

## NOTES ON THE GENUS *SCOLICIOSPORUM* (LECANORALES, ASCOMYCOTA) IN UKRAINE

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**Abstract.** The study focuses on the seven *Scoliciosporum* species recognized in Ukraine: *S. chlorococcum*, *S. curvatum*, *S. gal-lurae*, *S. perpusillum*, *S. pruinatum*, *S. sarothamni* and *S. umbrinum*. *S. curvatum* is reported as new to the country. The paper gives notes on the morphological and anatomical characters of the species, data on their ecology and distribution, and a modern key for the studied taxa.

**Key words:** lichens, *Scoliciosporum*, new record, key, distribution, Ukraine

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### INTRODUCTION

The genus *Scoliciosporum* was described by Mas-salongo in 1852. In the following years the genus was combined into *Bacidia* De Not. *s.l.* by Zahl-bruckner (1921–1940), according to whom *Bacidia* comprised all crustose lichens with a chlorococ-coid photobiont, biatorine or lecideine apothecia, and spores with three or more transverse septa. Zahlbruckner's *Catalogue Lichenum Universalis* (1921–1940) was the most influential work of 20<sup>th</sup>-century lichenology even though it was realized that the system is highly artificial (Ekman 1996). The genus *Scoliciosporum* was reinstated by Vězda (1978) to unite species characterized by their biatorine apothecia with a poorly developed proper exciple consisting of paraphysis-like hyphae, abundantly branched and anastomosed paraphyses, and *Lecanora*-type structure of the ascus apex.

According to Lumbsch and Huhndorf (2007) the genus *Scoliciosporum* belongs to the mono-typic family *Scoliciosporaceae* Hafellner of the order *Lecanorales* Nannf.

At present the genus *Scoliciosporum* includes 10 accepted species, most of them known from the Northern Hemisphere (Ekman & Tønsberg 2004; Himelbrant 2008; Kantvilas 2008). They occupy various substrates such as bark and branches of different deciduous and conifer trees, leaves of

tropical plants, siliceous or basic rocks, and occasionally wood or thalli of other lichens. The majority of species are widespread and tolerant to air pollution (Kondratyuk & Solonina 1990; Dymytrova 2009; Smith *et al.* 2009). Taxonomically this group of lichens is very difficult. There has been no modern revision of the genus since Vězda (1978) and Poelt and Vězda (1981). Since then only a few studies have been published: Nimis and Poelt (1987), Tønsberg (1992), Wirth (1995), Sparrius (2000), Baltzo (2004) and Himelbrant (2008). Most recently, several species of *Scoliciosporum* have been described, mostly from tropical countries such as Brazil, Madagascar and New Zealand: for example, *S. camptosporum* (Vain.) Aptroot, *S. vouauxii* (B. de Lesd.) Hafellner, *S. intrusum* (Th. Fr.) Hafellner, *S. arachnoideum* Aptroot, and *S. pennsylvanicum* R. C. Harris (Aptroot 2002, 2008; Hafellner 2002, 2004; Harris 2009).

According to the checklist of the Ukrainian lichen biota (Kondratyuk *et al.* 1998) and the most recent publications (Kondratyuk & Coppins 2000; Khodosovtsev & Khodosovtseva 2007), six species of *Scoliciosporum* are known from Ukraine. The species have not been studied in detail until the present. The only comprehensive work, *Lichen flora of Ukraine* (Oxner 1968), contains data on

four species; it included the *Scoliciosporum* species in the genus *Bacidia* in the separate section *Scoliciosporum* (A. Massal.) Jatta. The species *S. chlorococcum* (Graewe ex Stenh.) Vězda was transferred to the genus *Bilimbia* De Not. since the ascospores of that taxon are wider and fusiform, not acicular as in other *Bacidia*. Some Ukrainian species, for example *S. gallurae* Vězda & Poelt and *S. sarothamni* (Vain.) Vězda, are still poorly known in Ukraine because it occurs mainly in sterile form and is often confused with the green algae *Desmococcus* Bialosukina. Other taxa such as *S. corticola* (Anzi) Arnold and *S. perpusillum* (Lahm) Körb. usually occur in fertile form but are still insufficiently studied and their diagnostic characters are not yet clearly defined.

This paper is a result of a revision focused on the *Scoliciosporum* species kept in the herbarium of the M. G. Kholodny Institute of Botany, National Academy of Science of Ukraine, Kyiv (KW). During the study, one species, *S. curvatum* Sérus., was recognized as new to Ukraine. Five other species were recognized in the studied material: *S. chlorococcum*, *S. gallurae*, *S. perpusillum*, *S. sarothamni* and *S. umbrinum* (Ach.) Arnold. One species recorded from the literature only, *S. pruinatum* (P. James) Vězda, is also included. Notes on the morphological and anatomical characters of the species, and data on their ecology and distribution are presented. Some of the species are illustrated. Their distribution in Ukraine is presented in dot maps.

## MATERIALS AND METHODS

The study was based on more than 120 specimens deposited in KW. Some additional specimens from Kherson Pedagogical University, Kherson (KHER) were also studied. Cross sections of apothecia were made by hand. Ascospores and structures of apothecia were measured in distilled water. Paraphyses and ascospores were observed in 10% KOH. Spot test reactions of soredia were made with calcium hypochlorite (C).

Anatomical structures were photographed with a Primo Star Zeiss microscope using Power Shot A640. Photos of morphological structure were made with a Lumix DMC-FZ5 digital camera.

The maps of *Scoliciosporum* species distributions

in Ukraine were elaborated based on examined material and/or literature data (Kondratyuk *et al.* 1998, 2003; Khodosovtsev 1999; Bielczyk & Kiszka 2000; Kondratyuk & Coppins 2000; Bielczyk *et al.* 2005; Fedorenko *et al.* 2006; Kondratyuk & Martynenko 2006; Smerechynskaya 2006; Nazarchuk & Kondratyuk 2007; Postoyalkin *et al.* 2007; Naumovich & Khodosovtsev 2008; Boyko 2009; Gavrylenko & Khodosovtsev 2009; Nadyeina 2009; Rusina *et al.* 2010).

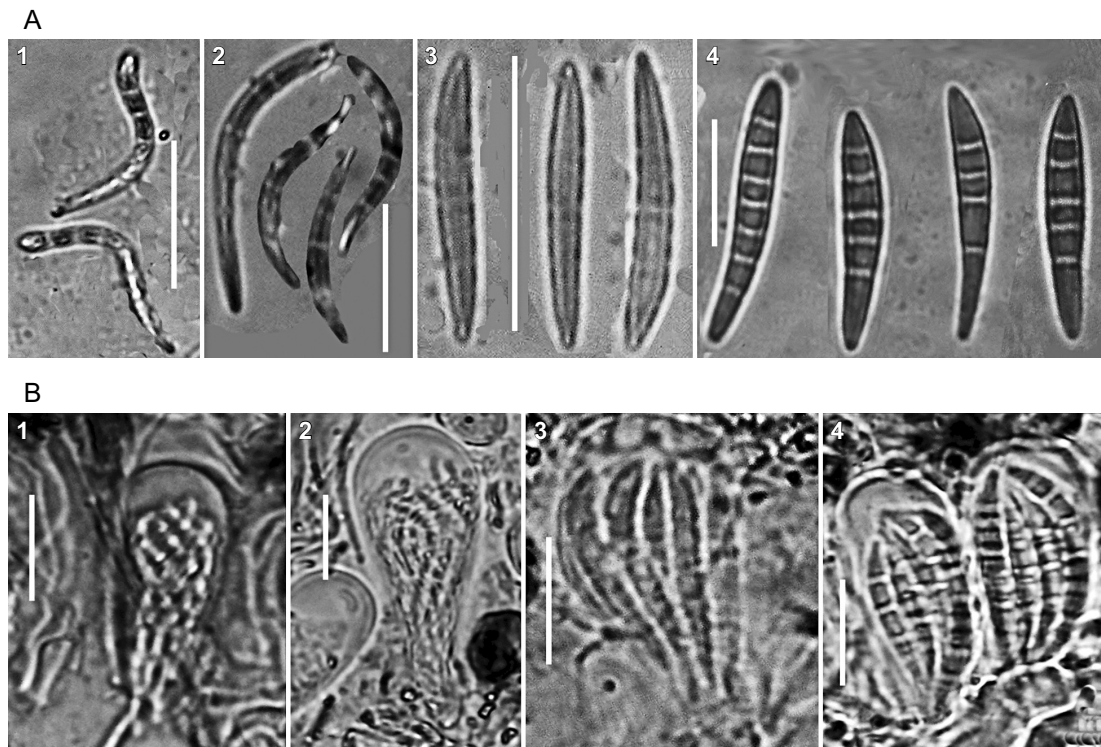
COMPARATIVE MATERIAL EXAMINED: *Scoliciosporum chlorococcum*. BELARUS. Grodno region, Svislach district, Belavezhszkaya Pushcha National Park, on *Pinus sylvestris*, 17 Aug. 1967, *M. Makarevich* (KW 30458). CZECH REPUBLIC. Na vrbách u Vap. Podola, 1910, *V. Kuták* (Suza: *Lich. Bohem.* 107) (KW).

*Scoliciosporum corticolum*. AUSTRIA. Tirolia australis. Ad ramos dessicatos Abietis prope pagum Jenesien, ca 1300 m, *E. Kernstock* (*Fl. Exsicc. Austro-Hung.* 2762) (KW).

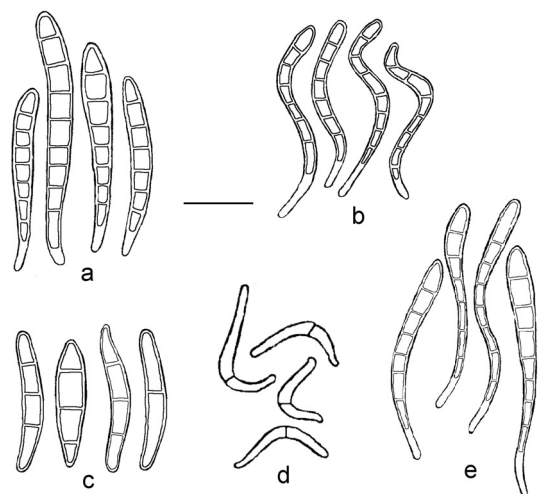
*Scoliciosporum umbrinum*. BELARUS. Minsk region, Molodechenskiy district, 350 m E of vicinity of Zagortsy, 21 May 2009, *A. Yatsyna* (KW 65320). CZECH REPUBLIC: Vap. Podol, 1917, *V. Kuták* (Suza: *Lich. Bohem.* 416) (KW); Na pískovci u Úpice, 1911, *V. Kuták* (Suza: *Lich. Bohem.* 110) (KW); Na pískovci, 1918, *V. Kuták* (Suza: *Lich. Bohem.* 471) (KW). RUSSIA. Sakha Republic (Yakutia), vicinity of Tiksi Bay, delta of Lena River, on rocks, 24 Aug. 1935, *A. Oxner* (KW 14699).

## CHARACTERIZATION OF THE GENUS *SCOLICIOSPORUM* IN UKRAINE

The genus *Scoliciosporum* is represented by seven species in Ukraine. The taxa are characterized by crustose, granular, yellowish green, greyish green to brown thalli. Soredia are typical for only two species: *S. gallurae* and *S. sarothamni*. However, the thallus of *S. chlorococcum* could be eroded due to destruction of the upper cortex, and may appear sorediate. Apothecia are biatorine, rounded, flat or convex. The color of apothecia varies greatly from white, cream and pale brown (e.g., *S. pruinatum*) to dark brown and black (e.g., *S. umbrinum*). Young and mature apothecia often differ in color, and even the same apothecium can be of mixed color. Asci are broadly clavate, *Lecanora*-type. Most species have 8-spored asci (Fig. 1). Only *S. curvatum* is characterized by



**Fig. 1.** Ascospores (A) and their position in the asci (B) of four *Scoliciosporum* species. 1 – *S. sarothamni* (Vain.) Vězda, 2 – *S. umbrinum* Poelt & Vězda, 3 – *S. gallurae* Poelt & Vězda, 4 – *S. chlorococcum* (Graewe ex Stenh.) Vězda. Scale bars = 20 μm.



**Fig. 2.** Ascospores. a – *Scoliciosporum chlorococcum* (Graewe ex Stenh.) Vězda, b – *S. sarothamni* (Vain.) Vězda, c – *S. gallurae* Poelt & Vězda, d – *S. curvatum* Sérus., e – *S. umbrinum* (Ach.) Arnold. Scale bar = 10 μm.

12–16-spored asci. Ascospore shape and width are important diagnostic characters of *Scoliciosporum* species. *Scoliciosporum chlorococcum* and *S. gallurae* have straight or slightly curved fusiform ascospores 4–5 μm wide. Spirally twisted, acicular ascospores 2.5–3.5 wide are typical for *S. perpusillum*, *S. sarothamni* and *S. umbrinum* (Fig. 1). *Scoliciosporum curvatum* has falcate or sigmoid, 1-septate ascospores. Ascospores of the other taxa are 4–7-septate, except for *S. gallurae* with 1–3-septate ascospores (Fig. 2). Lichen products are not detected by TLC in the thallus of most species. Only two sorediate species, *S. gallurae* and *S. sarothamni*, are characterized by the presence of traces of gyrophoric acid which gives a positive reaction with C.

For more details about the genus *Scoliciosporum* see Poelt and Vězda (1981), Ekman (1996), Ekman and Tønsberg (2004), Himelbrant (2008) and Smith *et al.* (2009).

Table 1. Comparison of characters of *Scoliciosporum* species.

Character	<i>S. chlorococcum</i>	<i>S. gallurae</i>	<i>S. sarothamni</i>	<i>S. umbrinum</i>	<i>S. perpusillum</i>
Thallus	Minutely granular, yellowish green to dark green	Areolate, entirely sorediate, whitish grey, yellowish grey to greenish grey	Granular, greyish yellow to green	Uneven, areolate, brownish green to blackish brown	Scattered, granular, yellowish green to greyish green
Soralia	Absent	Typical soralia not evident	Soralia discrete and rounded up to 2 mm in diam.	Absent	Absent
Reaction	C-	C+ (red)	C+ (red)	C-	C-
Apothecia	Black, mostly shiny, 0.2-0.4 mm in diam.	Dark brown to black, matte, 0.2-0.3 mm in diam.	Red brown to dark brown, 0.2-0.3 mm in diam.	Dark brown to black, 0.3-0.8 mm in diam.	Pale brown, red brown to dark brown, 0.1-0.3 mm in diam.
Spores	25-30 × 4-5 µm, straight to slightly curved, fusiform, 5-8-septate	15-24 × 3.5-4.0 µm, straight to slightly curved, fusiform, 1-3-septate	25-35 × 2.5-3.0 µm, spirally twisted, acicular, 3-7-septate	25-30 × 2.5-3.5 µm, spirally twisted, acicular, 3-7-septate	28-40 × 2.5-3.0 µm, curved or slightly spirally twisted, acicular, 3-7-septate
Substrate	Twigs and bark of trees	Twigs and bark of trees	Twigs and bark of trees	Usually rocks, rarely bark	Twigs and bark of trees

KEY TO THE *SCOLICIOSPORUM* SPECIES  
IN UKRAINE

1. Asci 12- to 16-spored. Ascospores 1-septate, falciform or sigmoid. . . . . ***S. curvatum***
- 1\* Asci 8-spored . . . . . 2
  2. Apothecia very pale, white, yellowish or brownish white, densely pruinose . . . . . ***S. pruinosum***
  - 2\* Apothecia usually red-brown, brown to black . . . . . 3
3. Thallus with soredia; soredia C+ red . . . . . 4
- 3\* Thallus without soredia; thallus C- . . . . . 5
  4. Ascospores up to 7-septate, mostly spirally twisted. Soralia more or less discrete and rounded . . . . . ***S. sarothamni***
  - 4\* Ascospores 1 to 3-septate, fusiform, straight to slightly curved. Typical soralia absent, thallus entirely sorediate . . . . . ***S. gallurae***
5. Ascospores fusiform, straight to slightly curved, 4-5 µm wide . . . . . ***S. chlorococcum***
- 5\* Ascospores acicular, curved to spirally twisted, 2.5-3.5 µm wide . . . . . 6
  6. Apothecia 0.1-0.3 mm in diam., brown to dark brown. On bark . . . . . ***S. perpusillum***
  - 6\* Apothecia 0.3-0.8 mm in diam., black. Usually on rocks. . . . . ***S. umbrinum***

***Scoliciosporum chlorococcum*** (Graewe ex Stenh.)  
Vězda Figs 1-4

Thallus thick, minutely granular, uneven, yellowish green to dark green. The upper cortex often destroyed and the bright yellow leprose medulla visible, resembling soredia (C-). Apothecia often abundant, black (immature apothecia brown), convex, shiny. Epithecium pale brown, red-brown to dark brown. Hypothecium colorless. Asci 8-spored. Ascospores straight or slightly curved, fusiform, narrowing to one end, 4-7-septate, 25-30 × 4-5 µm.

HABITAT. The species grows commonly on trees with acid bark, especially conifers and *Betula pendula*; 40% of the specimens from KW were collected on bark of *Pinus sylvestris*. Besides those tree species, *S. chlorococcum* was also collected from *Acer platanoides*, *A. saccharinum*, *Aesculus hippocastanum*, *Alnus* sp., *Carpinus betulus*, *Cerasus avium*, *Fraxinus excelsior*, *Malus* sp., *Picea* sp., *Populus nigra*, *P. tremula*, *Quercus robur* and *Tilia cordata*.

*Scoliciosporum chlorococcum* is tolerant to air pollution. In polluted areas the species occurs rather on bark of deciduous trees (Kondratyuk & Solonina 1990; Dymytrova 2009).

DISTRIBUTION IN UKRAINE. *Scoliciosporum chlorococcum* is common in Ukraine and is more or less evenly distributed in the country. Kondratyuk and Solonina (1990) presented the distribution pattern of the species in terms of its toxitolerance.

WORLD DISTRIBUTION. Austria (Hafellner & Türk 2001), Belgium (Diederich *et al.* 2011), Canada (Brodo *et al.* 2001), Czech Republic (Liška *et al.* 2008), Estonia (Randlane & Saag 1999), Finland (Santesson *et al.* 2004), France (Diederich *et al.* 2011), Germany (Wirth *et al.* 2010), Great Britain (Smith *et al.* 2009), Italy (Nimis & Martellos 2003), Japan (Kashiwadani & Thor 1995), Latvia, Lithuania (Himmelbrant 2008), Luxembourg (Diederich *et al.* 2011), Netherlands (Aptroot *et al.* 1998), Norway (Santesson *et al.* 2004), Mongolia (Himmelbrant 2008), Poland (Nowak & Tobolewski 1975), Portugal (Aptroot

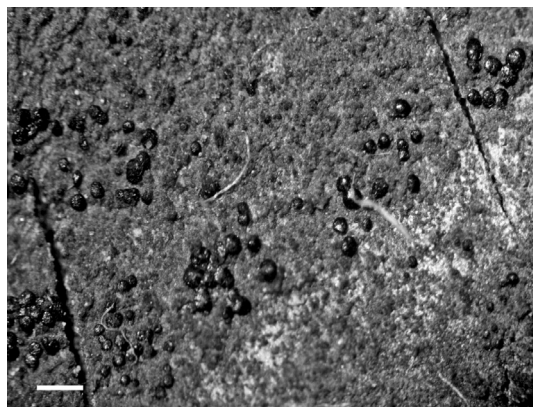


Fig. 3. Habit of *Scoliciosporum chlorococcum* (Graewe ex Stenh.) Vězda (*Y. Kopachevska*, KW 31921). Scale bar = 1 mm.

*et al.* 1992), Russia (Himmelbrant 2008), Slovakia (Pišút *et al.* 1996; Kondratyuk *et al.* 2003), Slovenia (Suppan *et al.* 2000), Sweden (Santesson *et al.* 2004), Switzerland (Scheidegger *et al.* 2002), Turkey (Doğru & Güvenç 2007), Ukraine (Oxner 1968), U.S.A. (Brodo *et al.* 2001; Ekman & Tønsberg 2004).

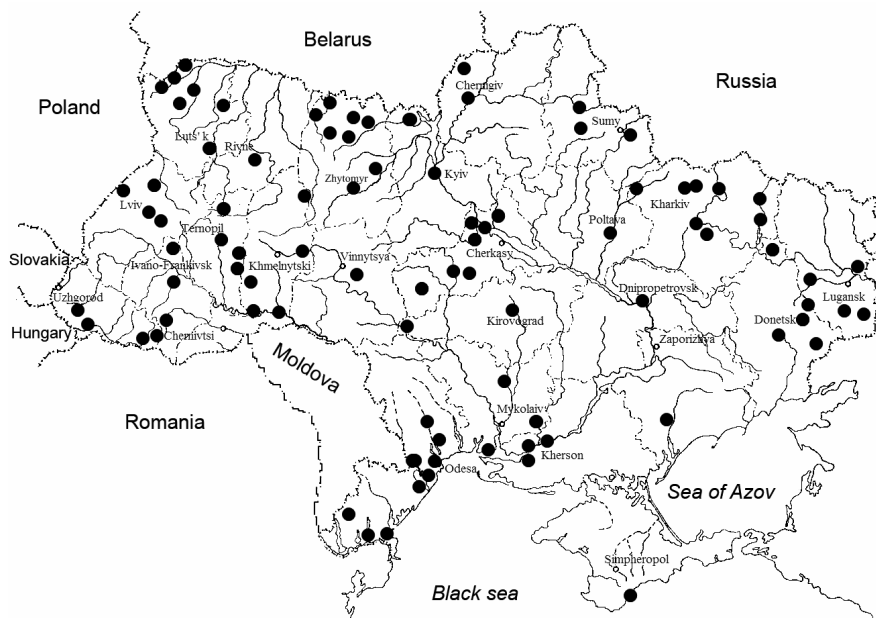


Fig. 4. Distribution of *Scoliciosporum chlorococcum* (Graewe ex Stenh.) Vězda in Ukraine.



**Fig. 5.** Distribution of *Scoliciosporum pruinosum* (P. James) Vězda (1), *S. perpustillum* (Lahm) Körb. (2 – confirmed record, 3 – doubtful record) and *S. curvatum* Sérus. (4) in Ukraine.

NOTES. The species is easily identified by its fusiform (4–5 µm wide), straight to slightly curved 4–7-septate ascospores. Sterile specimens could be mistaken with *S. sarothamni*. For comparison of the two taxa see Table 1 and notes under the latter species.

SELECTED SPECIMENS EXAMINED (75 samples studied). UKRAINE. CHERKASY REGION. Shpola district, vicinity of Krymky village, on *Pinus sylvestris*, 7 June 1975, *Y. Kopachevska* (KW 31826, 31833, 31925, 31929, 31931, 31936); Korsun-Shevchenkivskiy district, Korsun forest, on *Pinus sylvestris*, 6 June 1971, *Y. Kopachevska* (KW 31834, 31924, 31927, 31928, 31932); Cherkasy district, vicinity of Moshny village, on *Pinus sylvestris*, 8 June 1975, *Y. Kopachevska* (KW 31921, 31922, 31923, 31930), Sofiivka forest, on *Betula pendula*, 24 May 1983, *S. Kondratyuk* (KW 34762, 34817, 34832), *ibid.*, on *Quercus robur*, 23 May 1983, *S. Kondratyuk* (KW 34828); Gorodysche district, Mliiv forest, on *Carpinus betulus*, 9 June 1983, *S. Kondratyuk* (KW 34818); Kaniv district, Buchak forest, on *Cerasus avium*, 24 May 1983, *S. Kondratyuk* (KW 34827), Mykhailivka forest, on *Pinus sylvestris*, 24 May 1983, *S. Kondratyuk* (KW 34826), *ibid.*, on *Betula pendula*, 24 May 1983, *S. Kondratyuk* (KW 34825, 34830). KIROVOGRAD RE-

GION. Golovanivsk district, Golocha locality, on *Fraxinus excelsior*, 19 June 1983, *S. Kondratyuk* (KW 34918). KYIV REGION. Kyiv city, near Zhuliany Airport, on *Acer saccharinum*, 20 Sept. 2006, *L. Dymytrova* (KW 60897), vicinity of Kyiv city, Muromets Island, on *Populus tremula*, 7 July 2007, *L. Dymytrova* (KW 60898). VINNYTSIA REGION. Vinnytsya district, Stryzhavka village, on *Betula pendula*, 27 Aug. 1983, *S. Kondratyuk* (KW 34823). TRANSCARPATHIAN REGION (ZAKARPATSKA OBLAST'). Tiachiv district, vicinity of Mala Uholka village, Carpathian Biosphere Reserve, Uholskyi Massif, on the ridge, near Mt. Menchul, 48°16'37.4"N/23°37'13.3"E, alt. 812 m, on dry twigs of *Picea*, 9 Oct. 2009, *L. Dymytrova* (KW 64409).

***Scoliciosporum curvatum* Sérus. Figs 2 & 5**

Thallus thin, granular or areolate, uneven, whitish, grey to green-grey. Apothecia very small, up to 0.2 mm in diam., flat or slightly convex, scattered, often immersed in thallus granules, pinkish, brownish to brown, matte. Epitecium brownish. Hypothecium colorless. Asci 12–16-spored. Ascospores 1-septate (or with indistinct septa), falciform or sigmoid, colorless, 10–15(–18) × 1.5–2.5 µm.

**HABITAT.** The species grows on dry twigs of *Picea* in humid areas.

**DISTRIBUTION IN UKRAINE.** It is known from the Carpathians from only one locality at present. This is the first record of the species from Ukraine.

**WORLD DISTRIBUTION.** Austria (Hafellner & Türk 2001), Czech Republic (Liška *et al.* 2008), France (Diederich *et al.* 2011), Germany (Wirth *et al.* 2010), Great Britain (Smith *et al.* 2009), Hungary (Vondrak *et al.* 2009), Ireland (Smith *et al.* 2009), Italy (Nimis & Martellos 2003), Norway (Santesson *et al.* 2004), Poland (Himelbrant 2008), Romania (Palice 1999), Slovakia (Palice 1999), Spain (Himelbrant 2008), Sweden (Santesson *et al.* 2004), Switzerland (Scheidegger *et al.* 2002), Ukraine.

**NOTES.** This species is clearly distinguished by its sigmoid 1-septate ascospores, 12–16-spored asci and very small pale brown apothecia, but this minute species can easily be overlooked in the field.

**SPECIMENS EXAMINED.** UKRAINE. TRANSCARPATIAN REGION (ZAKARPATS'KA OBLAST'). Tiachiv district, vicinity of Mala Uholka village, Carpathian Biosphere Reserve, Uholskyi Massif, on the ridge, near Mt. Menchul, 48°16'37.4"N/23°37'13.3"E, alt. 812 m, on dry twigs of *Picea*, 9 Oct. 2009, L. Dymytrova (KW 63203).

***Scoliciosporum galluræ* Poelt & Vězda**

Figs 1, 2 & 6

Thallus thin, areolate, entirely sorediate, whitish grey, yellowish grey to greenish grey. Soredia minutely granular, C+ faintly red. Apothecia occasional, black, matte or slightly shiny. Epithecium pale brown to brown. Hypothecium colorless. Asci 8-spored. Ascospores 1–3-septate, straight, fusiform, 15–24 × 3.5–4 µm.

**HABITAT.** The species occurs on twigs or bark of *Fraxinus excelsior*, *Populus nigra* and *Pyrus communis*.

**DISTRIBUTION IN UKRAINE.** *Scoliciosporum galluræ* is quite rare in Ukraine. It is known from the Lugansk, Kherson, Kirovograd and Ternopil

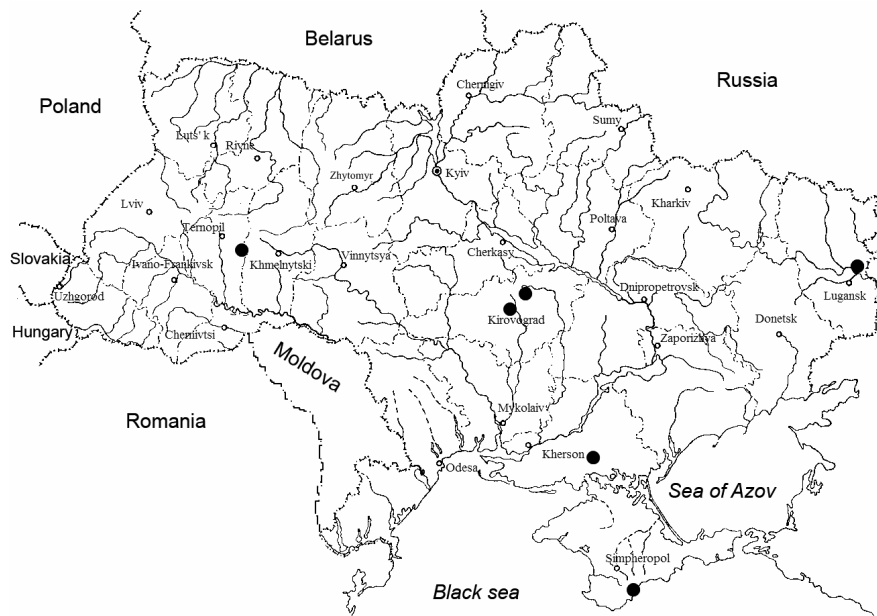


Fig. 6. Distribution of *Scoliciosporum galluræ* Poelt & Vězda in Ukraine.

regions. It was first reported from the vicinity of Yalta, the Crimea, by Khodosovtsev and Khodosovtseva (2007). It is insufficiently known in the country because it usually occurs without apothecia. Probably it has been overlooked and further work will add new localities of *S. gallurae* in Ukraine.

**WORLD DISTRIBUTION.** Austria (Hafellner & Türk 2001), Belgium (Diederich *et al.* 2011), Czech Republic (Liška *et al.* 2008), France (Diederich *et al.* 2011), Germany (Sparrus 2000; Wirth *et al.* 2010), Guatemala (van den Boom *et al.* 2007), Italy (Nimis & Martellos 2003), Luxembourg (Diederich *et al.* 2011), Norway (Santesson *et al.* 2004), Switzerland (Scheidegger *et al.* 2002), Ukraine (Khodosovtsev & Khodosovtseva 2007), Poland (Kukwa & Kubiak 2007), Portugal (van den Boom & Giralt 1996), Turkey (Yazici *et al.* 2010).

**NOTES.** This species is very close to *S. chlorococcum* and *S. sarothami*. For distinguishing characters see Table 1. Sterile samples of *S. gallurae* can be distinguished from *S. chlorococcum* by TLC. The presence of gyrophoric acid is diagnostic for *S. gallurae*.

Nevertheless, some authors (e.g., Tønsberg 1992; Himelbrant 2008) consider *S. gallurae* to be a sorediate counterpart of *S. chlorococcum* with young immature spores.

**SPECIMENS EXAMINED.** UKRAINE. KHERSON REGION. Chaplynka district, Askania-Nova Biosphere Reserve, arboretum, 16 Apr. 2006, *O. Khodosovtsev* & *S. Postoialkin* (KHER). TERNOPIL REGION. Gusiатыn district, Medobory Nature Reserve, Krasne forest, on *Pyrus communis*, 12 July 2004, *T. Smerechynska* (KW 62598).

***Scoliciosporum perpusillum*** (Lahm) Körb.

Fig. 5

Thallus thin, scattered, granular, yellowish green. Apothecia very small, up to 0.3 mm in diam., convex, brownish, red-brown to black, matt. Epitecium olive to brownish. Hypothecium colorless. Asci 8-spored. Ascospores curved or slightly spirally twisted, with indistinct septa, 28–40 × 2.5–3.0 μm.

**HABITAT.** This species was recorded on bark of *Alnus incana*.

**DISTRIBUTION IN UKRAINE.** Only one confirmed record of the species from Ukraine is known, from the Chernivtsi region.

The species was reported from the country by Shperk (1870) and Makarevich (1955). However, the record published by Shperk (1870) from the Donetsk region (territory of the present Sviati Gory National Park) is doubtful. As the author himself pointed out, the specimen had apothecia of a different size and form and did not agree with the description of *S. perpusillum* by Körber (1865). Unfortunately, the lichen collection of Shperk is not available now.

**WORLD DISTRIBUTION.** Austria (Himelbrant 2008), Czech Republic (Liška *et al.* 2008), France, Italy (Himelbrant 2008), Germany (Wirth *et al.* 2010), Norway, Sweden (Santesson *et al.* 2004), Poland (Nowak & Tobolewski 1975), Russia (Himelbrant 2008), Ukraine (Oxner 1968).

**NOTES.** *Scoliciosporum perpusillum* is similar to *S. umbrinum*, but the latter differs from *S. perpusillum* by having bigger apothecia and spirally twisted ascospores. The taxa also differ in ecology: *S. perpusillum* grows on bark, while *S. umbrinum* occurs mostly on rocks. For more distinguishing features see Table 1. Nevertheless, some authors consider *S. perpusillum* an epiphytic form of *S. umbrinum* (Santesson *et al.* 2004; Himelbrant 2008).

In addition, *S. perpusillum* resembles the problematic taxon *S. corticola* (Anzi) Arnold. The taxonomic status of the latter is unclear. Based on literature data, the main differences between the species are the color of the apothecia and the shape and size of ascospores. According to Lindau (1913) and Nowak and Tobolewski (1975) *S. corticola* (as *B. corticicola*) has brownish, red-brown to brown apothecia and strongly twisted ascospores, 20–35 × 2–3 μm, while the apothecia of *S. perpusillum* (as *B. perpusilla*) are black and produce ascospores slightly twisted, 15–20 × 1.5–2.0 μm. Most recently, Himelbrant (2008) gave different dimensions for *S. perpusillum* ascospores: 14–40



× 1.5–3.0 µm. The studied Ukrainian specimen of *S. perpusillum* from KW had brownish, red-brown, brown and black apothecia in the same specimen, and ascospores 28–40 × 2.5–3.0 µm. The taxa *S. perpusillum*, *S. umbrinum* and *S. corticola* definitely require further taxonomic and molecular analysis.

SPECIMEN EXAMINED. UKRAINE. CHERNIVTSI REGION. Putyla district, vicinity of Shepit village, alt. 980 m, on *Alnus incana*, 17 Aug. 1952, *M. Makarevich* (KW 30456).

***Scoliciosporum pruinosum* (P. James) Vězda**  
Fig. 5

Thallus thin, granular, greyish green. Apothecia convex, pale, white to pale brown, densely pruinose. Epithecium colorless. Hypothecium colorless. Asci 8-spored. Ascospores 3–5-septate, spirally twisted, acicular, 22–40 × 1–2 µm (Himelbrant 2008).

HABITAT. The species was found on bark of *Fagus sylvatica* in old beech forest.

DISTRIBUTION IN UKRAINE. Only one record of this species is known so far, from the Carpathian Mountains [Kondratyuk & Coppins 2000; Transcarpathian region (Zakarpats'ka oblast'), Velyky Berezny district, Eastern Carpathian Mts, Uzhansky National Park, Parashynsky Stream, 48°59'N/22°37'E, alt. 370–400 m]. Unfortunately, the herbarium specimen is not available.

WORLD DISTRIBUTION. Belgium (Diederich *et al.* 2011), Estonia (Halonen *et al.* 2000), Finland (Santesson *et al.* 2004), Germany (Wirth *et al.* 2010), Great Britain (Smith *et al.* 2009), Italy (Nimis & Martellos 2003), Luxembourg (Diederich *et al.* 2011), Netherlands (Aptroot *et al.* 1998), Portugal (van den Boom 2005), Russia (Himelbrant 2008), Sweden (Santesson *et al.* 2004), Switzerland (Scheidegger *et al.* 2002), Ukraine (Kondratyuk & Coppins 2000), U.S.A. (Brodo *et al.* 2001).

NOTES. This species differs from other *Scoliciosporum* species in having asci of *Bacidia*-type. Kantvilas (2008) suggests that *S. pruinosum* is misplaced generically and that on the basis of the

structure of apothecia and asci it probably belongs to the tropical genus *Jarmania* Kantvilas.

***Scoliciosporum sarothamni* (Vain.) Vězda**  
Figs 1, 2, 7 & 8

Thallus thick, areolate, minutely granular, greyish green to greyish brown. Soredia discrete, scattered or sometimes confluent, rounded to elongate, efflorescent, yellowish green, C+ faintly red. Apothecia occasional, rather crowded and confluent, flat, dark brown, matte. Epithecium pale brown to olive brown. Hypothecium colorless. Asci 8-spored. Ascospores 3–7-septate, spirally twisted, 25–35 × 2.5–3.0 µm.

HABITAT. The species occurs on twigs of *Prunus domestica* and *Pyrus communis* as well as on branches and trunks of *Acer tataricum*, *Betula pendula* and *Fagus sylvatica*.

DISTRIBUTION IN UKRAINE. *Scoliciosporum sarothamni* is quite rarely reported from Ukraine. It is known from the Carpathians and the Cherkasy, Kherson, Khmelnycki, Kirovograd, Lugansk, Mykolaiv and Vinnytsia regions. The species is probably overlooked in the field or often misidentified, especially as *S. chlorococcum*.

WORLD DISTRIBUTION. Austria (Hafellner & Türk 2001), Belgium (Diederich *et al.* 2011),



Fig. 7. Habit of *Scoliciosporum sarothamni* (Vain.) Vězda (*S. Kondratyuk*, KW 61921). Scale bar = 1 mm.

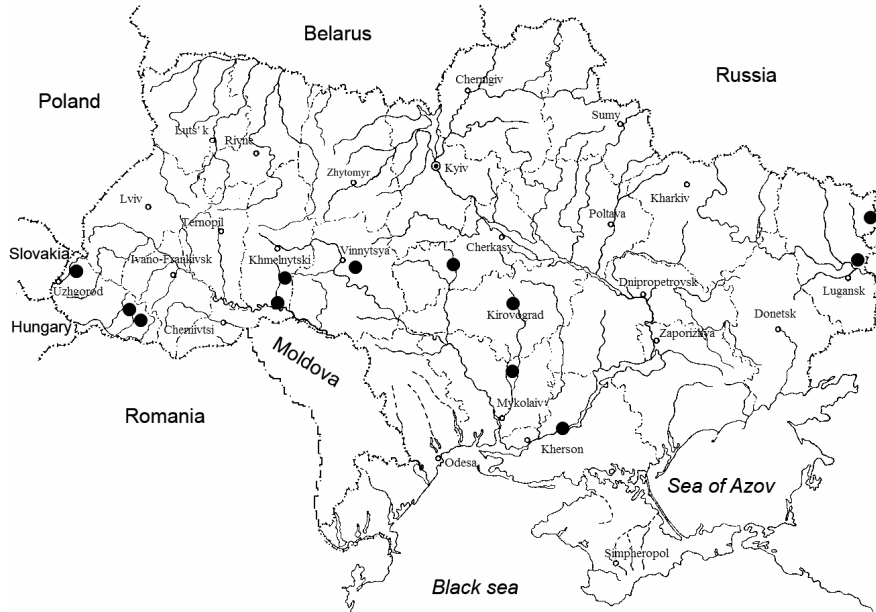


Fig. 8. Distribution of *Scoliciosporum sarothamni* (Vain.) Vězda in Ukraine.

Czech Republic (Liška *et al.* 2008), Estonia (Randlane & Saag 1999), Finland (Santesson *et al.* 2004), France (Roux *et al.* 1999), Germany (Wirth *et al.* 2010), Great Britain (Smith *et al.* 2009), Italy (Nimis & Martellos 2003), Norway (Santesson *et al.* 2004), Poland (Kowalewska & Kukwa 2003), Russia (Himmelbrant 2008), Sweden (Santesson *et al.* 2004), Switzerland (Scheidegger *et al.* 2002), Ukraine (Oxner 1968), U.S.A. (Baltzo 2004).

NOTES. *Scoliciosporum sarothamni* may be confused with *S. chlorococcum*. The former has spirally twisted ascospores and discrete soralia giving a C+ red reaction (gyrophoric acid), while the latter is characterized by straight or slightly curved ascospores and the complete absence of soredia. The sterile forms of the two species are easily distinguished by C testing or TLC (the presence of gyrophoric acid is conclusive). In the studied Ukrainian material, *S. sarothamni* was misidentified as *S. chlorococcum*. What is more, the two species had been found growing side by side.

Similarly to *S. sarothamni*, *S. galluare* produces soredia but it differs from the former in having as-

cospores of a different size and shape, and soralia of a different type. For more distinguishing features see Table 1. It is worth mentioning that the studied specimens of *S. sarothamni* and *S. galluare* were clearly C+ red when the reagent was applied directly on the soredia. The same feature was observed in specimens from Poland (Kowalewska & Kukwa 2003). Tønsgberg (1992), on the other hand, remarked that only the squash preparation of these species reacted C+ faintly red.

SPECIMENS EXAMINED. UKRAINE. CHERKASY REGION. Zvenygorod district, Khlypnivka village, on *Pyrus communis*, 9 June 1983, *S. Kondratyuk* (KW 29578), *ibid.*, on *Prunus domestica*, 9 June 1983, *S. Kondratyuk* (KW 61921). VINNYTSIA REGION. Vinnytsia district, Stryzhavka village, on twigs, 27 Aug. 1983, *S. Kondratyuk* (KW 29166). TRANSCARPATHIAN REGION (ZAKARPATSKA OBLAST). Tiachiv district, vicinity of Posich village, Carpathian Biosphere Reserve, Shyrokoluzhanskyi Massif, 48°17'34.4"N/23°44'17.0"E, alt. 626 m, on *Betula pendula*, 4 Oct. 2009, *L. Dymytrova* & *A. Naumovich* (KW 64412), vicinity of Mala Uholka village, Carpathian Biosphere Reserve, Uholskyi Massif, alt. 1000 m, on *Fagus sylvatica*, 24 July 2005, *O. Khodosovtsev* & *S. Postoiialkin* (KHER).

***Scoliciosporum umbrinum* (Ach.) Arnold**

Figs 1, 2, 9 &amp; 10

Thallus thin to thick, uneven, composed of scattered or confluent, flat to slightly convex areoles, yellowish green, brownish green to blackish brown. Apothecia dark brown to black, matte, convex, 0.3–0.8 mm in diam. Epithecium very variable, dull olive green to bluish green. Hypothecium colorless. Asci 8-spored. Ascospores spirally twisted, 3–7-septate,  $25\text{--}30 \times 2.5\text{--}3.5 \mu\text{m}$ .

**HABITAT.** *Scoliciosporum umbrinum* grows mainly on basaltic or siliceous rocks and outcrops. Only a few records of this species were listed on tree bark: *Fagus sylvatica* and *Pistacea mutica*.

*Scoliciosporum umbrinum* is considered tolerant to air pollution and widely distributed in built-up areas on anthropogenic substrates (memorials, walls, concrete bridges, etc.).

**DISTRIBUTION IN UKRAINE.** This species is quite common in Ukraine.

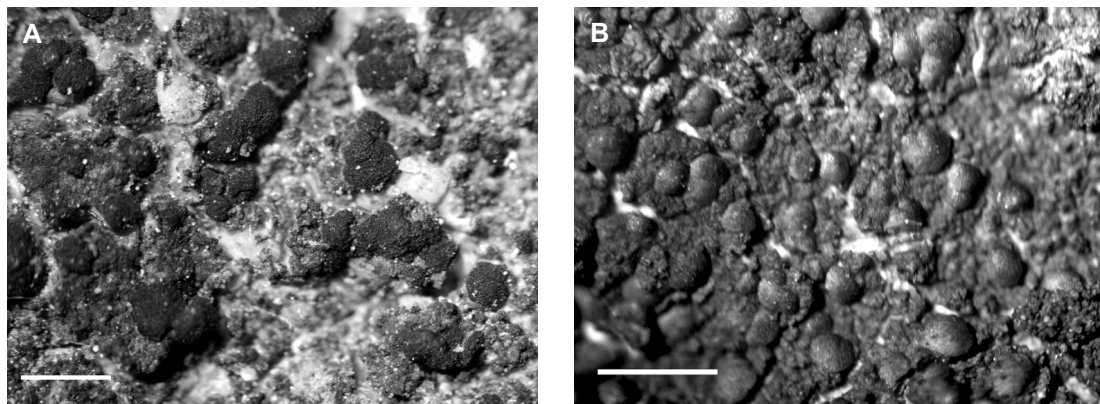
**WORLD DISTRIBUTION.** Australia (Kantvilas 2008), Austria (Hafellner & Türk 2001), Belarus (Himmelbrant 2008), Belgium (Diederich *et al.* 2011), Bulgaria (Himmelbrant 2008), Canada (Brodo *et al.* 2001), Caucasus (Himmelbrant 2008), Czech Republic (Liška *et al.* 2008), Estonia (Randlane & Saag 1999), Finland (Santesson *et al.* 2004), France (Diederich *et al.* 2011), Germany (Wirth

*et al.* 2010), Great Britain (Smith *et al.* 2009), Italy (Nimis & Martellos 2003), Japan (Kashiwadani & Thor 1995), Latvia, Lithuania (Himmelbrant 2008), Luxembourg (Diederich *et al.* 2011), Mexico, Mongolia (Himmelbrant 2008), New Zealand (Malcom & Vězda 1996), Norway (Santesson *et al.* 2004), Poland (Nowak & Tobolewski 1975), Romania (Kondratyuk *et al.* 2003), Russia (Himmelbrant 2008), Slovakia (Pišút *et al.* 1996), Slovenia (Suppan *et al.* 2000), Sweden (Santesson *et al.* 2004), Switzerland (Scheidegger *et al.* 2002), Turkey (Öztürk 1990), Ukraine (Oxner 1968), U.S.A. (Brodo *et al.* 2001).

**NOTES.** *Scoliciosporum umbrinum* is highly polymorphic and may include other taxa. Several characters of this species such as thallus structure and the color and size of apothecia and the epithecium vary greatly.

As stated above, *S. perpusillum* is considered by some authors to be an epiphytic form of *S. umbrinum*. For distinction of the two taxa, see remarks under *S. perpusillum* and Table 1. Also, *S. sarothamni* is very similar to *S. umbrinum* but differs in having sorediate thalli and a C+ reaction of soredia.

The uncommon specimens of *S. umbrinum* growing on bark are characterized by having a more or less continuous, granular, dark green thallus and apothecia mostly flat, matte, dark



**Fig. 9.** Habit of *Scoliciosporum umbrinum* (Ach.) Arnold. (A) on rocks (*V. Maslova*, KW 46288); (B) on bark with young pale brown apothecia and continuous granular thallus (*O. Nadyeina*, *S. Postoialkin* & *C. Scheidegger*, KW 64411). Scale bars = 1 mm.

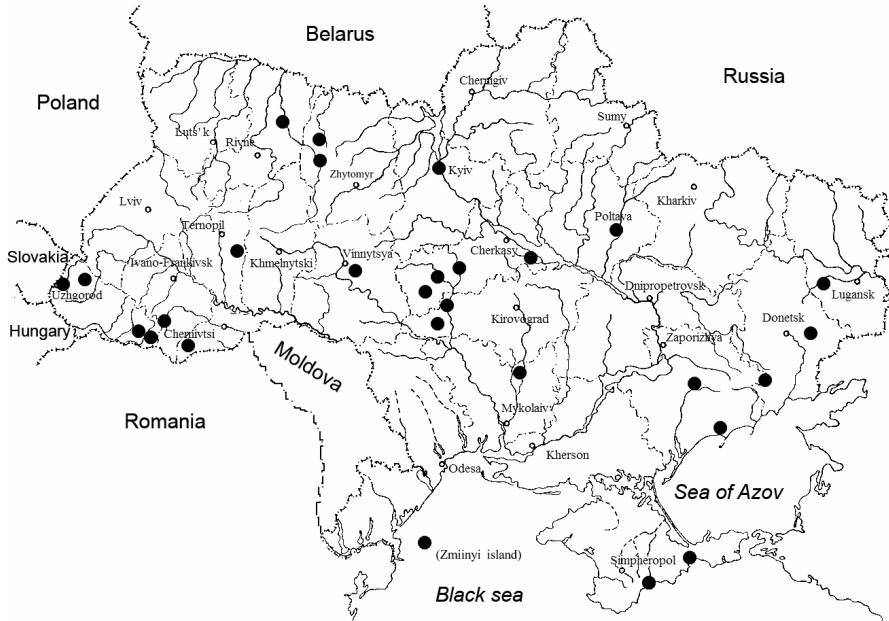


Fig. 10. Distribution of *Scoliciosporum umbrinum* (Ach.) Arnold in Ukraine.

brown to black (only the young apothecia can be very pale).

SELECTED SPECIMENS EXAMINED. (31 samples studied) – UKRAINE. CHERKASY REGION. Uman district, Babanka village, on rocks, 27 June 1925, *A. Lazarenko* (KW 31851). CHERNIVTSI REGION. Vyzhnytsya district, vicinity of Lopushna village, alt. 730 m, on rocks, 19 Aug. 1952, *M. Makarevich* (KW 30453); Storozhynets district, vicinity of Banyliv village, 5 km S of Koshuia, alt. 705 m, on rocks, 13 Sept. 1951, *M. Makarevich* (KW 44660). CRIMEA. Theodosia city municipality, Kara Dag Nature Reserve, on *Pistacia mutica*, 20 Sept. 2001, *O. Redchenko* (KW 61920). DONETSK REGION. Volodar district, Kamiani Mogyly National Reserve, on rocks, 2 July 1975, *Y. Kovalenko* (KW 62029); Shakhtarsk district, vicinity of Petrivske village, on siliceous sandstone, 18 Apr. 2006, *O. Nadyeina* (KW 61913). IVANO-FRANKIVSK REGION. Chornogora, Verchovynskiy district, vicinity of Verchovyna (former Zhab'ie), on rocks, 1881, *A. Rehman* (KW 38325). KIROVOGRAD REGION. Ulianiivka district, vicinity of Ulianiivka town, on rocks, 9 June 1983, *S. Kondratyuk* (KW 29356); Novoarkhangel'sk district, vicinity of village Ternivka, on rocks, 1982, *S. Kondratyuk* (KW 61906). RIVNE REGION. Berezne district, Sosnove village, on bank of Sluch River, on basaltic

rocks, 25 June 1969, *V. Maslova* (KW 44814, 46288). TRANSCARPATHIAN REGION (ZAKARPATSKA OBLAST). Tiachiv district, vicinity of Shyrokyi Luh village, Carpathian Biosphere Reserve, Shyrokoluzhanskyi Massif, 48°17'47.2"N/23°44'29.5"E, alt. 842 m, on *Fagus sylvatica*, 7 Oct. 2009, *L. Dymytrova* & *A. Naumovich* (KW 66854), *ibid.*, 48°18'36.1"N/23°42'17.0"E, alt. 1145 m, on *Fagus sylvatica*, 10 Aug. 2010, *L. Dymytrova* & *A. Naumovich* (KW 66849), vicinity of Mala Uholka village, Carpathian Biosphere Reserve, Uholskyi Massif, 48°15'44.0"N/23°38'46.3"E, alt. 884 m, on *Fagus sylvatica*, 8 July 2010, *L. Dymytrova* & *A. Naumovich* (KW 66853), *ibid.*, between Swiss and L'viv sampling plots, on *Fagus sylvatica*, 15 July 2009, *O. Nadyeina*, *S. Postoiialkin* & *C. Scheidegger* (KW 64411).

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