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СООБЩЕНИЯ

ACAROSPORA FUSCATA AND *A. UMBILICATA* (ACAROSPORACEAE, ASCOMYCOTA) IN BELARUS

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The article presents the results of a revision of herbarium specimens of gyrophoric acid containing *Acarospora* species in Belarus. Two species were recorded, *A. fuscata* and *A. umbilicata*. Morphological and anatomical characters, ecology and distribution of both species are discussed. Our revision sufficiently extended the knowledge about range of *Acarospora umbilicata* in Eastern Europe. For this species, two genes, nrITS and mtSSU, were generated and available through GenBank for further phylogenetic research. Based on a list of 1081 species and infraspecific names we estimated the genus *Acarospora* is currently represented by 307 taxa.

Key words: biodiversity, lichen, distribution

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The lichen genus *Acarospora* A. Massal. (Acarosporaceae, Acarosporales, Lecanoromycetes) is characterized by polyspored asci with simple hyaline ascospores, ascomata that are immersed, pseudolecanorine or lecideine, and crustose thalli that are areolate to squamulose growing on rock, soil, and occasionally wood and anthropogenic substrates (Magnusson, 1929; Knudsen, 2007, 2021a). *Acarospora* occur all around the world, usually in xerothermic or arid habitats, and many species are pioneers. Phylogenetic analyses have found the genus *Acarospora* is a nonmonophyletic group whose richness and evolutionary relationships will only be discovered through a multigene global sampling (Westberg et al., 2015; Knudsen et al., 2020, 2021a,b, in press). The genus contains approximately 307 species out of 1081 species and infraspecific names of "*Acarospora*" available in Index Fungorum (Index..., 2021) which is still significantly higher than previous estimates (Wijayawardene et al., 2020). Many names have disappeared in synonymies or in the rejection of infraspecific categories. Other *Acarospora* species names have been transferred to the genera *Myriospora* Nägeli ex Uloth, *Pleopsidium* Körb., and *Trimmatothelopsis* Zschacke (Hafellner, 1993; Westberg et al., 2011; Arcadia, Knudsen, 2012; Knudsen et al., 2021a).

For biodiversity inventories, the revision of many taxa of *Acarospora* in Eurasia is needed. Magnusson's monographic work remains invaluable but is limited by the taxonomic method of his species concepts and his labyrinthine and often useless keys (Magnusson, 1929, 1956; Knudsen, 2004, Knudsen et al., 2020). The keys of Claude Roux are keys to Magnusson's monograph and are limited by unproven opinions, unnecessary synonymies, the lack of peer review, and the use of Esperanto (Roux, 2007; Roux et al., 2019). The

excellent and invaluable work of the great Russian lichenologist N.S. Golubkova needs to be revised for use in the Russian Federation in the Russian language as well as in English translation for international use (Golubkova, 1988).

The purpose of this paper is to explore the taxonomy and distribution of the two gyrophoric acid producing *Acarospora* species in Belarus, *A. fuscata* (Schrad.) Arnold and *A. umbilicata* Bagl.

MATERIAL AND METHODS

This study is based on specimens deposited in GSU, MSK, MSKH, MSKU and private herbarium of J. Kocourková and K. Knudsen (hb. K et K). In total, 92 specimens of Acarosporaceae from 73 localities collected in 1956–2015 were studied. Morphology was checked under Nikon SMZ 745 and Olympus SZX 16 stereomicroscopes. Anatomy was studied under Nikon Eclipse 80i, Olympus BX 51 and Olympus CX 31 microscopes. Macrophotographs were taken with the DSLR camera Canon EOS 450D equipped with Canon EF 100 mm f/2.8 USM Macro lens. Anatomical measurements were made in water. The amyloid reaction of the hymenial gel and subhymenium was tested with fresh undiluted IKI (Merck's Lugol) using the protocol in K. Knudsen, J. Kocourková (2018). The ascus stain was studied in IKI (Hafellner, 1993). The presence of gyrophoric acid was tested with C and KC. Secondary metabolites were checked in all specimens with K, KC, C spot tests. Most species from Belarus are well-known for not producing secondary metabolites and there were only two gyrophoric acid species, both never spot test negative.

DNA was extracted from a collection by P. Bely of *A. umbilicata* from Belarus. Genomic DNA was extracted from lichenized thalli via the Invisorb® Spin Plant Mini Kit (Invitek), according to the manufacturer's protocol with slight modifications (i.e. eluted in 55 μL of DNA, instead of 100 μL), and incubated in buffer for 15 minutes before final centrifuging. Total extracted DNA was stored at –20°C. The quality and yield of DNA isolated was checked on a 1% agarose gel and DNA concentration and purity were then measured precisely using a UVS-99 spectrophotometer (ACTGene). The selected markers for this study were the internal transcribed spacer complete repeat, nrITS (White et al., 1990), and the small subunit of the mitochondrial ribosomal DNA, mtSSU (Zoller et al., 1999). The nrITS and mtSSU regions were amplified via polymerase chain reaction (PCR). Each reaction contained 1 μL (20–25 ng) of extracted genomic DNA, 10 μL of 2x MyTaq TM Red Mix DNA Polymerase (Bioline), 8.2 μL of water, 0.4 μM of forward/reverse primer (10 μM) for a total reaction volume of 20 μl. Conditions for nrITS, mtSSU rDNA: initial denaturation 95°C for 5 min, followed by five cycles (95°C for 33 s, 56°C for 30 s, and 72°C for 30 s), than ten cycles (95°C for 30 s, 54°C for 30 s, and 72°C for 30 s), and twenty cycles (95°C for 30 s, 50°C for 30 s, and 72°C for 30 s) with a final extension 72°C for 10 min. Before sequencing, the PCR products were purified using the enzymatic method Exo-Sap-IT TM Express provided by Thermo Fisher Scientific, Inc. according to the manufacturer's protocol. PCR products were run on a 1.0% agarose gel via electrophoresis and stained with ethidium bromide for 25 min. Purified PCR products (8 μL in total volume) were sent to the BIOCEV, Vestec, CZE). Sequences were checked against the UNITE database and NCBI database for contamination. The sequences were deposited in GenBank and were included in a phylogeny of Acarosporaceae in Knudsen et al. (in press).

TAXONOMY

Acarospora fuscata (Schrad.) Arnold. *Flora*, Regensburg **53**(30–31): 469 (1871) [1870] Conserved Type: Czech Republic, Western Bohemia, Distr. Tachov, Natural park Sedmihoří, between Mezholezy and Racov, 524 m, 49°37'53.15" N 12°51'41.03" E, granite outcrops in *Pinus sylvestris* forest, 1 Oct 2014, *Kocourková 8499 et Knudsen*. (holotype, S; isotypes: B, GZU, H, NY, PRA, PRM, SBBG, UPS).

Description. Thallus indeterminate of areoles, often contiguous, occasionally imbricate, covering areas to 5 cm. Areoles 0.1–3.0 mm wide, up to 1 mm thick irregular in shape, sometimes lobulate with edges free and often with a black margin, broadly attached to the substrate, replicating by division. Upper surface light brown, epruinose, matte, smooth. Lower surface light or dark brown, corticate under the margins, becoming black through melanization. Epicortex thin (<10 μm) or absent. Cortex 25–50 μm thick, upper layer yellow brown, lower layer hyaline, paraplectenchymatous, with cells 3–5 um diam., perpendicularly arranged and usually distinct. Algal layer 50–100 μm thick, uninterrupted by hyphal bundles, with cells 5–12 μm diam. Medulla forming a thick mycelial base (gomphate), 0.1–0.8 mm thick, not distinctly stipitate, medullary hyphae intricate, thin-walled, septate, 3–4 μm thick. Apothecia solitary or up to 10 per areole, immersed, punctiform 0.1–0.4 μm, disc round or irregular, reddish-brown, darker than the thallus, epruinose, smooth or rough. Parathecium 10–20 μm diam., not expanding around the disc. Hymenium (80–)100–120(–140) μm high, epihymenium ca. 10–15 μm, reddish-yellow, coherent. Paraphyses (1.0–)1.5–2.0 μm diam. at mid-level, not branching, septate, often with oil drops, with the apices barely expanded or capitate, 3–5 μm, hymenial gel IKI+ red or blue turning red (hemiamyloid). Asci 60–90 × 15–18 μm, ascospores 4.0–5.0 × 1.5–2.0 μm, narrowly ellipsoid to ellipsoid. Subhymenium 30–60 μm thick, IKI+ blue (euamyloid). Hypothecium 10–20 μm thick. Pycnidia 100–110 × 60–70 μm, conidiogenous cells ampulliform, conidia 1.0–2.0 × 0.5–1.0 μm.

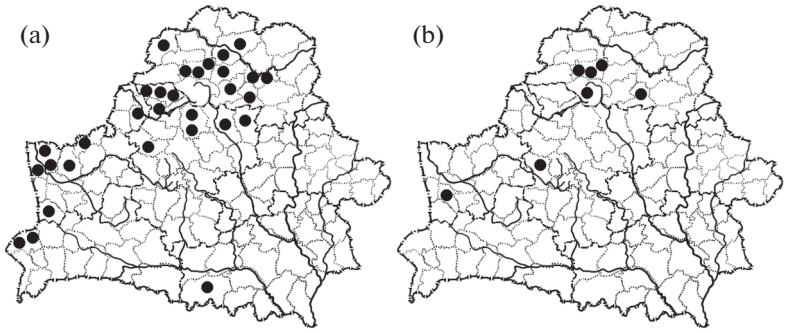

Fig. 1. Distribution of *Acarospora fuscata* (a) and *A. umbilicata* (b) in Belarus.

Fig. 2. A typical granite boulder of glacier origin in Belovezhskaya Puscha National Park representing main available substrate for *Acarospora* species in Belarus.

Secondary metabolite: gyrophoric acid in cortex, C+, KC+ pinkish red in thin section.

Sequences available in GenBank: nrITS (MW989393) and mtSSU (MW989442).

Distribution and ecology. The world distribution of *Acarospora fuscata* is unclear. The species has been reported from Europe (Magnusson, 1929; Golubkova, 1988; Knudsen et al., 2019b, 2021a), Asia (Golubkova, 1988; Ohmura, Kashiwadani, 2018), Africa (Egea, 1996; Amrani et al., 2018), North America (Golubkova, 1988; Knudsen, 2007; Esslinger, 2019), South America (Rodriguez de Flakus et al., 2016), and from Australia (McCarthy, 2020). However, all reports outside of Eurasia are doubtful and need verification (Knudsen et al., 2019b; Knudsen, Kocourková, 2020). The species occurs in at least eastern North America and Reeb's report of *A. complanata* H. Magn. from Canada is *A. fuscata* s. str. (Reeb et al., 2004). A phylogenetic and taxonomic study of a taxon from New Mexico that could be identified as *A. fuscata* recovered a new species, *A. agostiniana* K. Knudsen, Kocourk. et Hodková, which probably extends through the sky islands of the American southwest into the Rocky Mountains (Knudsen et al. in press).

In Belarus, *Acarospora fuscata* is the most widely distributed and most common species of the genus being known from 31 localities. Similar to most saxicolous lichens in Belarus (Golubkov 1992, 1996; Tsurykau et al., 2018), the species is most frequent in the northwestern part of the country (Fig. 1a). We associate this with the concentration of boulder material of glacial origin (Fig. 2) that entered the study area during the Pleistocene together with the Scandinavian glaciers (Makhnach, 2004). The last glacier did not reach southern Belarus (territories of the Belarusian Polesie) and therefore lack of suitable substrata is considered to be the main limiting factor in distribution of saxicolous lichens in those areas. Stone quarries are extremely rare in Belarus and a granite stone quarry near Glushkovichi village represents the single known locality of *A. fuscata* in southern Belarus (Fig. 1a).

Discussion. In Europe, *Acarospora fuscata* is the most common species of the genus and shows a wide phenotypic variability (Magnusson, 1929). Aspect, elevation, whether a surface is flat or rough, whether in shade or full sun, etc. is the major cause of the polymorphism (Knudsen et al., 2021a). For instance, on a vertical surface *A. fuscata* forms an areolate non-lobu-

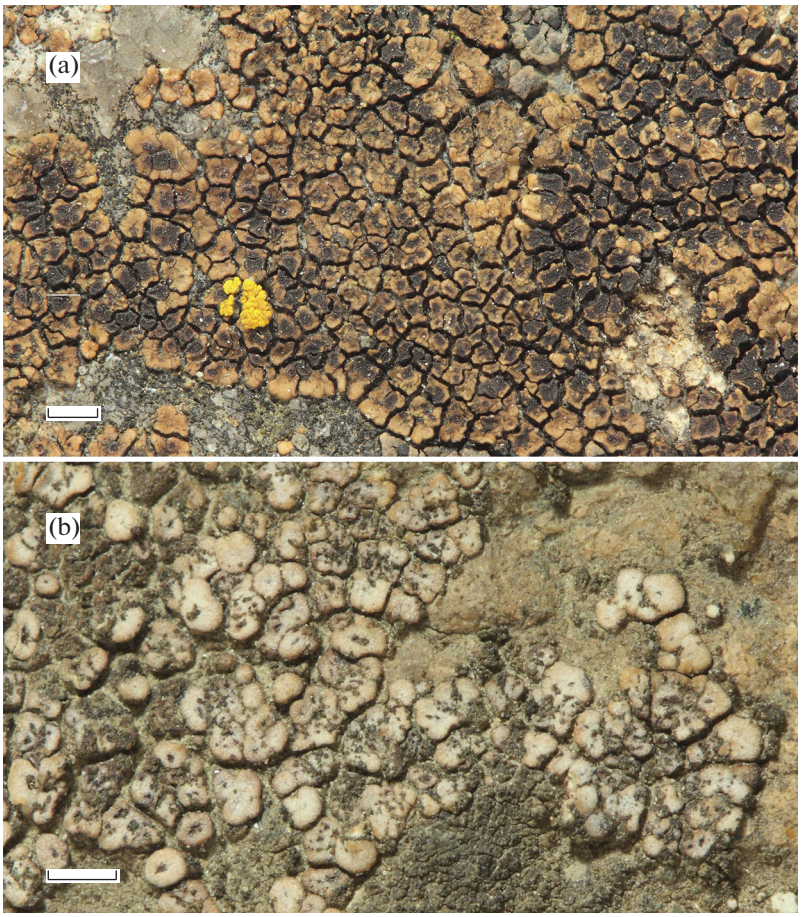

Fig. 3. Morphology of well-developed typical specimens of *Acarospora fuscata* (a) and *A. umbilicata* (b) in Belarus. Scale = 1 mm.

late crust that can easily be mistaken for a member of the *A. atrata* group except for its production of gyrophoric acid. It is also possible that some of the phenotypic variability is caused by hybridization or at this evolutionary moment *A. fuscata* is in the slow millennial process of speciation into new taxa. W. Weber promulgated a broad concept of *A. fuscata* in his numerous and influential annotations of herbarium specimens which was responsible for brown C+ red *Acarospora* taxa from around the world being identified as *A. fuscata*. His identifications were based on the same discredited taxonomic theory as his treatment of yellow *Acarospora* in which 83 described yellow species were synonymized with either *Acarospora schleicheri* (Ach.) A. Massal. or *A. chlorophana* (Wahlenb.) A. Massal. based on the principal of environmental modification of two super species (Weber, 1968). Only recently a modern conserved type of *A. fuscata* was designated, and a detailed description of this material was made as well as nrITS and mtSSU sequences were published (Arcadia et al., 2015; Knudsen et al., 2019b).

Despite the species revealing a wide range of phenotypic variability in Eurasia, most of the material examined from Belarus easily fits the description of the conserved type from West Bohemia in central Europe (Fig. 3a) (Knudsen et al., 2019b). The typical specimens are characterized by epruinose areoles which are broadly attached to the substrate (Fig. 4a, c), and by containing gyrophoric acid (C/KC+ reddish cortex reaction in microscopic section). However, some specimens of *A. fuscata* can become pruinose from flooding and evaporation therefore attention is needed during the identification (Knudsen, 2021). While all Belarusian collections were epruinose, a few vouchers were distinctly lobulate with free edges, and therefore they were hardly distinguishable from poorly pruinose morphotypes of *A. umbilicata* that were not squamulose or subsquamulose.

Notes. The studied specimens of *Acarospora fuscata* also included material previously identified as "*Acarospora peliscypha*", a current synonym of *Acarospora squamulosa* (Schrad.) Trevis. (Knudsen et al., 2019a). The latter species also contains gyrophoric acid in the cortex and is a Holarctic species that can occur at a variety of elevations. At low elevations in central Europe it can form areolate thalli with smaller apothecia and this form could occur in Belarus. *Acarospora squamulosa* differs from *A. fuscata* especially in having large

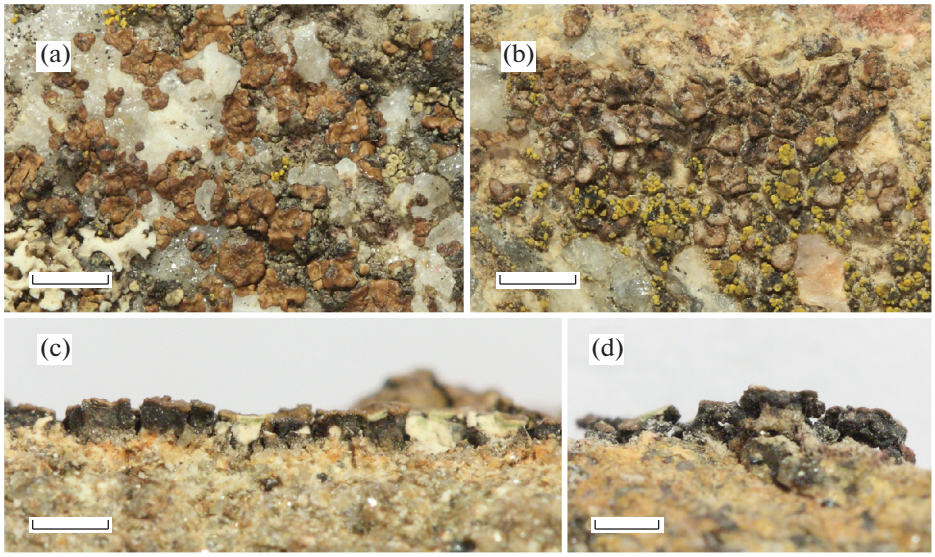

Fig. 4. Differences in growth morphology between *Acarospora fuscata* and *A. umbilicata*. *A. fuscata*: young thalli formed by adnate areoles (a); mature areoles broadly attached to the substrate (c). *A. umbilicata*: young areoles already have ascending margins (b); mature areoles with a distinct umbilicus (d). Scale = 1 mm.

apothecia up to 1 mm wide with a rugulose disc with a wider parathecium expanding up to 60 μm vs. a parathecium 10–20 μm wide. It is possible it could be discovered in Belarus.

Specimens examined: BELARUS, Brest region, Kamenets district, Belovezhskaja Puscha National Park, 0.3 km SE Kamenjuki village, 52°33'N, 23°47'E, on granite stone, 14.06.1984, V. Golubkov (MSK, GSU, hb. K et K); same place, 12.06.1985, V. Golubkov (MSK, GSU, hb. K et K); **Gomel region,** Lelchitsy district, 11 km of Glushkovichi village, "Kamenye" tract, on granite, 07.10.1960, N.V. Gorbach, I.N. Koneva (MSK, GSU, hb. K et K); **Grodno region,** Grodno district, 5 km SW of the city of Grodno, 5th fort of the Grodno fortress, 53°35'N, 23°44'E, on granite stone, V. Golubkov (MSK, GSU, hb. K et K); close to Kvasovka village, 53°30'N, 23°59'E, on syenite stone, Rogovsky (GSU, hb K et K); the city of Grodno, close to JSC "Belcard", 53°39'N, 23°50'E, on syenite stone, Rogovsky (GSU, hb K et K); Shchuchin district, close to Pugachi village, 53°79'N, 24°61'E, on granite stone, 17.09.1999, V. Golubkov (MSK, GSU, hb K et K); Smorgon district, 1.5 km N of Balobany village, 54°16'N, 26°16'E, hills among the spruce plantations, on granite boulder, 16.06.1985, V. Golubkov (MSK, GSU, hb. K et K); Svisloch district, 1 km S of Porozovo village, 52°55'N, 24°22'E, Ros' river terrace, on granite stone, 11.06.1983, V. Golubkov (MSK, GSU, hb. K et K); Voronovo district, 3 km E of Bastuny village, 54°04'N, 25°20'E, on granite boulder, 14.06.1989, V. Golubkov (MSK, GSU, hb K et K); **Minsk region,** Borisov district, close to Malyshki village, 54°04'N, 28°43'E, edge of a pine forest to the right of the Berezino-Borisov highway, on stone, 28.06.1991, V. Golubkov (MSK, GSU, hb K et K); Krupki district, 1 km S of Lutyye village, 54°28'N, 29°16'E, on granite boulder, 15.09.1995, V. Golubkov (MSK, GSU, hb K et K); Logoisk district, 1 km S of Shvaby village, 54°15'N, 28°09'E, on granite boulder, 04.07.1987 V. Golubkov (MSK, GSU, hb K et K); 1.5 km NE of Shvaby village, 54°17'N, 28°10'E, on granite boulder, 02.07.1987 V. Golubkov (MSK, GSU, hb K et K); Miadzel district, Narochansky National Park, on boulder, 28.08.2005, A.P. Yatsyna, (MSKU-2288, GSU, hb K et K); 0.8 km S of Yatsyny village, 54°58'N, 27°15'E, on granite stone by the road, 23.06.1990, V. Golubkov (MSK, GSU, hb K et K); close to Nekasetsk village, 54°53'N, 27°00'E, on granite stone, 10.06.1986, V. Golubkov (MSK, GSU, hb K et K); Vileika district, close to Andolovshchina village, 54°35'N, 27°15'E, on granite stone, 04.07.1983, V. Golubkov (MSK, GSU, hb K et K); Volozhyn district, close to Zabrezye village, 0.5 km along the southern slope near the Minsk-Oshmyany road, 54°10'N, 26°27'E, meadow, on granite stone, 18.09.1988, V. Golubkov (MSK, GSU, hb K et K); **Vitebsk region,** Beshenkovichi district, 0.1 km SW of Komoski village, 55°02'N, 29°22'E, on stone, 23.06.1991, V. Golubkov (MSK, hb K et K); 2 km NNW of Rubezh village, 55°00'N, 29°35'E, field by the road, on boulder, 24.04.1991, V. Golubkov (MSK, hb K et K); Braslav district, close to Braslav town, on granite, 1956, N.V. Gorbach (MSK, GSU, hb K et K); Chashniki district, 0.8 km S of Dobromysli village, 54°42'N, 28°53'E, on granite stone, 23.04.1991, V. Golubkov (MSK, GSU, hb K et K); Glubokoye district, E bank of Dolgoje lake, 55°12'N, 28°12'E, on granite, 13.07.1985, V. Golubkov (MSK, GSU, hb K et K); 1.5 km E of Plisa village, 55°13'N, 27°58'E, on granite boulder by the road, 16.06.1990, V. Golubkov

(MSK, GSU, hb K et K); close to Proshkovo village, 55°13'N, 28°03'E, on granite stone, 15.06.1990, V. Golubkov (MSK, hb K et K); Lepel district, Berezinsky Biosphere Reserve, Domzheritsy village, 54°44'N, 28°19'E, on granite boulder, 02.09.2006, P. Bely (MSKH-6553, MSKH-6557, GSU, hb K et K); Polotsk district, 1.5 km NW of Bikulnichi village, 55°16'N, 28°45'E, on granite boulder, 29.08.1989, V. Golubkov (MSK, GSU, hb K et K); 4 km SE of Gritskovshchina village, 55°20'N, 28°38'E, edge of a bushy forest, on granite boulder in a field, 08.08.1997, V. Golubkov (MSK, GSU, hb K et K); Ushachi district, 0.5 N of Verkudy village, shore of Verkudy lake, 55°12'N, 28°54'E, on granite stone, 08.06.1990, V. Golubkov (MSK, GSU, hb K et K).

Acarospora umbilicata Bagl. Mém. R. Accad. Sci. Torino, Ser. 2 **17**: 397 (1857) TYPE: ITALY, vive sopra un antico muron el villageo Creveri presso Voltri (holotype, n..v.)

Description. Hypothallus endosubstratal. Thallus up to 5 cm wide, forming either a continuous crust or dispersed, usually ca. 0.3 mm wide areoles, broadly attached to substrate, eventually widening to up to 1.5 mm, becoming more loosely attached to the substrate, becoming subsquamulose and lobulate with a broad mycelial base (gomphate) or squamulose with a stipe half or less of the diameter of the upper surface. Upper surface white and densely pruinose or partially pruinose, lower surface pale to brown, sometimes darkened by substrate interactions, cortex a pale yellow-brown and not castaneous as in *Acarospora fuscata* in all Belarusian specimens. Epicortex layer very thin to absent. Cortex 25–50 μm thick, upper layer a light brown, vertical hyphae to 2 μm becoming disarticulated into cells irregular in shape 2–5 μm wide. Algal layer 60–100 μm wide, not dense, occasional interrupted by hyphal bundles ca. 10 μm wide, thin below hymenium, algal cells mostly 8–10 μm wide. Medulla usually 100 μm thick, not obscure of thin-walled hyphae 2–4 μm, occasionally forming round cells. Lower cortex distinctly brown ca. 10 μm thick. Areoles or squamules infertile or with 1–9 punctiform reddish-brown epruinose apothecia usually less than 0.5 mm wide. Parathecium expanding up to 20 μm, around the apothecial disc, partially merging with cortex, not forming a parathecial crown. IKI-, hyphae 1 μm. Hymenium 100–130 μm high, epihymenium ca. 10 μm high, reddish-brown, paraphyses 1.0–1.5 μm, apices not expanded, hymenial gel IKI+ red (hemiamyloid). Asci 60–100 × 10–16 μm, ascospores 4–5 × 1.5 μm. Subhymenium 30–50 μm high IKI+ blue (euamyloid). Hypothecium ca. 10 μm tall. Pycnidia not observed.

Secondary metabolite: gyrophoric acid in cortex, C+, KC+ pinkish red in thin section.

Sequences available in GenBank: nrITS (OK14255) and mtSSU (OK032140).

Distribution and ecology. *Acarospora umbilicata* has been reported from Europe (Magnusson, 1929; Golubkova, 1988), Asia (Yazıcı et al., 2020; Sohrabi, Rico, 2021), Northern Africa (Magnusson, 1929; Egea, 1996; Amrani et al., 2018) and the Azores (Berger, Aptroot, 2002). Some reports of *A. umbilicata* in the literature are no doubt *A. fuscata*. The confusion is based on not recognizing the difference between squamulose and areolate thalli. Both species are areolate-squamulose based on their life form (Tsurykau, 2020). Morphologically, *A. umbilicata* is usually squamulose with lobulate margin units while *A. fuscata* is usually areolate with fissured unit margins. Unfortunately, in poor microhabitats *A. umbilicata* does not become squamulose or lobulate, for instance on uneven rock or in partial daily shade (Knudsen et al., 2021a). Younger specimens of *A. umbilicata* begin areolate too. Of course, young or poor specimens will always be a problem for identification. Unfortunately, also the anatomical measurements of both species are similar and minor differences are not diagnostic.

In Europe, *Acarospora umbilicata* occurs at lower elevations on siliceous rock and mica-schist and has mainly a Mediterranean-Atlantic distribution, being rarely reported from Central European countries, e.g. Austria, Germany, Czech Republic and Poland (Magnusson, 1929, 1935; Popiel, Szczepańska, 2014; Knudsen, 2021). P.L. Nimis reports it growing on anthropogenic substrates such as statues in Italy (Nimis, 2015) but all Belarusian reports are on granite. The seven Belarusian findings significantly extend the known range of *Acarospora umbilicata* to eastern Europe (Fig. 1b). In Russia, the species has not been reported from the European part of Eurasia, being known only from Southern Siberia (Golubkova, 1988; Urbanavichus, 2010). Obviously, it is expected to occur at least in Russia near the Belarus administrative regions.

Discussion. In Belarus, the typical specimens of this species can be easily identified by lobulate squamules with a white pruinose yellow-brown surface (Fig. 3b) and by C/KC+ reddish cortex reaction in microscopic section due to the production of gyrophoric acid. If not squamulose, epruinose or partially or thinly pruinose vouchers can be mistaken for *A. fuscata*. Such material of *A. umbilicata* can be distinguished by some thallus units being attached on a wide mycelial base (gomphate) or being stipitate, loosely attached to substrate, and by the paler yellow-brown color (Fig. 4b, d) and lack of any melanization of the lower surface. Young non-lobulate areoles of *A. umbilicata* with partial pruina are misidentified sometimes as *A. versicolor* Bagl. et Carestia, a species which produces no secondary metabolites, and often occurs on siliceous rock (Magnusson, 1929; Knudsen et al., 2021a).

The species is in need of sampling with molecular methods across its whole range. It is quite possible there is another taxon with an areolate thallus. But one must give credit to Magnusson who did an excellent morphological and anatomical study of the species

(Magnusson, 1929). The above description based on Belarus specimens is congruent with Magnusson's description. During this research we have generated sequences of *A. umbilicata* from Belarus. In a phylogenetic tree of the family Acarosporaceae *A. umbilicata* not closely related to *A. fuscata* (Knudsen et al., in press), but in a clade with *A. admissa* (Nyl.) Kullh., *A. intermedia* H. Magn., and *A. fusca* H. Magn., all sympatric species in Belarus (Knudsen, Kocourková, 2020).

Notes. E.O. Yurchenko (2011) reported *Acarospora nitrophila* H. Magn. new to Belarus based on two old specimens stored in MSK herbarium. Later, the presence of *A. nitrophila* in Belarus, a rare species known with certainty only from Norway and Sweden (Knudsen, Kocourková, 2017), was doubted by A. Tsurykau (2018). The species was temporarily excluded from Belarusian lichen checklist as a report waiting for critical revision. During this study, we re-identified all specimens of *A. nitrophila* mentioned by Yurchenko (2011) as belonging to *A. umbilicata*. *Acarospora nitrophila* will be excluded from the next edition of checklist of the lichens of Belarus as erroneous report.

We followed a protocol for testing hymenial gel with Lugol's (Knudsen, Kocourková, 2018). We keep Lugol's in lab in dark when not in use and change Lugol's in dropper bottles every 30 days. We noticed that *A. umbilicata* is persistently a light blue in squash preparations to dark blue in thick sections in old Lugol's, which could lead to misidentifications. *Acarospora fuscata* is always light blue in squash preparations when Lugol's is old.

Specimens examined: BELARUS. Grodno region, Volkovyssk district, 1 km NW of Druzhnaja village, 53°04'N, 24°24'E, on a side of Volkovyssk-Porozovo road, on granite, 11.06.1989, V. Golubkov (MSK, GSU, hb. K et K); **Minsk region,** Stolbtsy district, 5.5 km S of Rubezhevichi village, 53°38'N, 26°51'E, on granite, 05.05.1989, V. Golubkov (MSK, GSU, hb. K et K); **Vitebsk region,** Chashniki district, 0.3 km SW of Gogolevka village, 54°41'N, 28°56'E, on granite, 23.04.1991, V. Golubkov (MSK, GSU, hb. K et K), Dokshytsy district, 0.3 km N of Zavlichie village, 55°00'N, 27°25'E, on granite, 23.06.1990, V. Golubkov (MSK, GSU, hb. K et K); Glubokoje district, 1.5 km E of Plisa village, 55°12'N, 27°59'E, on granite stones at a roadside, 14.06.1990, V. Golubkov (MSK, hb. K et K); same place, 19.09.2015, P. Bely (MSKH-6558, GSU, hb. K et K); close to Derkovschina village, 55°03'N, 27°33'E, on granite stones, 25.06.1990, V. Golubkov (MSK, GSU, hb. K et K).

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ACAROSPORA FUSCATA И *A. UMBILICATA* (ACAROSPORACEAE, ASCOMYCOTA) В БЕЛАРУСИ

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В статье представлены результаты ревизии белорусских гербарных образцов лишайников рода *Acarospora*, содержащих гирофоровую кислоту. Выявлено два вида этого рода, *A. fuscata* и *A. umbilicata*. В работе обсуждаются морфологические и анатомические признаки обоих видов, а также их распространение. Проведенная ревизия существенно расширила представления об ареале *Acarospora umbilicata* в Восточной Европе. Для этого вида были получены последовательности фрагментов генов nrITS и mtSSU, доступные в настоящее время в GenBank для последующих филогенетических исследований. Исходя из доступных 1081 названия видов и внутривидовых таксонов, по нашей оценке, мировое разнообразие рода *Acarospora* составляет 307 видов.

Ключевые слова: биоразнообразие, лишайник, распространение