



Integrative taxonomic review of the genus *Synopsia* Hübner, 1825 in the Middle East (Lepidoptera: Geometridae: Ennominae)

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Abstract

The geometrid genera *Synopsia* Hübner, 1825 and *Synopsidia* Djakonov, 1935 are revised, both being earlier validated at genus rank. Type specimens, original descriptions and additional specimens from different localities were examined. The revision is based on morphological characters, molecular data and distribution records. As a result, *Synopsidia* **syn. nov.** is regarded as junior synonym of the genus *Synopsia*. The synonymies of the species *Scodonia tekkearia* Christoph, 1883 and *Synopsia znojkoii* Djakonov, 1935 with *Synopsia phasidaria phasidaria* (Rogenhofer, 1873) **comb. nov.** are confirmed. Furthermore, *Synopsidia phasidaria alvandi* Wiltshire, 1966 **syn. nov.**, *Synopsidia phasidaria ardschira* Brandt, 1938 **syn. nov.**, *Synopsidia phasidaria chiraza* Brandt, 1938 **syn. nov.**, *Hashtaresia jodes* Wehrli, 1936 **syn. nov.** and *Synopsidia phasidaria mirabica* Wehrli, 1941 **syn. nov.** are regarded as synonyms of *Synopsia phasidaria phasidaria* (Rogenhofer, 1873) **comb. nov.**. *Synopsia phasidaria afghana* (Wiltshire, 1966) **comb. nov.** is tentatively validated at subspecific rank. *Synopsia centralis* (Wiltshire, 1966) **comb. nov.**, **bona sp.** is upgraded from subspecies to species level. Wing pattern, as well as male and female genitalia and diagnostic characters of examined genera and species are illustrated and analyzed. The distribution patterns of *Synopsia phasidaria* **comb. nov.** and *Synopsia centralis* **bona sp.**, as well as the type localities of all discussed taxa, are provided. A complete checklist of the genus is given.

Key words: *Angerona*, *Chariaspilates*, Gnophini, *Hypoxystis*, new combinations, new synonyms, *Phthonandria*, *Siona*, *Synopsidia*

Introduction

In current taxonomy, *Synopsia* Hübner, 1825 is a monotypic genus containing only the type species of the genus, *S. sociaria* (Hübner, 1899). Though, some authors also have placed the taxon *strictaria* Lederer, 1853 in *Synopsia* (e.g. Viidalepp 1996, Mironov *et al.* 2008, Beljaev & Mironov 2019), while others placed it in *Megalycinia* Wehrli, 1939 (e.g. Ahola *et al.* 1999, Scoble 1999, Hausmann *et al.* 2004, 2011). Müller *et al.* (2019) transferred the taxon *strictaria* to the genus *Phthonandria* Warren, 1894.

Synopsia sociaria is widely distributed from Portugal and Spain to the southern Ural Mountains, Turkey, Transcaucasia and Kazakhstan (Müller *et al.* 2019). Its polyphagous larvae feed on different species of e.g. Asteraceae, Fabaceae, Ranunculaceae or Rosaceae (see Müller *et al.* 2019).

Synopsidia Djakonov, 1935 was originally described as a subgenus of *Synopsia*, based on the type species *Synopsia znojkoii* Djakonov, 1935 from Azerbaijan: Paraga. Wehrli (1954) transferred *Nychiodes phasidaria* Rogenhofer, 1873 (described from Georgia: Akhaltsikhe) into *Synopsidia* and regarded it as the type species of *Synopsidia*. Subsequently he raised *Synopsidia* from subgenus to genus level and listed six subspecies for *Synopsidia phasidaria*. This classification has been followed later by Scoble (1999) and Hausmann & Scoble (2007), who listed

eight subspecies under *Synopsidia phasidaria*, including the subspecies *znojkoii*. *Synopsidia* is a monotypic genus and occurs widely in the Middle East from Caucasus to Afghanistan.

Synopsidia phasidaria mirabica, originally described as a variation by Wehrli (1941), is not listed in both above-mentioned catalogues. According to article 45.6.4. of the International Code of Zoological Nomenclature (ICZN2000) this name should be regarded as a subspecies (Ride *et al.* 1999).

In current phylogenetic analyses *Synopsia* is classified in tribe Gnophini (Beljaev 2016), which has recently been supported by a multi-gene phylogenetic analysis (Murillo-Ramos *et al.* 2019), while *Synopsidia* is not included in either of these publications.

As the validity of all subspecies was still controversial and questioned by several authors (Viidalepp 1996, Lehmann & Zahiri 2011), the present study has two main aims: (1) investigation of the status of the genus *Synopsidia*; (2) a taxonomic review of the subspecies of *Synopsidia phasidaria*.

To achieve these goals, we mainly focused on morphological characters, combined with distribution data and DNA barcoding. Morphological characters (e.g. head, male and female genitalia and wing venation) of *Synopsia* and *Synopsidia*, as well as some of related Palearctic genera (see Material and Methods) were compared. Most type specimens were examined and original descriptions were critically reviewed. Large series of additional specimens from different localities were studied internally and externally to test the validity of the subspecies.

Material and methods

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

NHMUK	Natural History Museum, London, United Kingdom
NHMV	Natural History Museum Vienna, Austria
NHRS	Naturhistoriska Riksmuseet, Stockholm, Sweden
PCJM	Private collection of Jörg-Uwe Meineke, Kippenheim, Germany
PCPS	Private collection of Peder Skou, Vester Skerninge, Denmark
SMNK	Staatliches Museum für Naturkunde Karlsruhe, Germany
SMNS	Staatliches Museum für Naturkunde Stuttgart, Germany
ZFMK	Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany
ZSM	Zoologische Staatssammlung München, Germany

Morphological examination. Morphological characters of the following genera were compared with those of *Synopsia* and *Synopsidia* to allow definition of diagnostic genus-level characters: *Siona* Duponchel, 1829; *Hypoxystis* Prout, 1915; *Angerona* Duponchel, 1829; *Phthonandria* Warren, 1894; and *Chariaspilates* Wehrli, 1953. These genera have been chosen based on close relationships with *Synopsia* as presented in Murillo-Ramos *et al.* (2019) as well as Müller *et al.* (2019). The structural comparisons against these genera are based on one male and female specimens per species. Therefore, the variation within these structures, for instance in wing venation, was not examined.

Type material of the investigated subspecies of *S. phasidaria* and original descriptions served for the identification and comparison of specimens. A Visionary Digital photography system (LK Imaging System, Dun. Inc., equipped with a Canon EOS 5DSR), as well as an Olympus E3 digital camera were used for the documentation of external characters. Genitalia preparations were carried out following standard techniques (e.g. Robinson 1976) and vesica evertion according to the method by Sihvonen (2001). For the photography of genitalia characters in their natural position before embedding, we followed the methods proposed by Wanke & Rajaei (2018) and Wanke *et al.* (2019). A Keyence VHX-5000 was used for their photography. Genitalia were finally embedded as permanent slides in Euparal and photographed with a Keyence VHX-5000.

The morphology of male and female antennae were studied using a Zeiss Scanning Electron Microscope (SEM, EVO-LS15). Before imaging with SEM, the antennae were mounted on holders and sputter-coated with 6 nm gold-palladium using a Leica coating system (EM ACE 200).

Distribution patterns. For tracing geographical coordinates, we used 'Google Earth Pro' (vers. 7.3.1.4507 for Mac) and distribution patterns were plotted and prepared in QGIS (vers. 2.18.15 for Mac). Preparation of the el-

evation profile in QGIS was conducted using Global Multi-resolution Terrain Elevation Data 2010 (GMTED2010) downloaded from <https://earthexplorer.usgs.gov>.

DNA barcoding. Extraction of DNA and amplification of the “barcode” fragment (658 base-pairs of the 5’ terminus) of the mitochondrial Cytochrome-C Oxidase I were carried out using standard protocols (e.g. Ivanova *et al.* 2006). PCR amplification products were partly sent to Macrogen for sequencing and partly sequenced at the CCDB, Guelph. A specimen list used for DNA analysis is given in the appendix table along with their sampling site and process ID numbers. All sequences, photographs and metadata are accessible in the public dataset DS-SYNOPSISIA on BOLD (Barcode of Life Datasystems; doi: dx.doi.org/10.5883/DS-SYNOPSISIA). For the maximum likelihood analysis (with 1000 bootstrap replications) and calculation of genetic distances MEGA X (Kumar *et al.* 2018, Stecher *et al.* 2020) was used (using K2P model: Kimura 1980). The type species of the genera listed above for the morphological examination (except *Phthonandria*) served as outgroups in this analysis.

Results and discussion

Synopsia Hübner, 1825

Synopsia Hübner, [1825] 1816. Verzeichnis bekannter Schmetterlinge, 317. Type species: *Geometra sociaria* Hübner, 1799 [Europe].

Synopsidia Djakonov, 1935. Lambillionea 35, 147. Type species: *Synopsia znojkoii* Djakonov, 1935. Herewith regarded as **new synonym** of *Synopsia* based on morphological examination (see below).

Taxonomic remark. *Synopsidia* has been described as subgenus of *Synopsia* referring to the absence of a proboscis (which is also rudimentarily developed in *Synopsia* (see figs 1A–D)), a simplified wing pattern, a blunter and broader uncus, as well as a smaller number of cornuti on the vesica (Djakonov 1935). Also, within the diagnosis of *Synopsidia* (see Djakonov 1935), all characters and similarities with *Synopsia* were stated (e.g., the congruent wing venation (fig. 3) and details of the genitalia structures). Later, *Synopsidia* was raised to genus rank referring only to the absence of the proboscis (Brandt 1938, Wehrli 1954). Our investigation supports the view that *Synopsidia* needs to be regarded as a new synonym of *Synopsia* based on similar morphology (see diagnosis).

Description and diagnosis. *Wings and body.* Medium-sized moths (wingspan between 26–44 mm). Antennae bipectinate in males, filiform or bipectinate in females (if bipectinate, length of branches from 0.1 mm to 0.48 mm) (figs 1–2). Proboscis reduced or represented by barely visible rudimentary slats (Djakonov 1935) (see fig. 1A–D). Wings brown with light grey areas, bright beige or white to darker yellow with some brown spots (wings white with dark brown veins in *Siona*; wings light yellow, strongly intermixed with brown in *Hypoxystis*; varying combinations of yellow and orange in *Angerona*; varying shades of brown in *Phthonandria*; golden brown-yellow in *Chariaspilates*) (figs. 5–26; see Skou & Sihvonen 2015, pages 487, 495, 499 & Müller *et al.* 2019, page 587). Frons, thorax and abdomen concolorous with wings. Chaetosemata developed as two small separate patches.

Venation (figs 3–4). In the forewing Sc and R1 arising from a common stalk (similar condition in *Hypoxystis*, *Angerona*, *Phthonandria* and *Chariaspilates*; Sc arising separately from the wing base and continuing to the costal margin of the wing, R1 free, originating from the cell in *Siona*). In *Synopsia* R2 arising on a separate stalk; in its second half shortly anastomosing with common stalk of R3 and R4, (similar condition in *Chariaspilates*; *Phthonandria*; *Angerona*; *Hypoxystis*; R2 touching the common stalk of R3 and R4 without anastomosis in *Siona*) (fig. 4). R3–5 arising from a common stalk originating from the cell. R3–4 on common stalk distally of origin of R5. In the hindwing Sc+R1 fused, strongly curved in basal area, anastomosing with Rs and with vein M2 reduced.

Male genitalia (figs 27–36; Skou & Sihvonen 2015, pages 529, 537, 543 & Müller *et al.* 2019, page 651). Uncus strongly sclerotized and slightly to strongly bifurcate, sometimes tip only concave in the centre (uncus absent in *Siona*; short and stout in *Hypoxystis*; as a shallow plate in *Angerona*; small and bifid in *Phthonandria*; tapering in *Chariaspilates*). Gnathos strongly sclerotized, upturned, tongue-shaped, width of tongue differing (upturned and tapered in *Siona*; plate-shaped in *Hypoxystis*; upturned and tapered in *Angerona*; large and upturned in *Phthonandria*; as a large medial plate in *Chariaspilates*). Costa of valva with projection at the centre (similar condition in *Hypoxystis* and *Chariaspilates*; basal projection in *Siona*, *Angerona* and *Phthonandria*).

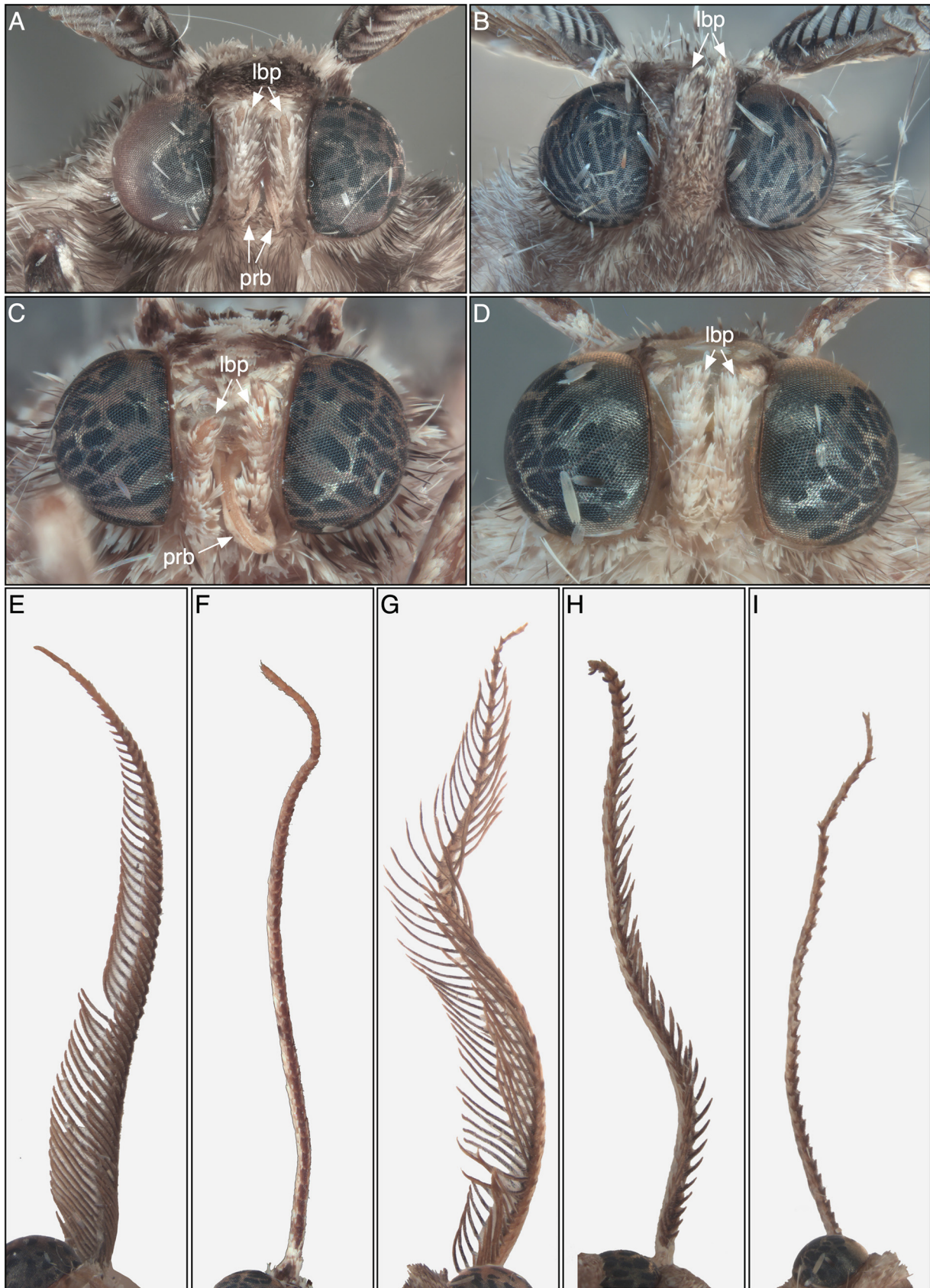


FIGURE 1. Structures of the head and antennae of *Synopsis sociaria* and *Synopsis phasidaria* **comb. nov.**. A male and C female head of *Synopsis sociaria* (proboscis rudimentary developed); B male and D female head of *Synopsis phasidaria* **comb. nov.** (proboscis strongly reduced, not reaching through the labial palps). E male bipectinate antennae and F female filiform antennae of *Synopsis sociaria*. G male bipectinate antennae and H, I female bipectinate antennae (slightly differing in specimens) of *Synopsis phasidaria* **comb. nov.**. Abbreviations: *lbp* – labial palps; *prb* – proboscis. Photos E-I in scale (scale-bar 1 mm).

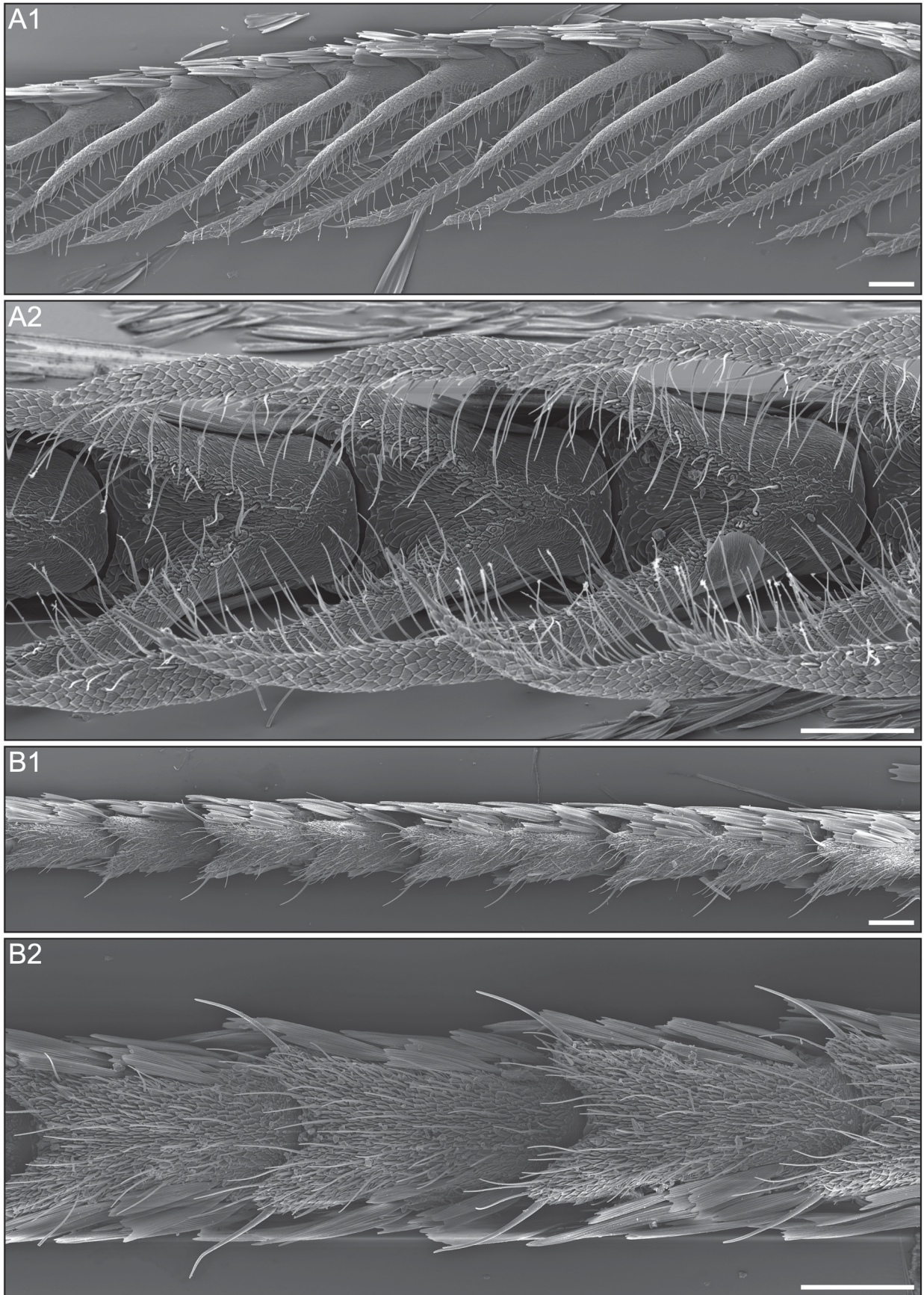


FIGURE 2. SEM close-up photos of the two different forms of bipectinate antennae in female of *Synopsis phasidaria* **comb. nov.** Photos A strongly bipectinate (A1 lateral, A2 ventral); B weakly bipectinate (B1 lateral, B2 ventral). Scale-bar 100 μ m.

Costal projection bearing one or more spines (only one spine in *Siona*; spines absent in *Hypoxystis*; spinose in *Angerona*; bearing spines in *Phthonandria* and *Chariaspilates*). Saccus wide and round, sometimes with extensions (without extensions in *Siona*, *Hypoxystis*, *Angerona*, *Phthonandria* and *Chariaspilates*).

Aedeagus with several strongly sclerotized cornuti on the vesica (a small row in *Siona*; small and dentate in *Hypoxystis*; one cornutus in *Angerona*; cornuti variable in number in *Phthonandria*; patch of microcornuti in *Chariaspilates*) (fig. 36).

Female genitalia (figs 37–40; Skou & Sihvonen 2015, pages 571, 579, 585; Müller *et al.* 2019, page 716). Ductus bursae sclerotized (short, laterally sclerotized in *Siona*; membranous short and wide in *Hypoxystis* and *Angerona*; short in *Phthonandria* and *Chariaspilates*). Corpus bursae anteriorly membranous (anterior part membranous in *Siona*; large and membranous in *Hypoxystis* and *Phthonandria*; anteriorly elongated in *Angerona*; anteriorly subtriangular in *Chariaspilates*). Signum present, serrated (elongated, with dentate margins in *Siona*; rectangular in *Hypoxystis*; rectangular with hollow centre in *Angerona*; oval with hollow centre in *Phthonandria*; elongated with sclerotized margins in *Chariaspilates*).

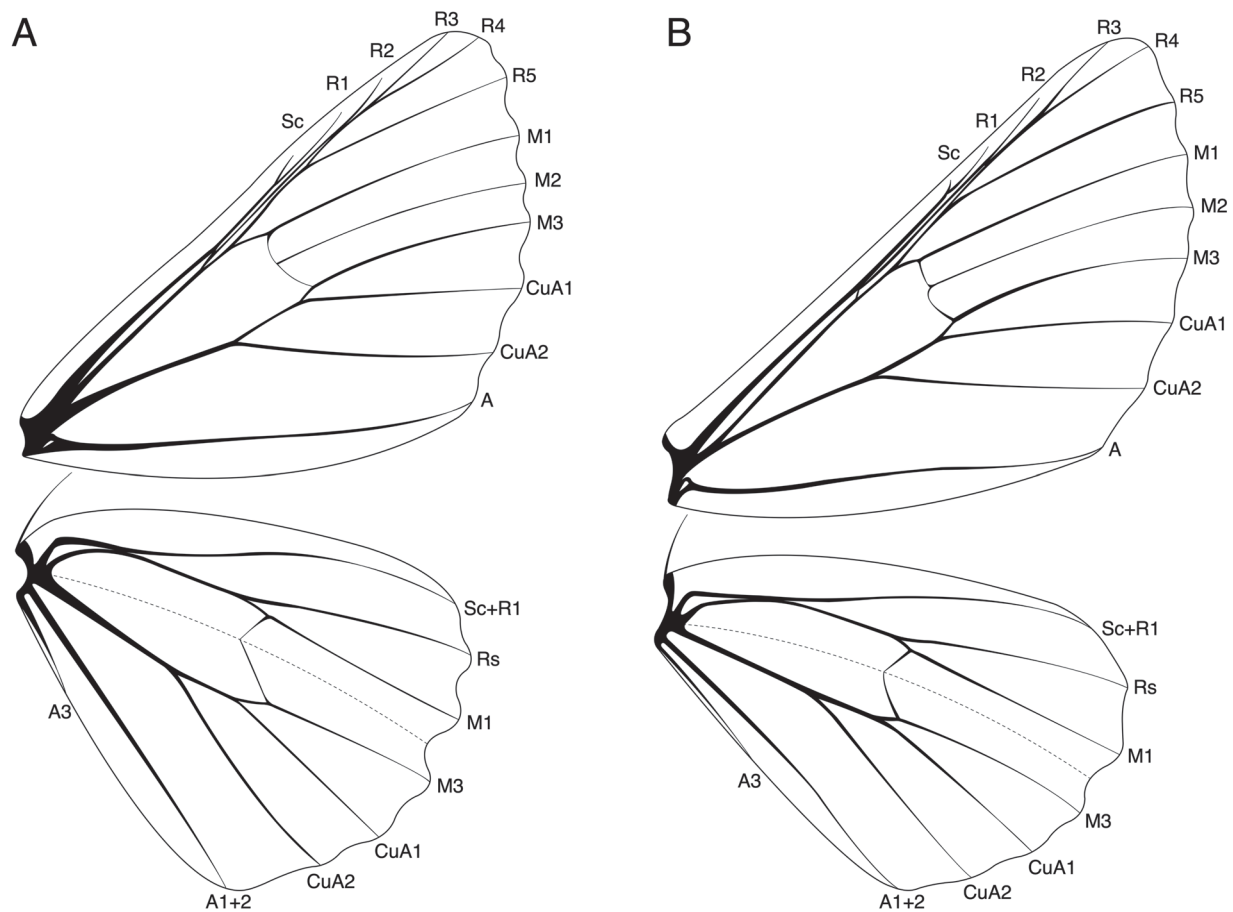


FIGURE 3. Wing venation of male specimens of A: *Synopsia* (*S. sociaria* type species for the genus) and B: *Synopsidia* (*S. phasidaria*) **syn. nov.** of *Synopsia*. Note that both wing venations do not show significant differences.

Species account

Synopsia phasidaria phasidaria (Rogenhofer, 1873) **comb. nov.**

(figs 8–22, 29–33, 36, 38–40, 42)

Nychiodes phasidaria Rogenhofer, 1873. Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien 23, 572. Syntypes (Caucasus, Achalzik [Akhaltzikhe]) (deposition of type specimen(s) unknown).

Scodonia tekkearia Christoph, 1883. In Romanoff, Mémoires sur les Lépidoptères 2, 123. Holotype ♂ ([Turkmenistan], near Nuchur [Nokhur]). According to Wehrli (1954) deposited in museum of St Petersburg. Wehrli (1941) combined this taxon with *Synopsidia*. This subspecies is regarded as a junior synonym of *Synopsidia phasidaria* by Viidalepp (1996). Here

confirmed as junior synonym of *Synopsia phasidaria phasidaria* **comb. nov.**, based on morphological examination and sympatric occurrence of these forms.

Synopsia znojkoii Djakonov, 1935. *Lambillionea* 35 (7), 142. Syntypes ♂ (Transcaucasus: Paraga, NW of Ordubad). Deposition of type specimen(s) unknown. Examination after Djakonov's description and illustration of the male genitalia. This subspecies is regarded as a junior synonym of *Synopsidia phasidaria* by Viidalepp (1996). Here confirmed as junior synonym of *Synopsia phasidaria phasidaria* **comb. nov.**, based on morphological examination and sympatric occurrence of these forms.

Hashtaresia jodes Wehrli, 1936. *Lambillionea* 36 (12), 276. Holotype ♂ (NHMUK, examined). Wehrli (1941) combined this taxon with *Synopsidia*. Hereby regarded as a **new synonym** of *Synopsia phasidaria phasidaria* based on morphological examination and sympatric occurrence of these forms.

Synopsidia phasidaria ardschira Brandt, 1938. *Entomologische Rundschau* 55 (51), 602. Holotype ♂ (NHRS examined). Hereby regarded as a **new synonym** of *Synopsia phasidaria phasidaria* based on morphological examination and sympatric occurrence of these forms.

Synopsidia phasidaria chiraza Brandt, 1938. *Entomologische Rundschau* 55 (51), 602. Syntypes (Iran, Sine-Sefid). (NHRS). Hereby regarded as a **new synonym** of *Synopsia phasidaria phasidaria* based on morphological examination and sympatric occurrence of these forms.

Synopsidia phasidaria mirabica Wehrli, 1941. In: Seitz, A. (Ed.), *Die Großschmetterlinge der Erde. Supplement zu Band 4*, 464. Syntypes ♂, ♀ (ZFMK, examined). Hereby regarded as a **new synonym** of *Synopsia phasidaria phasidaria* based on morphological examination and sympatric occurrence of these forms.

Synopsidia phasidaria alvandi Wiltshire, 1966. *Zeitschrift der Wiener Entomologischen Gesellschaft*, 51, 146. Holotype ♂ (NHMUK, examined). Hereby regarded as a **new synonym** of *Synopsia phasidaria phasidaria* based on morphological examination and sympatric occurrence of these forms.

Type material examined. *Synopsidia phasidaria alvandi*: Holotype, ♂, Iran, Mt. Alvand, 9000ft. [2743 m], 27.vii.1938, E.P. Wiltshire, g.prep. E.P. Wiltshire 1470; in NHMUK (fig. 9).

Synopsidia phasidaria ardschira: Paratype, 1 ♂, Iran, Fars, Straße Ardekan-Talochosroe, Comèe [Komehr] (Barm i Firus), ca 3750 m, 4. und 5.vi.1937, coll. Brandt, g.prep. 11026; in NHRS (fig. 8).

Synopsidia phasidaria jodes: Holotype, ♂, Iran, Hashtar, Demawend, 2500 m, viii.1935, F. Fusek, g.prep. 7100; in NHMUK (fig. 10).

Synopsidia phasidaria mirabica: Syntype, 1 ♂, Nordost-Iran, Kuh i Mirabi, Waldzone, 1600–1900 m, Juli, Exp. Wernicke, g.prep. 0501/2020 D. Wanke; Syntype, 1 ♀, Nord-Iran, Schahkuh, Westabhang, Geröllzone, 1800–2000 m Juni, Exp. Wernicke, g.prep. 0502/2020 D. Wanke; all in ZFMK (figs 11–12).

Additional material examined. 2 ♀, Iran, Mt. Alvand, 9000 ft. [2743 m], 27.vii.1938, E.P. Wiltshire; in NHMUK.

1 ♂, Iran, Fars, Straße Chiraz-Kazeroun, Fort Sine-Sefid, ca. 2200 m, Sept.1937, coll. Brandt, g.prep. 11027; 1 ♂, Iran, Fars, Strasse Ardekan-Talochosroe [Ardakan-Talle Khosrow], Comèe [Komehr] (Barm i Firus), ca. 3750 m, 4. und 5.vi.1937, Brandt, g.prep. 11028; in NHRS.

1 ♂, Iran, Kordestan, Baneh 15 km NE, Gharawol-Kaneh [Khaneh], 2000 m, 26./27.vi.2009, leg. A. Hofmann, J.-U. Meineke, H. Rayai [Rajaei], g.prep. 0213/2019 D. Wanke; in PCJM.

1 ♂, Türkei, Cukurca, Prov. Hakkari, 20.vi.1986, leg. Dittrich, Austria, 16273 coll. R. Wimmer, g.prep. 0382/2019 D. Wanke; 1 ♂, 2 ♀, Republic Armenia, Yeros Mts. 1600 m, Dvin village suburbs, Arat district, 11.–13.vi.2009, leg. Yuriy Shevnin, g.prep. 0381/2019 D. Wanke; 1 ♂, 1 ♀, Republic Armenia, Yeros Mts. 1600 m, Dvin village suburbs, Arat district, 14.–15.vi.2009, leg. Yuriy Shevnin, g.preps (♂) 0492/2019 D. Wanke, (♀) 0493/2019 D. Wanke; 2 ♂, Republic Armenia, Yeros Mts. 1600 m, Dvin village suburbs, Ararat district, 11.vi.2009, leg. Yuriy Shevnin, coll Danny Nilsson, g.prep. 0494/2019 D. Wanke; 1 ♂, Republic Armenia, Aiotzdorsky range, 2000 m, Yeghegnadzor suburbs, 150 km to SE from Yerevan, Mozrov Village, Mountain steppes, 12.vii.2009, leg. Yuriy Shevnin; 2 ♂, Iran, Prov. Esfahan, Zagros Mts, Fereidun Shar, 3000 m, 15.–17.vi.2010, leg. B. Benedek & T. Hác, g.preps 0383, 0495/2019 D. Wanke; 1 ♂, NW-Iran, Provinz Chahar Mahal, ca. 35 km SE Aligudarz Seitental SW Murak, Umg. Dorf Darreh Hoz, 1800–2000 m, 13.–15.vi.2001, leg. de Freina, g.prep. 0384/2019 D. Wanke; 1 ♂, [Iran], Azarbeijan-e Gharbi, Takab, Takht-e soleiman, N36°35'40.0", E047°19'43.5", 2528 m, 1.vii.2013, leg. M. Afsarian, g.prep. 0385/2019 D. Wanke; 1 ♂, Iran, Zanjan, Zanjan-Gilvan, Gargovol Dag, 2500 m, 26./27.vi.2001, leg. A. Hofmann, J.-U. Meineke, W.G. Tremewan, g.prep. 0386/2019 D. Wanke; all in PCPS.

1 ♂, W-Iran, Lorestan, Dorud, Paß S Darrya-che Gahar, Partsche Kabud, 2800 m, 1.–3.viii.1975, leg. Ebert & Falkner, g.prep. 0195/2018 D. Wanke; 2 ♂, 1 ♀, W-Iran, Kordestan, Straße Saghez-Baneh, 21 km NE Baneh, 1950 m, 30.[vi.]–2.vii.1975, leg. Ebert & Falkner, g.preps (♂) 0196/2018 D. Wanke, (♀) 0487/2019 D. Wanke; 2 ♂, 1 ♀, Nordiran, Elbursgebirge östl. Shemshak, 50 km nördl. Teheran, 2100–2500 m, 8.–24.vi.1973, leg. G. Junge, g.preps

(♂) 0209/2018, 0489/2019 D. Wanke; 1 ♂, NE-Iran, prov. Ostan-e Khorasan, Kopet Dag, ca 50 km N Bojnurd, Sizmansufla, N 37°44'20", E 57°25'53", 10.v.2008, 1240 mNN, lux, leg. R. Trusch, M. Falkenberg & B. Müller, SMNK E-Lep. 247, g.prep. 0488/2019 D. Wanke; 1 ♂, N-Iran, Elburs-Mts., Prov. Tehran, 15km E Gatschisar, 2600 m, 5.viii.1972, leg. Ebert; 1 ♂, N-Iran, Elburs-Geb., 12 km v. Keregi, 1650 m, 27.v.1969, leg. G. Ebert, g.prep. 0490/2019 D. Wanke; 1 ♂, Persia s. [Iran], Elburs, Kendevan, ca. 3000 m, 3.–9.vii.[year missing], coll. Wagner, Wien; all in SMNK.

3 ♂, 1 ♀, [Turkey], Kleinasien, Prov. Hakkari, 20km E Uludere, Suvarihalil-Paß, 2300–2600 m, 14.–15.vii.[19]85, leg. de Freina, g.preps (♂) 0465, 0466/2019 D. Wanke, (♀) 0467/2019 D. Wanke; 2 ♀, [Turkey], Kleinasien, Prov. Hakkari, Tanin-Tanin-Paß, 2000–2300 m, 12.–13.vii.[19]85, leg. de Freina, g.preps 0468, 0480/2019 D. Wanke; 1 ♂, 1 ♀, [Turkey], Kleinasien, Hakkari, Ö-Uludere, 1900 m, 28.–29.vi.1982, leg. W. Thomas, g.prep. (♀) 0469/2019 D. Wanke; 1 ♂, [Turkey], Kleinasien, Hakkari, Tanin-Tanin-Paß, 2000 m, 3.–5.vii.1983, leg. W. Thomas; 2 ♀, [Turkey], Kleinasien, Prov. Artvin, NO-Anatolisches Randgebirge SE Seite, Barhal Tal, 4 km NE Altiparmak, 1100 m, 31.vii.–03.viii.[19]83, leg. de Freina; 1 ♂, Türkei, Prov. Van, Kuzgun Kiran-Gecidi, 1900 m, 21.vi.–8.vii.[19]81, ex. coll. A. Hofmann; 1 ♂, Türkei, Prov. Agri, 2km S Dogubayazit, 2100 m, 25.vii.[19]92, leg. P. Kautt & V. Weiss, g.prep. 0470/2019 D. Wanke; 1 ♂, 2 ♀, Iran, Ostan Tehran, Reshteh Ye Alborz, Dizin Gardaneh, 2700–3000 m, 5.–8.vii.1978, leg. W. L. Blom, g.preps (♂) 0471/2019 D. Wanke, (♀) 0472/2019 D. Wanke; 1 ♂, 1 ♀, Iran, Elburz-Geb., Dizin, 2600 m, vii.1976, leg. Czipka; 1 ♂, Iran, Elburs, Shemshak, 2700 m, 10.–11.viii.1978, leg. W. Thomas, g.prep. 0473/2019 D. Wanke; 1 ♂, Iran, Elburs, Kendevan, 8.–15.viii.1978, 2300–2800 m, leg. W. Thomas; 1 ♀, Iran, Elburs, vic. Kendevan, 7.–9.viii.1977, 2500–3000 m, leg. W. Thomas, g.prep. 0474/2019 D. Wanke; 9 ♂, 2 ♀, Iran, Zanjan prov., E Zanjan, road to Gilvan, Alt. 1889 m, N36°45'21.8", E48°49'20.7", 6.vii.2013, leg. H. Rajaei, J.-U. Meineke, B. Hafezi, g.preps (♂) 0105, 0106/2018, 0475, 0476/2019 D. Wanke, (♀) 0477/2019 D. Wanke; 5 ♂, 2 ♀, Iran, Kohkiluyeh va Boyer-Ahmad, Yasuj, Sisakht, Dena, 2799 m, 30°57'23.6"N, 51°23'28.9"E, 30.vii.2016, leg. Sh. Feizpour, g.preps (♂) 0118/2018, 0484, 0485/2019 D. Wanke, (♀) 0486/2019 D. Wanke; 1 ♂, 4 ♀, Iran, Lorestan, Dorud, Astaneh door, 1801 m, 33°24'48.61"N, 49°08'42.5"E, 25.vii.2016, leg. Sh. Feizpour, g.preps (♂) 0123/2018 D. Wanke, (♀) 0478, 0496/2019 D. Wanke; 1 ♀, Iran, Azerbaijan-e Gharbi prov., Khoy to Ghotur road, Esteran vill., Alt. 1637 m, N 38°27'03.1", E 44°44'33.6", 1.vii.2013, leg. J.-U. Meineke, H. Rajaei, B. Hafezi, g.prep. 0299/2019 D. Wanke; 2 ♀, Iran, Shahrud, Shahkogh, Tash, Ayoub, Hosseini region, 2588 m, 36°37'18"N, 54°33'42.6"E, 11.vii.2016, leg. Sh. Feizpour, g.prep. 0481/2019 D. Wanke; 2 ♂, Iran, Prov. Golestan, Shahrud-Golestan road, Shahkuh, 2585 m, 36°38'36"N, 54°31'31"E, 16.vii.2015, leg. Sh. Feizpour, g.preps 0482, 0483/2019 D. Wanke; all in SMNS.

1 ♂, Iran, Khorassan, Kouh i Binaloud (Meched), 3000 m, 30.vii.1938, coll. Brandt, g.prep. 0503/2020 D. Wanke; in ZFMK.

1 ♂, 1 ♀, Iran, Fars, Straße Chiraz-Kazeroun, Fort Sine-Sefid, ca. 2200 m, 26.v.1937, coll. Brandt, both labelled as 'Paratyloid'; 2 ♂, Iran, Fars, Strasse Ardekan-Talochosroe [Ardakan-Talle Khosrow], Comè [Komehr] ca. 2600 m, 2.viii.1937, coll. Brandt; all in ZSM.

Taxonomic remark on the subspecies. Based on the sympatric occurrence of the forms, absence of clear and constant morphological characters and evidence from the molecular data, most subspecies (except *Synopsia phasidaria afghana* **comb. nov.**) are treated as synonym to *Synopsia phasidaria phasidaria* **comb. nov.** All subspecies and forms of *S. phasidaria* have been described based on small series of specimens, mainly referring to a different wing pattern and differences in the male genitalia (e.g. shape of the uncus, the number of cornuti and differences in the shape of the harpe). Nonetheless, in *S. phasidaria* all these characters are highly variable even within a single population, which has been stated also by different previous authors (Brandt 1938, Wiltshire 1966) and thus are inadequate as diagnostic characters (see fig. 36).

Furthermore, we observed two kinds of bipectinate antennae in females (short or long pectination) (figs 1H–I, 2), even in the same populations. However, these specimens with different shape of antennae do not show any correlated diagnostic differences in the wing pattern, genitalia characters, and DNA barcodes (fig. 41). All evidence therefore support the synonymy of these subspecies and lead us to conclude that the structurally different female antennae are intraspecific variation.

Diagnosis. *Wings and body* (figs 8–22). Wingspan ♂ 26–38 mm, ♀ 32–42 mm, female specimens rarely smaller (forewing length ♂ 15–20 mm, ♀ 17–23 mm). Wing pattern highly variable, ground colour of wings from bright beige or sandy yellow with some brown spots, to brown (sandy yellow with some brown and orange spots in *S. phasidaria afghana*; similar in *S. centralis*; beige to brown, spotted dark in *S. sociaria*). Transverse lines faint or slightly visible (brown in *S. phasidaria afghana* and *S. centralis*; black in *S. sociaria*) (figs 5–7, 23–26).

Male genitalia (figs 29–33, 36). Uncus sclerotized, slightly bifurcate or tip only concave in the centre (sclerotized tip concave in *S. centralis*; sclerotized and strongly bifurcate in *S. sociaria*). Gnathos well developed, arms fused, forming a tongue-shaped upturned plate, variable in shape (similar in *S. centralis*; almost similar in *S. phasidaria afghana* and *S. sociaria*). Costa of valva with central projection usually bearing one to three spines (similar in *S. phasidaria afghana*; without central projection in *S. centralis*; central projection bearing one to two spines in *S. sociaria*). Harpe sickle-shaped (similar in *S. phasidaria afghana*; thumb-shaped in *S. centralis*; without any harpe in *S. sociaria*). Aedeagus thick, bearing a small amount of cornuti, from 4 to 8 (5–6 cornuti in *S. phasidaria afghana*; 8 cornuti in *S. centralis*; vesica with two groups of cornuti, with a total amount of up to 25 spines in *S. sociaria*) (figs 27–28, 34–36). **Female genitalia** (figs 38–40). Apophyses anteriores about half the length of apophyses posteriores (similar in *S. sociaria*). Ductus bursae sclerotized, short and wide, with longitudinal foldings (wide and sclerotized, hardly any longitudinal foldings in *S. sociaria*). Corpus bursae, posteriorly sclerotized, anteriorly membranous (membranous in *S. sociaria*). Signum irregularly star-shaped (similar in *S. sociaria*, see fig. 37b).

Phenology. Investigated specimens collected from May to September, suggesting that this species has more than one generation per year.

Biology. Larva feeding on Apiaceae and Fabaceae (e.g. *Trifolium* sp.) (Wehrli 1954).

Habitat. In altitudes from 1100 up to 3750 m.

Distribution. Anatolian-Iranian, from eastern Turkey and southern Armenia, to western, northern and south-eastern Iran. In Afghanistan rarely recorded, occurrence so far restricted to the type locality of the subspecies *S. phasidaria afghana* (see fig. 42).

Genetic data. BIN: BOLD:AAC8929 (n=25). Nearest species: *S. sociaria* at a distance of only 3.5 %, which underpins the close phylogenetic relationship and thus the synonymy of *Synopsidia* with *Synopsia*.

Genetic distance of *Synopsia* (sensu lato) from species of Palearctic related genera is much larger, i.e. *Hypoxystis* (represented by *pluviaria*) (7.1 %), *Chariaspilates* (represented by *formosaria*) (8.8 %), *Angerona* (represented by *prunaria*) (8.9 %), *Siona* (represented by *lineata*) (8.9 %) (fig. 41).

***Synopsia phasidaria afghana* (Wiltshire, 1966) comb. nov.**

(figs 23, 24, 34, 42)

Synopsidia phasidaria afghana Wiltshire, 1966. Zeitschrift der Wiener Entomologischen Gesellschaft, 51, 145. Holotype ♂ (NHMV). This subspecies is regarded valid at subspecific rank. Due to the lack of material from this region, a further examination in the present study is not possible, and we recommend a more detailed study with a larger series of specimens.

Type material examined. *Synopsidia phasidaria afghana*: Holotype, ♂, 17.vi.1965, 40km SW von Kabul, 2300 m, Afghanistan, Kasy & Vartian; Paratype, 1 ♂, same locality, Kasy & Vartian, g.prep. WW. 216; all in NHMV (fig. 23).

Diagnosis. *Wings and body* (figs 23, 24). Wingspan ♂ 27–35 mm, ♀ 36–41 mm (Wiltshire 1966). Ground colour of wings sandy yellow with some brown and orange spots (bright beige to brown and rarely similar forms in *S. phasidaria phasidaria* and *S. centralis*; beige to brown, spotted dark in *S. sociaria*). Transverse lines brown (faint or slightly visible in *S. phasidaria phasidaria*; brown in *S. centralis*; strongly black in *S. sociaria*) (figs 5–22, 25, 26).

Male genitalia (fig. 34). Uncus sclerotized, tip concave (sclerotized, slightly bifurcate or tip only concave in the centre in *S. phasidaria phasidaria* and *S. centralis*; sclerotized and strongly bifurcate in *S. sociaria*). Gnathos well developed, arms fused, forming a tongue-shaped upturned thin plate (similar but upturned plate variable in shape in *S. phasidaria phasidaria* and *S. centralis*; almost similar but upturned plate broad in *S. sociaria*). Costa of valva with central projection bearing one to three spines (similar in *S. phasidaria phasidaria*; without central projection in *S. centralis*; central projection bearing one or two spines in *S. sociaria*). Harpe sickle-shaped (similar in *S. phasidaria phasidaria*; thumb-shaped in *S. centralis*; without any harpe in *S. sociaria*). Aedeagus thick, bearing 5–6 cornuti (number of cornuti variable, from 4 to 8 in *S. phasidaria phasidaria*; 8 cornuti in *S. centralis*; vesica with two groups of cornuti, with a total amount of up to 25 spines in *S. sociaria*) (fig. 27–33, 35, 36).

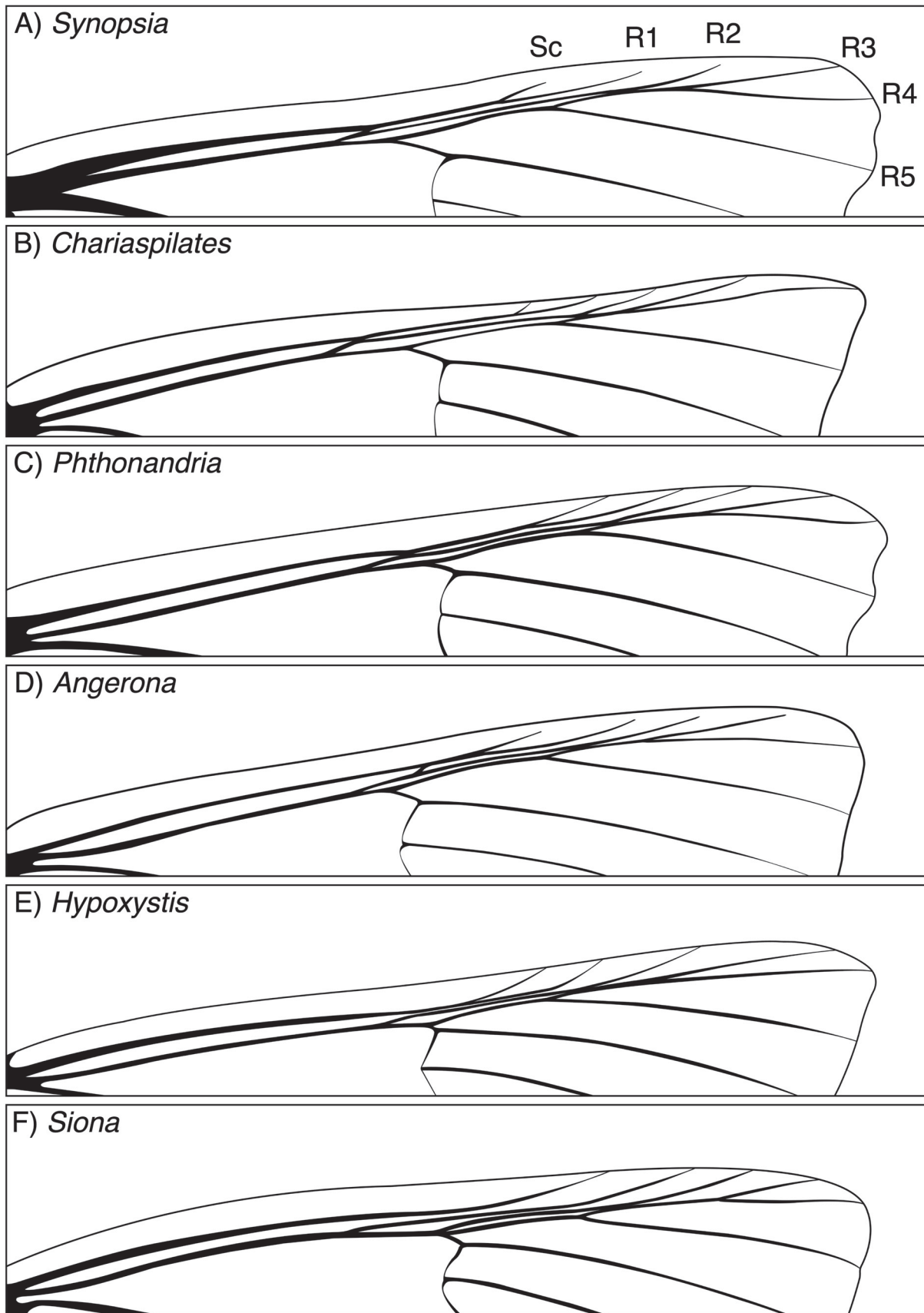
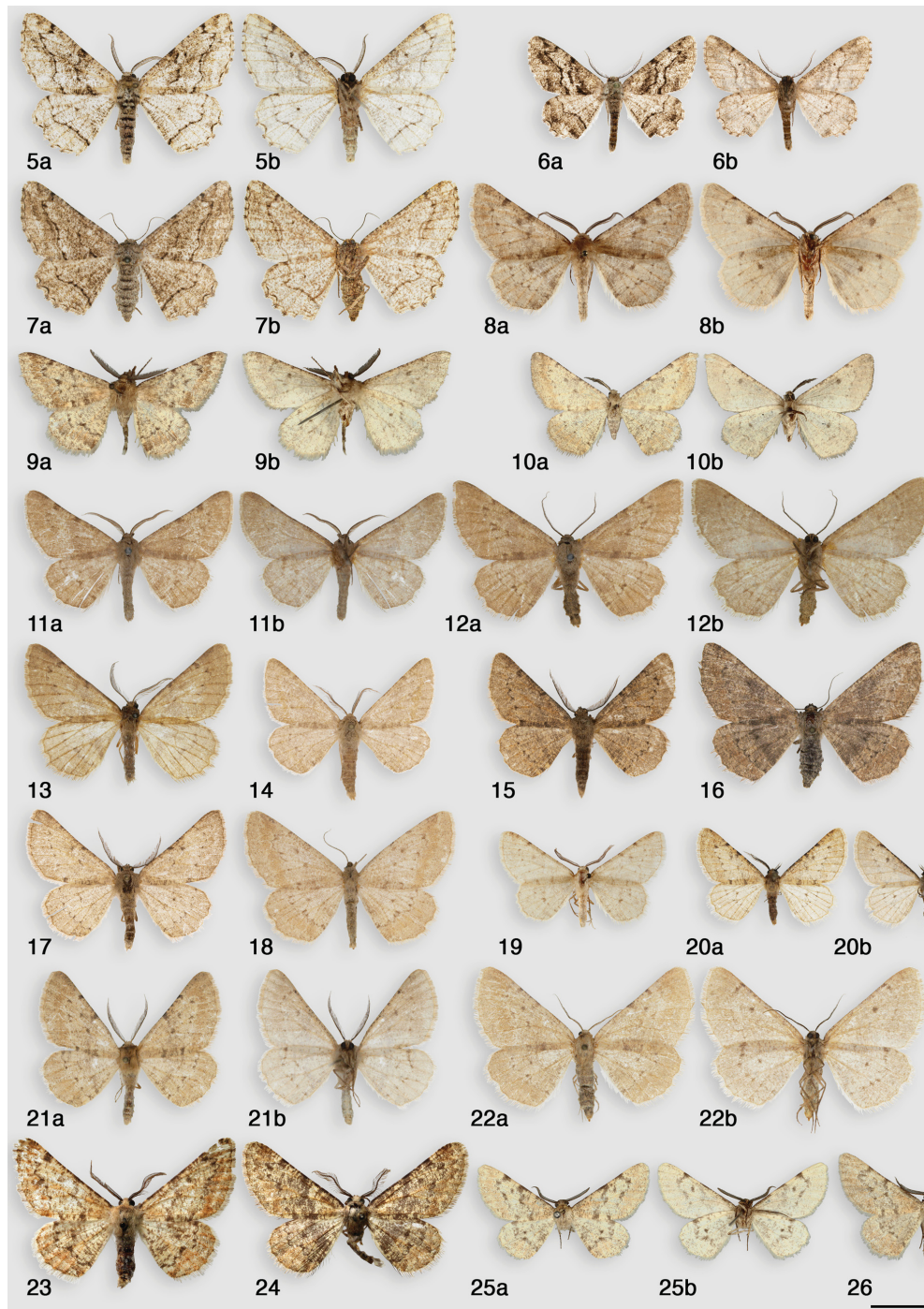
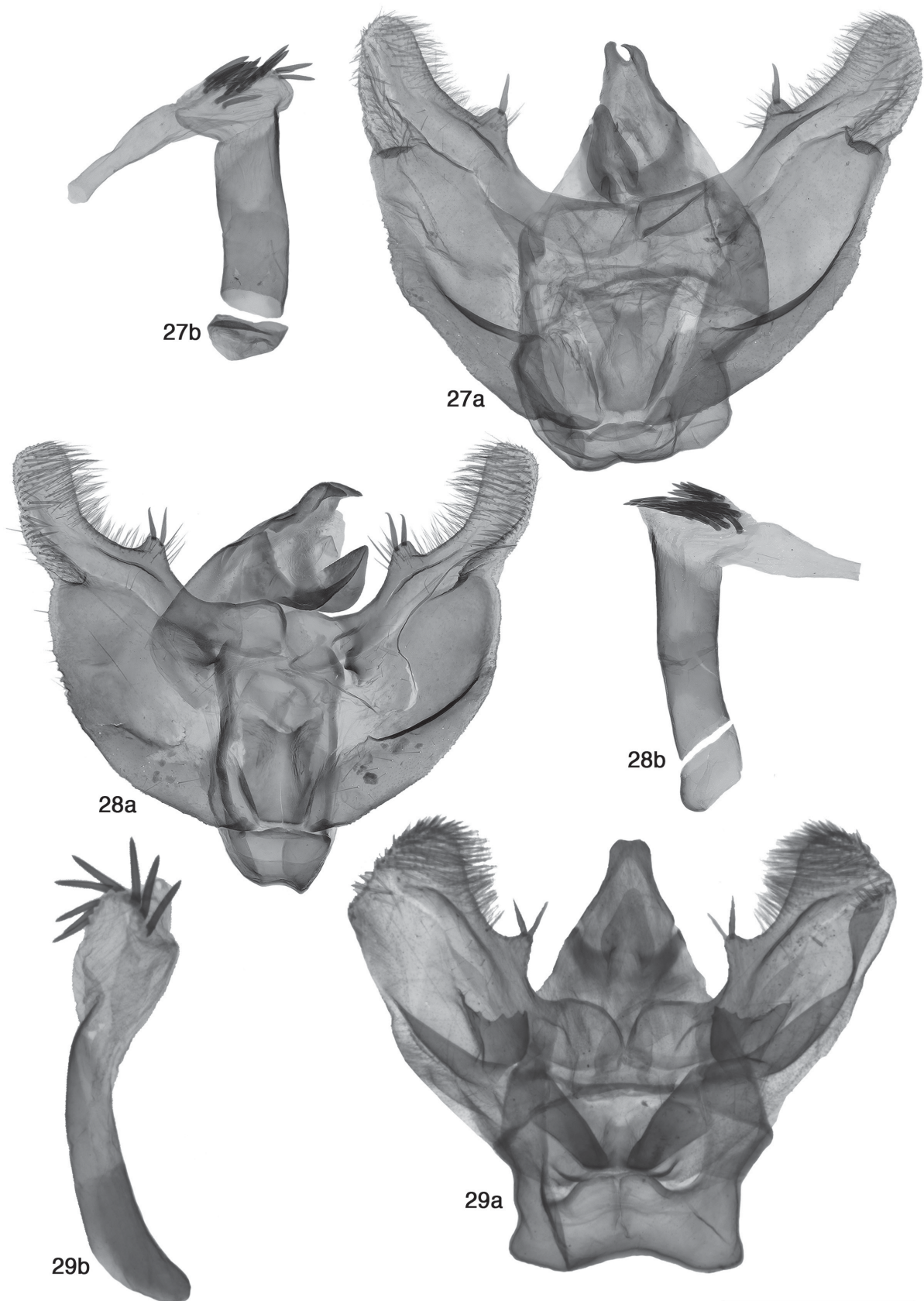


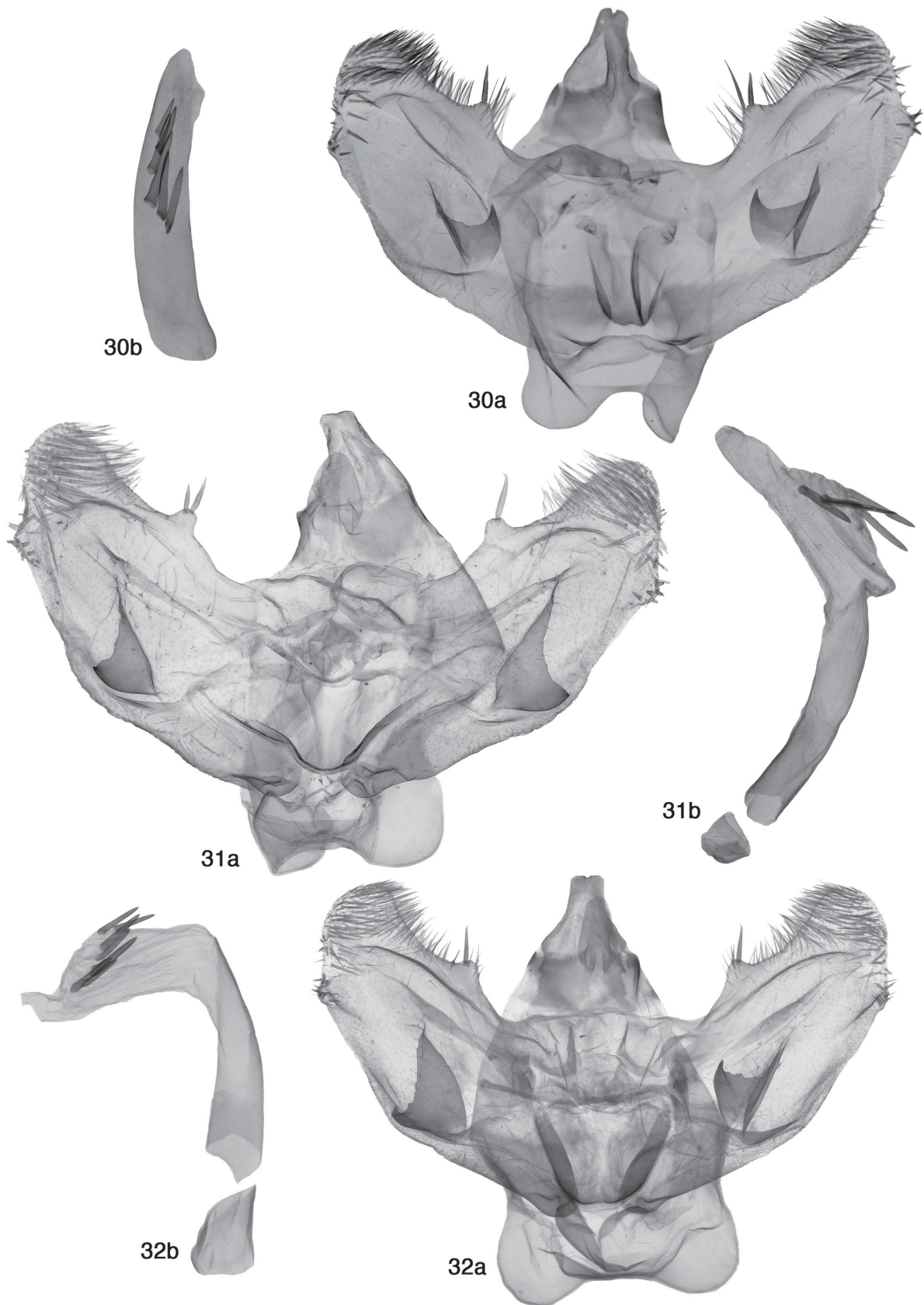
FIGURE 4. Comparison of the forewing venation of *Synopsis* and related genera. (Species taken for drawing: A: *Synopsis sociaria*; B: *Chariaspilates formosaria*; C: *Phthonandria atrilineata indica*; D: *Angerona prunaria*; E: *Hypoxystis pluviaria*; F: *Siona lineata*).



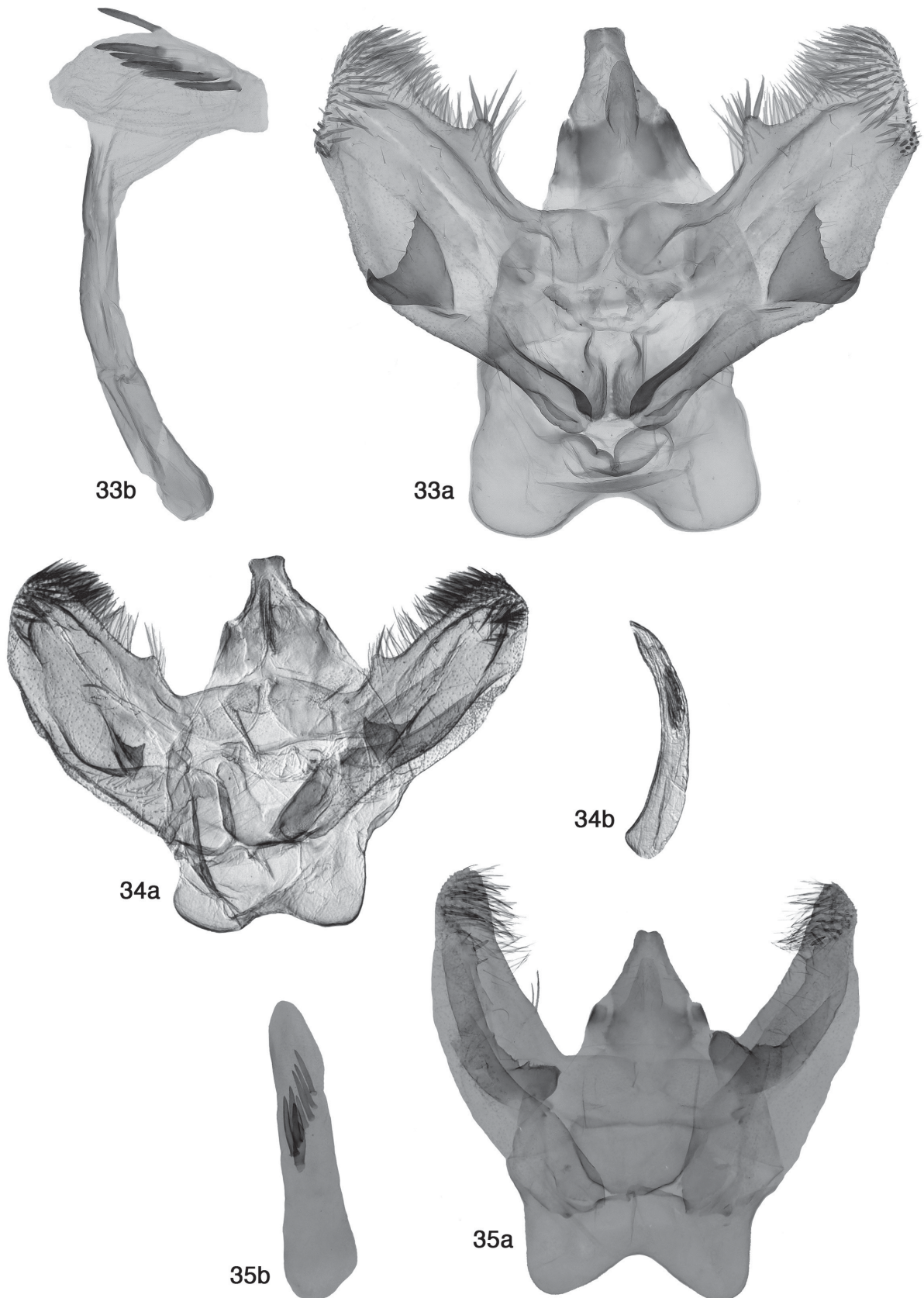
FIGURES 5–26. Wing pattern of *Synopsisia* species. 5–7: *S. sociaria* (5: France, Le Meés; 6: Armenia, Syunik, g.prep. 0230/2019 D. Wanke; 7: Italy, Naturns, g.prep. 0497/2019 D. Wanke); 8–22: Nominotypical subspecies; 8: Paratype of *Synopsisia phasidaria ardschira* **syn. nov.** of *Synopsisia phasidaria phasidaria* (Iran, Fars, g.prep. 11026); 9: Holotype of *Synopsisia phasidaria alvandi* **syn. nov.** of *Synopsisia phasidaria phasidaria* (Iran, Alvand, g.prep. EP Wiltshire 1470, NHMUK 010920110); 10: Holotype of *Synopsisia phasidaria jodes* **syn. nov.** of *Synopsisia phasidaria phasidaria* (Iran, Demawend, g.prep. 7100, NHMUK 014172449); 11: Holotype of *Synopsisia phasidaria mirabica* **syn. nov.** of *Synopsisia phasidaria phasidaria* (Iran, Kuh i Mirabi, g.prep. 0501/2020 D. Wanke); 12: Paratype of *Synopsisia phasidaria mirabica* **syn. nov.** of *Synopsisia phasidaria phasidaria* (Iran, Kuh i Mirabi, g.prep. 0502/2020 D. Wanke); 13–22: *Synopsisia phasidaria phasidaria* **comb. nov.** (13: Turkey, Hakkari, g.prep. 0466/2019 D. Wanke; 14: Armenia, Yeranós, g.prep. 0381/2019 D. Wanke; 15: Iran, Zanjan, g.prep. 0106/2018 D. Wanke; 16: Iran, Zanjan, g.prep. 0477/2019 D. Wanke; 17: Iran, Zanjan, g.prep. 0105/2018 D. Wanke; 18: Iran, Tehran, g.prep. 0472/2019 D. Wanke; 19: Iran, Fars, Sine Sefid, g.prep. 11027 [no type specimen of *Synopsidia phasidaria chiraza* was traced in the collection of Brandt, except this specimen labeled as *Synopsidia phasidaria chiraza* by Brandt]; 20: Iran, Yasuj, g.prep. 0485/2019 D. Wanke; 21: Iran, Golestan, g.prep. 0483/2019 D. Wanke; 22: Iran, Lorestan, g.prep. 0478/2019 D. Wanke); 23: Holotype of *Synopsisia phasidaria afghana* **comb. nov.** (Afghanistan, Kabul); 24: Paratype of *Synopsisia phasidaria afghana* **comb. nov.** (Afghanistan, Kabul, g.prep. WW216); 25: Holotype of *Synopsisia centralis bona* **sp.** (Iran, Fars, g.prep. EP Wiltshire 1467, NHMUK 010920114); 26: *Synopsisia centralis bona* **sp.** (Iran, Fars, NHMUK 014172450); a = upperside; b = underside. Scale-bar 1cm.



FIGURES 27–29. Male genitalia of *Synopsis* species. 27: *Synopsis sociaria* (Kazakhstan, NE Rudnichnyy, g.prep. 0103/2018 D. Wanke); 28: *Synopsis sociaria* (Armenia, Syunik, g.prep. 0230/2019 D. Wanke); 29: Paratype of *Synopsis phasidaria ardschira* **syn. nov.** of *Synopsis phasidaria phasidaria* (Iran, Fars, g.prep. 11026); a = genitalia capsule; b = aedeagus. Scale-bar 1 mm.



FIGURES 30–32. Male genitalia of *Synopsis* species. 30: Holotype of *Synopsis phasidaria alvandi* **syn. nov.** of *Synopsis phasidaria phasidaria* (Iran, Alvand, g.prep. EP Wiltshire 1470, NHMUK 010920110); 31: Holotype of *Synopsis phasidaria mirabica* **syn. nov.** of *Synopsis phasidaria phasidaria* (Iran, Kuh i Mirabi, g.prep. 0501/2020 D. Wanke); 32: *Synopsis phasidaria phasidaria* **comb. nov.** (Iran, Zanjan, g.prep. 0106/2018 D. Wanke); a = genitalia capsule; b = aedeagus. Scale-bar 1 mm.



FIGURES 33–35. Male genitalia of *Synopsia* species. 33: *Synopsia phasidaria phasidaria* **comb. nov.** (Turkey, Hakkari, g.prep. 0466/2019 D. Wanke); 34: Paratype of *Synopsia phasidaria afghana* **comb. nov.** (Afghanistan, Kabul, g.prep. WW216); 35: Holotype of *Synopsia centralis bona* **sp.** (Iran, Fars, g.prep. EP Wiltshire 1467); a = genitalia capsule; b = aedeagus. Scale-bar 1mm

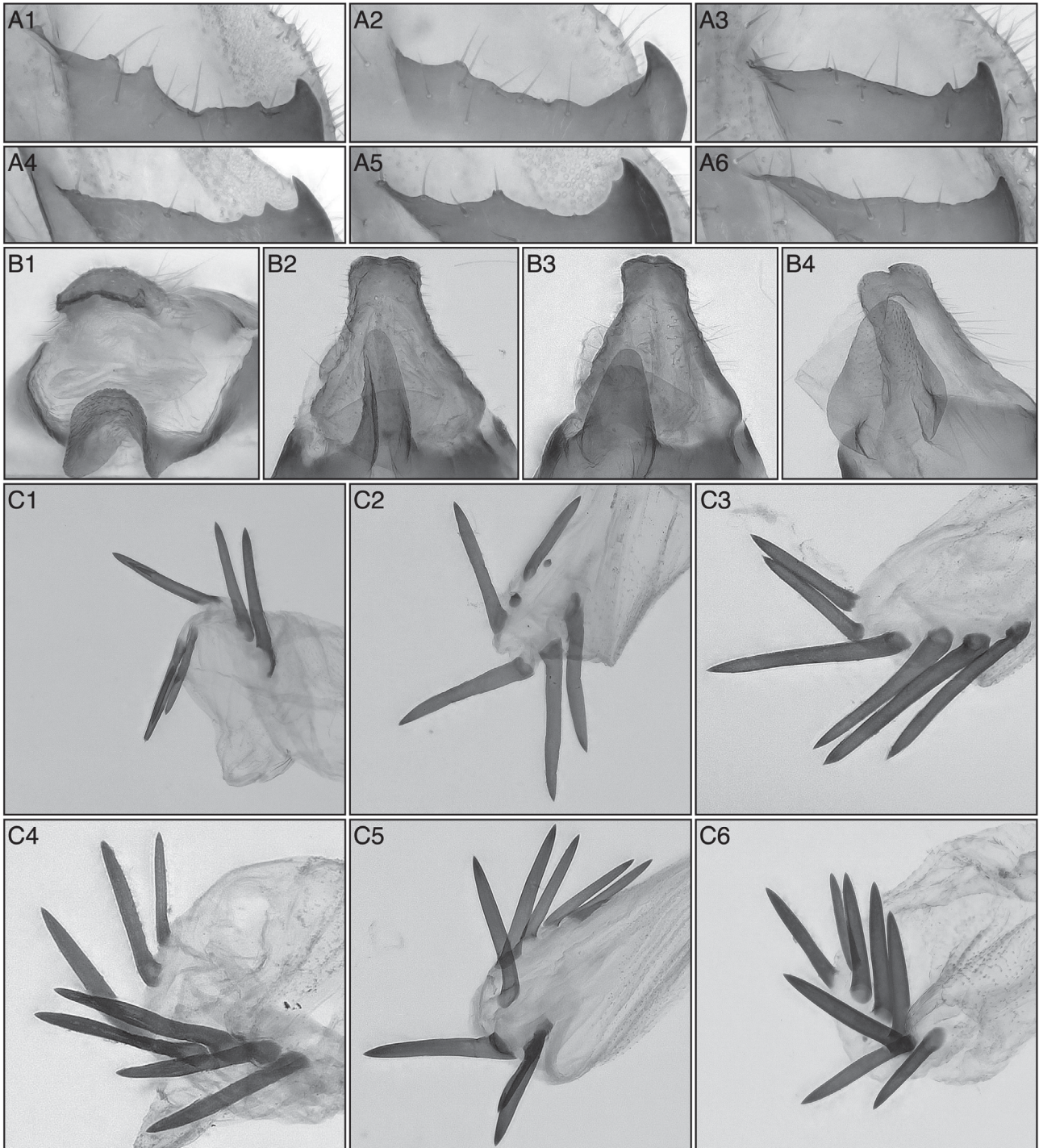


FIGURE 36. Details of the male genitalia capsule and the aedeagus of *Synopsis phasidaria phasidaria* **comb. nov.**, showing the intraspecific variation. A: distal margin of the harpe; B1: gnathos from posterior view; B2-3: gnathos from ventral view, C1-6: cornuti on the vesica.

Female genitalia. Unknown.

Phenology. Type specimens collected in June.

Biology. Unknown.

Habitat. Up to now recorded only at an altitude of 2300 m.

Distribution. So far only known from the type locality in Afghanistan (see fig. 42).

Genetic data. No data available.

***Synopsia centralis* (Wiltshire, 1966) comb nov., bona sp.**

(figs 25, 26, 35, 42)

Synopsidia phasidaria centralis Wiltshire, 1966. Zeitschrift der Wiener Entomologischen Gesellschaft, 51, 146. Holotype ♂ (NHMUK). Hereby combined with genus *Synopsia* and regarded as **bona species** based on morphological examination.

Type material examined. Holotype, ♂, Persia [Iran], N. Fars, Bavant, Kuh Taj Kirmani, 8500 feet [2591 m], 7.viii.[19]50, leg. E.P. Wiltshire, g.prep. E.P. Wiltshire 1467; in NHMUK (fig. 25). Paratype, 1 ♂, same data as Holotype; in NHMUK.

Diagnosis. *Wings and body.* Wingspan ♂ 32 mm (forewing length ♂ 15.5 mm). Ground colour of wings bright beige with some brown spots (similar forms in *S. phasidaria*; beige to brown, spotted dark in *S. sociaria*). Transverse lines present, brown (faint or slightly visible in *S. phasidaria*; strongly black in *S. sociaria*) (figs. 5–24).

Male genitalia (fig. 35). Uncus sclerotized, tip concave (sclerotized, slightly bifurcate or tip only concave in the centre in *S. phasidaria*; sclerotized and strongly bifurcate in *S. sociaria*). Gnathos well developed, arms fused, forming a tongue-shaped upturned plate, variable in shape (similar in *S. phasidaria*; almost similar in *S. sociaria*). Costa of valva without any central projection (central projection present, usually bearing one to three spines in *S. phasidaria*; central projection bearing one to two spines in *S. sociaria*). Harpe thumb-shaped (harpe sickle-shaped *S. phasidaria*; harpe absent in *S. sociaria*). Aedeagus thick, bearing 8 cornuti (number of cornuti variable, from 4 to 8 in *S. phasidaria*; vesica with two groups of cornuti, with a total amount of up to 25 spines in *S. sociaria*) (figs. 27–34, 36).

Female genitalia. Unknown.

Phenology. Specimens (n=2) collected in August.

Biology. Most likely similar to that of *Synopsia phasidaria*.

Habitat. In altitudes up to 2600 m.

Distribution. So far only known from its type locality in southern Iran (see fig. 42).

Genetic data. No data available.

Taxonomic remarks. *S. centralis* shares similar external and internal character combinations with its sister species, *S. phasidaria*, like wing pattern, shape of the uncus, gnathos and the harpe. Nevertheless, on the costa of valva this species lacks the central projection, which is unique and does not occur in *S. phasidaria phasidaria*. We therefore suggest to treat this taxon as separate species and upgrade it therefore from subspecies to species level. This taxonomic decision needs further examination based on a larger series of specimens to be confirmed.

Complete checklist of the taxa of *Synopsia* with taxonomic changes in this paper

(Distribution data for European species taken from Müller *et al.* 2019):

Synopsia sociaria (from Europe to southern Ural Mountains, in Middle East and Central Asia)

Synopsia phasidaria phasidaria **comb. nov.** (eastern Turkey, southern Armenia, Azerbaijan, northern, western and southern Iran, southern Turkmenistan)

phasidaria tekkearia **syn. rev.**

phasidaria znojkoii **syn. rev.**

phasidaria alvandi **syn. nov.**

phasidaria ardschira **syn. nov.**

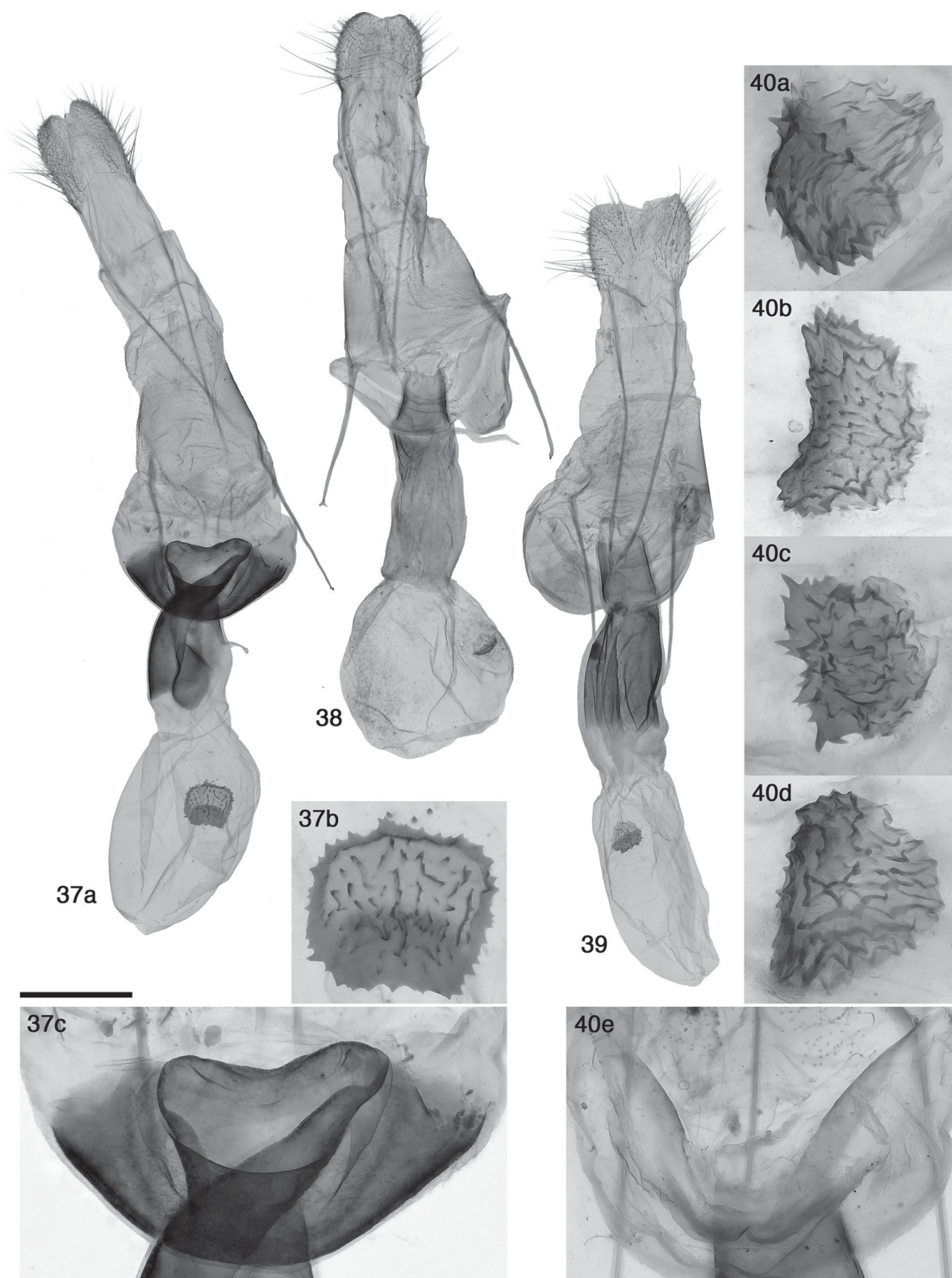
phasidaria chiraza **syn. nov.**

phasidaria jodes **syn. nov.**

phasidaria mirabica **syn. nov.**

Synopsia phasidaria afghana **comb. nov.** (Afghanistan: Kabul)

Synopsia centralis **comb. nov., bona sp.** (Iran: Fars)



FIGURES 37–40. Female genitalia and details characters of *Synopsis* species. 37: *Synopsis sociaria* (Italy, Naturns, g.prep. 0497/2019 D. Wanke; a: genitalia; b: signum; c: lamella antevaginalis); 38: Paratype of *Synopsis phasidaria mirabica* **syn. nov.** of *Synopsis phasidaria phasidaria* (Iran, Kuh i Mirabi, g.prep. 0502/2020 D. Wanke); 39: *Synopsis phasidaria phasidaria* **comb. nov.** (Iran, Azerbaijan-e-Gharbi, g.prep. 0299/2019 D. Wanke); 40a-d: signum of *Synopsis phasidaria phasidaria* **comb. nov.** showing the intraspecific variation (a: Turkey, Hakkari, g.prep. 0468/2019 D. Wanke; b: Iran, Lorestan, g.prep. 0478/2019 D. Wanke; c: Iran, Zanzan, g.prep. 0477/2019 D. Wanke; d: Iran, Yasuj, g.prep. 0486/2019 D. Wanke); 40e: lamella antevaginalis of *Synopsis phasidaria phasidaria* **comb. nov.** (Iran, Kendevan, g.prep. 0474/2019 D. Wanke). 37b-c and 40 out of scale. Scale-bar 1mm

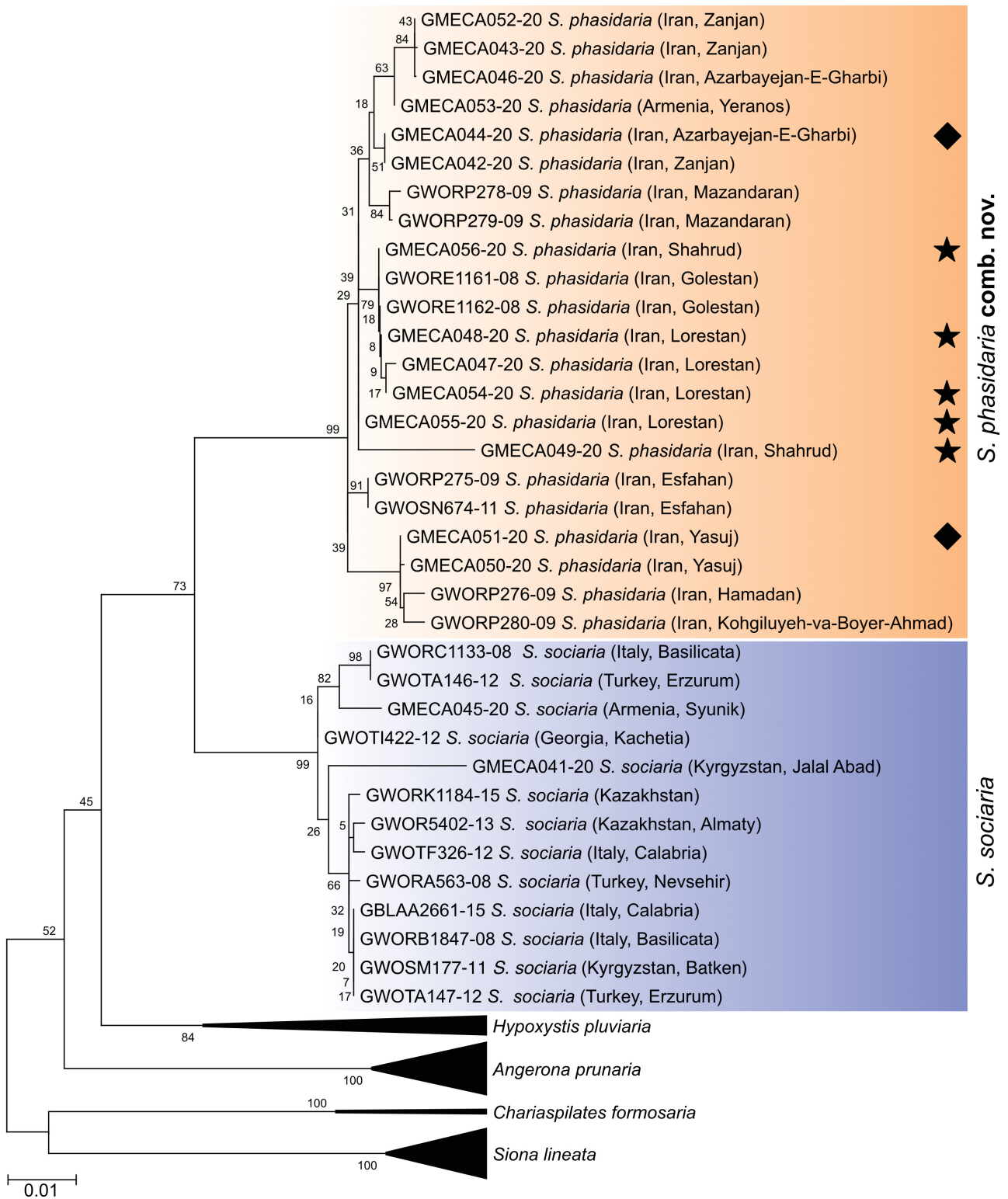


FIGURE 41. Maximum likelihood analysis of the two *Synopsia* species and 4 closely related genera (*Chariaspilates*, *Angerona*, *Hypoxystis*, *Siona*) based on COI 5' sequences (built with MEGA X; Kimura 2-parameter model; bootstrap method, 1000 replications). Symbols in *S. phasidaria*: Stars indicating on females with strongly bipectinate antennae; diamonds indicating on females with shortly bipectinate antennae.

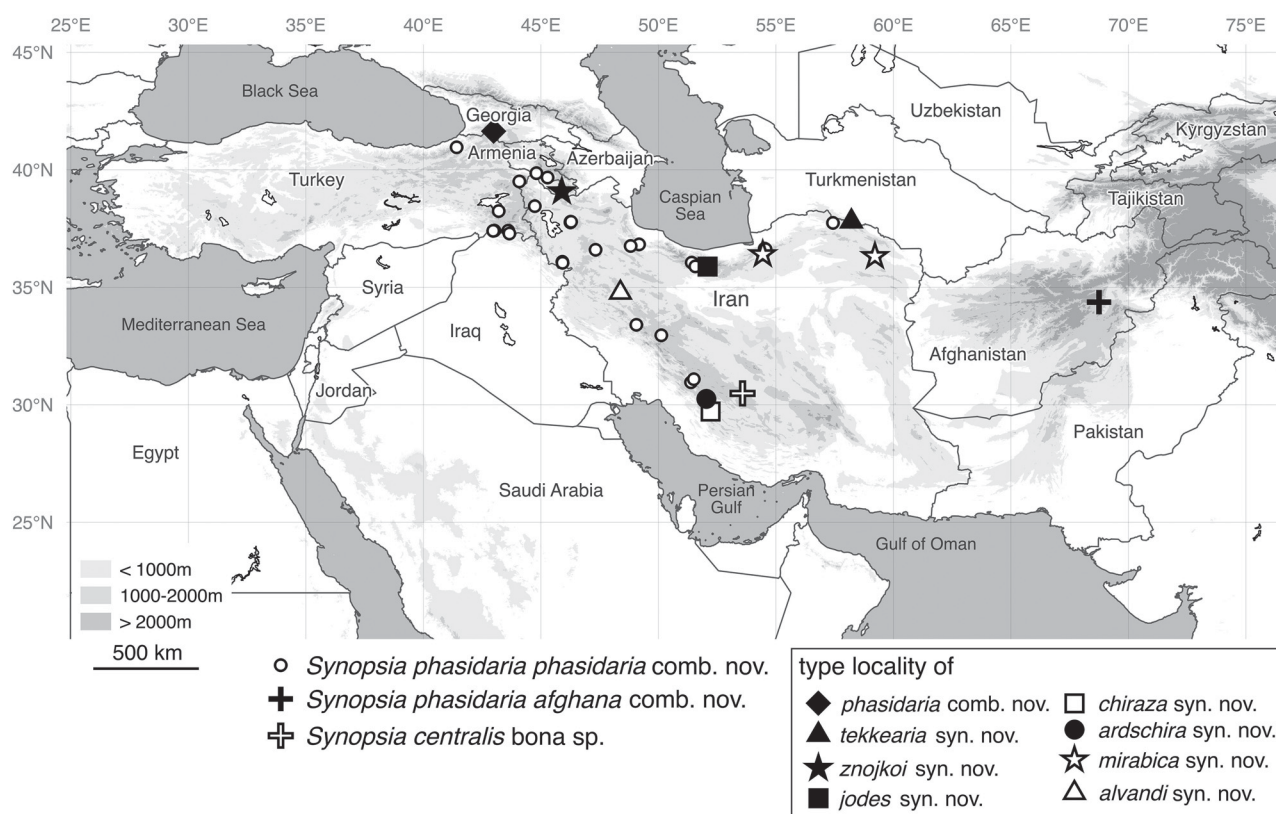


FIGURE 42. Map of *Synopsisia phasidaria phasidaria* **comb. nov.**, *Synopsisia phasidaria afghana* **comb. nov.** and *Synopsisia centralis bona sp.* showing the distribution of these taxa. Different symbols illustrated in the rectangle indicating on the type localities of the subspecies of *Synopsisia phasidaria phasidaria* **comb. nov.**

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APPENDIX TABLE. Sequenced specimens of *Angerona prunaria*, *Chariaspilates formosaria*, *Hypoxystis pluviaria*, *Siona lineata*, *Synopsis sociaria*, *Synopsis phasidaria* **comb. nov.** with identification, sampling site and process ID in the Barcode of Life Data Systems (BOLD). Tissue provided or data generated by: Axel Hausmann⁽¹⁾; Antoine Leveque⁽²⁾; Andreas Segerer⁽³⁾; Xue Dayong⁽⁴⁾; Claude Herbulot⁽⁵⁾; Marco Infusino⁽⁶⁾; Iva Mihoci⁽⁷⁾; Jörg Gelbrecht⁽⁸⁾; Norbert Poell⁽⁹⁾; Bernd Müller⁽¹⁰⁾; Wanke *et al.* (current paper)⁽¹¹⁾.

Taxon Identification	Sampling Site	Process ID
<i>Angerona prunaria</i> ⁽¹⁾	China, Hebei, Chongli, Baiqi, 23.vi.2006, C. Wang	GWOR877-08
<i>Angerona prunaria</i> ⁽¹⁾	China, Hebei, Chongli, Baiqi, 22.vi.2006, C. Wang	GWOR941-08
<i>Angerona prunaria</i> ⁽¹⁾	China, Hebei, Chongli, Shizigou, 16.vii.2007, C. Wang	GWORB2683-08
<i>Angerona prunaria</i> ⁽¹⁾	China, Hebei, Chongli, Shizigou, 16.vi.2007, C. Wang	GWORB2705-08
<i>Angerona prunaria</i> ⁽²⁾	France, Hauts-de-France, Picardy, Oise, Marolles (Marais de Bourneville), 17.vi.2005, Jerome Barbut & Jeremy Lebrun	GWOAL011-08
<i>Angerona prunaria</i> ⁽²⁾	France, Hauts-de-France, Picardy, Oise, Verberie (Le Murger), 06.vii.2003, Jerome Barbut	GWOAL012-08
<i>Angerona prunaria</i> ⁽²⁾	France, Centre-Val de Loire, Centre, Loiret, Vitry-aux-Loges (Foret d’Orleans, Carrefour du Sanglier), 10.vi.2006, Antoine Leveque	GWOAL013-08
<i>Angerona prunaria</i> ⁽²⁾	France, Centre-Val de Loire, Centre, Loiret, Vitry-aux-Loges (Foret d’Orleans, Carrefour de Nestin), 27.v.2005, Antoine Leveque	GWOAL015-08
<i>Angerona prunaria</i> ⁽³⁾	Germany, Bavaria, south, Berchtesgadener Land, Melleck—Steinbachtal, 13.vi.1998, A. Segerer	GWORB2980-08
<i>Angerona prunaria</i> ⁽¹⁾	Germany, Bavaria, Upper Bavaria, Schlagenhofen a. Woerthsee, 31.iii.2007, Karl Ambil	GWOR4048-09
<i>Angerona prunaria</i> ⁽³⁾	Germany, Bavaria, Niederbayern, Landshut, Niederaichbach, 24.v.2009, Dr. Theo Gruenewald	FBLMT431-09
<i>Angerona prunaria</i> ⁽¹⁾	Russia, Altayskiy Kray, Altai Shebalino, 30.vi.1993, Dirgela	GWOSK704-11
<i>Angerona prunaria</i> ⁽¹⁾	Russia, Altayskiy Kray, Altai, Ulagan district, Chibit, 09.viii.2009, R. Yakovlev	GWOSU251-11
<i>Angerona prunaria</i> ⁽¹⁾	Germany, Brandenburg, Dahme-Spreewald, Mittenwalde, Toepchin, 28.vi.2012, Franz Theimer	GBLAB088-13
<i>Angerona prunaria</i> ⁽¹⁾	Germany, Saarland, Rubenheim, NSG Hanickel, 25.v.2012, A. Werno	GBLAB803-13
<i>Angerona prunaria</i> ⁽⁴⁾	China, Beijing Shi, Donglingshan, Xiaolongmen, 28.vi.2011, Y. Zou	GWOTL900-13
<i>Angerona prunaria</i> ⁽¹⁾	Germany, Thuringia, Bad Blankenburg, Schwarzatal, Schieferbrueche, 07.vii.2013, S. Erlacher	GBLAC260-13
<i>Angerona prunaria</i> ⁽¹⁾	Germany, Bavaria, Oberbayern, Haag, Schachenwald, 22.vii.2013, O. Hawlitschek	GBLAC640-13

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APPENDIX TABLE . (Continued)

Taxon Identification	Sampling Site	Process ID
<i>Angerona prunaria</i> ⁽¹⁾	Germany, Saxony, Koenigsbrueck, Altes Dorf, 16.vii.2013, S. Erlacher	GBLAD112-14
<i>Angerona prunaria</i> ⁽¹⁾	Germany, Brandenburg, Oberhavel, Kreuzbruch, Umgebung Roemerwegbruecke, 19.vi.2012, Rainer & Uljana Busse	GBLAF206-14
<i>Angerona prunaria</i> ⁽¹⁾	Germany, Rhineland-Palatinate, Fellerbachtal, 30.v.2011, V. Gayk	GBLAA857-14
<i>Angerona prunaria</i> ⁽¹⁾	Germany, Rhineland-Palatinate, Fellerbachtal, 31.v.2011, V. Gayk	GBLAA858-14
<i>Chariaspilates formosaria</i> ⁽¹⁾	Liechtenstein, Schaan, Aescher/Schwabbruennen, 14.vi.2000, U. Aistleitner	GWORL451-09
<i>Chariaspilates formosaria</i> ⁽⁵⁾	Russia, Primorskiy Kray, Vladivostok dist.20, Nachodka, 31.vii.1994, Kuzneoooy	GWOST761-11
<i>Hypoxystis pluviana</i> ⁽¹⁾	Germany, Bavaria, Oberbayern, Isar-Muendungsdelta am Sylvensteinsee, 19.v.2004, Schacht	GWORL454-09
<i>Hypoxystis pluviana</i> ⁽¹⁾	Germany, Bavaria, Oberbayern, Isar-Muendungsdelta am Sylvensteinsee, 19.v.2004, Schacht	GWORL455-09
<i>Hypoxystis pluviana</i> ⁽¹⁾	Germany, Bavaria, Oberbayern, Berchtesgadener Land, Ramsau bei Berchtesgaden, Klausbachtal, 09.vi.2004, A. Haslberger	GWORE2199-09
<i>Hypoxystis pluviana</i> ⁽¹⁾	Germany, Bavaria, Oberbayern, Bad Toelz-Wolfratshausen, Vorderriss, 24.v.2010, M. Seizmair	GWOSK877-11
<i>Hypoxystis pluviana</i> ⁽¹⁾	Russia, Tyva Republic, Tuva, south, 12 km Khol-Oozku, 31.v.2010, R. Yakovlev	GWOSU274-11
<i>Hypoxystis pluviana</i> ⁽¹⁾	Russia, Kemerovskaya Oblast, 35 km SW Mariinsk, 07.vi.2009, R. Yakovlev	GWOSU279-11
<i>Hypoxystis pluviana</i> ⁽¹⁾	Romania, Transylvania, Voslabeni, 12.vii.2012, Z. Varga	GBLAC218-13
<i>Siona lineata</i> ⁽³⁾	Germany, Bavaria, centr, Regensburg, Regensburg—Matting-Bhf, 26.v.2000, A. Segerer	GWORB2990-08
<i>Siona lineata</i> ⁽¹⁾	Germany, Bavaria, Oberbayern, Muenchen—Allach, 30.vi.2003, K. Ambil	GWORL467-09
<i>Siona lineata</i> ⁽⁶⁾	Italy, Sicily, Bosco di Malabotta, 06.vi.2008, M. Infusino	GWORL909-09
<i>Siona lineata</i> ⁽⁶⁾	Italy, Sicily, Bosco di Malabotta, 06.vi.2008, M. Infusino	GWORL910-09
<i>Siona lineata</i> ⁽¹⁾	Germany, Bavaria, Oberbayern, Muenchen—Allach, 25.v.2002, K. Ambil	GWORE2015-09
<i>Siona lineata</i> ⁽¹⁾	Croatia, Primorje-Gorski Kotar, Rijeka, Rijeka, Bribir, 10.vi.2001, A. Haslberger	GWORM213-09
<i>Siona lineata</i> ⁽³⁾	Germany, Bavaria, Niederbayern, Kelheim, Kelheim, Lehnberg, 23.v.2009, Dr. Theo Gruenewald	FBLMT408-09
<i>Siona lineata</i> ⁽⁷⁾	Croatia, Medjimurska, Medjimurje, Jurovcak, 20.v.2005, F. Perovic	GWOSI056-10
<i>Siona lineata</i> ⁽¹⁾	Russia, Altayskiy Kray, Altai Shebalino, 30.vi.1993, Dirgela	GWOSK702-11
<i>Siona lineata</i> ⁽¹⁾	Kazakhstan, Tarbagatai District, Zhagalbaily Mts., 18.v.2006, R. Yakovlev	GWOSQ460-11
<i>Siona lineata</i> ⁽¹⁾	Germany, Brandenburg, Spree-Neisse, Neuhausen/Spree, Kathlow/ Umgebung, 26.v.2012, Franz Theimer	GBLAB210-13
<i>Siona lineata</i> ⁽¹⁾	Germany, Saarland, Huettersdorf, 22.v.2011, N. Zahm	GBLAC090-13
<i>Siona lineata</i> ⁽¹⁾	Germany, Saarland, Huettersdorf, 24.v.2011, N. Zahm	GBLAC091-13
<i>Siona lineata</i> ⁽¹⁾	Germany, Thuringia, Koenigssee, Unterkoeditz, 08.vi.2013, B. Kirchner	GBLAD271-14

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APPENDIX TABLE . (Continued)

Taxon Identification	Sampling Site	Process ID
<i>Siona lineata</i> ⁽¹⁾	Germany, Brandenburg, Teltow-Flaeming, Ludwigsfelde, 07.vi.2013, F. Theimer	GBLAF717-14
<i>Siona lineata</i> ⁽¹⁾	Russia, Orenburgskaya Oblast, Kuvandyksky, South Ural Mountains, Kuvandyk town, 14.v.2012	GBLAD1070-14
<i>Siona lineata</i> ⁽¹⁾	Kyrgyzstan, Chuy, Kirghizsky Mts., Arashan settlement, 25.v.2014, S. Korb	GWOTO767-15
<i>Siona lineata</i> ⁽¹⁾	Germany, Brandenburg, Oberhavel, Roehmerwegbruecke, 08.vi.2014, R. Busse, U. Busse	GBLAA2317-15
<i>Siona lineata</i> ⁽¹⁾	Italy, Calabria, Cosenza, 6 km S Cosenza, Pianette di Dipignano, 01.vi.2015, G. Posa	GBLAA2676-15
<i>Siona lineata</i> ⁽¹⁾	Germany, Berlin, Marienfelde (Sued), NSG auf ehemaliger Deponie, 25.v.2014, J. Gelbrecht & E. Schwabe	GBLAA2780-15
<i>Siona lineata</i> ⁽¹⁾	Germany, Berlin, Marienfelde ehemaliger TUEP am suedlichen Stadtrand, 22.v.2014, J. Gelbrecht	GBLAA2781-15
<i>Synopsia sociaria</i> ⁽¹⁾	Italy, Basilicata, Valle Noce Trecchina, 29.viii.2001, A. Hausmann	GWORB1847-08
<i>Synopsia sociaria</i> ⁽¹⁾	Italy, Basilicata, Potenza, Valle Noce, Trecchina, 05.vi.1996, A. Hausmann	GWORC1133-08
<i>Synopsia sociaria</i> ⁽⁸⁾	Turkey, Nevsehir, Ic Anadolu, Kapodokya, Uchisar, 18.vi.1996, J. Gelbrecht, S. Beshkov & T. Drechsel	GWORA563-08
<i>Synopsia sociaria</i> ⁽⁹⁾	Kyrgyzstan, Prov. Batken, Distr. Batken, Turkestan-Range, Kara-Kol-Valley, 7 km W Kara-Bulak, 12.vi.2010, leg. N. Poell (A-Bad Ischl)	GWOSM177-11
<i>Synopsia sociaria</i> ⁽¹⁰⁾	Turkey, Erzurum, Mescit Daglari, Ispir, Tshoru valley, 12.vi.2003, B. Mueller	GWOTA146-12
<i>Synopsia sociaria</i> ⁽¹⁰⁾	Turkey, Erzurum, Mescit Daglari, Ispir, Tshoru valley, 13.vi.2003, B. Mueller	GWOTA147-12
<i>Synopsia sociaria</i> ⁽¹⁾	Italy, Calabria, M. Pollino, 3 km N Civita, 30.viii.2011, A. Hausmann	GWOTF326-12
<i>Synopsia sociaria</i> ⁽¹⁾	Georgia, Kachetia, David Gazeta, M. Franzen	GWOTI422-12
<i>Synopsia sociaria</i> ⁽¹⁾	Kazakhstan, Almaty, Tien Shan, Nurly, 27.iv.2010, G. Nazymbetova	GWOR5402-13
<i>Synopsia sociaria</i> ⁽¹⁾	Italy, Calabria, Cosenza, 6 km S Cosenza, Pianette di Dipignano, 01.v.2015, G. Posa	GBLAA2661-15
<i>Synopsia sociaria</i> ⁽¹⁾	Kazakhstan, Tarbagatai m.r.-S Urdzhar, 21.vii.1993, A. Berg	GWOR1184-15
<i>Synopsia sociaria</i> ⁽¹¹⁾	Kyrgyzstan, Jalal Abad, Chatkal Valley, Kanysh-Kija, 16.vi.2014, D. Bartsch	GMECA041-20
<i>Synopsia sociaria</i> ⁽¹¹⁾	Armenia, Sy Syunik prov, north of Shvanidzor, 17.vii.2013, D. Bartsch	GMECA045-20
<i>Synopsia phasidaria</i> comb. nov. ⁽⁹⁾	Iran, Golestan, Golestan National Park, Maghazy Valley, 25 km SW Gorgan, 13.vi.2007, N. Poell	GWORE1161-08
<i>Synopsia phasidaria</i> comb. nov. ⁽⁹⁾	Iran, Golestan, Golestan National Park, Maghazy Valley, 25 km SW Gorgan, 13.vi.2007, N. Poell	GWORE1162-08
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Esfahan, Kuhha-ye-Zagros, Fereidun Sahr, 27.vi.2005, Petronyi G.	GWORP275-09
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Hamadan, Kuhha-ye-Zagros, Nehavand, 26.vi.2005, Petronyi G.	GWORP276-09
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Mazandaran, Resteh-Ye-Elborz, Minokh, Baladeh Valley, 18.vi.2007, Hacz T.—Nadai L.	GWORP278-09

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APPENDIX TABLE . (Continued)

Taxon Identification	Sampling Site	Process ID
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Mazandaran, Resteh-Ye-Elborz, Minokh, Baladeh Valley, 18.vi.2007, Hacz T.—Nadai L.	GWORP279-09
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Boyer Ahmadi-e Kohkiluyeh, Kuhha-ye-Zagros, Kuh-e-Dinar, 15km N of Vazag, 12.vi.2007, Hacz T.—Nadai L.	GWORP280-09
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Esfahan, Zagros, Fergidun Shar, 17.vi.2010, B. Benedek, T. Hacz	GWOSN674-11
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Lorestan, Dorud, Astaneh door, 25.vii.2016, Sh. Feizpour	GMECA047-20
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Zanjan prov., E Zanjan, road to Gilvan, 6.vii.2013, H. Rajaei, J.-U. Meineke, B. Hafezi	GMECA042-20
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Azerbaijan-e Gharbi prov., Khoys to Ghotur road, Esteran vill., 1.vii.2013, J.-U. Meineke, H. Rajaei, B. Hafezi	GMECA044-20
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Republic Armenia, Yeranos Mts., Dvin village suburbs, Arat district, 11.vi.2009, Yuriy Shevnin	GMECA053-20
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Zanjan prov., E Zanjan, road to Gilvan, 6.vii.2013, H. Rajaei, J.-U. Meineke, B. Hafezi	GMECA052-20
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Zanjan prov., E Zanjan, road to Gilvan, 6.vii.2013, H. Rajaei, J.-U. Meineke, B. Hafezi	GMECA043-20
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	[Iran], Azarbaijan-e Gharbi, Takab, Takht-e soleiman, 1.vii.2013, M. Afsarian	GMECA046-20
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Kohkiluye va Boyerahmad, yasuj, Sisakht, Dena, 30.vii.2016, Sh. Feizpour	GMECA051-20
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Kohkiluye va Boyerahmad, yasuj, Sisakht, Dena, 30.vii.2016, Sh. Feizpour	GMECA050-20
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Lorestan, Dorud, Astaneh door, 25.vii.2016, Sh. Feizpour	GMECA048-20
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Lorestan, Dorud, Astaneh door, 25.vii.2016, Sh. Feizpour	GMECA054-20
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Shahrud, Shahkoush, Tash, Ayoub, Hosseini region, 11.vii.2016, Sh. Feizpour	GMECA049-20
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Shahrud, Shahkoush, Tash, Ayoub, Hosseini region, 11.vii.2016, Sh. Feizpour	GMECA056-20
<i>Synopsia phasidaria</i> comb. nov. ⁽¹⁾	Iran, Lorestan, Dorud, Astaneh door, 25.vii.2016, Sh. Feizpour	GMECA055-20