.vii.1993, g. prep. 0042/2018 D. Wanke; 26: paratype, Alai, Dugoba, 27.vii.1993, g. prep. 0041/2018 D. Wanke); 27: holotype of *Triphosa agnata* syn. n. of *Triphosa sabaudiata* (Turkey, Cesarée, g. prep. 223); 28–30: *Triphosa sabaudiata* (28: Germany, Herrlingen, Tiefental; 29: Germany, Gempen, i.1959, g. prep. 0052/2018 D. Wanke; 30: Gempen, 25.vii.1955, g. prep 0005/2018 D. Wanke); 31–32: female ‘syntypes’ of *Triphosa taochata* (31: lectotype here designated, Azerbaijan, Hankynda; 32: paralectotype, Georgia, Achalziche); 33–34: *Triphosa taochata* (both Iran, Elburs, Damavand, 11.vii.1972; 33: g. prep 0012/2018 D. Wanke; 34: g. prep 0011/2018 D. Wanke); 35: *Rheumaptera hastata* (Germany, Federseemoor, 30.v.1967); 36: *Hydria cervinalis* (Germany, Heidelberg, 29.iii.1974, g. prep. 0051/2018 D. Wanke); 37: lectotype of *Hydria ravulata* (Issyk-kul, g. prep. 0048/2018 D. Wanke). a = upperside; b = underside.



FIGURES 38–40. Male genitalia. 38: *Tripfosa dubitata* (Georgia, Borjomi, 22.vii.2006, g. prep. 0016/2018 D. Wanke); 39: *Tripfosa silviae* sp. n. (Khorasan, Kopedagh-Allahakbar, 16.vi.1974, g. prep. 0008/2018 D. Wanke); 40: *Tripfosa lecerfi* sp. n. (Kirghizia, Alay range, Dugoba riv., 15.vii.1995, g. prep. 0039/2018 D). a = genitalia capsule; b = aedeagus.

***Tripfosa silviae* sp. n.**

(figs 14, 23, 24, 39, 47; map)

Material examined. HOLOTYPE. ♂, Iran, Fars, Straße Chiraz-Kazeroun, Fort Mian – Kotal, ca 2000 m, Mai [v.] 1937, coll. Brandt; g. prep. 0059/2018 D. Wanke; in SMNK.

PARATYPES. 1 ♂, Iran, Fars, Shiraz, 3.v.1941, E.P. Wiltshire, Wiltshire Coll. B.M. 1979-433, NHMUK 010920569, g. prep. 0050/2018 D. Wanke; 1 ♂, Iran, Baloutchistan, Kouh i Taftan (Khach), 2800 m, 20.v.1938,

coll. Brandt, L.B. Prout Coll. B.M. 1939-643, NHMUK 010920568; 1 ♀, Iran, Fars, Pireh Zan, 6.v.1940, E.p. Wiltshire, Wiltshire Coll. B.M. 1979-433, NHMUK 010920570; 1 ♀, Iran, nr. Yazd [Yazd], Barfkhaneh, 6.vi.1940, E.p. Wiltshire, Wiltshire Coll. B.M. 1979-433, NHMUK 010920571; all in BMNH. 1 ♀, Fars-Dasht, Arjan, 27.v.77, Abai, g. prep. 0006/2018 D. Wanke; 1 ♀, Fars, Mamassani-Chahgah, 19-29.v.1976, Abai L.T.; 1 ♀, Fars, Mamasani-Chahgah, 1-8.vi.1976, Abai L.T., g. prep. 0007/2018 D. Wanke; 1 ♂, Khorassan, Kopedagh-Allahakbar, 1950 m, 16.vi.1974, Leg: Radj./Paz., g. prep. 0008/2018 D. Wanke; all in HMIM. 1 ♂, E-Iran, Prov. Ostan-e Khorasan, N 36°55'56.6" E 059°02'18.6", Kopet Dagh, NW Mashad, N Tschenanar, N Radkan, Dolmeh Olia, 1560 m NN, 09.v.2008, legit Bernd Müller, Robert Trusch & Michael Falkenberg, g. prep. 0019/2018 D. Wanke; in PCBM. 1 ♂, Iran, Fars, Straße Chiraz-Kazeroun, Fort Mian – Kotal, ca 2000 m, v.1937, coll. Brandt, g. prep. 0010/2018 D. Wanke; 1 ♂, Iran, Baloutchistan, Kouh i Taftan (Khach), 2500 m, 16.v.1938, coll. Brandt, g. prep 753/2009 H. Rajaei; 1 ♀, Kerman-Bam, Dehbakri/2200 m, 1-2.v.1973, g. prep 1909/2015 H. Rajaei; 2 ♀, S-Iran, Prov. Fars, Tange Surkh, 50 km NW Ardekan, 2250 m NN, 12.-15.vi.1975, leg. Ebert/Falkner, SMNK E-Lep. -47, g. preps. 755/2009 H. Rajaei, 1235/2010 H. Rajaei; 1 ♂, 1 ♀, NE-Iran, Prov. Ostan-e Khorasan, Kopet Dagh, NW Mashad, N Tschenanar, N Radkan, Dolmeh Olia, N 36°55'56'.6", E 59°02'18.6". 9.v.2008, 1560 mNN, lux, leg. R. Trusch, M. Falkenberg & B. Müller, SMNK E-Lep. 247, g. prep (♂) 0140/2018 D. Wanke; all in SMNK. 2 ♀, Iran, prov. Kohkiluyeh-va-Boyerahmad, 30 km S Yassuj, road Abshare-Tange-Tamoradi, 8 km before Abshar, N 30°31'53" E 051°25'11", Alt. 2254 m, 24.v.2009, leg. Hossein Rajaei, g. prep (♀) 0009/2018 D. Wanke; 1 ♂, Iran, Isfahan prov. Abade-Semirom road, 30 km before Hanna protected area, 2435 m, N 31°12'22", E 051°51'37", 09.vi.2010, leg. H. Rajaei, g. prep 1910/2015 H. Rajaei; all in SMNS. 1 ♀, Iran, Khorasan, NP Golestan-Dasht, 1138 m, 21-22.v.2001, 37,17.8325/ 5,56.836, leg. Dr. Ch. Wieser, BC ZSM Lep 08631, g. prep 1386 H. Rajaei; 1 ♀, N-Iran, Demavend, 4500 m, (Licht), 21.-31.vii.1996, leg. Müller, BC ZSM Lep 07132, g. prep 1392 H. Rajaei; all in ZSM.

Description. Wingspan 36–42 mm (forewing length 19–23 mm). Antennae filiform. Frons slightly convex, projecting about half the diameter of eye, smoothly scaled. Chaetosemata present. Labial palpi rather thick and long, exceeding frons by half diameter of eye, tip darker scaled. Ground colour of wings beige, sandy coloured. Forewing with stronger wing pattern, termen slightly wavy. Transversal lines greyish-brown, fading from costa to the inner margin. Hindwing pale, transversal lines faint. Terminal line of both wings varies from beige to greyish-brown. Termen of the hindwing heavily wavy. Fringes clearly visible, slightly paler than ground colour.

Male genitalia (figs 14, 39). Uncus long, thin, tapered, sub-medially curved and heavily sclerotized. Socii present, weakly developed; consisting of a few numbers of setae at the base of the uncus. Subscaphium sclerotized, strewn with plenty of little spines on both sides. Tegumen arched, consisting of two broad sclerotized tapes with a posterior rounded notch touching the base of the uncus. Valva apically rounded, its apical half weakly sclerotized; costa of valva and sacculus projection heavily sclerotized, the latter distally forked, both distally not connected to the valva. Costal projection proximally narrow, slightly dilating to distal part, tip kidney-shaped. Labides on ventral view flat and setose, thickened to the centre, almost touching each other. In posterior view, the labides are broader than in ventral view. Juxta three-lobed. Saccus laterally elongated, centrally furrowed (shape differs due to preparation technique). Sacculus projection heavily sclerotized, distally forked. Fork-shaped tip consisting of two slightly different prongs; upper prong somewhat longer and broader than the lower one. Aedeagus broad and short, sclerotized. Vesica membranous, partially covered with patch of mirocornuti.

Female genitalia (fig. 47). Ovipositor short and broad. Apophyses posteriores approximately twice length of apophyses anteriores. Antrum short, funnel-shaped. Ductus bursae bent, very short, flat, wide in ventral view, but narrow in lateral view. Corpus bursae pyriform; posterior part strongly sclerotized, with longitudinal folds, very long and strongly funnel-shaped (on average 1.8 mm length, 1.0 mm width). Second, anterior part membranous. Signum lacking.

Diagnosis. Like other *Triphosa* species, *T. silviae* **sp. n.** is mainly characterized and distinguishable by the male genitalia. The socii consist of a small number of setae located at the base of the uncus (few setae at the base of the uncus in *T. dubitata*; more setae at the uncus base in *T. lecerfi* **sp. n.**; setae located on protrusions in *T. sabaudiata* and *T. taochata*) (figs 13a–17a). Labides are flat, thickened to the centre and setose unlike those in the other *Triphosa* species (hump-shaped, not touching each other, equipped with setae in *T. dubitata*; flat, strongly and densely setose in *T. lecerfi* **sp. n.**; labides stick-like fused in *T. sabaudiata*; spoon-shaped, fused, tip strongly setose in *T. taochata*) (figs 13b–17b). Prongs at the tip of sacculus projection slightly different, with upper prong longer and broader, and the angle between prongs being less than 90° (lower prong shorter than upper one, upper prong curved, both arranged in less than 90° in *T. dubitata*; both prongs blunt and short, arranged in more than 90° in *T.*

lecerfi sp. n.; two identical prongs, arranged in $\sim 45^\circ$ in *T. sabaudiata*; upper prong long, lower prong shortened, arranged in $\sim 90^\circ$ in *T. taochata* (figs 13c–17c).

Identification based on female genitalia is difficult: corpus bursae pyriform; posterior part strongly sclerotized, with longitudinal folds, funnel-shaped (similar in *T. lecerfi* sp. n., *T. sabaudiata* and *T. taochata*; ‘guitar-shaped’, posterior part of corpus bursae tubular, heavily sclerotized with few longitudinal folds; anterior part membranous, in *T. dubitata*) (figs 46–52).

Biology. Unknown.

Habitat. Some specimens were collected at altitudes of 1560–2500 m.

Distribution. So far only known from Iran (several populations in the north and in the south to south-eastern Iran) (see map).

DNA barcoding. Clusters with *T. taochata*, genetic distance rather small (1.7%) (tab. 2). However, these species show clear diagnostic characters in morphology (see figs 13–17). Diverging by more than 2% from *T. sabaudiata* (2.2%) and *T. lecerfi* sp. n. (3.3%) (tab. 2).

Etymology. The name of the new species is dedicated in great thankfulness to Silvia Wanke (1954–2007), Beutelsbach, Germany, to make her remembered forever.

***Triphosa lecerfi* sp. n.**

(figs 15, 25, 26, 40, 48; map)

Material examined. HOLOTYPE. 1 ♂, [Kyrgyzstan] Alai mts, riv. Dugoba, h=2500 m, 27.vii.1993, g. prep. 0042/2018 D. Wanke; in ZSM.

PARATYPES. 1 ♂, Kirgisia [Kyrgyzstan], Suusamyр Gebirge, Kobyk, 2000 m, 9.vii.1996, V. Lukhtanov leg. EMEM, g. prep 0147/2018 D. Wanke; 1 ♂, Kirgisia [Kyrgyzstan], Alay [Alai] range, Dugoba riv., 2300 m, 15.vii.[19]95, BC ZSM Lep 62744, g. prep. 0039/2018 D. Wanke; 2 ♂, 1 ♀, Alai mts, riv. Dugoba, h=2500 m, 27.vii.1993, g. preps (♀) 0041/2018 D. Wanke, (♂) Pr. N. 7052 C. Herbulot; all in ZSM. 1 ♂, 1 ♀, same data as latter, g. preps (♀) 0040/2018 D. Wanke; in SMNS. 1 ♂, 1 ♀ Tadjikistan [Tajikistan], Gissar Gebirge, Kondara, 1100 m, 7.-8.viii.1999, g. prep (♂) 0058/2018 D. Wanke; in PCPS.

Description. Wingspan 38–42 mm (forewing length 22–24 mm). Antennae filiform. Frons slightly convex (about half the diameter of eye), smoothly scaled. Chaetosemata present. Labial palpi rather thick and long, exceeding the frons by half the diameter of eye, tip darker scaled. Ground colour from beige, sandy-coloured to very bright brown. Forewing with stronger wing pattern, termen slightly wavy. Transversal lines visible, fading from costa to the inner margin. Hindwing with pale pattern. Termen strongly wavy. Fringes bright brown to pale yellow.

Male genitalia (figs 15, 40). Uncus long, curved, tapered and well-sclerotized. Socii present, weakly developed; consisting of a large number of setae at the base of the uncus. Subscaphium sclerotized, strewn with plenty of little spines on both sides. Tegumen arched, consisting of two broad sclerotized tapes with a posterior rounded notch touching the base of the uncus. Valva apically rounded, its apical half weakly sclerotized; costa of valva and sacculus projection heavily sclerotized, the latter distally forked, both distally not connected to the valva. Costal projection finger-shaped. Tip bent away from the valva. Labides thin, flat, long, almost touching each other in the centre, strongly and densely setose. Juxta three-lobed. Saccus laterally elongated, centrally furrowed, extremely weakly humpy (shape differs due to preparation technique). Sacculus projection well-sclerotized, distally forked, prongs of the forked tip of similar length, blunt and short. Aedeagus broad, sclerotized. Vesica membranous, partially covered with patch of microcornuti.

Female genitalia (fig. 48). Ovipositor broad. Apophyses posteriores approximately twice the length of the apophyses anteriores. Antrum short, funnel-shaped. Ductus bursae short, arched folded, heavily sclerotized, flat, wide in ventral view, but narrow in lateral view. Corpus bursae pyriform; its posterior part strongly sclerotized, with longitudinal folds and strongly funnel-shaped (length on average 1.4 mm, width 0.8 mm), its anterior part membranous, without signa.

Diagnosis. In *Triphosa lecerfi* sp. n. socii consist of a large number of setae located at the base of the uncus (few setae at the base of the uncus in *T. dubitata* and *T. silviae* sp. n.; setae located on protrusions in *T. sabaudiata* and *T. taochata*) (figs 13a–17a). Labides thin, flat, strongly and densely setose (hump-shaped, not touching each

other, equipped with setae in *T. dubitata*; flat, thickened to the centre and setose in *T. silviae* **sp. n.**; labides stick-like fused in *T. sabaudiata*; spoon-shaped, fused, tip strongly setose in *T. taochata* (figs 13b–17b). Prongs of the forked sacculus projection apically blunt and short, the angle between the prongs is more than 90° (lower prong shorter than upper one, upper prong curved, both arranged in less than 90° in *T. dubitata*; slightly different with upper prong longer and broader, both arranged in less than 90° in *T. silviae* **sp. n.**; two identical prongs, arranged in ~45° in *T. sabaudiata*; upper prong long, lower prong shortened, arranged in ~90° in *T. taochata*) (figs 13c–17c).

Discrimination from other species based on female genitalia is difficult: corpus bursae pyriform; posterior part strongly sclerotized, with longitudinal folds, funnel-shaped (similar in *T. silviae* **sp. n.**, *T. sabaudiata* and *T. taochata*; ‘guitar-shaped’, posterior part of corpus bursae tubular, heavily sclerotized with few longitudinal folds; anterior part membranous, in *T. dubitata*) (figs 46–52).

Biology. Unknown.

Habitat. Specimens collected in mountains at altitudes of 1100–2500 m.

Distribution. So far known only from the Alai and the Suisamyr Mountains in Kyrgyzstan and the Gissar mountains in Tajikistan.

DNA barcoding. The species clusters as a sister to *T. sabaudiata*, *T. taochata* and *T. silviae* **sp. n.** (fig. 54) at a distance of more than 2%, however *T. lecerfi* **sp. n.** shows clear morphological diagnostic characters from all those species (see figs 13–17).

Etymology. Claude Herbulot labeled the specimens in his collection investigated during this study as *T. lecerfi*, assuming they could belong to a new species. Unfortunately, he did not investigate more deeply and his suggestion remained unpublished. Therefore, it is a great honor to confirm Herbulot’s assumption and name the species after the French entomologist Ferdinand Le Cerf.

Triphosa sabaudiata (Duponchel, 1830)

(figs 16, 27–30, 41, 42, 49; map)

Larentia sabaudiata Duponchel, 1830. In: Godart, J.B. & Duponchel, P.A.J., *Histoire naturelle des lépidoptères ou papillons de France*, 8 (1), 370. Syntypes (France, Aix en Savoie).

Larentia millierata Bruand, 1855. *Annales de la Société entomologique de France*, 3 (1), LIX. Holotype (France, Mont d’Or, near Ferrière).

Triphosa agnata Le Cerf, 1918. *Bulletin du Muséum national d’histoire naturelle*. Paris 1918 (6), 412. Holotype ♂ ([Turkey]: ‘Césarée (Cappadoce)’). Deposited in France, Paris, Muséum National d’Histoire Naturelle. Hereby regarded as a **new synonym** of *Triphosa sabaudiata* (see remark).

Type material examined. (Holotype of *T. agnata* **syn. n.**, figs 27, 42) 1 ♂, Cesarée, Type, F. LeCerf det. 1918, gen. prep. 223; in MNHM.

Further material examined. 1 ♂, [Turkey] Isparta (in cave), Yalvac-Turkey, 19.x.2016, leg. Gökhan Aydın; 1 ♀, Borabey-Amasya, Turkey, 14.vi.2003, 1066 m, N 40°48’12” E 36°08’52”, leg. Feza Can; all in MKU. 1 ♀, Gümüşrhane, ex coll. Staudinger, g. prep 0021/2018 D. Wanke; 2 ♀, Amasia, ex coll. Staudinger, g. preps 0022, 0023/2018 D. Wanke; all in MNHU. 1 ♀, Türkei, Prov. Antalya, 17.iv.2001, ca. 1200 m, Civizli W Seydisehir, leg. Bernd Schacht, BC Lep DS 0011, g. prep 0032/2018 D. Wanke; in PCDS. 1 ♀, Montenegro/Crna Gora mer. Lovcen NP. E-Seite, Jezerski vrh, Njegos Mausoleum und Umgebung, ca. 1550–1657 m, 25.vii.2009, leg. L. Lehmann, BMB Lep 00790, g. prep 0038/2018 D. Wanke; in PCJG. 1 ♀, S-Türkei, Taurus: Camliyayla bei Tarsus, 1300–1400 m, 10.–14.vi.1996, leg. J. Gelbrecht, S. Beshkov & T. Drechsel, BMB Lep 00792, g. prep 0036/2018 D. Wanke. 1 ♂, Türkei, Pontisches Gebirge, Ilgaz Daglari Ilgaz, ca. 800 m, 6.vii.1990 LF, leg. J. Gelbrecht & E. Schwabe, BMB Lep 00791, g. prep 0037/2018 D. Wanke; all in PCJG. 1 ♀, Erciyas Dagi, Kayakeri, prov. Kayseri, Turquie, 2100 m, 10.vii.1990, leg. E. Drovot, g. prep 0055/2018 D. Wanke; 1 ♀, Turkey, Prov. Kayseri, 5 km. nw. Ercios Dag, 2000 m, 22.vii.1986, leg. M. Fibiger, g. prep 0056/2018 D. Wanke; all in PCPS. 1 ♀, Tirol, e.I. 21.vi.[19]40, Fleiss Innsbruck, g. prep 752/2009 H. Rajaei; 1 ♂, 1 ♀, Turkey, Prov. Kayseri, 5km. nw. Ercios Dag., 2000 m, 22.vii.1986, leg. M. Fibiger, ex coll. Michael Fibiger, SMNK; E. Lep 281, g. prep (♂) 0143/2018 D. Wanke; 8 ♂, 6 ♀, Turkey, Prov. Kayseri, 20 km S, 2000 m, Erciyas Dagi, 28.vii.1989, leg. Fibiger & Esser, ex coll. Michael Fibiger, SMNK; E. Lep 281, g. prep (♂) 0144/2018 D. Wanke; all in SMNK. 2 ♂, 1 ♀, Gempenhöhle, 29.xii.[19]47, g. prep (♂) 1911/2015 H. Rajaei; 2 ♂, 1 ♀, Gempenhöhle, 23.xi.[19]47, g. prep (♂)

0024/2018 D. Wanke; 1 ♂, Gempenhöhle, 30.xii.1956, coll. W. Schäfer, Stuttgart, SMNS-Lep.1997-11; 1 ♀, Gempen, 7.i.[19]50, coll. W. Schäfer, Stuttgart, SMNS-Lep.1997-11; 1 ♀, Gempen, 25.vii.[19]55, coll. W. Schäfer, Stuttgart, SMNS-Lep.1997-11, g. prep 0005/2018 D. Wanke; 2 ♂, 2 ♀, Bas. Jura, Gempenhöhlen, 8.ix.[19]46, Wolf; 1 ♂, Gempen, i.[19]59, B. Blattner, g. prep 0052/2018 D. Wanke; 1 ♀, Croatia, di Frasassi, Ancona, ix.1956, coll. W. Schäfer, Stuttgart, SMNS-Lep.1997-11; 1 ♂, Schwäb. Alb, 1894, Fauna Baden-Württemberg, Funddaten registriert 1995/1996; 2 ♂, Rosenstein, Heubach, 5.xi.[19]06, Fauna Baden-Württemberg, Funddaten registriert 1995/1996; 1 ♂, Herrlingen b. Ulm, Tiefental, G. Hammer, Fauna Baden-Württemberg, Funddaten registriert 1995/1996; 1 ♂, Reiteraln Höhle, 1650, 1.xi.[19]65, Dr. Stüber, leg. K. Mazzucco, Salzbr.; 1 ♂, Ob. Öst., Schönbg. Alm, 10.viii.[19]53, R. Löberbauer; 1 ♂, Oberdonau, Traunstein, 500 m, 24.xi.1949, Foltin; 1 ♂, Preda, ex Coll. W. Pfitzenmeier Stuttgart, g. prep 0001/2018 D. Wanke; (more specimens from France, Italy and Switzerland examined), all in SMNS. 1 ♂, Asia min., Turcia, Kizilcahamam, 952 m, 23. u. 24.vi.1969, leg. G. Friedel, g. prep 0149/2018 D. Wanke; 1 ♂, Asia min., Ankara-Barrage, 13.–17.vi.[19]66, leg. Friedel, g. prep 0151/2018 D. Wanke; 1 ♂, Asia minor, Barrage, 10 km no Ankara, 1100 m, 13.–17.vi.[19]66, R. Löberbauer, g. prep 0152/2018 D. Wanke; all in ZSM.

Remark. *Triphosa sabaudiata* and *T. agnata* **syn. n.** share the genitalia characters, which are most diagnostic in this species-group (e.g. *socii* weakly developed on protrusions at the uncus base; labides fused into one long and thin stick) (figs 41, 42).

Diagnosis. Wingspan 38–45 mm, rarely 32–38 mm (length of forewing 20–25 mm), no sexual dimorphism in size. Ground colour from pale grey to bright yellowish-white, with some grey shine (greyish brown, with red shimmer in *T. dubitata*; beige, sandy coloured in *T. silviae* **sp. n.**; beige, from sand-coloured to very bright brown in *T. lecerfi* **sp. n.**; sandy-yellow covered with a slate-coloured shroud in *T. taochata*). Transversal lines faint, sometimes slightly visible. Wing pattern stronger towards costa. Colour of fringes not differing from the ground colour (figs 27–30).

Male genitalia (figs 16, 41, 42). Uncus base with protrusions carrying weakly developed *socii* on each side (few setae at the base of the uncus in *T. dubitata* and *T. silviae* **sp. n.**; more setae at the uncus base in *T. lecerfi* **sp. n.**; setae located on protrusions in *T. taochata*) (figs 13a–17a). Labides fused into one long and thin stick reaching further than the uncus base; labides tip covered with setae (hump-shaped, not touching each other, equipped with setae in *T. dubitata*; flat, thickened to the centre and setose in *T. silviae* **sp. n.**; thin, flat, strongly and densely setose in *T. lecerfi* **sp. n.**; spoon-shaped, fused, tip strongly setose in *T. taochata*) (figs 13b–17b). Juxta three-lobed. Sacculus projection distally forked, heavily sclerotized; fork-shaped tip consists of two identical prongs, the angle between the prongs being ~45° (lower prong shorter than upper one, upper prong curved, both arranged in less than 90° in *T. dubitata*; prongs slightly different with upper prong longer and broader, both arranged in less than 90° in *T. silviae* **sp. n.**; both prongs blunt and short, arranged in more than 90° in *T. lecerfi* **sp. n.**; upper prong long, lower prong shortened, arranged in ~90° in *T. taochata*) (figs 13c–17c).

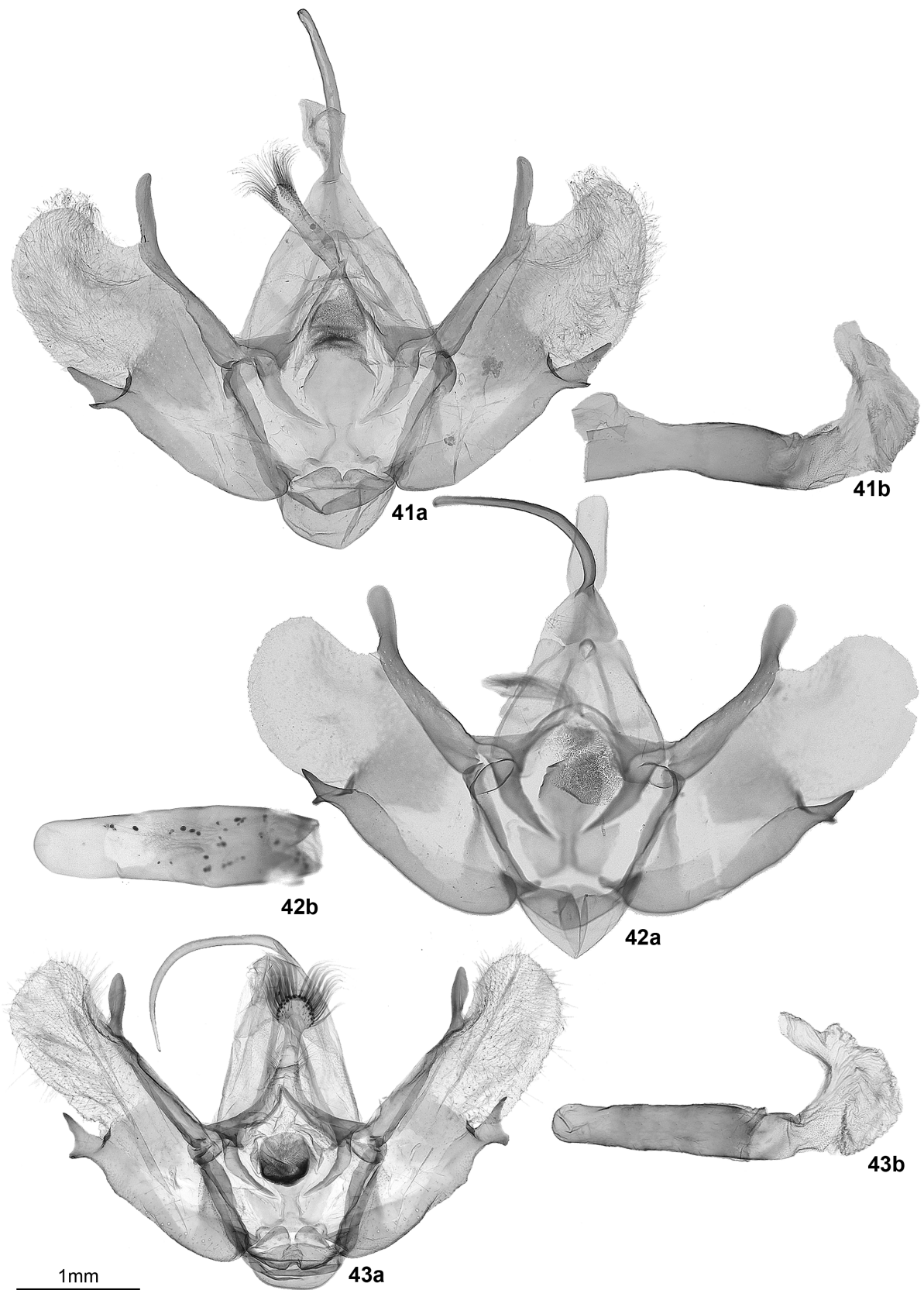
Female genitalia (fig. 49). Ovipositor broad, antrum short, wide and funnel-shaped. Ductus bursae bent, very short, flat, wide in ventral view, but narrow in lateral view. Corpus bursae pyriform, its posterior part funnel-shaped, heavily sclerotized with longitudinal folds; its anterior part bag-shaped; membranous (similar in *T. silviae* **sp. n.**, *T. lecerfi* **sp. n.** and *T. taochata*; ‘guitar-shaped’, posterior part of corpus bursae tubular, heavily sclerotized with few longitudinal folds; anterior part membranous, in *T. dubitata*) (figs 46–52).

Phenology. Univoltine. One very long generation of about nine months (emerging late June or early July; both sexes hibernating in caves; in spring active from April to late May) (Ebert 2001; Hausmann & Viidalepp 2012).

Biology. Larva monophagous on Rhamnaceae (*Rhamnus pumilus*, *R. saxatilis*, *R. cathartica*), observed nectar-feeding of adults on *Clematis vitalba* and *Adenostyles* (Heinicke & Müller 1976; Ebert 2001; Hausmann & Viidalepp 2012).

Habitat. Mountain regions, troglophilous (Hausmann & Viidalepp 2012). Flying in rocky slopes, lime rocks, rocky valleys and often found when resting in dry caves (Heinicke & Müller 1976; Hausmann & Viidalepp 2012). Occurring at altitudes from 600–2700 m (Ebert 2001; Hausmann & Viidalepp 2012).

Distribution. West-Palaeartic, with fragmented distribution from western Europe to the Balkan Peninsula and Turkey. Outside Europe, its range extends from northern Morocco to the central Asian mountains (Hausmann & Viidalepp 2012). Distribution in the Middle East and Central Asia reported by Viidalepp (1996), but questioned by Hausmann & Viidalepp (2012). Hereby we confirm the occurrence of *Triphosa sabaudiata* in Turkey (see map).



FIGURES 41–43. Male genitalia. 41: *Triphosa sabaudiata* (Germany, Gempen, i.1959, g. prep. 0052/2018 D. Wanke); 42: holotype of *Triphosa agnata* **syn. n.** (Turkey, Cesarée, g. prep. 223); 43: *Triphosa taochata* (Turkey, Artvin, Tekkale near Yusufeli, 13.iv.2002, g. prep. 0033/2018 D. Wanke). a = genitalia capsule; b = aedeagus.

DNA barcoding. The species clusters at low genetic distance with *T. taochata* (1.4%), diverging by more than 2% from *T. silviae* **sp. n.** (2.2%) and from *T. lecerfi* **sp. n.** (2.6%) (see table 2).

TABLE 2. Interspecific genetic distances between fourteen species of the genera *Triphosa* (in %). Distances between the *Triphosa sabaudiata*, *Triphosa taochata*, *Triphosa silviae* **sp. n.**, *Triphosa lecerfi* **sp. n.** cluster are marked in bold.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. <i>T. sericata</i>													
2. <i>T. inca</i>	13.0												
3. <i>T. taochata</i>	5.0	11.9											
4. <i>T. dubitata</i>	7.0	13.6	6.7										
5. <i>T. silviae</i> sp. n.	6.0	12.4	1.7	7.6									
6. <i>T. sabaudiata</i>	4.9	12.4	1.4	6.9	2.2								
7. <i>T. tauteli</i>	7.5	14.7	8.2	4.2	8.9	8.4							
8. <i>T. dyriata</i>	7.4	14.8	7.5	4.7	9.1	7.6	3.8						
9. <i>T. lugens</i>	6.5	12.8	7.4	7.3	8.1	7.5	8.3	7.8					
10. <i>T. pallescens</i>	8.5	14.0	8.4	9.9	8.7	8.9	9.1	9.1	8.0				
11. <i>T. lecerfi</i> sp. n.	4.8	12.6	2.6	6.1	3.3	2.6	7.3	7.1	6.1	7.8			
12. <i>T. affirmata</i>	9.7	12.6	8.6	8.4	9.4	9.0	9.6	9.6	8.6	10.7	8.6		
13. <i>T. venimaculata</i>	5.6	13.2	5.9	7.2	6.9	6.4	7.6	6.9	6.4	6.4	5.4	9.3	
14. <i>T. dubiosata</i>	9.2	13.0	9.8	8.8	10.7	10.4	9.5	10.1	9.3	11.8	9.7	6.7	10.4

Triphosa taochata Lederer, 1870

(figs 17, 31–34, 43, 50–52; map)

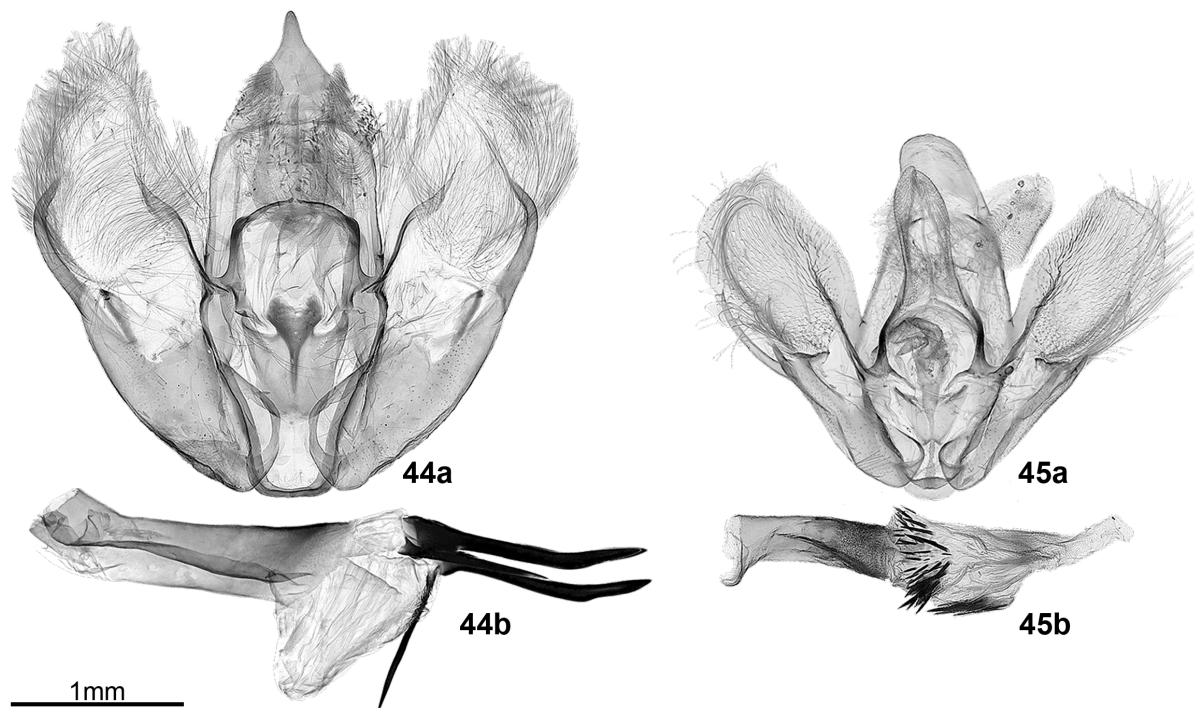
Triphosa taochata Lederer, 1870. Annales de la Société entomologique de Belgique. 13, 40; 50. Syntypes 2 ♂, 2 ♀ ([Georgia]: Achalziche, Hankynda). Deposited in Museum für Naturkunde der Humboldt-Universität, Berlin, Germany.

Type material examined. LECTOTYPE (hereby designated based on examination of morphology and DNA barcoding, figs 31, 51) ♀, Hankynda, Origin, 242, Coll. Led., g. prep. 0020/2018 D. Wanke.

PARALECTOTYPES (hereby designated) 1 ♀, Achalzich, Origin, 435, Coll. Led., g. prep. 2070/2016 H. Rajaei (according to morphological and barcoding studies this female specimen (figs 32, 50) belongs to *T. dubitata*); also based on morphological studies the next two male specimens (figs 18, 19) are externally *Triphosa*, but their genitalia are characteristic to *Hydria cervinalis* (see remark below): 1 ♂ Achalzich, Origin, 434, Coll. Led., g. prep. 2068/2016 H. Rajaei; 1 ♂ Achalzich, Origin, 436, Coll. Led., g. prep. 2069/2016 H. Rajaei; all in MNHU.

Further material examined. 2 ♂, NE-Türkei, Provinz Erzurum, Höhle ca. 7 km östlich Ispir (Tal des Coruh), 1100 m, 27.vi.2002, leg. J. Gelbrecht & E. Schwabe, g. preps (♂) 0017, 0018/2018 D. Wanke; in PCBM. 1 ♂, Armenia, Yeghegnadzor, Villiage, Vayots Dzor, 39°46,0'N 45°19,5'E, 1280 m.ü.M, 24.vi.2011, LF, leg. Daniel Bolt, g. prep. 0088/2018 D. Wanke; 1 ♀, Armenia, Meghri, Old City, Syunik, 38°53,8'N 46°14,5'E, 660 m.ü.M, 29.v.2010, LF, leg. Daniel Bolt, g. prep. 0145/2018 D. Wanke; all in PCDB. 1 ♂, NE-Türkei, Provinz Artvin, Tekkale bei Yusufeli, 800 m (Tal des Coruh), 13.iv.2002, e.o.: 30.v.–1.vi.2002, leg. T. Drechsel; coll. J. Gelbrecht, g. prep. 0033/2018 D. Wanke; 2 ♀, NE-Türkei, Provinz Erzurum, Höhle ca. 7 km östlich Ispir (Tal des Coruh), 5.vii.2002, leg. J. Gelbrecht & E. Schwabe, g. preps. 0034, 0035/2018 D. Wanke; all in PCJG. 1 ♂, 1 ♀, Turkey, Agri, Ararat Ns, 18 km SE Suveren, 2050 m, 1.vii.2001, K. Larsen, g. prep. (♂) 0054/2018 D. Wanke; 1 ♂, 1 ♀, Turkey, Kars, Karakurt, 10 km E, 1550 m, 7.vii.2001, K. Larsen, g. prep. (♂) 0057/2018 D. Wanke; all in PCPS. 9 ♂, 9 ♀, N-Iran, Elburs-Mts, Masandaran, Polur, Damavand, 2200 m, Ebert & Falkner leg. 11.vii.1972, g. preps (♂) 1231, 1232/2010 H. Rajaei, (♀) 754/2009, 1233/2010 H. Rajaei, (♂) 0012, (♀) 0011, (♀) 0027, (♀) 0028/2018 D. Wanke; all in SMNK. 3 ♂, 4 ♀, N-Iran, Elburs-Mts, Masandaran, Polur, Damavand, 2500 m, Ebert & Falkner leg. 7.–10.vii.1972, g. preps (♀) 1233/2010 H. Rajaei; 2 ♂, 1 ♀, Turkey, G. Hane, Bayburt, 1500 m, 18.vii.1973, leg. A. Kocak, g. prep. (♂) 0141/2018 D. Wanke; 1 ♂, Kars, Kagizman, 1900 m, 20.vi.1972, leg. A. Kocak; in SMNK. 1

♀, Achalzich, Chambobel, 1910, Korb, Sammlung Osthelder, g. prep. 0146/2018 D. Wanke; 1 ♂, Persia sept., Elburs mts.c.s., Tacht i Suleiman, Sārdab-Tal (Vanderban), 25–2700 m, 14.–18.vii.[19]37, leg. E. Pfeiffer & W. Forster, München, g. prep. 0148/2018 D. Wanke; 1 ♀, Persia sept., Elburs mts.c.s., Tacht i Suleiman, Sārdab-Tal (Hasankif), 10–1400 m, 7.–10.vii.[19]37, leg. E. Pfeiffer & W. Forster, München; all in ZSM.



FIGURES 44–45. Male genitalia. 44: *Hydria cervinalis* (Germany, Heidelberg, 29.iii.1974, g. prep. 0051/2018 D. Wanke); 45: lectotype of *Hydria ravulata* (Issyk-kul, g. prep. 0048/2018 D. Wanke). a = genitalia capsule; b = aedeagus.

Remark. Lederer (1870) described *T. taochata* based on four syntype specimens: 2 ♂, 1 ♀ from Achalziche (Georgia) and 1 ♀ from Hankynda [= Khankendi / Stepanakert] (Azerbaijan). All these four specimens belong to *Triphosa* according to their external characters (figs 18, 19, 31, 32). Genitalia investigation of these specimens revealed that the abdomens of both ‘male’ specimens from Achalziche belong to *Hydria cervinalis* (Scopoli, 1763) (figs 18d–e, 19d–e, 44). A second look at the specimens confirmed that their abdomens had been secondarily glued, apparently taking the abdomen from another specimen (figs 18b–c, 19b–c). Additional external examination of one of them revealed that it is a female (with female frenulum but with male abdomen). These evidences convinced us that both of these specimens have wrong abdomens secondarily attached to them. It’s imaginable that an unlucky accident broke the abdomen of multiple specimens in a box containing the specimens of both *Triphosa* and *Hydria* in the Staudinger collection (figs 18c, 19c) (Wanke & Rajaei 2019). The genitalia of the female syntypes (one from Achalziche, the other from Hankynda) strongly differ from each other. The genitalia of the specimen from Achalziche are reminiscent of those of *T. dubitata* (fig. 50), while those of the other (fig. 51) are more similar to those of *T. sabaudiata*. To resolve the identity of the taxon we used a special protocol for DNA barcoding of old museum specimens which was successful at the Canadian Centre for DNA barcoding. Neighbour-joining analyses showed that the dissected female paralectotype from Achalziche clustered with *T. dubitata* (fig. 54). The female (lectotype) specimen from Hankynda, however, clustered with several investigated specimens from Turkey, Armenia and Iran (fig. 54). Both female genitalia and barcoding data convinced us to confirm this syntype of *T. taochata* as bona species. We designate the female from Hankynda as the lectotype, the other three as paralectotypes, and redescribe this species below.

Re-description. Wingspan 34–41 mm, forewing length 22–24 mm. Antennae filiform. Frons slightly convex (about half the diameter of eye), smoothly scaled. Chaetosemata present. Labial palpi rather thick and long, exceeding frons by half the diameter of eye, tip darker scaled. Ground colour sand-yellow covered with a slate-coloured tinge, which differs in its intensity. Forewing with a dark slate tinge, with stronger marked wing pattern of

transversal lines towards costa, with bright sandy coloured scales between. Wing pattern fading from costa to the inner margin. Termen slightly wavy. Hindwing brighter, transversal lines fainter than those of the forewing. Termen heavily wavy. Fringes from yellow (sand-coloured) to pale yellow.

Male genitalia (figs 17, 43). Uncus long, curved, tapered and heavily sclerotized. Socii present, weakly developed, consisting of few setae, placed on protrusions at both sides of the uncus base. Subscaphium sclerotized, strewn with plenty of little spines on both sides. Tegumen arched, consisting of two broad sclerotized tapes. Valva apically rounded, its apical half weakly sclerotized; costa of valva and sacculus projection heavily sclerotized, the latter distally forked, both distally not connected to the valva. Costal projection, proximally narrow, finger-shaped, elongated slightly dilated at the distal part. Labides heavily sclerotized, fused into a spoon-shaped structure, apically covered with a lot of stout setae. Juxta three-lobed. Saccus laterally elongated, centrally furrowed. Sacculus projection well sclerotized, distally forked, the upper prong long, the lower prong short, with the angle between prongs being $\sim 90^\circ$. Aedeagus broad, sclerotized. Vesica membranous, terminally bearing a patch of small microcornuti.

Female genitalia (figs 51, 52). Ovipositor broad. Apophyses posteriores approximately twice the length of apophyses anteriores. Antrum funnel-shaped, short. Ductus bursae short, arch-shaped, folded, flat, wide in ventral view, but narrow in lateral view. Corpus bursae consisting of two parts: posterior part heavily sclerotized with thin longitudinal folds, anterior part membranous without signum.

Diagnosis. *Triphosa taochata* is mainly characterized and distinguishable by the male genitalia. Socii consist of a number of setae, placed on protrusions at each side of the uncus base (few setae at the base of the uncus in *T. dubitata* and *T. silviae* **sp. n.**; more setae at the uncus base in *T. lecerfi* **sp. n.**; setae located on protrusions in *T. sabaudiata*) (figs 13a–17a). Labides are fused into a spoon-shaped structure (hump-like, not touching each other, equipped with setae in *T. dubitata*; flat, thickened to the centre and setose in *T. silviae* **sp. n.**; flat, strongly and densely setose in *T. lecerfi* **sp. n.**; labides stick-like fused in *T. sabaudiata*) (figs 13b–17b). Tip of sacculus projection with long upper prong and short lower prong, with a right angle ($\sim 90^\circ$) between them (lower prong shorter than upper one, upper prong curved, both arranged in less than 90° in *T. dubitata*; prongs of sacculus projection tip slightly different with upper prong longer and broader, both arranged in less than 90° in *T. silviae* **sp. n.**; both prongs blunt and short, arranged in more than 90° in *T. lecerfi* **sp. n.**; two identical prongs, arranged in $\sim 45^\circ$ in *T. sabaudiata*; upper prong long, lower prong shortened, arranged in $\sim 90^\circ$ in *T. taochata*) (figs 13c–17c). Discrimination from other species based on female genitalia is difficult: corpus bursae pyriform; posterior part strongly sclerotized, with longitudinal folds, funnel-shaped (similar in *T. silviae* **sp. n.**, *T. lecerfi* **sp. n.** and *T. sabaudiata*; ‘guitar-shaped’, posterior part of corpus bursae tubular, heavily sclerotized with few longitudinal folds; anterior part membranous, in *T. dubitata*) (figs 46–52).

Phenology and Biology. Scarce data. Collection data from mid-April and from late June to mid-July potentially indicating a phenology similar to that of the sister species *T. sabaudiata*.

Habitat. Montane, most specimens have been collected at altitudes from 1100 m up to 2700 m, exceptionally as low as at 660 m. Some specimens have been collected in caves.

Distribution. The species is distributed from Azerbaijan, Armenia and eastern Turkey to north-eastern Iran.

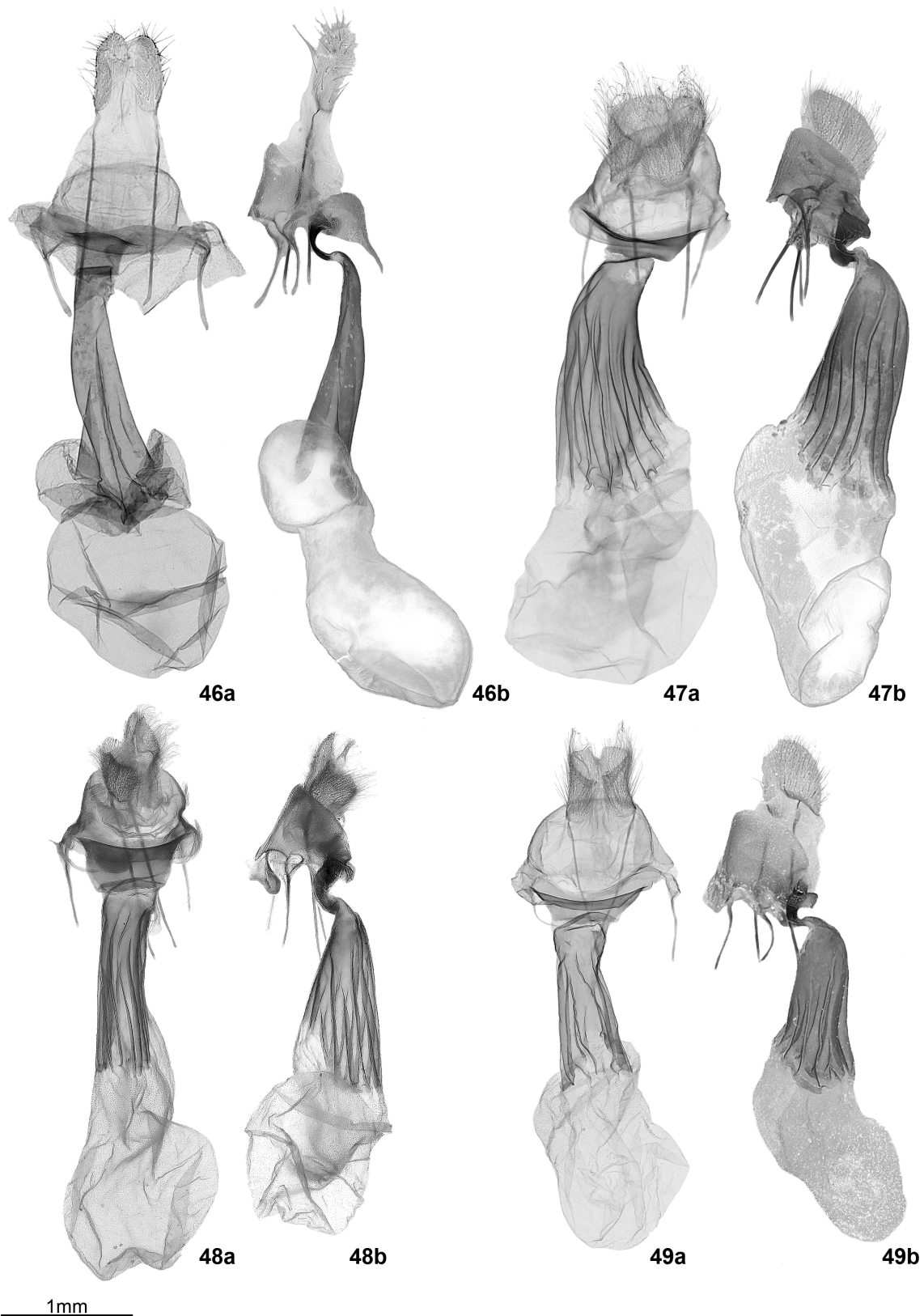
DNA barcoding. The species clusters at low genetic distances (1.4%, 1.7%) (tab. 2) with *T. sabaudiata* and *T. silviae* **sp. n.** However, these species show clear-cut morphological diagnostic characters (see figs 13–17). Diverging from *T. lecerfi* **sp. n.** by more than 2.6% (tab. 2).

***Hydria ravulata* (Staudinger, 1892), comb. rev.**

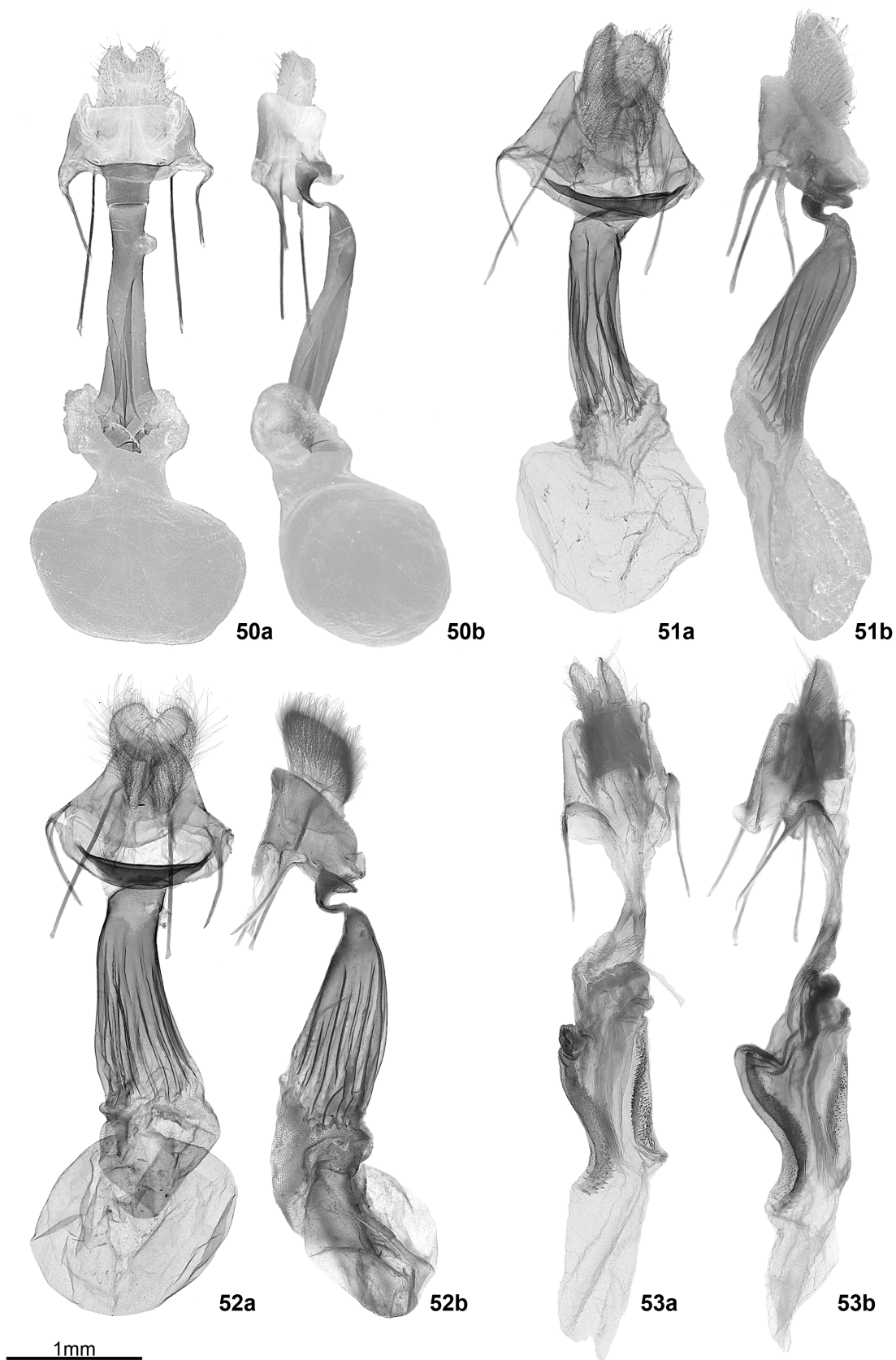
(figs 37, 45, 53; map)

Triphosa ravulata Staudinger, 1892. Deutsche entomologische Zeitschrift Iris, 5, 221. Syntypes 1 ♂, 4 ♀ ([Kyrgyzstan]: Central Asia, Issyk Kul). Deposited in Museum für Naturkunde der Humboldt-Universität, Berlin, Germany (in MNHU).

Type material examined. LECTOTYPE (hereby designated) ♂, Issyk-kul, Origin, ex coll. Staudinger, g. prep 0048/2018 D. Wanke; 4 ♀ PARALECTOTYPES (hereby designated), Issyk-kul, Origin, ex coll. Staudinger, g. prep 0049/2018 D. Wanke; all in MNHU.



FIGURES 46–49. Female genitalia. 46: *Triphosa dubitata* (Italy, Trafoi, 15.vi.1927, g. prep. 0013/2018 D. Wanke); 47: *Triphosa silviae* sp. n. (Iran, Kohkiluyeh-va-Boyerahmad, 24.v.2009, g. prep 0009/2018 D. Wanke); 48: *Triphosa lecerfi* sp. n. (Kyrgyzstan, Alai, Dugoba riv., 27.vii.1993, g. prep. 0041/2018 D. Wanke); 49: *Triphosa sabaudiata* (Switzerland, Preda, g. prep 0001/2018 D. Wanke). a = ventral view; b = lateral view.



FIGURES 50–53. Female genitalia. 50: paralectotype of *Triphosa taochata*, conspecific with *T. dubitata* (Achalzich, g. prep. 2070/2016. H. Rajaei); 51: lectotype of *Triphosa taochata* (Hankynda, g. prep. 0020/2018 D. Wanke); 52: *Triphosa taochata* (Türkei, Erzurum, Tal des Coruh, 5.vii.2002, g. prep. 0034/2018 D. Wanke); 53: paralectotype of *Hydria ravulata* (Issyk-kul, g. prep. 0049/2018 D. Wanke). a = ventral view; b = lateral view.

Diagnosis. Wingspan 29–33 mm, forewing length 16–19 mm (33–57 mm in the examined *Triphosa* species). Antennae filiform. Palpi flattened, length about the diameter of eye (twice diameter of eye in *Triphosa*). Proboscis well developed. Chaetosemata consisting of two patches of setae, which are not connected to each other. Ground colour yellowish-brown. Wing pattern strongly pronounced on forewing and hindwing, but the latter brighter in colour. Termen of both wings wavy, but waves extremely weakly pronounced on the forewing (termen of both wings are more strongly wavy in *Triphosa*). Transversal lines clearly visible. Terminal line darker. Fringes clearly visible, concolourous with wings.

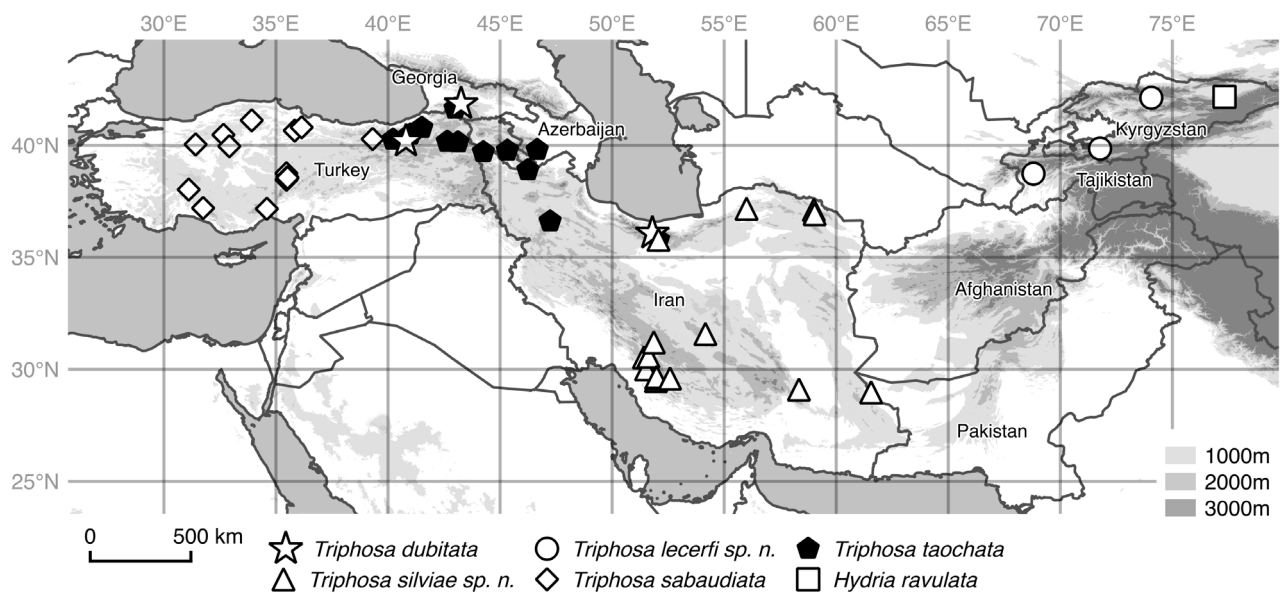
Male genitalia. Uncus broad, flat, spatulate, sclerotized, uncus base slightly broader than the tip (uncus long, thin, tapered, sub-medially curved and heavily sclerotized in *Triphosa*) (figs 6, 45a). Subscaphium membranous with setae (developed as flat spatulate sclerite sclerotized and strewn with plenty of little spines on both sides in *Triphosa*) (figs 7, 45a). Valva apically flat, rounded, with ampulla arising from the base of transtilla (without ampulla in *Triphosa*) (figs 6, 45a). Labides elongated, tapering, tip reaching to the central part of the uncus (different from two single, not elongated, arms to a spoon-shaped structure in *Triphosa*) (figs 13b–17b, 45a, 38–43). Sacculus projection heavily sclerotized, furcate. Lower prong shorter than the upper one, placed on a thickening; upper one curved; lower prong only one third the length of the upper one (sacculus projection heavily sclerotized, distally forked in *Triphosa*) (figs 13c–17c, 45a). Aedeagus short, broad. Vesica with well sclerotized cornuti, and a patch of microcornuti at the tip of vesica (without well sclerotized cornuti, but with microcornuti in *Triphosa*) (figs 9, 10, 45b).

Female genitalia (fig. 53). Ovipositor slim, rather tender (short and broad in *Triphosa*) (figs 46–53). Apophyses posteriores approximately twice length of apophyses anteriores. Ductus bursae narrow, membranous (extremely short, arched, flat, wide in ventral view, but narrow in lateral view in *Triphosa*) (figs 11, 53). Corpus bursae membranous, elongated with large and heavily sclerotized, dentate, lateral ridge and a large patch of spinules at the opposite side (with heavily sclerotized posterior part, membranous anterior part and signum absent in *Triphosa*) (figs 46–53).

Phenology, Biology and Habitat. Unknown.

Distribution. Only known from the type locality Issyk Kul.

Remark. Viidalepp (1996) formally transferred *ravulata* from *Triphosa* to the genus *Hydria*, but without explanation and describing any characters. In subsequent works, *H. ravulata* has therefore again been regarded as *Triphosa* (Scoble 1999, Scoble & Hausmann 2007). To confirm that *ravulata* indeed belongs to the genus *Hydria*, we investigated the type material and pointed out the relevant characters.



MAP. Distribution of *Triphosa dubitata*, *T. silviae* sp. n., *T. lecerfi* sp. n., *T. sabaudiata*, *T. taochata* and *Hydria ravulata* in the Middle East and Central Asia.

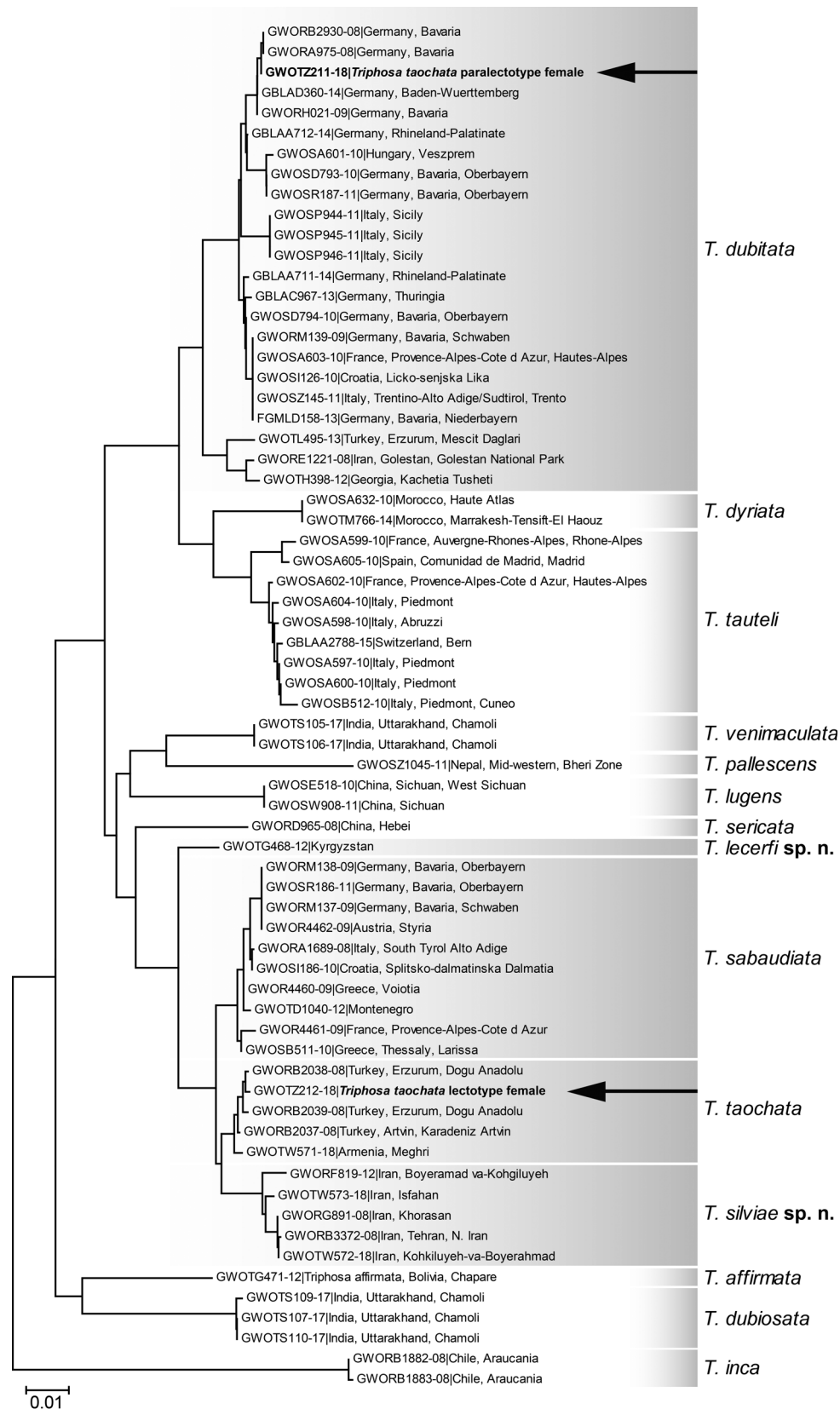


FIGURE 54. Un-rooted neighbour joining tree (Saitou & Nei 1987) based on 14 species of the genus *Triphosa* (calculated using K2P model: Kimura 1980 with MEGA7 (Kumar *et al.* 2016). Black arrows indicate the female lecto- and paralectotype of *Triphosa taochata* (the female paralectotype specimen that clustered with *Triphosa dubitata* has also *dubitata* genitalia pattern (see figs 46, 50); the female lectotype specimen that clustered with specimens from the Middle East has *taochata* genitalia pattern (see figs 51, 52).

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APPENDIX. List of sequenced specimens of *Triphosa*, with identification, Sampling sites collecting data, Accession numbers, and process ID in BOLD database. Data taken from BOLD and generated by Axel Hausmann ⁽¹⁾; Bernd Müller ⁽²⁾; Dirk Stadie ⁽³⁾; Iva Mihoci ⁽⁴⁾; Marco Infusino, Stefano Scalercio ⁽⁵⁾; Norbert Poell ⁽⁶⁾; Wanke *et al.* ⁽⁷⁾.

Taxon Identification	Sampling Site	Process ID
<i>T. affirmata</i> ⁽¹⁾	Bolivia, Chapare, San Jocinto, 30-Nov-1996, leg. Thoeny	GWOTG471-12
<i>T. dubiosata</i> ⁽¹⁾	India, Uttarakhand, Chamoli, Joshimath, 14-Apr-2015, leg. Pritha Dey	GWOTS107-17
<i>T. dubiosata</i> ⁽¹⁾	India, Uttarakhand, Chamoli, Lata, 15-May-2015, leg. Pritha Dey	GWOTS109-17
<i>T. dubiosata</i> ⁽¹⁾	India, Uttarakhand, Chamoli, Joshimath, 03-May-2014, leg. Pritha Dey	GWOTS110-17
<i>T. dubitata</i> ⁽¹⁾	Germany, Bavaria, Schwaben, Oberallgaeu, Oberstdorf, Oytal, 01-Jul-2008, leg. A. Haslberger	GWORM139-09
<i>T. dubitata</i> ⁽¹⁾	Georgia, Samzche-Dschawachetien, Achalzich, 31-Jul-1880, leg. Lederer	GWOTZ211-18
<i>T. dubitata</i> ⁽¹⁾	Hungary, Veszprem, Veszprem county, 10 km N Veszprem, 30-Jun-2002, leg. B. Skule, C. Hviid	GWOSA601-10
<i>T. dubitata</i> ⁽¹⁾	France, Provence-Alpes-Cote d'Azur, Hautes-Alpes, Col de la Cayolle, 30-Jul-2009, leg. P. Skou	GWOSA603-10
<i>T. dubitata</i> ⁽¹⁾	Germany, Bavaria, centr, Regensburg, Regensburg - Keilberg, 29-Apr-2000, leg. A. Segerer	GWORB2930-08
<i>T. dubitata</i> ⁽¹⁾	Germany, Bavaria, south, Schlagenhofen, Schlagenhofen am Woerthsee, 15-Apr-2007, leg. K. Ambil	GWORA975-08

<i>T. dubitata</i> ⁽¹⁾	Germany, Bavaria, south, Fuerstenfeldbruck, Dietramszell (Zeller Wald), 03-May-1997, leg. W. Schacht	GWORH021-09
<i>T. dubitata</i> ⁽¹⁾	Italy, Trentino-Alto Adige/Sudtirol, Trento, Cavalese-Daiano, 30 km NE Trento, 31-May-2010, leg. A. Hausmann	GWOSZ145-11
<i>T. dubitata</i> ⁽¹⁾	Germany, Bavaria, Oberbayern, NP Berchtesgaden, St. 36, Kuehrint, Watzmann, 03-Sep-2004, leg. W. Ruckdeschel	GWOSD793-10
<i>T. dubitata</i> ⁽¹⁾	Germany, Bavaria, Oberbayern, NP Berchtesgaden St. 4, Wimbachgries, 08-Aug-1997, leg. W. Ruckdeschel	GWOSD794-10
<i>T. dubitata</i> ⁽¹⁾	Germany, Bavaria, Oberbayern, Berchtesgaden, Hagengebirge, Gamsbemmerllabyrinth, Wildpalfensystem, 31-Oct-2011, leg. Menne	GWOSR187-11
<i>T. dubitata</i> ⁽¹⁾	Georgia, Kachetia, Tusheti, Omalo 2400 masl, 06-Jul-2010, leg. M. Franzen	GWOTH398-12
<i>T. dubitata</i> ⁽¹⁾	Germany, Thuringia, Schwarzatal, Bad Blankenburg, Schieferbrueche, 21-Oct-2012, leg. S. Erlacher	GBLAC967-13
<i>T. dubitata</i> ⁽¹⁾	Germany, Bavaria, Niederbayern, Regen, Achslach, Rauher Kulm, 19-Sep-2009, leg. Dr. Andreas H. Segerer	FGMLD158-13
<i>T. dubitata</i> ⁽¹⁾	Germany, Baden-Wuerttemberg, Grenzach-Wyhlen, Mal.-F. 17, Otto-Jaeggi-Weg, 31-Jul-2011, leg. Doczkal & Ssymank	GBLAD360-14
<i>T. dubitata</i> ⁽¹⁾	Germany, Rhineland-Palatinate, Ettringer, Hochstein (Suedhaenge), Vulkaneifel, 17-Apr-2013, leg. V. Gayk	GBLAA711-14
<i>T. dubitata</i> ⁽¹⁾	Germany, Rhineland-Palatinate, Ettringer, Hochstein (Suedhaenge), Vulkaneifel, 17-Apr-2013, leg. V. Gayk	GBLAA712-14
<i>T. dubitata</i> ^(1,3)	Turkey, Erzurum, Mescit Daglari, Goelyurt Gecidi, 05-Jul-2000, leg. Bernd Schacht	GWOTL495-13
<i>T. dubitata</i> ^(1,4)	Croatia, Licko-senjska, Lika, Mt. Licka Pljesivica L6, 21-Jul-2008, leg. I. Mihoci, M. Vajdic	GWOSI126-10
<i>T. dubitata</i> ^(1,5)	Italy, Sicily, Bosco della Tassita, 31-Jul-2009, leg. M. Infusino	GWOSP944-11
<i>T. dubitata</i> ^(1,5)	Italy, Sicily, Bosco della Tassita, 31-Jul-2009, leg. M. Infusino	GWOSP945-11
<i>T. dubitata</i> ^(1,5)	Italy, Sicily, Bosco della Tassita, 31-Jul-2009, leg. M. Infusino	GWOSP946-11
<i>T. dubitata</i> ^(1,6)	Iran, Golestan, Golestan National Park, Deraznu vic., 14-Jun-2007, leg. N. Poell	GWORE1221-08
<i>T. dyriata</i> ⁽¹⁾	Morocco, Haute Atlas, 3,7 km SSE Oukaimeden, Tizi-n Eden, 13-Jul-1994, leg. Stengel	GWOSA632-10
<i>T. dyriata</i> ⁽¹⁾	Morocco, Marrakesh-Tensift-El Haouz, H. Atlas, Oukaimeden, Tizi-n-Eddi, 10-Jul-2012, leg. G. Mueller & E. Revay	GWOTM766-14
<i>T. inca</i> ⁽¹⁾	Chile, Araucania, Malleco, Rio Blanco, 25-Feb-1995, leg. H. Thoeny	GWORB1882-08
<i>T. inca</i> ⁽¹⁾	Chile, Atacama, Copiapo, La Guardia, 14-Jan-1996, leg. H. Thoeny	GWORB1883-08
<i>T. lecerfi</i> ⁽¹⁾	Kyrgyzstan, Alay range Dugoba riv., 15-Jul-1995, leg.	GWOTG468-12
<i>T. lugens</i> ⁽¹⁾	China, Sichuan, West Sichuan, West from Chengdu, near Dayi, 19-Oct-2009, leg. Floriani & Saldaitis	GWOSE518-10
<i>T. lugens</i> ⁽¹⁾	China, Sichuan, Kangding, road Menghugang, 12-Apr-2010, leg. A. Saldaitis	GWOSW908-11
<i>T. pallescens</i> ⁽¹⁾	Nepal, Mid-western, Bheri Zone, Dailekh, 11 km N Dailekh, 19-Jan-1999, leg. Karma Sherpa	GWOSZ1045-11
<i>T. sabaudiata</i> ⁽¹⁾	Germany, Bavaria, Schwaben, Oberallgaeu, Oberstdorf, Edmund-Probst-Haus, 15-Jul-2007, leg. A. Haslberger	GWORM137-09
<i>T. sabaudiata</i> ⁽¹⁾	Germany, Bavaria, Oberbayern, Berchtesgadener Land, NP Berchtesgaden, Kaerlinger Haus, 16-Aug-2002, leg. A. Haslberger	GWORM138-09
<i>T. sabaudiata</i> ⁽¹⁾	Italy, South Tyrol, Alto Adige, 2 km SW Burgeis (BZ), 27-Jun-2008, leg. A. Hausmann	GWORA1689-08
<i>T. sabaudiata</i> ⁽¹⁾	Greece, Thessaly, Larissa, Olimpos Mt., below Skotio, 11 km NE Kalivia, 03-Jul-2004, leg. B. Skule	GWOSB511-10

<i>T. sabaudiata</i> ⁽¹⁾	Germany, Bavaria, Oberbayern, Berchtesgaden, Hagengebirge, Gamsbemmerllabyrinth, Wildpalfensystem, 31-Oct-2010, leg. Menne	GWOSR186-11
<i>T. sabaudiata</i> ⁽¹⁾	Austria, Tirol, Oberes Lechtal, Lechleiten, 31-Dec-2004, leg. Michael Leinnitz	GWOST114-11
<i>T. sabaudiata</i> ^(1,2)	Montenegro, Lovcen NP, Jezerski vrh, Njegos mausoleum, 25-Jul-2009, leg. L. Lehmann	GWOTD1040-12
<i>T. sabaudiata</i> ^(1,4)	Croatia, Splitsko-dalmatinska, Dalmatia, , NP Mt. Biokovo L11, 18-Jun-2007, leg. I. Mihoci, M. Vajdic	GWOSI186-10
<i>T. sabaudiata</i> ^(1,6)	Greece, Voiotia, Arachova, Parnass, 25-Jun-2002, leg. N. Poell	GWOR4460-09
<i>T. sabaudiata</i> ^(1,6)	France, Provence-Alpes-Cote d'Azur, Col du Lauteret, 30-Jul-2006, leg. N. Poell	GWOR4461-09
<i>T. sabaudiata</i> ^(1,6)	Austria, Styria, Goessl, Zimitzalm, 07-Sep-2006, leg. N. Poell	GWOR4462-09
<i>T. sericata</i> ⁽¹⁾	China, Hebei, Chongli, Baiqi, 25-May-2006, leg. C. Wang	GWOR965-08
<i>T. silviae</i> ⁽¹⁾	Iran, Tehran, N. Iran, Damavand, 31-Jul-1996, leg. Mueller	GWORB3372-08
<i>T. silviae</i> ⁽¹⁾	Iran, Khorasan, NP Golestan-Dasht, 22-May-2001, leg. Dr. Ch. Wieser	GWORG891-08
<i>T. silviae</i> ^(1,7)	Iran, prov. Kohkiluyeh-va-Boyerahmad, 30 km S Yassuj, road Abshare-Tange-Tamoradi, 8 km before Abshar, 24-May-2009, leg. Hossein Rajaei	GWOTW572-18
<i>T. silviae</i> ^(1,7)	Iran, Isfahan prov. Abade-Semirom road, 30 km before Hanna protected area, 09-Jun-2010, leg. H. Rajaei	GWOTW573-18
<i>T. silviae</i> ^(1,7)	Iran, Boyeramad va-Kohgiluyeh, S Zagros, 30 km S Yassuj, road Abshare-Tange-Tamoradi, 8 km before Abshar, 24-May-2009, leg. H. Rajaei	GWORF819-12
<i>T. taochata</i> ⁽¹⁾	Turkey, Artvin, Karadeniz, Artvin, Tekkale bei Yusufeli, 13-Apr-2002, leg. T. Drechsel	GWORB2037-08
<i>T. taochata</i> ⁽¹⁾	Turkey, Erzurum, Dogu Anadolu, Ispir, Hohle ca 7 km östlich Ispir, 05-Jul-2002, leg. J. Gelbrecht & E. Schwabe	GWORB2038-08
<i>T. taochata</i> ⁽¹⁾	Turkey, Erzurum, Dogu Anadolu, Ispir, Hohle ca 7 km östlich Ispir, 05-Jul-2002, leg. J. Gelbrecht & E. Schwabe	GWORB2039-08
<i>T. taochata</i> ⁽¹⁾	Azerbaijan, Nagorno-Karabach, Hankynda, 31-Jul-1880, leg. Staudinger	GWOTZ212-18
<i>T. taochata</i> ^(1,7)	Armenia, Meghri, Old City, Syunik, 29-May-2010, leg. Daniel Bolt	GWOTW571-18
<i>T. tauteli</i> ⁽¹⁾	Italy, Piedmont, 26 km W Caraglio, Cima Fauniera, 31-Jul-2009, leg. P. Skou	GWOSA597-10
<i>T. tauteli</i> ⁽¹⁾	Italy, Abruzzi, Castel di Ieri, 11-Jun-2005, leg. P. Skou	GWOSA598-10
<i>T. tauteli</i> ⁽¹⁾	France, Auvergne-Rhones-Alpes, Rhone-Alpes, Vallee de l Ibie, 02-Feb-2006, leg. Ph. Henry	GWOSA599-10
<i>T. tauteli</i> ⁽¹⁾	Italy, Piedmont, 26 km W Caraglio, Cima Fauniera, 28-Jul-2009, leg. P. Skou	GWOSA600-10
<i>T. tauteli</i> ⁽¹⁾	France, Provence-Alpes-Cote d'Azur, Hautes-Alpes, 4 km N Col de la Cayolle, 05-Aug-2005, leg. P. Skou	GWOSA602-10
<i>T. tauteli</i> ⁽¹⁾	Italy, Piedmont, 26 km W Caraglio, Cima Fauniera, 28-Jul-2009, leg. P. Skou	GWOSA604-10
<i>T. tauteli</i> ⁽¹⁾	Spain, Comunidad de Madrid, Madrid, Sierra de Guadarrama, S Puerto de Navafria, 19-Jul-2003, leg. B. Skule	GWOSA605-10
<i>T. tauteli</i> ⁽¹⁾	Italy, Piedmont, Cuneo, Alpi Cozie, 26 km W Caraglio, Cima Fauniera, 28-Jul-2009, leg. P. Skou	GWOSB512-10
<i>T. tauteli</i> ⁽¹⁾	Switzerland, Bern, Orvin, Les Roches, 20-Jun-2014, leg. R. Bryner	GBLAA2788-15
<i>T. venimaculata</i> ⁽¹⁾	India, Uttarakhand, Chamoli, Joshimath, 12-Apr-2015, leg. Pritha Dey	GWOTS105-17
<i>T. venimaculata</i> ⁽¹⁾	India, Uttarakhand, Chamoli, Lata, 26-May-2014, leg. Pritha Dey	GWOTS106-17