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AGRESTIA ZEROVII (MEGASPORACEAE, LICHEN-FORMING ASCOMYCETES), A NEW SPECIES FROM SOUTHEASTERN EUROPE PROVED BY ALTERNATIVE PHYLOGENETIC ANALYSIS

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Abstract: *Agrestia zerovii* is described, illustrated, and compared here with closely related taxa. It is a member of the *A. hispida* complex of the steppe zone of Ukraine, southeastern Europe, and differs from *A. hispida* s. str. in having much thicker main thalline lobes, in forming thick "horizontal crust", and in the lack of black tips of secondary branchlets. The position of the newly described *A. zerovii* in the alternative combined phylogenetic tree of the Megasporaceae with all members for which reliable data on the nrITS, nrLSU, and mtSSU sequences are hitherto available is discussed. Four new robust branches and their taxonomic diversity are discussed, i.e.: the *Agrestia*, the *Chlorangium*, the *Sphaerothallia* s. str., and the "*Circinaria*" *lacunosa* clades being in separate position from the *Circinaria* s. str. clade (additionally to five genera of the Megasporaceae, i.e. *Aspicilia*, *Circinaria*, *Lobothallia*, *Megaspora* and *Sagedia* accepted by previous authors). The genera *Agrestia*, *Chlorangium*, and *Sphaerothallia*, proposed to be resurrected, and a number of aspicilioid lichens the status of which are in need of revision are discussed. Five new combinations for the species of the genus *Chlorangium* (*C. alpicola*, *C. aschabadense*, *C. asperum*, *C. gyrosum*, and *C. sphaerothallinum*) are proposed.

Key words: *Agrestia*, alternative combined phylogenetic analysis, *Chlorangium*, ITS and LSU nrDNA, 12S SSU mtDNA, sequences

INTRODUCTION

The most comprehensive treatment of the vagrant members of the genus *Aspicilia* to date was published by Oxner (1971), with some additional information by Andreeva (1987) and Sohrabi *et al.* (2013*a*) (in the latter treated as members of the genus *Circinaria*). Vagrant *Aspicilia* species are mainly known

from arid regions in Eurasia and North Africa. They are often collectively referred to as "manna lichens" (cf. the biblical Book of Exodus 16; see Donkin 1980, 1981). Some of the vagrant species were included in identification keys by Szatala (1957) and Poelt (1969). Nomenclatural problems involved in this group were recently discussed by Sohrabi and Ahti (2010), who also summarised the history of the group and listed the most important publications.

After Nordin *et al.* (2010) and Owe-Larsson *et al.* (2011) two "manna lichens", viz. *Circinaria emiliae* (Tomin) A. Nordin, S. Savič et Tibell and *C. hispida* (Mereschk.) A. Nordin, S. Savič et Tibell were segregated from the genus *Aspicilia* into the genus *Circinaria* for the first time. These authors recently revised the phylogeny of the Megasporaceae using a combined data set of nrLSU and mtSSU, and accepted the division of the Megasporaceae into the following five genera, i.e.: *Aspicilia* A. Massal., *Circinaria* Link, *Lobothallia* (Clauzade et Cl. Roux) Hafellner, *Megaspora* (Clauzade et Cl. Roux) Hafellner et V. Wirth, and *Sagedia* Ach. Taxonomy and molecular phylogeny of the "manna lichens" have considerable developed in the last years (Sohrabi *et al.* 2011*b*, 2013*a*).

Status of *Circinaria hispida* s. str. was outlined by Sohrabi *et al.* (2011*b*, 2013*a*) using the same combined data set of nrLSU and mtSSU, and separate nrITS analysis. From the data of these authors *Circinaria hispida* s. str., a vagrant morphotype sensu Mereschkowsky (1911), is characterised by subfruticose, tiny, bushy, more or less *Cladonia*-like thallus with narrow cylindrical branches, with black apices at the tip of the branchlets, and scattered whitish pseudocyphellae along the branches. It grows initially on soil and later becomes vagrant. Therefore, it is classified as erratic. *Circinaria hispida* s. str. has never been reported in fertile condition in Eurasia. So far, its fertile specimens have been reported from North America (Brodo 1976, Sohrabi *et al.* 2011*b*, Thomson 1961). In the nrITS analysis, *C. hispida* is grouped with a few Eurasian saxicolous specimens that are fertile. Therefore, the saxicolous specimens with crustose morphotype were accepted as *C. hispida* s. l. in contrast to the vagrant morphotypes as *C. hispida* s. str. (Sohrabi *et al.* 2013*a*). We follow similar terminology in this paper, too.

Ukrainian specimens previously recorded as *Agrestia hispida* (see Oxner 2010, Kondratyuk *et al.* 2014*c*) were found to be different from *A. hispida* s. str. based on molecular and morphological data, i.e.: different in having distinctly swollen basal portions of the lobes (main lobes), often forming "horizontal crust", as well as in the lack of black tips of the branchlets. Furthermore, Ukrainian specimens were shown to be different when applying phylogenetic analysis based on nuclear and mitochondrial DNA sequences (Kondratyuk *et al.* 2014*c*, and see below).

The aim of this paper is to provide legal description of a new taxon named here as *Agrestia zerovii* as well as to discuss its position in the phylogenetic tree

of the Megasporaceae based on ITS1/ITS2 nrDNA, LSU nrDNA and 12S SSU mtDNA sequences. *Chlorangium asperum*, which was assumed to be an appropriate name for the species described below as *Agrestia zerovii* at the beginning of this study, was included into the phylogenetic analysis, too. Status of the genera *Agrestia*, *Chlorangium*, *Sphaerothallia*, and the "*Circinaria*" *lacunosa* group are briefly discussed below.

MATERIAL AND METHODS

Material was collected during several field trips to Kharkiv oblast, Ukraine in 2012 and 2013, while the locality of the new species (as *Agrestia hispida*) has been known since the 1940s (Oxner 2010).

Extracting DNA, sequencing and phylogenetic analysis (alignment with Clustal and manual steps, and MP, ME and ML phylogenetic methods) were done as described in our previous papers (Kondratyuk *et al.* 2013, 2014*a*, *c*, 2015).

List of specimens included in the phylogenetic analysis along with their GenBank accession numbers are provided in Table 1 (a few specimens were not included in the final phylogenetic tree, Fig. 1).

The alternative combined phylogenetic analysis based on nrITS, nrLSU and mtSSU data sets, similarly as it was done in the Teloschistaceae (see Kondratyuk *et al.* 2013, 2014*a*, *b*, 2015) was used within this study.

RESULTS

It should be emphasised that a topology of the phylogenetic tree of the Megasporaceae obtained in the results of our analysis is different from the trees of previous authors. Four more robust clades, i.e. the *Agrestia*, the *Chlorangium*, the *Sphaerothallia*, and the "*Circinaria*" *lacunosa* group were resulted additionally to the five genera accepted by Nordin *et al.* (2010), Owe-Larsson *et al.* (2011) and Sohrabi *et al.* (2013*a*) within the Megasporaceae. The genera *Agrestia* J. W. Thomson, *Chlorangium* Link, and *Sphaerothallia* Nees ex Eversm., are resurrected within this study (see below).

Separate analyses

The ITS analysis included 74 sequences of 38 species and a total of 633 positions of which 441 were informative. The LSU analysis included 57 sequences representing 31 species and a total of 787 positions of which 206 were informative, whereas the 12S mtSSU analysis included 71 sequences of 33 species and a total of 826 positions of which 354 were informative.

Table 1. Material used in this study. Vouchers, their geographical origin, and herbaria where vouchers are deposited are also listed. GenBank accession numbers of the newly obtained sequences are in boldface.

Taxon name	Country, voucher, reference	ITS	LSU	12S SSU mtDNA
Agrestia hispida s. l.	USA, Sohrabi *et al.* (2011*a*)	HQ171234		
Agrestia hispida s. str.	Iran, Sohrabi *et al.* (2011*b*)	HQ389197		
Agrestia hispida s. str.	USA, Sohrabi *et al.* (2011*b*)	HQ389198		
Agrestia hispida s. str.	Iran, Golestan, Sohrabi 15099 (hb. M. Sohrabi), Sohrabi *et al.* (2011*a*)	HQ171233		
Agrestia hispida s. str.	Iran, Golestan, Sohrabi 15099 (hb. M. Sohrabi), Sohrabi *et al.* (2013*a*)		JQ797503	JQ797488
Agrestia hispida s. str.	Russia, Kalmyk, Sohrabi *et al.* (2011*a*)	HQ171235		
Agrestia hispida s. str.	Turkey, Candan 11 (ANES), Nordin *et al.* (2010)		HM060760	HM060722
Agrestia hispida s. str.	Turkey, Candan 11 (ANES), Owe-Larsson *et al.* (2011), Sohrabi *et al.* (2013*a* as *Circinaria hispida* s. str.)	HQ406806		
Agrestia hispida s. str.	Spain, Lumbsch, 2.06.2003 (F), Schmitt *et al.* (2006)		DQ780305	DQ780273
Agrestia zerovii	**SK A12,** Ukraine, Kharkiv oblast, Dvorychansky district, "Korobchyno" zakaznik, 19.06.2013, M. Kryvokhyzhaya (KW-L), **this paper**	**KT456205**	**KT456208**	
Agrestia zerovii	SK A12, Ukraine, Kharkiv oblast, Dvorychansky district, "Korobchyno" zakaznik, 19.06.2013, M. Kryvokhyzhaya (KW-L), Kondratyuk *et al.* (2014*c* as *Circinaria hispida*)			KP059052
Agrestia zerovii	**SK A15,** Ukraine, Kharkiv oblast, Dvorychansky district, "Korobchyno" zakaznik, 19.06.2013, M. Kryvokhyzhaya 2 (KW-L), **this paper**	**KT456206**	**KT456209**	
Agrestia zerovii	SK A15, Ukraine, Kharkiv oblast, Dvorychansky district, "Korobchyno" zakaznik, 19.06.2013, M. Kryvokhyzhaya 2 (KW-L), Kondratyuk *et al.* (2014*c* as *Circinaria hispida*)			KP059053

Table 1. (cont.).

Taxon name	Country, voucher, reference	ITS	LSU	12S SSU mtDNA
Aspicilia caesiocinerea	AFTOL-ID 653, Miadłikowska *et al.* (2006)			DQ986892
Aspicilia caesiocinerea	Sweden, Nordin *et al.* (2007)	EU057897		
Aspicilia caesiocinerea	UK: Wales, Orange 17594 (NMW) (unpubl.)	FJ532372		
Aspicilia cinerea	AFTOL-ID 647, Schmull *et al.* (2011)	HQ650637		
Aspicilia cinerea	AFTOL-ID 647, Miadłikowska *et al.* (2006)		DQ986779	DQ986890
Aspicilia cinerea	Sweden, Dalarna, Hermansson 13275 (UPS), Nordin *et al.* (2007)	EU057899	HM060733	HM060695
Aspicilia cinerea	France, Roux 25015 (MARSSJ), Roux *et al.* (2011)	JF710311		
Aspicilia epiglypta	Sweden, Nordin 6303 (UPS), Nordin *et al.* (2007)	EU057907		
Aspicilia epiglypta	Sweden, Nordin 6303 (UPS), Nordin *et al.* (2010)		HM060756	HM060718
Aspicilia laevata	Sweden, Tibell 23659 (UPS), Nordin *et al.* (2007)	EU057910		
Aspicilia laevata	Sweden, Tibell 23659 (UPS), Nordin *et al.* (2010)		HM060730	HM060692
Circinaria affinis	Russia: Astrakhan Region, Kulakov 1408B (M), Sohrabi *et al.* (2011*b*)	HQ389196		
Circinaria affinis	Russia: Astrakhan Region, Kulakov 1408B (M), Sohrabi *et al.* (2013*a*)		JQ797502	JQ797492
Circinaria calcarea	Sweden, Öland, Nordin 5888 (UPS), Nordin *et al.* (2007)	EU057898		
Circinaria calcarea	Sweden, Öland, Nordin 5888 (UPS), Nordin *et al.* (2010)		HM060743	HM060705
Circinaria calcarea	Sweden, Owe-Larsson *et al.* (2011)	HQ406804		
Circinaria calcarea	Sweden, Wedin 6500 (UPS), Wedin *et al.* (2005)			AY853310
Circinaria calcarea	Austria(?), Wilfling (GZU), Ivanova and Hafellner (2002)	AF332109		
Circinaria calcarea	AFTOL-ID 1358, Miadłikowska *et al.* (2006)			DQ986876

Table 1. (cont.).

Taxon name	Country, voucher, reference	ITS	LSU	12S SSU mtDNA
Circinaria cerebroides	Kyrgyzstan, Innerer Tian-Shan, Ringel 5138(H), Sohrabi *et al.* (2013*a*)	JQ797534	JQ797506	JQ797484
Circinaria contorta	Austria (GZU), Ivanova and Hafellner (2002)	AF332108		
Circinaria desertorum	USA, Nordin *et al.* (2007)	EU057905		
Circinaria desertorum	Russia, Owe-Larsson *et al.* (2011)	HQ406802		
Circinaria desertorum	Russia, Nordin *et al.* (2010)			HM060689
Circinaria digitata	Kyrgyzstan, Sohrabi *et al.* (2011*a*)	HQ171230		
Circinaria digitata	Kyrgyzstan, Sohrabi *et al.* (2011*a*)	HQ171236		
Circinaria elmorei	Russia, Owe-Larsson 9814 (UPS), Nordin *et al.* (2010)	HQ406802	HM060727	HM060689
Circinaria cf. *elmorei*	Ukraine: Crimea, Sohrabi *et al.* (2013*a*)	JQ797551		
Circinaria cf. *elmorei*	Iran, Sohrabi *et al.* (2013*a*)	JQ797542		
Circinaria cf. *elmorei*	Iran, Sohrabi *et al.* (2013*a*)	JQ797526		
Circinaria cf. *elmorei*	Iran, Sohrabi *et al.* (2013*a*)	JQ797558		
Circinaria emiliae	Kazakhstan, Atyrau, Kulakov 3702 (UPS), Sohrabi *et al.* (2013*a*)	JQ797512		
Circinaria emiliae	Kazakhstan, Atyrau, Kulakov 3702 (UPS), Nordin *et al.* (2010)		HM060728	HM060690
Circinaria emiliae	Kazakhstan, Atyrau, Kulakov 3702B (UPS), Sohrabi *et al.* (2013*a*)	JQ797513		
Circinaria emiliae	Kazakhstan, Atyrau, Kulakov 3798 (UPS), Nordin *et al.* (2010)		HM060729	HM060691
Circinaria fruticulosa	Ukraine: Crimea, Sohrabi *et al.* (2013*a*)	JQ797555		
Circinaria fruticulosa	Turkey, Sohrabi *et al.* (2013*a*)	JQ797535		
Circinaria fruticulosa	Kazakhstan, Tarbagatai, Lange 5186 (H), Sohrabi *et al.* (2013*b*)	HQ171228	JQ797505	JQ797486
Circinaria gibbosa	Sweden, Uppland, Nordin 5878 (UPS), Nordin *et al.* (2007)	EU057908		
Circinaria gibbosa	Sweden, Uppland, Nordin 5878 (UPS), Nordin *et al.* (2010)		HM060740	HM060702

Table 1. (cont.).

Taxon name	Country, voucher, reference	ITS	LSU	12S SSU mtDNA
Circinaria jussuffii	Morocco, Sohrabi *et al.* (2013*a*)	JQ797521		
Circinaria jussuffii	Algeria, Esnault 2033 (GZU), Sohrabi *et al.* (2013*a*)	JQ797518	JQ797495	JQ797489
Circinaria lacunosa	Kazakhstan, Sohrabi *et al.* (2013*a*)	JQ797520		
Circinaria lacunosa	China, Xinjiang, Abbas 940003 (H), Sohrabi *et al.* (2013*a*)	JQ797517	JQ797494	JQ797490
Circinaria leprosescens	Sweden, Uppland, Nordin 5906 (UPS), Nordin *et al.* (2007)	EU057911		
Circinaria leprosescens	Sweden, Uppland, Nordin 5906 (UPS), Nordin *et al.* (2010)		HM060749	HM060711
Circinaria rogeri	USA, Sohrabi *et al.* (2011*a*)	HQ171231		
Circinaria rogeri	USA, Sohrabi *et al.* (2011*a*)	HQ171232		
Circinaria rostamii	Iran, East Azerbaijan, Sohrabi 10212 (IRAN), Sohrabi *et al.* (2013*a*)	JQ797538	JQ797507	JQ797491
Chlorangium alpicola	Kyrgyzstan, Sohrabi *et al.* (2013*a*)	JQ797556		
Chlorangium alpicola	Kyrgyzstan, Sohrabi *et al.* (2013*a*)	JQ797552		
Chlorangium alpicola	Kyrgyzstan, Sohrabi *et al.* (2013*a*)	JQ797524		
Chlorangium alpicola	Kyrgyzstan, Ringel 5241, Sohrabi *et al.* (2013*a*)	JQ797554		
Chlorangium aschabadense	Turkmenistan, Sohrabi *et al.* (2013*a*)	JQ797519		
Chlorangium aschabadense	Turkmenistan, Sohrabi *et al.* (2010*a*)	GU289916		
Chlorangium cf. *asperum*	Russia, Astrakhan region, Sohrabi *et al.* (2013*a*)	JQ797531		
Chlorangium gyrosum	Spain, Sohrabi *et al.* (unpubl.)	JX306734		
Chlorangium gyrosum	Iran, Sohrabi *et al.* (2013*a*)	NR_120106		
Chlorangium gyrosum	Iran, East Azerbaijan, Sohrabi 10085 (hb. M. Sohrabi), Sohrabi *et al.* (2013*a*)	JQ797540	JQ797504	
Chlorangium gyrosum	Iran, Sohrabi *et al.* (2013*a*)	JQ797539		
Chlorangium gyrosum	Spain, Sohrabi *et al.* (2013*a*)	JQ797557		
Chlorangium gyrosum	Iran, East Azerbaijan, Sohrabi 10401A (hb. M. Sohrabi), Sohrabi *et al.* (2013*a*)	JQ797528		JQ797487

Table 1. (cont.).

Taxon name	Country, voucher, reference	ITS	LSU	12S SSU mtDNA
Chlorangium sphaerothallinum	Iran, Semnan, Sohrabi 9369 (hb. M. Sohrabi), Sohrabi *et al.* (2013*a*)	JQ797545	JQ797508	JQ797476
Chlorangium sphaerothallinum	Iran, Sohrabi *et al.* (2013*a*)	JQ797537		
Chlorangium sphaerothallinum	Iran, Sohrabi *et al.* (2013*a*)	JQ797536		
Chlorangium sphaerothallinum	Iran, Sohrabi *et al.* (2013*a*)	JQ797543		
Chlorangium sphaerothallinum	Armenia, Sohrabi *et al.* (2013*a*)	JQ797525		
Lobothallia alphoplaca	USA, Leavitt 447 (BRY), Sohrabi *et al.* (2013*b*)	JX306737		
Lobothallia alphoplaca	USA, Sohrabi *et al.* (2013*b*)	JX306738		
Lobothallia alphoplaca	USA, Sohrabi *et al.* (2013*b*)	JX306739		
Lobothallia alphoplaca	China, SDNU 20117646, Kou *et al.* (2013)	JX476025		
Lobothallia alphoplaca	**SK A20, Ukraine,** Donetzk oblast, "Kamjani Mogyly" zapovidnyk, near the stream, 131 m alt, 13.05.2011, Nadeina *et al.* [ex KW-L 68283]**, this paper**	**KT456207**	**KT456210**	**KT456211**
Lobothallia melanaspis	Norway, Valadbeigi *et al.* (2011)	JF825524		
Lobothallia melanaspis	Sweden, Jämtland, Nordin 6622 (UPS), Nordin *et al.* (2011)	HQ259272		
Lobothallia melanaspis	Sweden, Jämtland, Nordin 6622 (UPS), Nordin *et al.* (2010)		HM060726	HM060688
Lobothallia radiosa	Sweden, Roux *et al.* (2011)	JF703124		
Lobothallia radiosa	Switzerland, Schmitt *et al.* (2006)		DQ780306	DQ780274
Lobothallia recedens	Sweden, Dalarna, Nordin 6582 (UPS), Nordin *et al.* (2010)		HM060762	HM060724
Megaspora verrucosa	Austria, 1996, Trinkaus (GZU), Ivanova and Hafellner (2002)	AF332121		
Megaspora verrucosa	Austria(?), Hafellner 48544 & Ivanova (GZU), Ivanova and Hafellner (2002)	AF332122		
Megaspora verrucosa	USA, Sohrabi *et al.* (2013*b*)	KC667053		
Megaspora verrucosa	Sweden, Jämtland, Nordin 6495 (UPS), Nordin *et al.* (2010)		HM060725	HM060687

Table 1. (cont.).

Taxon name	Country, voucher, reference	ITS	LSU	12S SSU mtDNA
Megaspora verrucosa	Iran, East Azerbaijan, Sipman 55434 (B), Sohrabi *et al.* (2013*a*)		JQ797498	JQ797483
Megaspora verrucosa	Turkey, Prov. Çorum, Kinalioglu 1679 (B), Sohrabi *et al.* (2013*a*)		JQ797497	JQ797482
Oxneria alfredi	FNM 152, Russia, Fedorenko *et al.* (2009)	EU681344		EU680932
Oxneria huculica	FNM 199, Russia, Fedorenko *et al.* (2009)	EU681346		EU680931
Oxneria huculica	USA, Søchting 9566, C Arup *et al.* (2013)		KC179279	
Oxneria ulophyllodes	FNM 198, Fedorenko *et al.* (2009)	EU681342		EU680930
Oxneria ulophyllodes	USA: Wetmore 80270, LD Arup *et al.* (2013)		KC179283	
Sagedia mastrucata	Sweden, Lycksele Lappmark, Nordin 5481 (UPS), Nordin *et al.* (2007)	EU057914		
Sagedia mastrucata	Sweden, Lycksele Lappmark, Nordin 5481 (UPS), Nordin *et al.* (2010)		HM060737	HM060699
Sagedia mastrucata	Norway, Troms, Nordin 5708 (UPS), Nordin *et al.* (2007)	EU057913		
Sagedia mastrucata	Norway, Troms, Nordin 5708 (UPS), Nordin *et al.* (2010)		HM060736	HM060698
Sagedia simoënsis	Norway, Troms, Owe-Larsson 9000 (UPS), Nordin *et al.* (2010)		HM060739	HM060701
Sagedia zonata	Sweden, Nordin 6006 (UPS), Nordin *et al.* (2007)	EU057952		
Sagedia zonata	Sweden, Nordin 5949 (UPS), Nordin *et al.* (2007)	EU057953		
Sagedia zonata	Norway, Troms, Owe-Larsson 8942 (UPS), Nordin *et al.* (2010)		HM060738	HM060700
Sphaerothallia esculenta	Russia, Astrakhan region, Sohrabi *et al.* (2013*a*)	JQ797511		
Sphaerothallia esculenta	Russia, Astrakhan Region, Owe-Larsson 9796 (UPS), Sohrabi *et al.* (2013*a*)		JQ797493	JQ797485

The new species *Agrestia zerovii*, forms as a strongly supported clade in all separate analyses with the highest level of bootstrap support.

However, based on ITS analysis *Agrestia zerovii* forms a robust monophyletic clade within the *Agrestia* clade together with specimens of *Agrestia hispida* s. str. with GenBank accession numbers HQ389197 and HQ389198 (data not shown). The specimen of *Chlorangium asperum* (Mereschk.) S. Y. Kondr., A. B. Gromakova et Khodos. is a member of the *Chlorangium* clade with *C. jussuffii* (Link) Link, *C. sphaerothallinum* (J. Steiner) S. Y. Kondr., A. B. Gromakova et Khodos., *C. aschabadense* (J. Steiner) S. Y. Kondr., A. B. Gromakova et Khodos., and *C. alpicola* (Elenkin) S. Y. Kondr., A. B. Gromakova et Khodos.

Based on LSU analysis *Agrestia zerovii* forms as robust monophyletic branch a weakly supported clade with specimens of *Agrestia hispida* s. str. with GenBank accession numbers DQ780305 and HM060760 (data not shown). Unfortunately, LSU data are still missing for *Chlorangium asperum*.

According to the mtSSU analysis all specimens of *Agrestia zerovii*, *Agrestia hispida* s. str., and *Agrestia hispida* s. l., as well as specimen of *Chlorangium asperum* are rather different and they do not form a separate clade (data not shown).

Combined analysis

The alternative combined analysis based on nuclear ITS, LSU and 12S mtSSU data sets included 67 specimens of 29 species and a total of 2,084 positions of which 1,050 were informative.

The combined phylogenetic analysis based on ITS and LSU nrDNA, as well as 12S SSU mtDNA sequences strongly supports the proposal that the new species *Agrestia zerovii* is a member of the genus *Agrestia* (Fig. 1). *Agrestia zerovii* appears as a sister group to the other *Agrestia hispida* s. str. and *Agrestia hispida* s. l. specimens based on data so far available in GenBank. The genus *Agrestia* together with the genera *Sphaerothallia* Nees ex Eversm., *Chlorangium* Link, as well as the "*Circinaria*" *lacunosa* group form a weakly supported clade (Fig. 1). The specimen of *Chlorangium asperum* similarly to the nrITS analysis is a member of the *Chlorangium* clade.

DISCUSSION

Our data on the number of generic clades/branches within the Megasporaceae are, however, in conflict with Nordin *et al.* (2010), Owe-Larsson *et al.* (2011), and Sohrabi *et al.* (2013*a*), who accepted the division of the Megasporaceae into the following five genera, i.e. *Aspicilia*, *Circinaria*, *Lobothallia*, *Megaspora*, and *Sagedia* using a combined data set of nrLSU and mtSSU.

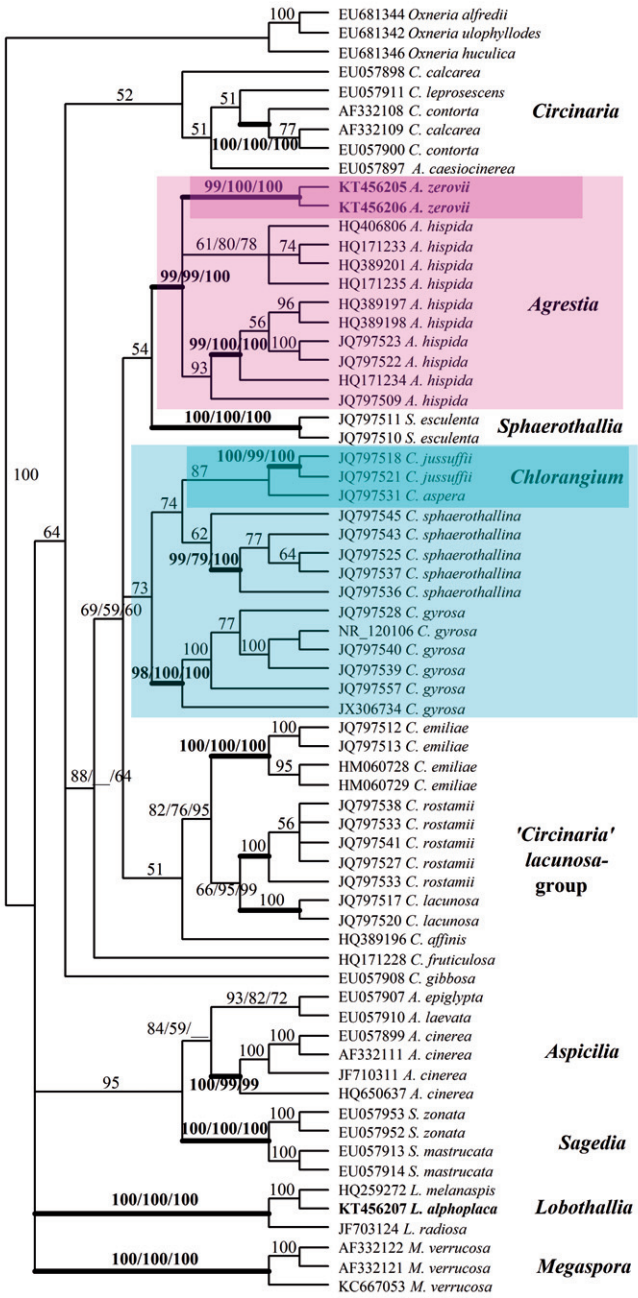

Fig. 1. The combined phylogenetic tree of the Megasporaceae based on nrITS, nrLSU and mtSSU data set (data of MP. ME and ML methods are shown if branches have had support in all the cases, otherwise only data of MP analysis are given).

The *Circinaria* s. str. branch

The genus *Circinaria* Link resurrected by Nordin *et al.* (2010) and Owe-Larsson *et al.* (2011) has very low support according to our alternative combined phylogenetic analysis based on the nrITS, nrLSU and mtSSU data sets, and probably can be accepted for a very narrow species group, i.e.: *C. contorta* group s. str., including only *C. contorta* (Hoffm.) A. Nordin, S. Savić et Tibell, *C. leprosescens* (Sandst.) A. Nordin, S. Savić et Tibell, *C. caesiocinerea* (Nyl. ex Malbr.) A. Nordin, S. Savić et Tibell, and *C. calcarea* (L.) A. Nordin, S. Savić et Tibell (Fig. 1). It should be mentioned that molecular data of one voucher specimen is still missing for *C. contorta*, the type species of this genus. Nordin *et al.* (2010) and Sohrabi *et al.* (2013*a*) provided nrITS sequences on one side and nrLSU and mtSSU sequences on another side from different voucher specimens. However, the rather weak support of the *Circinaria* s. str. branch in the phylogenetic tree of the Megasporaceae (Fig. 1) illustrates that *C. contorta* is still a complex taxon or the identification of some voucher specimens was incorrect.

The *Sphaerothallia* s. l. clade

The other species group included by previous authors into the genus *Circinaria* s. l. and forming separate group from the *Circinaria* s. str. clade, hereafter the *Sphaerothallia* s. l. clade, which, however, has very weak support (Fig. 1). The *Sphaerothallia* s. l. clade includes four robust branches, i.e.: the *Agrestia*, the *Chlorangium*, the *Sphaerothallia* s. str. and the "*Circinaria*" *lacunosa* group.

The *Agrestia* branch

Our data on the *Agrestia hispida* group are, however, in conflict with Sohrabi *et al.* (2013*a*), who proposed that this complex belongs to the genus *Sphaerothallia* (as *S. hispida* (Mereschk.) Follmann et A. Crespo). All specimens of *Agrestia hispida* s. str., as well as *Agrestia hispida* s. l. form a separate robust monophyletic branch, which is sister to the *Sphaerothallia* and the *Chlorangium* branches, as well as to the "*Circinaria*" *lacunosa* group within the *Sphaerothallia* s. l. clade.

For this reason *Agrestia* J. W. Thomson (Thomson 1961) might be assumed to be an appropriate generic name for this monophyletic clade if the type species, *Agrestia cyphellata* J. W. Thomson, a terricolous lichen from Canada and the USA, belongs to this clade. The status of this species needs urgent verification by molecular data.

After Sohrabi *et al.* (2013*a*) "*Circinaria*" *elmorei* (E. D. Rudolph) Owe-Larss., "*Circinaria*" sp. 3, "*Circinaria*" *rogeri* (Sohrabi) Sohrabi, and "*Circinaria*" *digitata* (Sohrabi et Litterski) Sohrabi are closely related to the *Agrestia hispida* complex based on the nrITS data set. However "*Circinaria*" *elmorei* was not in-

cluded in our combined data (see below), and "*Circinaria*" *rogeri* and "*Circinaria*" *digitata* for which data on nrLSU and mtSSU are still missing in GenBank were also excluded from our combined analysis. "*Circinaria*" *elmorei* was not included in our combined phylogenetic analysis since there are contradictive data on this species in GenBank. According to nrITS "*Circinaria*" *elmorei* is positioned in several branches, while data on nrLSU and mtSSU sequences originate from only one voucher which is not the type of this species. Unidentified and undescribed taxa are also excluded from our analysis.

The *Sphaerothallia* branch

The genus *Sphaerothallia* is assumed by Sohrabi *et al.* (2013*a*) to be a probably appropriate generic name for the rather large group of spherothalloid lichens (sensu Sohrabi *et al.* 2013*a*). However, our data indicate that the genus can be used for a very narrow group including so far only the type species *S. esculenta* (Pall.) Reichardt, which has the highest level of support as a separate branch in the phylogenetic tree of the family (Fig. 1). According to Sohrabi *et al.* (2013*a*) the *Sphaerothallia* s. str. clade includes also "*Circinaria*" *elmorei* s. l. using nrITS data set. However, "*Circinaria*" *elmorei* as it is emphasised above was not included in our combined phylogenetic analysis.

Our analysis demonstrates that another "*Circinaria*" species, "*Circinaria*"*emiliae* does not belong to the *Sphaerothallia* s. str. branch in contrast to the data by Sohrabi *et al.* (2013*a*) (Fig. 1).

Furthermore "*Circinaria*" sp. 2 according to Sohrabi *et al.* (2013*a*) is also closely related to this branch. However, unidentified and undescribed taxa are excluded from our analysis.

The *Chlorangium* branch

The *Chlorangium* clade includes the type species *C. jussuffii* (Link) Link, as well as *C. alpicola*, *C. aschabadense*, and *C. asperum*. The status of *Chlorangium gyrosum* (Sohrabi, Sipman, V. John et V. J. Rico) S. Y. Kondr., A. B. Gromakova et Khodos. and *C. sphaerothallinum* (J. Steiner) S. Y. Kondr., A. B. Gromakova et Khodos. in this branch is the most questionable since this clade has rather weak support. These species may belong to separate monophyletic clades.

Based on nrITS data set (both by Sohrabi *et al.* (2013*a*) and by our nrITS analysis) *Chlorangium alpicola* belongs to the *Chlorangium* clade, however, it was not included in the combined analysis since nrLSU and mtSSU data are still missing for this taxon. Based on nrITS data set "*Circinaria*" *fruticulosa* (Eversm.) Sohrabi is in sister position to *Chlorangium gyrosum* with very weak level of support (Sohrabi *et al.* 2013*a*). However, "*Circinaria*" *fruticulosa* was excluded from

our analysis because its mtSSU sequence data are very different from all other members of the Megasporaceae. The data on mtSSU of "*Circinaria*" *fruticulosa* need to be confirmed by further voucher specimens.

The "*Circinaria*" *lacunosa* group branch

The "*Circinaria*" *lacunosa* group includes "*C.*" *lacunosa* (Mereschk.) Sohrabi, "*C.*" *rostamii* Sohrabi, and "*C.*" *emiliae* (Tomin) A. Nordin, S. Savić et Tibell. The branch shows the highest level of support for all the species each sampled from four to five voucher specimens. According to the nrITS data set published by Sohrabi *et al.* (2013*a*), this group includes also "*Circinaria*" *affinis* (Eversm.) Sohrabi. However, based on our data "*C.*" *affinis*, for which there is only one voucher sequence with ITS and LSU nrDNA and 12S SSU mtDNA available in GenBank, falls out of the whole *Sphaerothallia* s. l. clade.

After Sohrabi *et al.* (2013*a*) this branch includes also "*Circinaria*" *cerebroides* (Mereschk.) Sohrabi based on nrITS data set. However, this species was excluded from our combined analysis because its nrLSU and mtSSU data are incomplete and very different from other taxa included in our combined matrix.

Our data support the data of previous authors (Sohrabi *et al.* 2013*a*) that the *Aspicilia epiglypta* group (including *A. epiglypta* (Norrl. ex Nyl.) Hue, *A. indissimilis* (H. Magn.) Räsänen, and *A. laevata* (Ach.) Arnold) has very low support together with *Aspicilia* s. str. (i.e. *Aspicilia cinerea* group). So the status of the *Aspicilia epiglypta* group requires further investigations.

Thus, four more robust monophyletic branches, i.e. the *Agrestia*, the *Chlorangium*, the *Sphaerothallia*, and the "*Circinaria*" *lacunosa* group branches within the *Sphaerothallia* s. l. clade, having very weak support and located in separate place from the *Circinaria* s. str. clade, are shown additionally to five genera accepted by Nordin *et al.* (2010), Owe-Larsson *et al.* (2011) and Sohrabi *et al.* (2013*a*) within the Megasporaceae (*Aspicilia*, *Circinaria*, *Lobothallia*, *Megaspora* and *Sagedia*).

Consequently, the genera *Agrestia* J. W. Thomson, *Chlorangium* Link, and *Sphaerothallia* Nees ex Eversm. are resurrected within this study.

Taxon description

Agrestia zerovii S. Y. Kondr., A. B. Gromakova et Khodos., *spec. nova*
(Figs 2–4)

MycoBank no.: MB 813878.

Similar to Agrestia hispida s. str., but differs in having well-developed, horizontally orientated, very thick thalline lobes often forming distinct crust of the central portion of thallus, in the lack of blackish tips of the erect secondary branchlets, as well as deviates in the nrDNA ITS region.

Type: Ukraine, Kharkiv oblast (= region), Dvorichansky district, in the vicinity of Dvorichana settlement, Korobchyno protected territory (= zakaznik), 49° 50' 00.5" N, 37° 40' 27.7" E, the upper part of the slope, to W from the road, below of plantation, leg. Gromakova, A. B., s.n., 27.05.2012, (holotype: KW-L 70479); the same locality (isotypes: KW-L 70480, KHER, CWU).

Thallus subfruticose, erratic (sensu Büdel and Wessels (1986), i.e. the facultatively unattached lichen), 2–3(–4) cm in diam./across and 1.5–3(–4)[–8] mm thick; bushy, more or less *Cladonia*-like thallus with abundant erect secondary branchlets or mainly "horizontal crusts" of densely compressed main lobes and scarce erect secondary branchlets, grey to greenish-grey if freshly collected especially in wet conditions; consisting of two morphologically different types of thalline lobes, i.e. the main lobes very thick, (1.5–)2–3(–3.5) mm wide and to 7–10(–14) mm long, massive, mainly horizontally orientated, often somewhat compressed or deformed, infrequently regularly cylindrical, often densely pressed to each other and form thick "horizontal crust" of (3–)7–10(–12) mm across with numerous erect secondary lobules.

Secondary lobules (1–)3–6(–8) mm long, ranging from very thin (0.2–0.3 mm diam.) to rather thick (0.5–)0.7–1.2(–1.5) mm diam.) at the basis and gradually becoming thinner towards the tips, mainly erect, usually regularly cylindrical, concolorous along the whole length (not blackish towards the tips); sometimes secondary lobules branched and secondary branchlets 1–2 mm long and *ca* 0.5 mm in diam. at the basis and becoming thinner towards the tips present; pseudocyphellae regularly rounded up to 0.2–0.3 mm in diam., white, sometimes quite distinct. Apothecia unknown. Conidia not seen.

Chemistry: All spot-tests (K, C, KC, CK, P) negative both in the cortex and medulla.

Ecology: The species grows together with *Collema tenax* (Sw.) Ach. var. *tenax*, *C. tenax* var. *ceranoides* (Borrer) Degel., *C. crispum* (Huds.) Weber ex F. H. Wigg., *Endocarpon pusillum* Hedw., *Megaspora verrucosa* (Ach.) Arcadia et A. Nordin, *Thrombium epigaeum* (Pers.) Wallr. on lime rich soil in arid steppe or steppe-like habitats. Vagrant forms accumulate in wind-deposited drifts.

The following plants accompanying *Agrestia zerovii* were registered: *Androsace koso-poljanskii* Ovcz., *Artemisia hololeuca* M. Bieb. ex Besser, *Asperula tephrocarpa* Czern. ex M. Pop. et Chrshan., *Astragalus albicaulis* DC., *Hedysarum grandiflorum* Pall., *Hyssopus cretaceus* Dubjan., *Linaria cretacea* Fisch. ex Spreng., *Linum ucranicum* (Griseb. ex Planch.) Czern., *Pimpinella titanophila* Woronow, *Polygala cretacea* Kotov, *Thymus calcareus* Klokov et Des.-Shost. (see also Gromakova 2013).

Two different morphotypes were observed in the field conditions of the type locality. Bushy, more or less *Cladonia*-like thallus with abundant, erect secondary branchlets are easily observable in the open areas, while mainly "horizontal crusts"

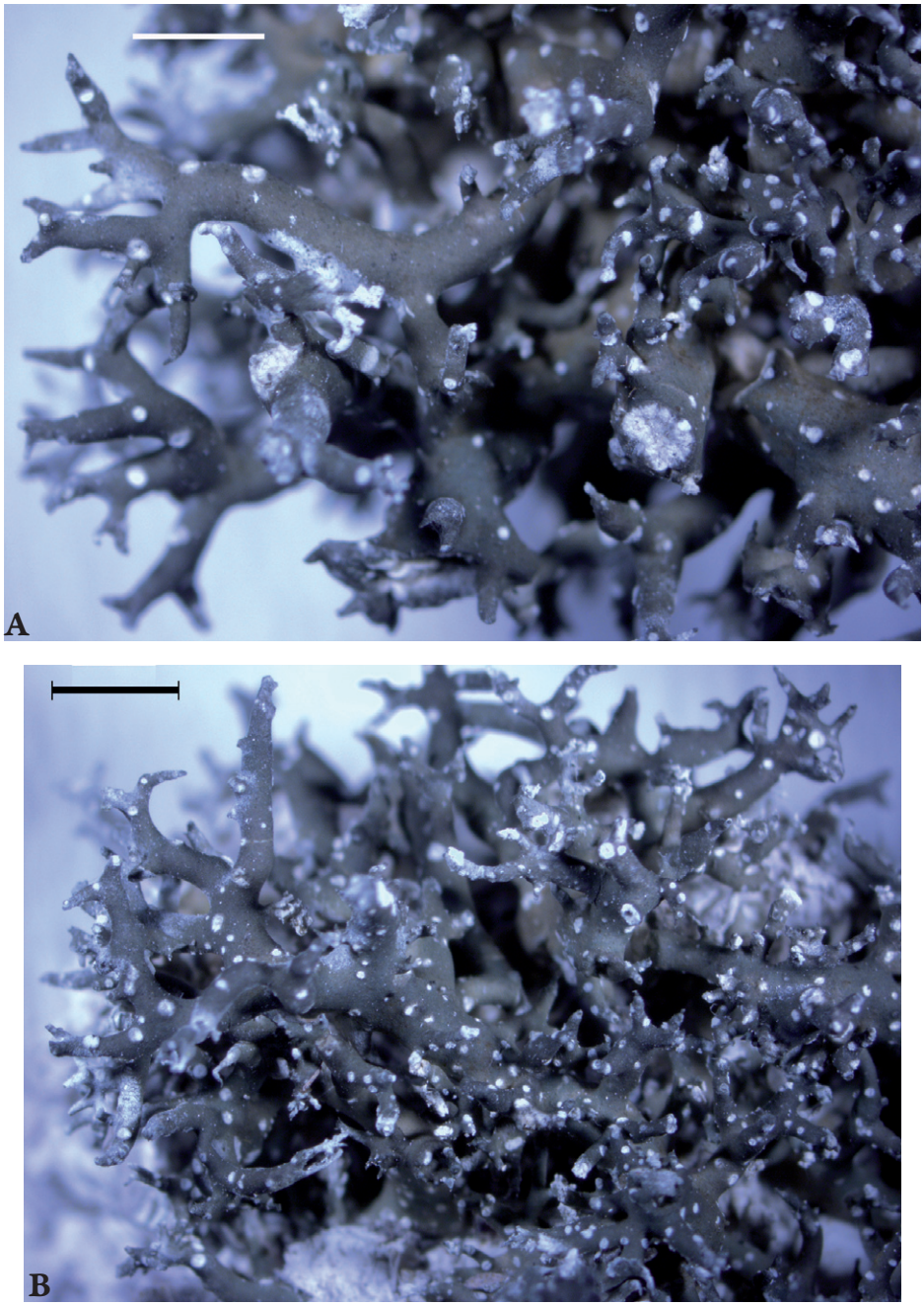

Fig. 2. *Agrestia zerovii* (holotype), general habit. Scale: A = 2 mm, B = 3 mm.

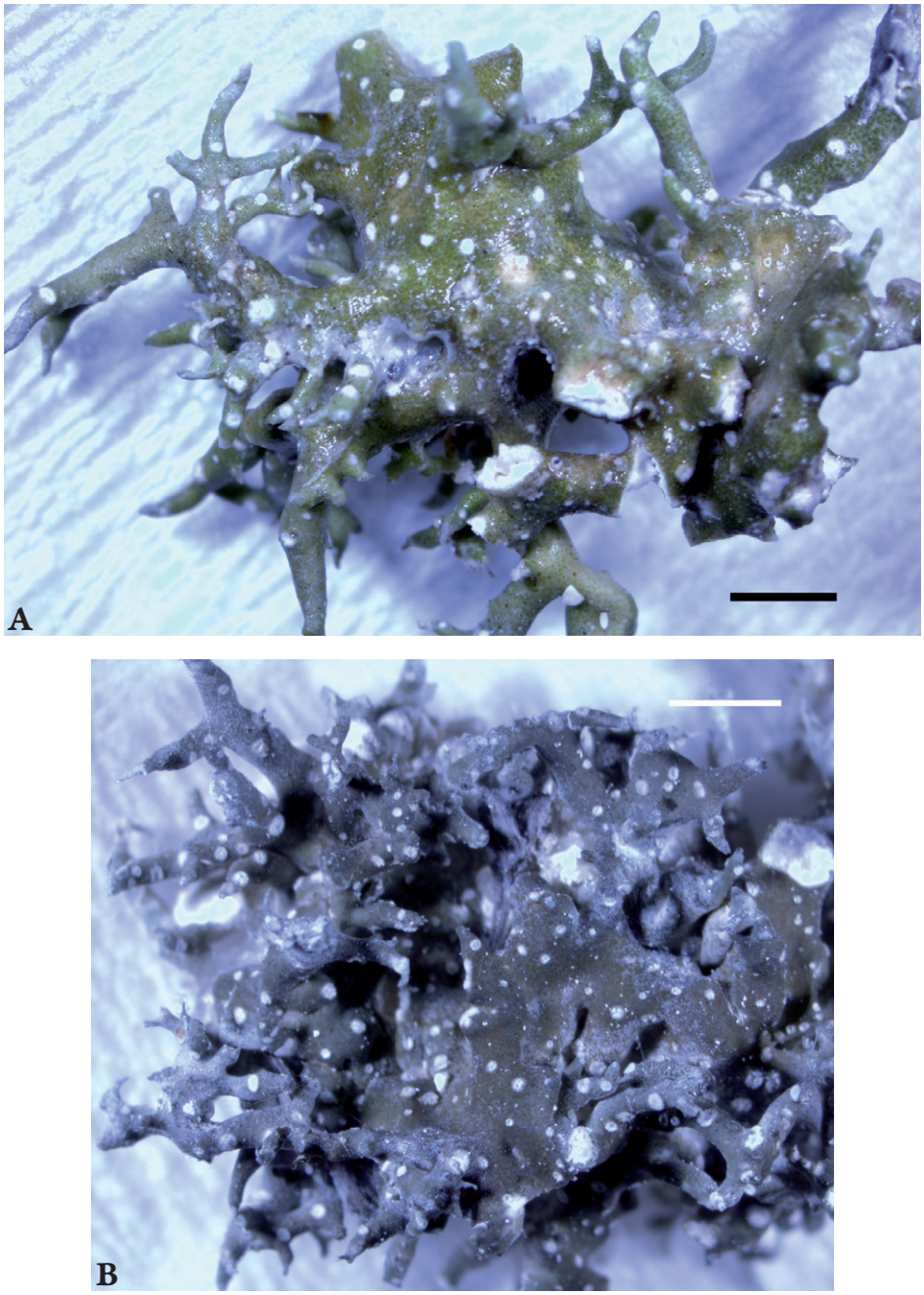

Fig. 3. *Agrestia zerovii* (holotype), enlarged "horizontal crust" of two different thalli, A = after wetting, B = in dry conditions. Scale: A and B = 2 mm.

of densely compressed main lobes and scarce erect secondary branchlets were observed under the crown layer of the endemic shrub species, *Thymus calcareus*.

Etymology: It is named after Dmytro K. Zerov (1895–1971) (Kyiv, Ukraine, KW-B) in honour of the 120th anniversary of his birthday. He was a well-known Ukrainian bryologist, palaeobotanist, and specialist of the phylogeny of non-vascular (= lower) plants, and the founder of the Kyiv bryological and Ukrainian palaeobotanical scientific schools.

Distribution: In contrast to *Agrestia hispida*, which is a widely distributed steppe element in temperate and subtropical, semi-arid regions of the Northern Hemisphere from Italy to the Russian part of the Caspian Sea coast, the Tian-Shan Mts in Kyrgyzstan and Iran (Andreeva 1987, Kulakov 2002, 2003, Hafellner *et al.* 2004, Seaward *et al.* 2008) and North America (Owe-Larsson *et al.* 2007), *A. zerovii* is so far known only from the type locality, where it was observed in the 1940s.

It is important to emphasise that *Agrestia zerovii* was first recorded/collected from locus classicus by a known Ukrainian bryologist, Dr Anna F. Bachurina, one of the students of Dmytro K. Zerov. The Ukrainian localities of *Agrestia hispida* recorded by Mereschkowsky (1911), Oxner (2010) and other colleagues require revision since some of them may belong to *A. zerovii* too.

Taxonomic notes: Though *Agrestia zerovii* is more or less similar to *A. hispida* s. str. it differs in having much thinner (1.3–3(–4) mm thick vs. 5–20 mm tall?) thalline tufts, two morphologically different types of thalline lobes, well-developed, horizontally orientated, much thicker (2–3(–3.5) mm diam. vs. (0.3–)0.5–1.5(–2) mm diam.) main lobes, often distinct "horizontal portion" or flattened crust of thallus consisting of interwoven/or to each other pressed flattened main lobes of (3–)7–10(–12) mm across, in the lack of blackish tips of the erect secondary branchlets. Finally, it has different sequence of the nrDNA ITS region.

Agrestia zerovii is positioned in a branch separate from the specimens of *Agrestia hispida* s. str. in the combined phylogenetic analysis based on ITS and LSU nrDNA and 12S SSU mtDNA sequences (Fig. 1).

The two morphotypes observed in the type locality and described above seem to differ only in the development level of the erect secondary branchlets. So, bushy, more or less *Cladonia*-like thallus with abundant erect secondary branchlets, which are common in the open areas has both types of thalline lobes, much thicker, mainly horizontally orientated main lobes and erect secondary branchlets. However, the first (main lobes) are usually not seen through the dense cover of the erect secondary branchlets or owing to the dust particles covering this portion of the thallus. The second morphotype, i.e. mainly "horizontal crusts" of densely compressed main lobes, which are more common under the crown layer

of the endemic shrub species *Thymus calcareus*, differs in having only scarce erect portions and the "horizontal crust" of this lichen is better observable. However, it should be mentioned that the "horizontal crust" is well developed in both cases, but it is poorly observable, especially in the first case.

Specimens of *Agrestia zerovii* were sterile (no apothecia were observed), similarly to all Eurasian specimens of *A. hispida* s. str. (cf. Sohrabi *et al.* 2013*a*).

Unfortunately, Sohrabi *et al.* (2013*a*) did not mention the length of the main lobes and secondary branchlets of *Agrestia hispida*, probably they did not think that these characters are important for taxonomy of this species group. However, differences between *A. zerovii* and *A. hispida* s. str. prove that details on lobe morphology are important. In our opinion the descriptions of *A. hispida* s. str., and of the crustose *A. hispida* s. l. should be completed with data on the length of main lobes and secondary branchlets.

Agrestia hispida was illustrated in the Red data book of Ukraine (Didukh 2009) by photos of North American material, because it was fertile. It is necessary to emphasise based on the morphological differences between *A. zerovii* and *A. hispida*, that the Ukrainian material is quite different from the North American one. Differences of *A. zerovii* and *A. hispida* are also observable by comparison of the illustrations of *A. hispida* published in the Red data book of Ukraine (Didukh 2009) and illustrations of *A. zerovii* provided here. To our opinion *Agrestia zerovii* should be included in the next edition of the Red data book of Ukraine.

Colour photos of the Eurasian and American representatives of *Agrestia hispida* based on Sohrabi *et al.* (2011*b*) presented on the Myco-Lich website (www.myco-lich.com) and edited by Sohrabi *et al.* (2010) were also consulted within this revision, too.

Other specimens examined: Ukraine: Kharkiv oblast, Dvorichansky district, in the vicinity of Dvorichana settlement, Korobchyno zakaznik, 49° 50' 00.5" N, 37° 40' 27.7" E, the upper part of the slope, below the plantation, 2 m W of the road, leg. M. Kryvokhyzhaya, 19.06.2013 (paratype: KW-L 70658); the same locality, (paratype: KW-L 70659); the same locality, S exposure of the slope, in the middle part of the slope, W of the road, leg. M. Kryvokhyzhaya, 19.06.2013 (paratype: KW-L 70660); the same locality, S exposure of the slope, in the middle part of the slope, to W of the road, near the *Thymus calcareus* shrub, leg. M. Kryvokhyzhaya, 19.06.2013 (paratype: KW-L 70661); the same locality, S exposure of the slope, in the middle part of the slope, to W of the road, just close to the *Thymus calcareus* shrub, leg. M. Kryvokhyzhaya, 19.06.2013 (paratype: KW-L 70662).

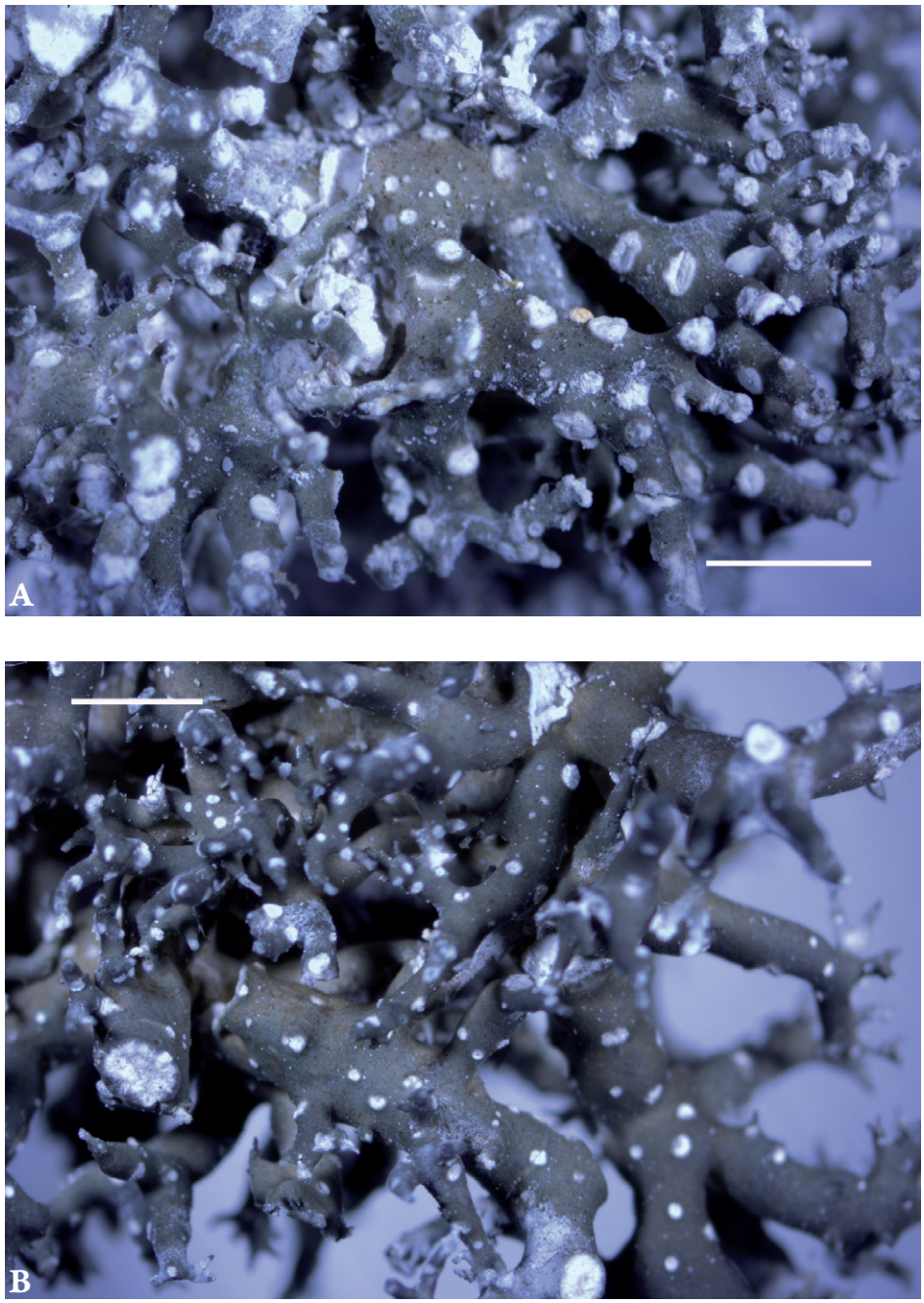

Fig. 4. *Agrestia zerovii* (holotype), enlarged main thalline lobes. Scale: A and B = 2 mm.

Fig. 5. General view of the type locality of *Agrestia zerovii.*

New combinations

Chlorangium alpicola (Elenkin) S. Y. Kondr., A. B. Gromakova et Khodos., *comb. nova* [MycoBank no.: MB 813879]. – Basionym: *Aspicilia alpicola* Elenkin, Fl. Lishaynikov Sredney Rossii [Lichenes Florae Rossiae Mediae] 2: 222 (1907). ≡ *Circinaria alpicola* (Elenkin) Sohrabi in Sohrabi *et al.*, Mycol Progr. 12: 244 (2013). – Type: Kyrgyzstan. "Ad terram argillosam in regione alpina montium Tian-Shan (Kaschgariae: Werchnij Syrt 12,000 ft. ped)", 1889, Roborowsky in Elenkin, Lich. Fl. Ross. No. 24d (lectotype: H; isolectotype: LE (L2008), designated by Sohrabi and Ahti (2010)). = *Aspicilia alpinodesertorum* f. *esculenta-alpina* Elenkin in Izv. Imp. S.-Peterburgsk. Bot. Sada 1: 36 (1901) (16 July), as "*esculenta alpine*" or "*esculenta* (*alpina*)". = *Aspicilia alpinodesertorum* f. *fruticulosofoliacea* Elenkin in Izv. Imp. S.-Peterburgsk. Bot. Sada 1: 27, 36, 39, tab. 2, rows IX–X, figs 1–7 (1901), as "*fruticuloso-foliacea*". = *Aspicilia fruticulosofoliacea* (Elenkin) Sohrabi in Taxon 59: 627 (2010).

Chlorangium aschabadense (J. Steiner) S. Y. Kondr., A. B. Gromakova et Khodos., *comb. nova* [MycoBank no.: MB 813881]. – Basionym: *Lecanora esculenta* subsp. *aschabadensis* J. Steiner in Ann. Mycol. 8: 227 (1910). ≡ *Aspicilia aschabadensis* (J. Steiner) Mereschk., Trudi naturh. Ver. ksl. Univ. Kasan 43: 34 (1911). ≡ *Circinaria aschabadensis* (J. Steiner) Sohrabi in Sohrabi *et al.*, Mycol Progress 12: 249 (2013). – Type: Turkmenistan. "Regio trans-caspica: Aschabad [Ashgabat] ad fines Persiae", sine dato, Sintenisin Zahlbruckner, Lich. Rarior. Exs. No. 32 (error "39") (lectotype: W; isolectotypes: LE, PC, designated by Sohrabi and Ahti (2010)).

Chlorangium asperum (Mereschk.) S. Y. Kondr., A. B. Gromakova et Khodos., *comb. nova* [MycoBank no.: MB 813882]. – Basionym: *Aspicilia desertorum* var. *aspera* Mereschk. in Trudy Obshch. Estestvoisp. Imp. Kazansk. Univ. 43(5): 13 (1911). ≡ *Lecanora aspera* (Mereschk.) Tomin, Prir. Sel'sk. Khoz. Zasushl.-Pustyn. Obl. SSSR. 1/2: 4 (1927), nom. illeg., non. *L. aspera* Stizenb. (1890). ≡ *Aspicilia aspera* (Mereschk.) Tomin, in Kopaczevskaja *et al.*, Handbook of the lichens of the USSR 1: 198 (1971). ≡ *Circinaria aspera* (Mereschk.) Sohrabi et Şenkard, in Sohrabi *et al.*, Mycol Progr. 12: 265 (2013). – Type: Azerbaijan. "In rupibus calcareis e gub. Baku in Caucaso", 1893, Lipsky in Elenkin: Lich. Fl. Ross. No. 24b (lectotype: LE (L 2017); isolectotypes: H (L 2016, L 2018), designated by Sohrabi *et al.* 2013*a*).

Chlorangium gyrosum (Sohrabi, Sipman, V. John et V. J. Rico) S. Y. Kondr., A. B. Gromakova et Khodos., *comb. nova* [MycoBank no.: MB 813885]. – Basionym: *Circinaria gyrosa* Sohrabi, Sipman, V. John et V. J. Rico, in Sohrabi *et al.*, Mycol Progr. 12: 255 (2013). – Type: Iran, East Azerbaijan, Marand district, 32 km N of Marand towards Jolfa, 38° 40.58' N, 45° 39.44' E, 1,440 m, leg. M. Sohrabi 10085, H. Sipman, U. Søchting, M. R. Asef, 2 Nov. 2007 (holotype: IRAN 14444; isotypes: B, H).

Chlorangium sphaerothallinum (J. Steiner) S. Y. Kondr., A. B. Gromakova et Khodos., *comb. nova* [MycoBank no.: MB 813887]. – Basionym: *Aspicilia calcarea* var. *sphaerothallina* J. Steiner, Ann. Naturhist. Hofmus. 20: 379 (1907). ≡ *Aspicilia sphaerothallina* (J. Steiner) Szatala, Annln K. K. naturh. Hofmus. Wien 50: 527 (1940) [1939]. ≡ *Circinaria sphaerothallina* (J. Steiner) Sohrabi, in Sohrabi *et al.*, Mycol Progr. 12: 266 (2013). – As mentioned by Sohrabi *et al.* (2013*a*) additional study is required before a lectotype specimen can be designated for this species.

CONCLUSIONS

Ukrainian as well as the whole Eurasian material of *Agrestia hispida* is in urgent need of revision to clarify the distribution of both *A. zerovii* and *A. hispida*. The inclusion of the type specimen of the genus *Agrestia* (i.e. *A. cyphellata*) and of further specimens of *A. zerovii* and *A. hispida* in the phylogenetic analysis is also very desirable.

The revision of the small species groups discussed above (i.e. *Aspicilia epiglypta*, *Chlorangium sphaerothallinum*, "*Circinaria*" *fruticulosa*, etc.) will clarify their relation to the genera *Agrestia*, *Chlorangium*, *Sphaerothallina* within the family Megasporaceae.

* * *

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Összefoglaló: Az *Agrestia zerovii* S. Y. Kondr., A. B. Gromakova et Khodos. új zuzmófaj az ukrán sztyeppzóna meszes talajain elterjedt, vándorló életmódot folytató *Agrestia hispida* fajkomplexből került leírásra. Az *A. hispida*-tól abban különbözik, hogy jóval vastagabb elsődleges telepi karéjokkal rendelkezik, melyek egy vastag vízszintes kérget alkotnak, továbbá a másodlagos ágacskák csúcsa nem fekete. A kombinált filogenetikai analízis (riboszomális DNS ITS, LSU, mitokondriális DNS SSU) a Megasporaceae család azon fajainak bevonásával történt, amelyekhez megbízható szekvenciaadatok álltak rendelkezésre. A kladogramon a *Circinaria* s. str. 5 klasszikus nemzetséget (*Aspicilia*, *Circinaria*, *Lobothallia*, *Megaspora* és *Sagedia*) tömörítő kládtól elkülönülten négy új, markáns klád vált el, az *Agrestia*, a *Chlorangium*, a *Sphaerothallia* s. str. és a "*Circinaria*" *lacunosa* komplex (a gyengén támogatott *Sphaerothallia* s. l. fajcsoport). Taxonómiai diverzitásuk részletes tárgyalása mellett az *Agrestia* J. W. Thomson, a *Chlorangium* Link és a *Sphaerothallia* Nees ex Eversm. nemzetségek újraértelmezése, visszaállítása, valamint több más aspicilioid zuzmófaj taxonómiai státusának rendezése javasolt további revíziós kutatásokat követően. Az analízis eredményeként 5 új kombinációt hajtottunk végre a *Chlorangium* Link nemzetségben (*C. alpicola*, *C. aschabadense*, *C. asperum*, *C. gyrosum*, *C. sphaerothallinum*).

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