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RESEARCH ARTICLE

Taxonomy and systematics of the enigmatic emerald moth *Xenochlorodes graminaria* (Kollar, 1850) (Lepidoptera: Geometridae), and its assignment to a new genus

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Abstract

A new genus, *Sabzia* Wanke & Rajaei, **gen. n.**, is described based on the Iranian species *Phorodesma graminaria* Kollar, 1850, which in recent taxonomy was combined with the genus *Xenochlorodes* Warren, 1897. Moreover, *Xenochlorodes albicostaria* Brandt, 1938, **syn. n.** is synonymized with *Sabzia graminaria* (Kollar, 1850), **comb. n.** The new genus is established based on external and internal characters of the adult specimens. Morphological traits including wing pattern, wing venation and male and female genitalia are described and illustrated.

Keywords: Iran, Middle East, new combination, new synonymy.

Zusammenfassung

Eine neue Gattung, *Sabzia* Wanke & Rajaei, **gen. n.**, wird anhand der iranischen Art *Phorodesma graminaria* Kollar, 1850 beschrieben. In vergangenen taxonomischen Untersuchungen wurde letztere in die Gattung *Xenochlorodes* Warren, 1897 gestellt. Außerdem wird *Xenochlorodes albicostaria* Brandt, 1938, **syn. n.** mit *Sabzia graminaria* (Kollar, 1850), **comb. n.** synonymisiert. Die neue Gattung wird, basierend auf äußeren und inneren Merkmalen adulter Exemplare, beschrieben. Morphologische Merkmale wie Flügelmuster, Flügeläderung, männliche und weibliche Genitalien werden beschrieben und illustriert.

Introduction

According to recent taxonomy, the genus *Xenochlorodes* Warren, 1897 consisted of nine species including *X. graminaria* (Kollar, 1850) and *X. albicostaria* Brandt, 1938, both described from, and endemic to, southern Iran (Scoble 1999; Scoble & Hausmann 2007). Viidalepp (1988) described the genus *Hissarica*, which was subsequently regarded as a subgenus of *Xenochlorodes* by Hausmann (1996). New results have demonstrated that *Hissarica* shows differences in wing shape, wing venation and genitalia characters, and it was therefore reinstated as a valid genus (Viidalepp & Kostjuk 2021).

In the framework of a revision of the subfamily Geometrinae in Iran (Feizpour et al., unpublished), we were faced with the unclear case of *X. graminaria* and *X. albicostaria*. Examination of specimens and of the relevant literature showed that *X. graminaria* and *X. albicostaria* most likely represent the same species. Moreover, this species differs greatly from other *Xenochlorodes* species in morphological characters (wing pattern and venation, male and female genitalia structures), as already suggested by Hausmann (1996), who questioned the generic assignment of *X. albicostaria*. In this study, we propose the synonymy of *X. albicostaria* with *X. graminaria* and assign *graminaria* to a new genus.

Material and methods

Type material and additional specimens examined in this study are deposited in the following collections: NHRS—Naturhistoriska Riksmuseet, Stockholm, Sweden; PCJM—Private collection of Jörg-Uwe Meineke, Kippenheim, Germany; SMNK—Staatliches Museum für Naturkunde Karlsruhe, Karlsruhe, Germany; SMNS—Staatliches Museum für Naturkunde Stuttgart, Stuttgart, Germany; ZSM—Zoologische Staatssammlung München, Munich, Germany (SNSB).

Morphological examination

Type material and the original descriptions served for the identification and comparison of specimens. Documentation of external characters was carried out using a Visionary Digital photography system (LK Imaging System, Dun. Inc.) equipped with a Canon EOS 5DSR camera, as well as an Olympus E3 digital camera. Genitalia preparations were carried out following standard techniques (e.g., Robinson 1976) and vesicae were everted following the method described by Sihvonen (2001). Before embedding, genitalia characters were photographed in their natural position using a Keyence VHX-5000 digital microscope, following the methods proposed by Wanke & Rajaei (2018) and Wanke et al. (2019, 2021). Genitalia were then embedded in Euparal on permanent slides and photographed with the same Keyence digital microscope.

DNA barcoding and analysis

Analysis of mitochondrial DNA was carried out by submitting one dry leg of each specimen to the Canadian Centre for DNA Barcoding, Guelph, Canada. Extraction and amplification

of DNA and sequencing of the barcode fragment (658 base-pairs at the 5' terminus) of the mitochondrial gene *Cytochrome-C Oxidase I* were performed using standard protocols (e.g., Ivanova et al. 2006). MEGA X (Kumar et al. 2018; Stecher et al. 2020) was used for the maximum likelihood analysis (with 1000 bootstrap replications) and calculation of genetic distances based on the K2P model (Kimura 1980). A list of all specimens used for the analysis is presented in Appendix 1 along with their sampling sites and Process ID numbers. Sequences, photographs and label data are accessible on BOLD, as dataset DS-SABZIA (doi: https://dx.doi.org/10.5883/DS-SABZIA).

Systematic part

Sabzia Wanke & Rajaei, **gen. n.**
(Figs. 1–5, 10, 11A, 12, 15)

Type species
Phorodesma graminaria Kollar, 1850: 51, 53.

Description

Wingspan: 24–32 mm in males, 22–27 mm in females. Antennae dorsally scaled, bipectinate in both male and female, branches shorter in females (longest branch about 1 mm in males, 0.25 mm in females). Frons flat, scaled, reddish-brown. Chaetosemata developed as two separate patches behind the eyes. Length of labial palpi in lateral view approximately equal to diameter of eye. Proboscis absent. Epiphysis almost equal to length of foretibia. Midtibia with one pair of spurs almost equal in size. Hindtibia with one pair of spurs, the inner spur slightly shorter than the outer spur. Thorax grass-green.

Wings grass-green, without transverse lines or discal spots. Forewing more densely scaled and slightly darker in colour than hindwing, costa beige. Like in many Geometrinae, the wing colour may vary due to killing and preservation methods and aging. Here, the colour varies from beige to yellow (Figs. 1–5). Fringes slightly lighter than wings. Wings rather long and narrow. Venation of forewing with discocellular vein strongly angled. Vein R1 basally fused with vein Sc, the latter distally not reaching costa. Areole absent. Vein R2 fused with vein R3, veins R2–M1 on a common stalk and veins M3 and CuA1 stalked. Hindwing veins Rs–M1 and M3–CuA1 stalked (Fig. 11A). Frenulum absent in both sexes.

In the male genitalia (Fig. 12), the uncus and gnathos are strongly sclerotized and pincer-shaped, both apically pointed. Uncus in lateral view curved and thick. Gnathos ventrally covered with tiny, sclerotized spines; hook-shaped in lateral view, with a serrated inner edge (Fig. 12c). Socii present, membranous and broad. Valva elongated but not exceeding tip of uncus, basal part strongly sclerotized towards centre, apical part membranous. Valva slightly concave ventrally and with a heavily sclerotized central ridge (harpe). Tip of harpe broad, apical part dentate and curved towards centre of valva. Saccus rounded (Fig. 12a). Aedeagus sclerotized and short, thin at base, broadening towards apex (Fig. 12b). Vesica without cornuti. Second tergite without interior processes (apodemes). Posterior margin of sternum A8 concave (Fig. 12d).

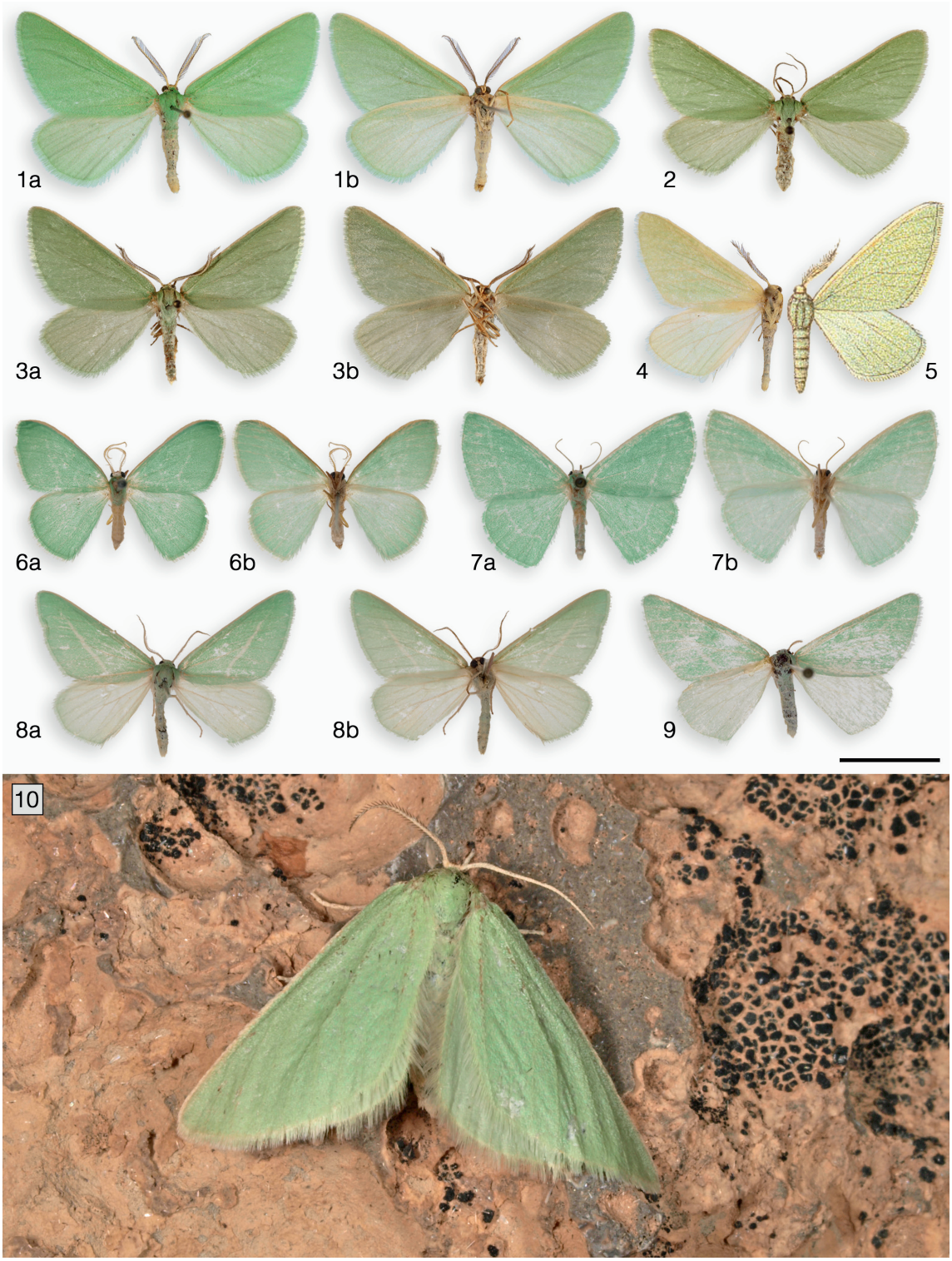
Female genitalia with broad papillae anales, length of apophyses anteriores approximately 1/2 length of apophyses posteriores. Lamella antevaginalis sclerotized. Ductus bursae broad and tubular, membranous; corpus bursae oval, membranous, without signa (Fig. 15).

Diagnosis

The new genus is compared to the closest genera, *Xenochlorodes* and *Hissarica*. Viidalepp & Kostjuk (2021) recently restored *Hissarica* from synonymy with *Xenochlorodes*, where it had been placed as a valid subgenus (Hausmann 1996). *Sabzia graminaria* **comb. n.** had been previously assigned to the genus *Xenochlorodes* (Prout 1938). However, *S. graminaria* **comb. n.** differs from *Xenochlorodes* species and the monotypic genus *Hissarica* by the narrow and elongated wings without transverse lines (Figs. 1–10). In the forewing venation, *Sabzia* **gen. n.** differs from *Xenochlorodes* and *Hissarica* in the absence of an areole, the fusion of vein R2 with vein R3, and in having veins M3 and CuA1 stalked (areole present, vein R1 fused with veins R2+R3, and veins M3 and CuA1 connate in *Xenochlorodes*; areole present, vein R1 fused with veins R2+R3, and veins M3 and CuA1 arising separately from cell in *Hissarica*). In the hindwing of *Sabzia* **gen. n.**, veins M3 and CuA1 are stalked (arising from cell in *Xenochlorodes*; arising separately from cell in *Hissarica*) (Fig. 11). In the male genitalia of *Sabzia* **gen. n.** the gnathos is laterally hook-shaped with a serrated inner edge, the valva has a sclerotized harpe with a broad tip, and the saccus is rounded (gnathos laterally curved, harpe absent, saccus forked in *Xenochlorodes*; gnathos laterally curved, harpe thin, its tip tapered, and saccus rounded in *Hissarica*). In *Sabzia* **gen. n.** the aedeagus is short, basally thin, broadening towards the apex (aedeagus long and slender in *Xenochlorodes*; aedeagus long and thick in *Hissarica*). The second tergite in males of *Sabzia* **gen. n.** lacks interior processes (apodemes) and the posterior margin of sternum A8 is concave (second tergite with paired, club-shaped apodemes and sternum A8 bilobed in *Xenochlorodes*; second tergite without any processes and sternum A8 concave with tip in the centre in *Hissarica*) (Figs. 12–14).

In the female genitalia of *Sabzia* **gen. n.** the ductus bursae is tubular and membranous and the corpus bursae is oval (ductus bursae narrowing proximally and strongly sclerotized, corpus bursae oval in *Xenochlorodes*; ductus bursae sclerotized, corpus bursae elongated in *Hissarica*) (Figs. 15–17).

In addition to morphological characters, we used DNA barcode data from the BOLD database to check whether



Figs. 1–10. Wing colouration and pattern of *Sabzia* Wanke & Rajaei, **gen. n.**, *Xenochlorodes* Warren and *Hissarica* Viidalepp spp. (**a** = upperside; **b** = underside). – **1–5**. *S. graminaria* (Kollar, 1850), **comb. n.** [1–3: Iran, Fars, Komehr; 2: g. prep. 11052; 3: g. prep. 11051; 4: Iran, Fars, Miyan Kotal, g. prep. 272/2016 S.F.; 5: Illustration from Prout (1935)]. **6–7**. *X. olympiaria* (Herrich-Schäffer, [1852]) [6: Krk, Fiumebucht, g. prep. 1087/2021, D. Wanke; 7: Turkey, Mugla, vic. Esen, g. prep. 1088/2021, D. Wanke]. **8–9**. *H. postalbida* Viidalepp, 1988 [all Tadjikistan, Kondara; 8: g. prep. 1091/2021, D. Wanke; 9: g. prep. 1090/2021, D. Wanke]. **10**. Adult of *S. graminaria* **comb. n.** from Iran (Kerman, Hanna protected area; photo by H. Rajaei). Scale bar: 1 cm.

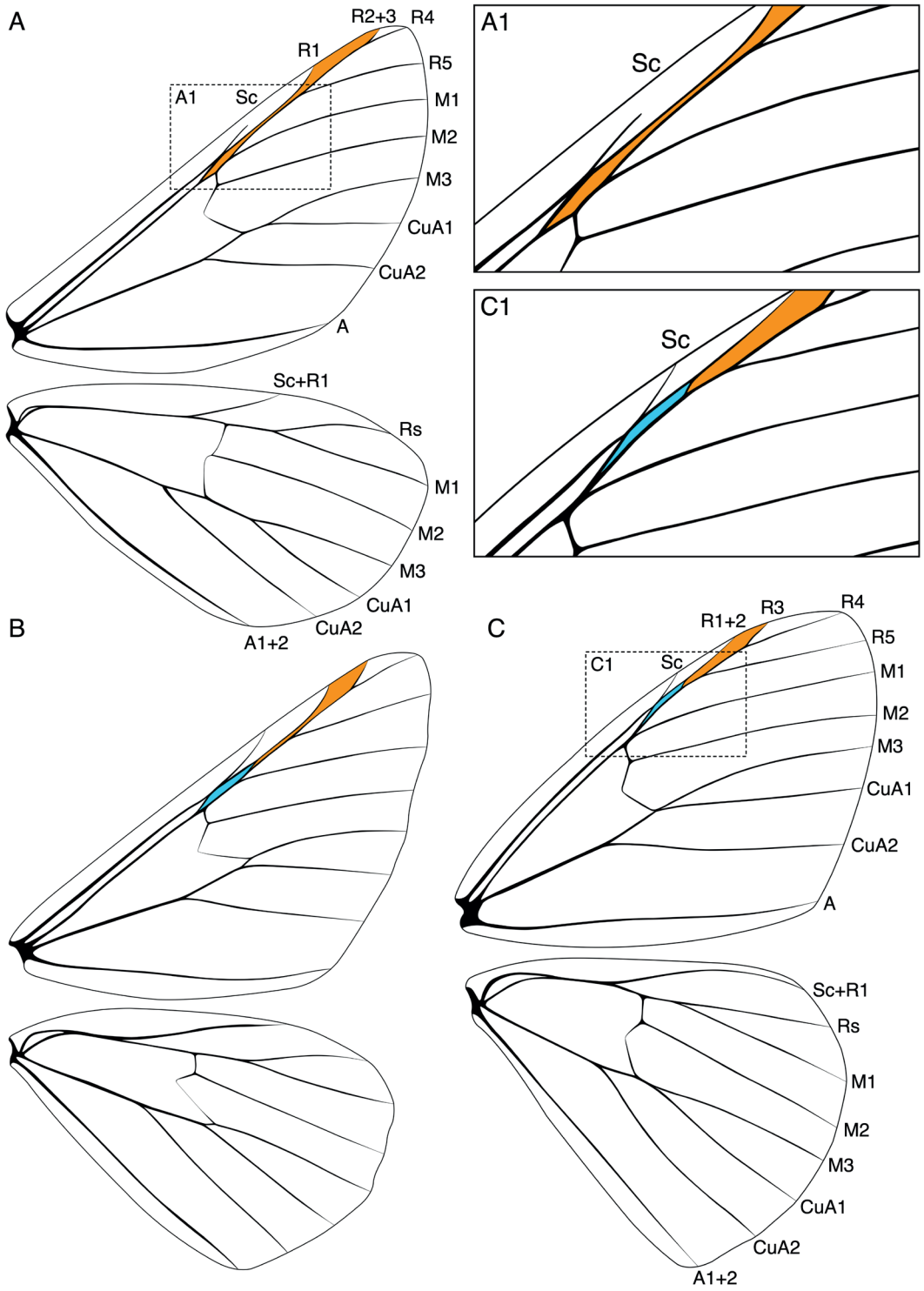
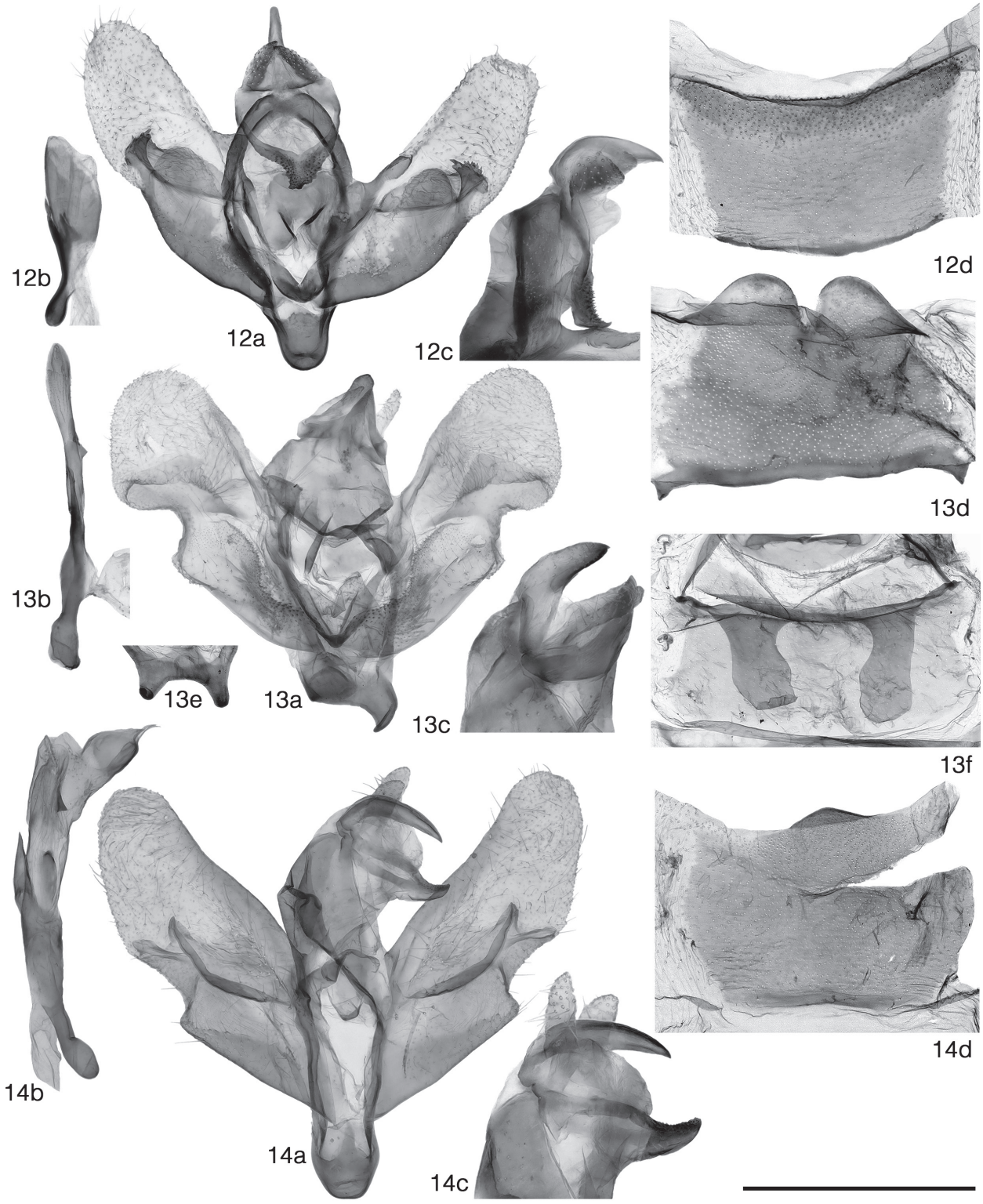


Fig. 11. Wing venation of (**A**) *Sabzia graminaria* (Kollar, 1850), **comb. n.**, (**B**) *Hissarica postalbida* Viidalepp, 1988 and (**C**) *Xenochlorodes olympiaria* (Herrich-Schäffer, [1852]). Areole blue coloured; area between R1 to R3 veins orange coloured. No areole is present in *S. graminaria* **comb. n.** (rectangle **A1**) and one areole (blue coloured) is present in *Xenochlorodes* (rectangle **C1**). Remark: according to Viidalepp & Kostjuk (2021), veins R2–M1 in the genus *Hissarica* (C) are stalked from the cell apex, R2 diverges after M1 and anastomoses with R1 towards the costa, therefore we here name this vein as R1+2. In *Sabzia* Wanke & Rajaei, **gen. n.** (B), veins R2–M1 are also stalked from the cell apex, but R2 does not diverge after M1 but reaches the costa along with R3; therefore, we here name this vein as R2+3.



Figs. 12–14. Male genitalia of *Sabzia* Wanke & Rajaei, **gen. n.**, *Xenochlorodes* Warren and *Hissarica* Viidalepp spp. – **12**. *S. graminaria* (Kollar, 1850), **comb. n.** (a, c, d: Iran, Kerman, Jiroft, g. prep. 1092/2021, D. Wanke; b: Iran, Fars, Komehr, g. prep. 11051). **13**. *X. olympiaria* (Herrich-Schäffer, [1852]) (a–d: Krk, Fiumebucht, g. prep. 1087/2021, D. Wanke; e–f: Spain, Girona, Puigventós, g. prep. 1086/2021, D. Wanke). **14**. *H. postalbida* Viidalepp, 1988 (a–d: Tadjikistan, Kondara, g. prep. 1091/2021, D. Wanke). **a** = genitalia capsule; **b** = aedeagus; **c** = uncus, lateral view; **d** = sternum A8; **e** = saccus; **f** = tergite 2. Scale bar: 1 mm; c, d, f are out of scale.

Figs. 15–17. Female genitalia of *Sabzia* Wanke & Rajaei, **gen. n.**, *Xenochlorodes* Warren and *Hissarica* Viidalepp spp. – **15**. *S. graminaria* (Kollar, 1850), **comb. n.** (Iran, Esfahan, vic. Sar Chesmeh, g. prep. 1093/2021, D. Wanke). **16**. *X. olympiaria* (Herrich-Schäffer, [1852]) (Turkey, Mugla, vic. Esen, g. prep. 1088/2021, D. Wanke). **17**. *H. postalbida* Viidalepp, 1988 (Tadjikistan, Kondara; g. prep. 1090/2021, D. Wanke). Scale bar: 1 mm.

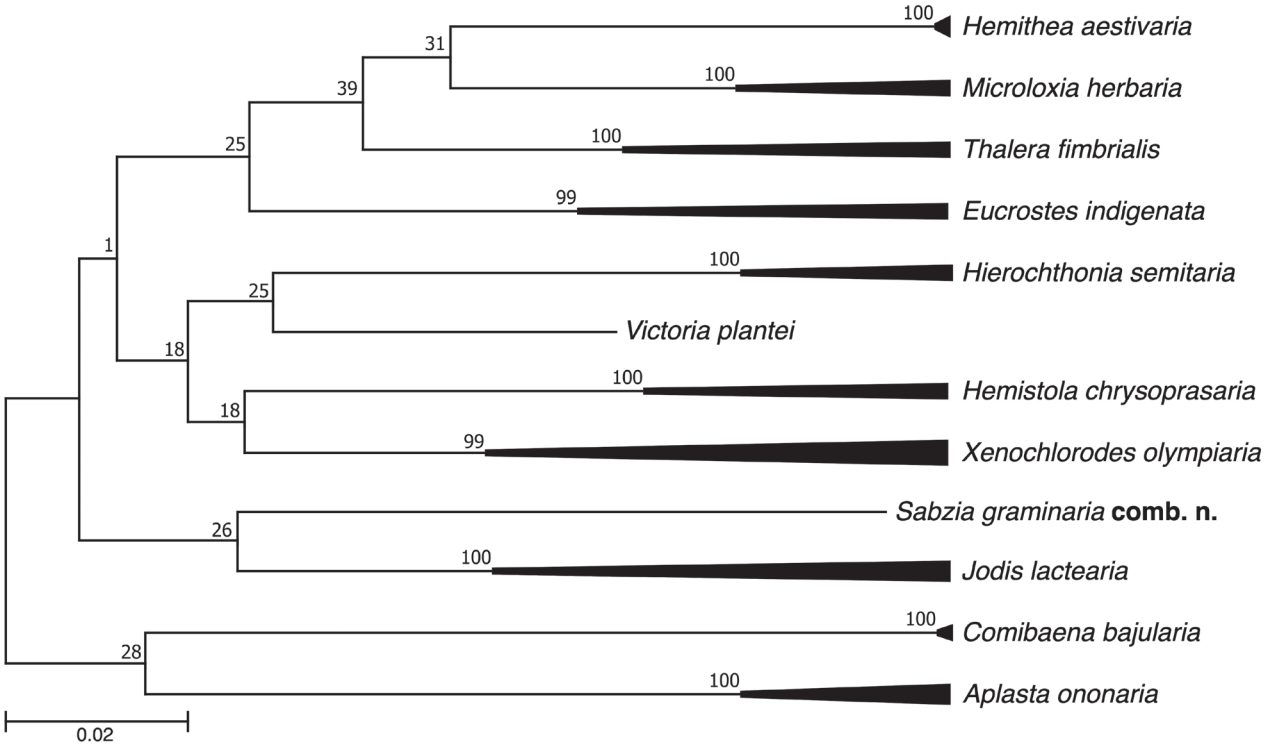


Fig. 18. Maximum likelihood analysis of *Sabzia* Wanke & Rajaei, **gen. n.** and closely related Palearctic species from different genera and tribes, based on *COI* 5' sequences (built with MEGA X; Kimura 2-parameter model; bootstrap method, 1000 replications). Remark: the *COI* data used here were only used to check whether or not *S. graminaria* (Kollar, 1850), **comb. n.** clustered with the genus *Xenochlorodes* Warren, and not for phylogenetic purposes; for a sound phylogenetic analysis of Hemitheini, see Murillo-Ramos et al. (2019).

or not *Sabzia graminaria* **comb. n.** clusters with the genus *Xenochlorodes*. The results of this analysis support our hypothesis to combine *S. graminaria* with a new genus, as it diverges by 11% from the type species of *Xenochlorodes*, *X. olympiaria* (Herrich-Schäffer, [1852]) (Fig. 18). Furthermore, the genetic distance from all other Palearctic Geometrinae is approximately 10%. We emphasize here that these results from *COI* barcoding alone should not be regarded as sound data for drawing any phylogenetic conclusions.

Tribal assignment

While placed within the genus *Xenochlorodes*, *Sabzia graminaria* was previously assigned to the tribe Hemistolini. According to the results of Murillo-Ramos et al. (2019), who subordinated Hemistolini under Hemitheini, we tentatively assign *Sabzia* **gen. n.** to the tribe Hemitheini. However, a comprehensive molecular phylogenetic study including *Sabzia* **gen. n.** is recommended for a reliable tribal assignment of the new genus.

Etymology

The name of this genus derives from the Persian word "Sabz", meaning green, and refers to the wing colour of type species *Sabzia graminaria* **comb. n.**

Sabzia graminaria (Kollar, 1850), **comb. n.**

Phorodesma graminaria Kollar, 1850: Kollar 1850: 51, 53. Holotype ♂ (South West Persia: Schiraz). Holotype not traced, possibly lost.

Xenochlorodes albicostaria Brandt, 1938: Brandt 1938: 55. Syntypes ♂♀ ([Iran]: Comèe [Komehr], Bam-i-Firus). Hereby regarded as a new synonym of *Sabzia graminaria*, **syn. n.** based on morphological examination and sympatric occurrence (see taxonomic note, below).

Material examined

P a r a t y p e ♂ of *X. albicostaria* Brandt, 1938: Iran, Fars, Straße Ardekan-Talochosroe [Tall Khosrow], Comèe [Komehr], 3600 m, 25.vi.1937, coll. Brandt, g. prep. ZSM G No. 1545 (ZSM).

1 ♂, 1 ♀, same data as paratype of *X. albicostaria*, 2600 m, 30.vi.1937, coll. Brandt, g. preps (♂) 11051, (♀) 11052 (NHRS).

2 ♀, Iran, Prov. Esfahan, NE of Naraq, Kuh-e Goran, 34°05′N 50°54′E, 2500 m, 06.vii.2003, leg. G. Ebert & R. Trusch; 1 ♀, Iran, Esfahan, Esfahan, Daran, Ashan vic., 2490–2500 m, 25.vi.2005, leg. A. Hofmann; 1 ♀, Iran, Boyer Ahmad-va-Kohgiluyeh, Yasuj E, Abnar Region, Kakan-Baba Hassan, 2550–2800 m, 24.vi.2005, leg. A. Hofmann; 1 ♂, Iran, Fars, Straße Ardekan-Talochosroe [Tall Khosrow], Comèe [Komehr], ca. 2600 m, 30.vi.1937, coll. Brandt; 1 ♂, Iran, 4–7.vi.1969, Miyan Kotal, 1900 m, östl. Kazerun, 29°30‘ N 51°40‘E, leg. G. Ebert, g. prep. 272/2016 S.F.; 1 ♀, Iran, Fars, Kaserun, Mian-Kotal, 1900 m, 11.vi.1972, leg. Ebert & Falkner, g. prep. 273/2016 S.F. (all SMNK).

1 ♀, Iran, Boyer Ahmad-va-Kohgiluyeh, Yasuj E, Abnar Region, Kakan–Baba Hassan, 2550–2800 m, 24.vi.2005, leg. A. Hofmann; 1 ♀, Iran, Esfahan, Miyandasht NW Afous, Chebleh-Kuh, Sar Chesmeh vic., 2700–2900 m, 12./13.vii.2003, leg. A. Hofmann, J.-U. Meineke, G. Tremewan, g. prep. 1093/2021 D. Wanke; 1 ♂, Iran, Kerman, Jiroft W, Shingera, 2800 m, 26./27.v. 2004, leg. A. Hofmann, J.-U. Meineke, G. Tremewan, g. prep. 1092/2021 D. Wanke (all SMNS).

1 ♀, Iran, Markazi, Tafresh 10 km SSE (Pass), 2400 m, 31.v.2005, leg. A. Hofmann, J.-U. Meineke; 1 ♂, 2 ♀, Iran, Boyeramabad va Kuhgiluye, Kuh-e Dinar, Paß E Sisahkt, 2800–3200 m, 14.vii.2000, leg. ten Hagen, g. preps (♂) 101, (♀) 100/2016 S.F.; 1 ♀, Iran, Boyer Ahmad-va-Kohgiluyeh, Gardaneh, Meymand, 2450–2800 m, 14./15.vi.2001, leg. A. Hofmann, J.-U. Meineke, G. Tremewan, g. prep. 162/2016 S.F.; 1 ♂, Iran, Esfahan, N Fereydun Shahr, vic. Shoohroud, 2700–3200 m, 5./6.vii.2002, leg. ten Hagen, g. prep. 102/2016 S.F.; 1 ♂, 1 ♀, Iran, Kerman, Kuh-e Bochrasman, S Darbmazar, 2800–3000 m, 1.vi.2004, leg. W. ten Hagen, g. prep. (♂) 106/2016 S.F.; 1 ♂, 1 ♀, Iran, Kerman, Jiroft NW, Gardaneh, Sarbishan, Shingara vic., 2700–2900 m, 3./4.vi.2002, leg., J.-U. Meineke, A. Hofmann, A. Kallies et al., g. prep. (♂) 103/2016 S.F.; 1 ♀, Iran, Kerman, Bam SW, Deh Bakri, 2000–2200 m, 1.-3.vi.2002, leg. J.-U. Meineke, A. Hofmann, A. Kallies et al., g. prep. 105/2016 S.F.; 1 ♂, 1 ♀, Iran, Kerman, Jiroft W, Shingera, 2800 m, 26./27.v. 2004, leg. A. Hofmann, J.-U. Meineke, G. Tremewan, g. prep. (♂) 104/2016 S.F. (all PCJM).

Taxonomic note

Kollar (1850) described *Phorodesma graminaria* based on one damaged male, the holotype, from southern Iran. According to Prout (1935), the holotype was left without a type label and, as already mentioned by Kollar (1850), was in damaged condition (five legs and the abdomen missing). Unfortunately, we could not find the holotype in any of the examined collections. Nevertheless, the original description and the additional notes of Prout, as well as his illustration (Prout 1935: 18, row h), served for identification of this species in the present study. Additionally, our revision of all known Iranian Geometrinae species has shown that *S. graminaria* is the only species with entirely green wings without markings, and that it therefore cannot be confused with other Geometrinae in this region. Considering all of the above, a neotype designation is not considered necessary, as the taxonomy of this species is stable and future retrieval of the holotype cannot be ruled out.

Surprisingly, *X. albicostaria*, described by Brandt (1938) from the southern Iranian province Fars, shows a high similarity with *S. graminaria*. It matches in all external characters, such as the long and narrow wing shape, the green colouration of the wings, the lack of transverse lines on the wings, the two terminal spurs on the hindleg, the absence of a frenulum, the strongly angled discocellular vein, vein R2 situated near the cell apex and vein M1 arising from the common stalk of veins R2–5 (Figs. 1–5). We therefore synonymize *X. albicostaria* with *S. graminaria*, **syn. n.**

Description and diagnosis

See generic part.

Phenology and habitat

Flying from May to July at altitudes from 1900 to 3600 m.

Biology

Unknown

Distribution

Species endemic to Iran, occurring from western to southern Iran along the Zagros Mountains.

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Appendix 1. List of specimens used for the maximum likelihood analysis, with species, sampling site and Process ID. Data taken from BOLD, generated by Axel Hausmann except GWORU553-10, generated by Norbert Pöll.

Species	Sampling Site	Process ID
Aplasta ononaria (Fuessly, 1783)	Israel, Northern, Hermon, 30.vi.2003, leg. Mueller, Kravchenko	GWOR317-07
Aplasta ononaria	Israel, Northern, Hermon, 30.vi.2003, leg. Mueller, Kravchenko	GWOR505-07
Aplasta ononaria	Israel, Northern, Hermon, 30.vi.2003, leg. Mueller, Kravchenko	GWOR517-07
Aplasta ononaria	Italy, Calabria, Cosenza, Fiumara Trionto, 09.ix.1999, leg. Scalercio, Intusino & Vuono	GWOTD327-12
Comibaena bajularia Fletcher, 1963	Germany, Thuringia, Bad Blankenburg, Schwarzatal, Schieferbrueche, 07.vii.2013, leg. S. Erlacher	GBLAC257-13
Comibaena bajularia	Germany, Brandenburg, Barnim, Zerpenschleuse, 20.vi.2013, leg. Rainer Busse	GBLAF456-14
Comibaena bajularia	Italy, Calabria, Cosenza, 6km S Cosenza, Pianette di Dipignano, 01.vi.2015, leg. G. Posa	GBLAA2691-15
Eucrostes indigenata (De Villers, 1789)	Greece, Crete, Western Crete, Levka Ori Gebirge Kalikratis, 13.v.2010, leg. Leipnitz	GWOSC945-10
Eucrostes indigenata	Italy, Abruzzi, Majella, vic. Lettopalena, 27.vi.2004, leg. N. Zahm	GWOTH289-12
Eucrostes indigenata	Greece, Thessaly, Strymon-Muendung, 24.ix.2005, leg. Weigert	GWOSO513-11
Hemithea aestivaria (Hübner, 1789)	Italy, Sardinia, Torpe, Baddore, 24.v.2007, leg. O. Cao	GWORD581-08
Hemithea aestivaria	Germany, Bavaria, centr, Woerth/Donau, Gmuender Au, 04.vi.2000, leg. A. Segerer	GWORG021-08
Hemithea aestivaria	Germany, Bavaria, centr, Traunstein, Traunstein - Uebersee, 03.vii.1997, leg. A. Segerer	GWORG022-08
Hemithea aestivaria	Germany, Bavaria, Upper Bavaria, Oberschleissheim, MW33, 13.vi.2007, leg. Axel Hausmann	GWOR4082-09
Hemistola chrysoprasaria (Esper, 1795)	Italy, Calabria, Cosenza, FmeArgentino, 3Km E Orsomarso, 10.viii.2007, leg. A. Hausmann	GWORC681-07
Hemistola chrysoprasaria	United Kingdom, 03.viii.2007, leg. OTL	CGUKA737-09
Hemistola chrysoprasaria	Germany, Bavaria, Upper Bavaria, Schlagenhofen a. Woerthsee, 06.vii.2008, leg. Karl Ambil	GWOR3778-09
Hierochthonia semitaria (Püngeler, 1901)	Israel, Jerusalem, Bet Shemesh, 30.vi.2003, leg. Mueller, Kravchenko	GWOR175-07
Hierochthonia semitaria	Israel, Haifa, Carmel, Carmel Haifa, 15 Km South of Haifa, 30.vi.2003, leg. Mueller, Kravchenko	GWOR176-07
Hierochthonia semitaria	Jordan, Al Karak, Al Karak, Al Karak, 31.v.2003, Li, leg. Mueller, Kravchenko	GWOR179-07
Jodis lactearia (Linnaeus, 1758)	Italy, Calabria, Lago dell`Angitola, 19.viii.2002, leg. S. Scalercio, M. Infusino & J. Tuscano	GWOTI892-12
Jodis lactearia	Germany, Bavaria, Upper Bavaria, Oberschleissheim, Flugahfen-Ost, 27.v.2008, leg. Axel Hausmann	GBLGC129-12
Jodis lactearia	Germany, Thuringia, Bad Blankenburg, Boehlscheiben, Schieferbrueche, 14.vi.2013, leg. B. Kirchner	GBLAD252-14

Species	Sampling Site	Process ID
Jodis lactearia	Italy, Lombardy, Lago d`Iseo, Solto Collina, 28.v.2015, leg. A. Hausmann	GBLAA1970-15
Microloxia herbaria (Hübner, [1813])	Kazakhstan, European Part, Ryn-kum sandy Steppe NW. Kandagash Loc., 17.vi.1999, leg. J. Miatlenski & V. Karalius	GWOSF890-10
Microloxia herbaria	Ukraine, Crimea, Feodosiya, Primorskiy, 08.viii.2011, leg. V. Savchuk	GWOTA861-13
Microloxia herbaria	Kazakhstan, Almaty, Tien Shan, Bakhanas, 05.v.2011, leg. G. Nazymbetova	GWOR5395-13
Thalera fimbrialis (Scopoli, 1763)	Turkey, Isparta, Akdeniz, Isparta, Kirazlidere, 26.vi.2007, leg. F. Can	GWORC577-07
Thalera fimbrialis	Kyrgyzstan, Naryn, Moldo-Too Mts., Koro-Goo Pass, 09.vii.2014, leg. S. Korb	GWOTO827-15
Thalera fimbrialis	Germany, Saarland, Saarpfalz-Kreis, Mandelbachtal, Hecken-dalheim, Lauterbachsklamm, 26.vii.2013, leg. Andreas Werno	FGMLG068-15
Victoria plantei Herbulot, 1976	Israel, Southern, Arava, Yotvata, 22.iv.1992, leg. G. Mueller	GWORL752-09
Xenochlorodes olympiaria (Herrich-Schäffer, [1852])	Italy, Basilicata, Valle Noce Trecchina, 12.vi.1996, leg. A. Hausmann	GWORB1676-08
Xenochlorodes olympiaria	Italy, Sardinia, Olbia, Porto San Paolo, 11.v.2000, leg. L. Weigert	GWOSI925-10
Xenochlorodes olympiaria	Italy, Calabria, Fiumara Trionto, 13.v.1999, leg. S. Scalercio, M. Infusino & M. Vuono	GWOTI894-12
Xenochlorodes olympiaria	Spain, Catalonia, Girona, Llanca, 30.v.1986, leg. Weigert	GWOSO517-11
Xenochlorodes olympiaria	Turkey, Adana, Akdeniz, Adana, Feke, 30.v.2002, leg. F. Can	GWORC602-07
Sabzia graminaria (Kollar, 1850), **comb. n.**	Iran, Fars, Dast-e-Arzan vic., 05.vi.1997, leg. A. Hoffmann, P. Kautt	GWORU553-10