

A new species of the genus *Dahlica* Enderlein, 1912, from Hungary (Lepidoptera, Psychidae)

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Abstract. In this paper a previously unknown species of the genus *Dahlica* Enderlein, 1912, from the subgenus *Postsolenobia* Meier, 1957, is described as *Dahlica (Postsolenobia) weidlichi* **sp. nov.** and compared with the already known species of this subgenus. Analysis of DNA barcodes for all five validly described taxa of the subgenus *Postsolenobia* show an unexpected pattern of genetic diversity. Careful re-examination of morphological traits fully supports this pattern and leads to the description of a new species. In addition, the habitat of the new species is characterised and the entire distribution of the subgenus is discussed.

Zusammenfassung. In dieser Arbeit wird eine bisher unbekannte Art der Gattung *Dahlica* Enderlein, 1912, aus der Untergattung *Postsolenobia* Meier, 1957, als *Dahlica (Postsolenobia) weidlichi* **sp. nov.** beschrieben und mit den bereits bekannten Arten dieser Untergattung verglichen. Die Analyse der DNA-Barcodes aller fünf beschriebenen Taxa aus der Untergattung *Postsolenobia* zeigte ein unerwartetes Muster genetischer Vielfalt. Eine sorgfältige erneute Untersuchung der morphologischen Merkmale unterstützte dieses Muster und führte zur Beschreibung der neuen Art. Darüber hinaus wird der Lebensraum der neuen Art vorgestellt und die gesamte Verbreitung der Untergattung *Postsolenobia* diskutiert.

Introduction

For years Michael Weidlich and I have known about a population of small psychids belonging to the subfamily Naryciinae, whose larval cases (bags) apparently belong to an undescribed species of the subgenus *Postsolenobia* Meier, 1957, in the genus *Dahlica* Enderlein, 1912.

Numerous adult males were found while working at the Psychidae collection of the Museum Witt Munich among the unsorted material which was collected in 1975 by Herbert Meier (Witt 1980) in Northern Hungary. Several more specimens, which apparently also belong to this new species, were detected by the author among the psychid collection of the SMNK (Arnscheid 2019), also collected by Meier and erroneously sorted by Leo Sieder (Arnscheid 1993) as belonging to other species of the genus. However, both the cases and the females were missing from the series but both are undoubtedly of high relevance for a correct taxonomic classification.

On his research trip to diverse biotopes on the Balkan Peninsula in 2019, Michael Weidlich again searched for fresh material at the locality for this cryptic species. He again found several larval cases and for the first time one male and one female emerged. This confirmed the identity of males from the Museum Witt's collection and the collection of SMNK as belonging to the same still undescribed species as well as their presumed membership of the subgenus *Postsolenobia*. In addition, it was possible to achieve a complete sequencing of the DNA barcode of the male within

the framework of the BOLD project, whereby a comparison of the relationship to the previously known species of the subgenus *Postsolenobia* became possible, since a number of sequences of other taxa are already available in the mentioned database.

The new species is described below as *Dahlica (Postsolenobia) weidlichi* sp. nov. The holotype was selected from the specimens collected by Meier and is deposited in the Psychidae collection of the SMNK.

Abbreviations

CMW	Private collection of Michael Weidlich, Neißemünde, Germany;
CWA	Private collection of Wilfried R. Arnscheid, Bochum, Germany;
GI	Genital Index (Phallus length : valvae length, after Sauter 1956);
MWM	Museum Witt München, Germany;
SMNK	Staatliches Museum für Naturkunde Karlsruhe, Germany;
ZSM	Zoologische Staatssammlung München, Germany.

Material and methods

Images of male genitalia (procedure as described in Arnscheid and Weidlich 2017) were taken with an Olympus OMD EM10 Mark II digital camera using an Olympus stereomicroscope with photo adapter and stacked with Combine ZP using Soft Stack; sharpened and de-noised with Neat Image V8 and post-processed with PhotoScape V.37. Images of the holotype were taken with an Olympus E1 digital camera with a 35–50 mm macro lens and a series of 12 single shots stacked with Combine ZP using Soft Stack; sharpened and de-noised with Neat Image V8.

DNA barcode sequences are based on a 658 base-pair long segment of the mitochondrial COI gene (cytochrome c oxidase 1). DNA samples of the new species (dried legs) were prepared and successfully processed at the Canadian Centre for DNA Barcoding (CCDB, Biodiversity Institute of Ontario, University of Guelph) to obtain DNA barcodes using the standard high-throughput protocol described in de-Waard et al. (2008), supplemented by public sequences available from BOLD. Further details including complete voucher data and images of the other already in BOLD available species can be accessed in the public dataset “Psychidae of East- and South Europe (POESE)” in the Barcode of Life Data Systems (BOLD; Ratnasingham and Hebert 2007). Percentages of interspecific variation of DNA barcode fragments were calculated under the Kimura 2 parameter model of nucleotide substitution using analytical tools of BOLD systems v. 4.0. (<http://www.boldsystems.org>). A Neighbor-Joining tree of DNA barcode data was constructed using MEGA 7 under the Kimura 2 parameter model for nucleotide substitutions.

The terminology in the description of the morphology of the species as well as the genitalia follows Arnscheid and Weidlich (2017). The classification of wing scales refers to Sauter (1956). Classification of the venation follows Comstock (1918). The calculation of the genital index according to Sauter (1956) is phallus length / valvae length.

Systematics

Dahlica (Postsolenobia) weidlichi sp. nov.

<http://zoobank.org/BC2ECF96-759D-4AD4-8B87-9CCBE83F892C>

Type material. *Holotype* ♂ (Fig. 1). Nord-Ungarn, Szarvaskő bei Eger, 24.iv.1975, leg. Meier. 47°59'17"N, 20°19'51"E.

Genitalia slide. GP4064 (CWA) (Fig. 2).

The holotype is here designated for deposition in the SMNK. Both the holotype and all paratypes in MWM and SMNK were subsequently labelled after the original pencil-written label written by Meier was found on the pin of the first specimen of the series in the MWM. This sole original label remains with the paratype series in the MWM and will later be accessioned to ZSM.

Paratypes ♂♀. 1 ♂ ex pupa with case and exuvia, Europe centralis/Hungaria, Nordungarn-Umg. Eger N, Bükk W, Umg. Szarvaskő N, 18.iv.2019; 1 case with ♂ and exuvia ditto, 09.iv.2019; 1 ♀ ex pupa with case and exuvia ditto, 14.iv.2019 (Fig. 3a, b, c); 2 cases with ♀ exuvia ditto, 09.iv.2019 (one in coll. Arnscheid); 4 ♀♀ cases ditto, 09.iv.2019; 2 cases ditto, 02.v.2012, all leg. Weidlich; 95 ♂♂ date as holotype, coll. CWA, CMW, MWM, ZSM.

Genitalia slides. 4063, 4064, and 4065 (CWA).

Diagnosis. All species of subgenus *Postsolenobia* are morphologically quite similar (Table 1). The males are characterized by their small size as well as the very broad cloaking scales on the upper side of the forewings. The new species differs from *D. (P.) juliella* (Rebel, 1919) and *D. (P.) thomanni* (Rebel, 1936) by its conspicuous grey-brown ground colouring and by a regular cream-white reticular pattern of the forewings on most specimens. *Dahlica (P.) banatica* (Hering, 1922) is clearly lighter in ground colour, the reticular pattern is much less clear than in *D. (P.) weidlichi* sp. nov. Furthermore, the new species differs from *D. (P.) juliella* ssp. *nanosella* Petrů & Liška, 2003 and *D. (P.) banatica* by the distinctly lower genital index.

Description. Male. Head: Frons and vertex densely covered with long yellowish hair-like scales. Compound eyes small and widely separated, distance between the eyes 1.5–2.5 times eye-diameter. Ocelli absent. Labial palp reduced to one segment. Maxillary palpus reduced to short stumps. Antenna thread-like with 28–30 segments including scape and pedicel, scaled, pecten ciliated (terminology follows Arnscheid and Weidlich 2017). **Thorax:** Yellowish grey, foreleg epiphysis absent, midleg with apical tibial spurs, hindleg with medial and apical tibial spurs.

Wingspan 8–11 mm. Forewing length 3.08–4.5 mm, elongate oval, apex broadly pointed, termen oblique; dorsal side dark greyish with distinct reticulate pattern consisting of creamy-white spots, submarginal area somewhat yellowish with brownish transverse stripes; series of brownish spots at termen and on dorsum; scales broad (classes 5–6), ventral side glossy grey scaled. Hindwing uniformly light-grey; veins M2 and M3 coincident, sometimes long-stalked.

Abdomen: Brownish grey scaled.

Male genitalia (Fig. 2). Tegumen oval and long in lateral view, slightly indented distally, vaulted and narrower caudally. Vinculum narrow laterally, broader ventrally. Valva relatively long, distinctly protruding from distal end of tegumen, broad at the base, more slender distally and covered with short hairs. Clasper of sacculus hook-shaped with a small, thorn, distally, very slender and curved upwards. Cucullus lobe-shaped. Saccus absent. Phallus long, distinctly curved, thin, attached basally to fultura inferior by a long chitinised clasp, cornuti absent. GI: 0.93–0.95 ($n = 4$).

Female (Fig. 3b, c). Apterous. Yellowish brown. Head and legs well developed. Antenna with 16 segments (incl. scapus and pedicellus). Labial palp reduced. All legs with 4 tarsal segments. Only hindlegs with a short pair of spurs. Anal hair-tuft (corethrogynae) ventral only, whitish. Female genitalia have not yet been examined, as only one female was available.

Pupa. Light brown. Antennal sheaths longer than leg sheaths.

Larval case (Fig. 3a). Small, about 2 mm long and about 1 mm in diameter. A dorsal edge is usually clearly visible. The cases are covered with very small particles of weathered rock and detritus and the colour ranges from dark grey to blackish brown.



Figure 1. Male holotype of *Dahlica (Postsolenobia) weidlichi* sp.nov. Northern Hungary, Szarvaskő near Eger, 24.iv.1975, leg. Meier, det. W.R.Arnscheid.

Table 1. Morphological characteristics of the *Postsolenobia* species-group in Europe.

Subgenus <i>Postsolenobia</i> Meier: Small species, hindwing with only 5 veins arising from discal cell. M2 and M3 mostly coincident. Tibial epiphysis absent. Female antenna long with more than 11 segments.					
species	Male wingspan	Scales (class)	Hindwing ven. M2/M3	Gen. index	Fem. pupal ant. sheaths
<i>weidlichi</i>	8–11	5–6	coincident or short stalked	0.93–0.95	long
<i>thomanni</i>	8–10	5–6	coincident	0.84–1.08	long
<i>juliella</i>	8–11	5–6	coincident or long stalked	0.85–1.16	long
<i>juliella</i> ssp. <i>nanosella</i>	8–10	5–6	coincident or short stalked	1.05–1.16	long
<i>banatica</i>	9–10	5	variable, often coincident	1.08–1.39	long

Etymology. It is a pleasure for me to dedicate this new species to my friend Dr Michael Weidlich, Neißemünde. As a leading authority of the Naryciinae worldwide, he has not only collected fresh material to solve the taxonomic questions about new species after years of laborious search, but he has also produced outstanding contributions to the Psychidae research in numerous publications.

Habitat. The type material was collected by M. Weidlich at the site called “Burgberg” near Szarvaskő (Fig. 4). This place likely represents the original location of the males collected by Meier in 1975. The Burgberg is volcanically shaped and consists mainly of Triassic basalts and Jurassic diabases (dolerites). Manganese-containing slate formations were also found in the rocks. Altogether these rock formations form the basis for a xerothermic fauna and flora.

Distribution. *D. (P.) weidlichi* sp. nov. is exclusively known so far only from the type locality in Hungary and this represents the northernmost record of a *Postsolenobia* species thus found (Fig. 6). Based on the distribution and analysis of the current habitats, all species of the subgenus *Postsolenobia* appear to be xero-thermophilic.



Figure 2. Male genitalia of *Dahlica (Postsolenobia) weidlichi* sp. nov. paratype in lateral view. Northern Hungary, Szarvaskő near Eger, 24.iv.1975, leg. Meier. Genitalia slide 4064 (CWA).



Figure 3. *Dahlica (P.) weidlichi* sp. nov. **a:** Paratype female case with exuvia. **b:** Paratype female with case in nature. **c:** Paratype female preserved in alcohol. (Photos: M. Weidlich).

Molecular results. Mean intraspecific distances for the barcode region are not known for *Dahlica* (*P.*) *weidlichi* sp. nov. because only one specimen was sequenced. The analysis of DNA barcodes (mt COI-5P) for all five validly described taxa of the subgenus *Postsolenobia* shows an unexpected pattern of genetic diversity. The maximum distance of *Dahlica* (*P.*) *weidlichi* to other species of the *Postsolenobia*-group is 6.4%. The minimum distance to the nearest neighbour, *Dahlica* (*P.*) *juliella nanosella*, is 4.80% (Fig. 5).

The sequences of *Dahlica* (*Postsolenobia*) *weidlichi* sp. nov. are generated as new for this study. These as well as the public sequences from the BOLD Systems database are available under the following Barcode Index numbers: BOLD:AAQ2015: (*Dahlica* (*P.*) *juliella* (Rebel, 1919), BOLD:ABW6648: (*Dahlica* (*P.*) *thomanni* (Rebel, 1936), BOLD:ABY8014: (*Dahlica* (*P.*) *juliella nanosella* Petrů & Liška, 2003, BOLD:ACF4253: (*Dahlica* (*P.*) *juliella* (Rebel, 1919), *Dahlica* (*P.*) *juliella nanosella* Petrů & Liška, 2003), BOLD:ACF5425: (*Dahlica* (*P.*) *juliella nanosella* Petrů & Liška, 2003, BOLD:ADD9269: (*Dahlica* (*P.*) *banatica* (Hering, 1922), BOLD:AED7175: (*Dahlica* (*P.*) *weidlichi* sp. nov.).



Figure 4. The “Burgberg“ near Szarvaskő, Hungary. Type locality of *Dahlica* (*Postsolenobia*) *weidlichi* sp. nov. Besides the new species, cases of the following Psychidae were also found: *Psyche* sp., *Taleporia tubulosa* (Retzius, 1783), and *Apterona helicoidella* (Vallot, 1827). (Photo: M. Weidlich, 09.v.2019).

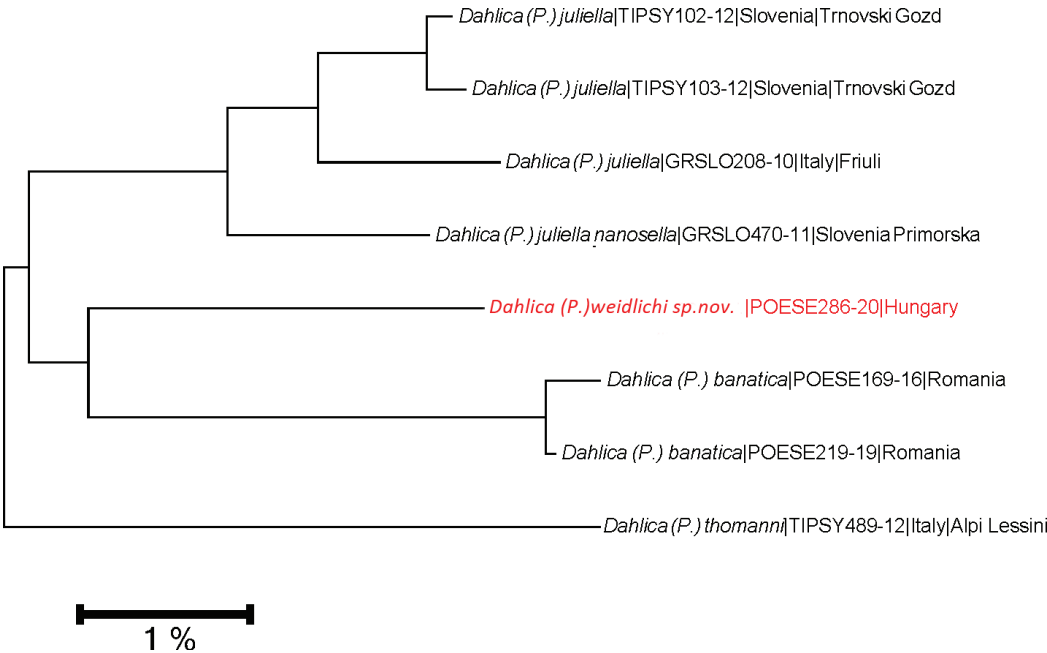


Figure 5. Neighbor-Joining tree of DNA barcode of the species of the subgenus *Postsolenobia* Meier.



Figure 6. Distribution of the three *Dahlica (Postsolenobia)* species in South-East Europe. Map created with SimpleMappr (www.simplemappr.net).

Discussion

The subgenus *Postsolenobia* is characterised as follows. Small psychids, male wingspan 8–11 mm, distinguished by the hindwing venation, with only five veins arising from discal cell; M2 and M3 mostly coalescent, but this feature is certainly not constant and M2 and M3 can also be long-stalked in several cases. Venation on forewing with eight veins from discal cell, accessory and intercalary cell absent. Forewing scales broad (classes 5–6) but also transitions to other subgenera exist. *Postsolenobia* was erected by Meier (1958) originally as a subgenus of *Dahlica* to which it is very closely related. The taxonomic status was considered uncertain (De Freina and Witt 1985; Arnscheid 1988; Sauter and Hättenschwiler 1999) because the morphological and phenological characters used to separate this subgenus are variable and transitions to related subgenera occur. At least *D. karatyshica* Rutjan (2000) and *D. rakosyi* Weidlich (2005) occupy rather transitional positions between subgenera *Postsolenobia* and *Dahlica*. Hence, Arnscheid and Weidlich (2017) treated *Postsolenobia* as a subgenus of *Dahlica* as it was originally when erected by Meier (1958). Closely examination of the new species reveals it represents the typical morphological features of the subgenus. This is also supported by the molecular data (Tab. 2, Fig. 4).

Table 2. Mean pairwise intraspecific distances of the barcode region of species of the *Postsolenobia*-group.

1 POESE286-20 <i>D. (P.) weidlichi</i> sp. nov. Hungary	1	2	3	4	5	6	7
2 POESE169-16 <i>D. (P.) banatica</i> Romania	0,052						
3 POESE219-19 <i>D. (P.) banatica</i> Romania	0,052	0,004					
4 GRSLO208-10 <i>D. (P.) juliella</i> Italy Friuli	0,058	0,058	0,054				
5 GRSLO470-11 <i>D. (P.) jul. nanosella</i> Slovenia Primorska	0,048	0,060	0,056	0,029			
6 TIPSYS102-12 <i>D. (P.) juliella</i> Slovenia Tmovski Godz	0,058	0,054	0,050	0,019	0,025		
7 TIPSYS103-12 <i>D. (P.) juliella</i> Slovenia Tmovski Godz	0,058	0,054	0,050	0,019	0,025	0,004	
8 TIPSYS489-12 <i>D. (P.) thomanni</i> Italy Alpi Lessini	0,062	0,070	0,070	0,064	0,060	0,060	0,064

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