Acta Botanica Hungarica 64(1–2), pp. 97–135, 2022
DOI: 10.1556/034.64.2022.1-2.6

CONTRIBUTIONS TO MOLECULAR PHYLOGENY OF LICHENS 3. New monophyletic branches of the Trapeliaceae and Xylariaceae

S. Y. Kondratyuk[1]*, L. Lőkös[2], A. S. Kondratiuk[1], I. Kärnefelt[3], A. Thell[3], E. Farkas[4] and J.-S. Hur[5]

[1]*M. H. Kholodny Institute of Botany, Tereshchenkivska str. 2, 01004 Kiev, Ukraine*
**E-mail: ksya_net@ukr.net, corresponding author*
[2]*Department of Botany, Hungarian Natural History Museum*
H-1431 Budapest, Pf. 137, Hungary
[3]*Botanical Collections, Biological Museum, Lund University*
Box 117, SE-221 00 Lund, Sweden; E-mail: arne.thell@biol.lu.se
[4]*Institute of Ecology and Botany, Centre for Ecological Research*
Hungarian Academy of Sciences, H-2163 Vácrátót, Alkotmány u. 2–4, Hungary
[5]*Korean Lichen Research Institute, Sunchon National University*
Sunchon 540–742, Republic of Korea; E-mail: jshur1@sunchon.ac.kr

(Received: 15 December 2021; Accepted: 5 January 2022)

Seven new genera, i.e. *Brianiopsis* for the former '*Lambiella*' *impavida* group, *Farkasiella* for the former '*Trapeliopsis*' *aeneofusca* group, *Gallowayiopsis* for the former '*Trapelia*' *collaris* group, *Kleopowiella* for the former '*Trapelia*' *placodioides* group, *Trapegintarasia* for the former '*Trapelia*' *lilacea* group, *Trapejamesia* for the former '*Trapelia*' *corticola* branch, as well as *Xyloelixia* for the former '*Xylographa*' *isidiosa* group are proposed.

Isolated position of '*Lambiella*' *caeca*, '*Lambiella*' *insularis*, '*Lambiella*' *hepaticicola*, '*Lambiella*' *sphacellata*, '*Placopsis*' *bicolor*, '*Xylographa*' *bjoerkii*, and '*Xylographa*' *lagoi*, is discussed too. Correctness of identification of vouchers of various species of the following genera *Placynthiella, Placopsis, Trapelia*, and *Trapeliopsis* is also discussed.

New combinations are proposed for the following 27 species: '*Ainoa*' *sphacellata* (for *Lecidea sphacelata* Th. Fr.), *Brianiopsis aliphatica* (for *Lambiella aliphatica* T. Sprib. et Resl), *Brianiopsis cerebriformis* (for *Rimularia cerebriformis* Kantvilas), *Brianiopsis globulosa* (for *Rimularia globulosa* Coppins), *Brianiopsis gyrizans* (for *Lecidea gyrizans* Nyl.), *Brianiopsis gyromuscosa* (for *Rimularia gyromuscosa* Aptroot), *Brianiopsis impavida* (for *Lecidea impavida* Th. Fr.), *Brianiopsis mullensis* (for *Lecidea mullensis* Stirt.), *Farkasiella aeneofusca* (for *Lecidea aeneofusca* Flörke ex Flot.), *Farkasiella gelatinosa* (for *Lecidea gelatinosa* Flörke), *Gallowayiopsis collaris* (for *Trapelia collaris* Orange), *Gallowayiopsis glebulosa* (for *Lichen glebulosus* Sm.), *Gallowayiopsis obtegens* (for *Biatora coarctata* subsp. *obtegens* Th. Fr.), *Gallowayiopsis roseonigra* (for *Placopsis roseonigra* Brodo), *Kleopowiella placodioides* (for *Trapelia placodioides* Coppins et P. James), *Kleopowiella bisorediata* (for *Trapeliopsis bisorediata* McCune et F. J. Camacho), *Kleopowiella thieleana* (for *Trapelia thieleana* Kantvilas, Lumbsch et Elix), *Rimularia coreana* (for *Trapelia coreana* S. Y. Kondr., Lőkös et Hur), *Trapegintarasia antarctica* (for *Trapelia antarctica* Ertz, Aptroot, G. Thor et Ovstedal), *Trapegintarasia lilacea* (for *Trapelia lilacea* Kantvilas et Elix), *Trapegintarasia tristis* (for *Trapelia tristis* Orange), *Trapejamesia corticola* (for *Trapelia corticola* Coppins et P. James), *Trapejamesia hurii* (for *Placynthiella hurii* S. Y. Kondr. et L. Lőkös), *Xyloelixia constricta* (for *Xylographa constricta* T. Sprib.), *Xyloelixia disseminata* (for *Xylographa disseminata* Willey), *Xyloelixia isidiosa* (for *Hypocenomyce isidiosa* Elix), and *Xyloelixia septentrionalis* (for *Xylographa septentrionalis* T. Sprib.).

Kew words: *Ainoa, Brianiopsis, Farkasiella, Gallowayiopsis, Kleopowiella,* Korea, *Lambiella, Placynthiella, Placopsis, Rimularia, Trapelia, Trapegintarasia, Trapejamesia, Trapeliopsis, Xyloelixia, Xylographa*

INTRODUCTION

Even though numerous molecular data on the members of the Trapeliaceae and Xylariaceae were accumulated during last two decades (Ertz *et al.* 2014, Orange 2018, Resl *et al.* 2015, 2018, Schneider *et al.* 2016) phylogeny of the total species diversity of these two families was not analysed to the same extent.

Among genera of the Trapeliaceae, Xylographaceae and other families listed in 'Outline of Fungi …' (Wijayawardene *et al.* 2020), unfortunately there are no molecular data on genera *Amylora* Rambold, *Coppinsia* Lumbsch et Heibel, *Lignoscripta* B. D. Ryan (Trapeliaceae), *Amphorothecium* P. M. McCarthy, Kantvilas et Elix, *Malvinia* Döbbeler, and *Pleiopatella* Rehm (Ostropomycetidae) or data on single molecular markers are hitherto available for the genera *Bachmanniomyces* D. Hawksw., *Aspilidea* Hafellner, *Ducatina* Ertz et Søchting, *Dictyocatenulata* Finley et E. F. Morris and the genera cannot be still included in the combined phylogeny.

Kantvilas *et al.* (2014) illustrated, on the basis of a three gene phylogeny, that *Trapelia* is not monophyletic being among *Aspiciliopsis*, *Orceolina*, *Placopsis*, *Placynthiella* and *Trapeliopsis*.

Originally the aim of this study was to provide molecular data for recently described South Korean taxa *Placynthiella hurii* and *Trapelia coreana* and some other Korean taxa and to clarify their position. These results were not published since 2015 because at that time molecular data on some genera of the Trapeliaceae were rather limited. Since 2015 status of the Trapeliaceae was dramatically revised with the usage of molecular markers too. As far molecular data on the Trapeliaceae were accumulated including the Xylariaceae in recent sense, main monophyletic branches of the two families Trapeliaceae and Xylariaceae are analysed below.

Several monophyletic branches within the Trapeliaceae and Xylariaceae were for the first time found within this study. They are illustrated in the final combined tree. During preparation of the final phylogenetic tree of the Trapeliaceae and Xylariaceae newly found monophyletic branches include all hitherto known taxa while the genera *Xylographa*, *Placopsis* are represented by 5–7 species as maximum. Data on other species confirming data of previous authors are discussed in the text while they not always are included in the tree (Fig. 1).

Thus, the aim of this paper is to provide further analyses of the monophyletic groups of the Trapeliaceae and Xylariaceae.

MATERIAL AND METHODS

Morphological and chemical analyses. Hand-cut sections were prepared with a razor blade under a stereomicroscope (Olympus SZ51; Olympus, Tokyo, Japan), examined under a compound microscope (Nikon Eclipse E400; Nikon, Tokyo, Japan) and imaged using a software program (NIS-Elements D; Nikon, Tokyo, Japan) and a DS-Fi3 camera (Nikon, Tokyo, Japan) mounted on a Nikon Eclipse Ni-U microscope (Nikon, Tokyo, Japan). The ascospores were investigated at 1,000× magnification in water. The length and width of the ascospores were measured and the range of spore sizes was shown with average, standard deviation, and number of measured spores. Thin-layer chromatography (TLC) was performed using solvent systems A and C according to standard methods (Orange *et al.* 2010).

Isolation, DNA extraction, amplification, and sequencing. Hand-cut sections of ascomata or thallus from all collected specimens were prepared for DNA isolation and DNA was extracted with a NucleoSpin Plant II Kit in line with the manufacturer's instructions (Macherey-Nagel, Düren, Germany). PCR amplification for the internal transcribed spacer region (ITS1-5.8S-ITS2 rDNA), the mitochondrial small subunit, and the nuclear large subunit ribosomal RNA genes were achieved using Bioneer's AccuPower PCR Premix (Bioneer, Daejeon, Korea) in 20 μL tubes and primers ITS5 and ITS4 (White *et al.* 1990), mrSSU1 and mrSSU3R (Zoller *et al.* 1999), and LR0R and LR5 (Rehner and Samuels 1994), respectively. The PCR thermal cycling parameters used were 95 °C (15 s), followed by 35 cycles of 95 °C (45 s), 54 °C (45 s), and 72 °C (1 min), and a final extension at 72 °C (7 min) based on Ekman (2001). DNA sequences were generated by the genomic research company GenoTech (Daejeon, Korea).

Phylogenetic analyses. All ITS and mtSSU sequences were aligned and edited manually using ClustalW in Bioedit V7.2.6.1 (Hall 1999). All missing and ambiguously aligned data and parsimony-uninformative positions were removed and only parsimony-informative regions were finally analysed in MEGA X (Kumar *et al.* 2018, Stecher *et al.* 2020). There were a total of 1,423 positions in the final dataset. The final alignment comprised 878 (ITS), and 900 (mtSSU) columns. Phylogenetic trees with bootstrap values were obtained in RAxML GUI 2.0 beta (Edler *et al.* 2021) using the maximum likelihood method with a rapid bootstrap with 1,000 bootstrap replications and GTR GAMMA for the substitution matrix. The posterior probabilities were obtained in BEAST 2.6.4 (Bouckaert *et al.* 2019) using the HKY (Hasegawa, Kishino and Yano) model, as the appropriate model of nucleotide substitution based on the Bayesian Information Criterion (BIC) (Schwarz 1978) as evaluated by bModelTest (Bouckaert and Drummond 2017), empirical base frequencies, gamma for the site heterogeneity model, four categories for gamma, and

Table 1
List of specimens and GenBank number of sequences included in phylogenetic analysis (newly proposed combinations and names identified within this study are in bold)

Species name	Vouchers / reference	ITS	nrLSU	mtSSU
Ainoa mooreana	Japan, O-L-209833	MH481916		
Ainoa mooreana	Sweden, 1088	KJ462262	KJ462339	KJ462394
Ainoa sp.	China, 15-48160	MH200708		
Ainoa sphacellata	Sweden, R22 sub *Xylographa sphacelata*	KR017113	KR017214	KR017378
Aspiciliopsis macrospora	US9398	AY212821	AY212838	
Aspiciliopsis macrospora	RP227	AY212820	AY212839	AY212862
Brianiopsis aliphatica	USA: Alaska, Spribille 39388 [sub *Lambiella* sp. Spribille 39388]	MH636003	MH627044	
Brianiopsis aliphatica	USA: Alaska, Spribille 39395-B [sub *Lambiella aliphatica*]	MN483114		
Brianiopsis globulosa	Sweden, R05 sub *Lambiella globulosa*	KR017105	KR017201	KR017365
Brianiopsis globulosa	Sweden, R09 sub *Lambiella globulosa*	KR017109	KR017204	KR017442
Brianiopsis gyrizans	Sweden, R20 sub *Lambiella globulosa*	KR017132	KR017212	KR017377
Brianiopsis impavida	Sweden, R10 sub *Lambiella impavida*	KR017114	KR017205	KR017370
Brianiopsis impavida	Sweden, R11 sub *Lambiella impavida*	KR017115	KR017206	KR017371
Farkasiella aeneofusca	Czech Republic, CP1030 [sub *Trapeliopsis aeneofusca*]	KR017051	–	KR017341
Farkasiella aeneofusca	Czech Republic, CP937 [sub *Trapeliopsis aeneofusca*]	KR017143	–	KR017397
Farkasiella gelatinosa	Scotland, CP945 [sub *Trapeliopsis gelatinosa*]	KR017147	–	KR017400
Farkasiella gelatinosa	Austria, KS70 [sub *Trapeliopsis gelatinosa*]	KR017078	–	KR017314
Gallowayiopsis collaris	UK, Orange 23518	KX961376		KY797803
Gallowayiopsis collaris	UK, Orange 23508	KX961375		KY797798
Gallowayiopsis collaris	UK, Orange 23483	KX961371		
Gallowayiopsis glebulosa	Austria KS46, Resl *et al.* (2015) [sub *Trapelia coarctata*]	KR017072	KR017170	KR017353
Gallowayiopsis glebulosa	Austria KS22, Resl *et al.* (2015) [sub *Trapelia glebulosa*]	KR017069	KR017159	KR017354
Gallowayiopsis glebulosa	Austria KS62 [sub *Trapelia coarctata*]	KR017058	KU844638, KR017173	KR017310
Gallowayiopsis* aff. *glebulosa	Austria KS28 [sub *Trapelia coarctata*]	KR017096	KR017161	–
Gallowayiopsis* aff. *glebulosa	South Korea, 151357 KoLRI	151357		–
Gallowayiopsis obtegens	Austria KS28 [sub *Trapelia obtegens*]	KR017070	KR017162	KR017345
Gallowayiopsis obtegens	Austria KS57 [sub *Trapelia obtegens*]	KR017057	KR017172	KR017308
Gallowayiopsis obtegens	UK, Orange 23478 [sub *Trapelia obtegens*]	KX961369	–	–
Gallowayiopsis roseonigra	USA: Alaska, KS94 [sub *Trapeliopsis roseonigra*]	KU844710	KU844586	KU844521

Table 1 (continued)

Species name	Vouchers / reference	ITS	nrLSU	mtSSU
Gallowayiopsis* aff. *roseonigra	Austria, KS61 [sub *Trapelia coarctata*]	KR017098	–	KR017309
Gallowayiopsis* aff. *roseonigra	UK: Wales, Orange 23617 [sub *Trapelia coarctata*]	KY797787	–	–
Kleopowiella bisorediata	USA, McCune 23928	AF353563	AF274103	AF431962
Kleopowiella placodioides	UK, Orange 22880	KX961327	–	KY797810
Kleopowiella placodioides	UK, Orange 23614	KY797784	–	KY797799
Kleopowiella placodioides	Canada: Ontario, KS27	KU844704	KU844582	KU844517
Kleopowiella placodioides	South Korea, 151622 KoLRI	151622	–	–
Kleopowiella placodioides	South Korea, 151619 KoLRI	151619	–	–
Kleopowiella* aff. *placodioides	Norway, O-L-204154	MK812690	–	–
Kleopowiella* aff. *placodioides	Norway, O-L-20869	MK812430	–	–
Kleopowiella* aff. *placodioides	South Korea, 121826 KoLRI	121826	–	–
Kleopowiella thieleana	Wales, Orange 23418 [sub *Trapelia placodioides*]	KX961343	–	KY797810
Kleopowiella thieleana	UK, Wales, Orange 22872 [sub *Trapelia placodioides*]	KX961320	–	KY797799
Kleopowiella thieleana	UK, England, Orange 23507 [sub *Trapelia placodioides*]	KX961374	–	KY797818
Kleopowiella thieleana	New Zealand: Otago, SDL-2016 voucher A. Knight 61767, OTA [sub *Trapelia* cf. *placodioides*]	KU672615	KU672605	KU672619
Kleopowiella thieleana	New Zealand, KS163 [Knight 064381], Schneider *et al.* (2016) [sub *Trapelia placodioides*]	KU844758	KU844623	KU844568
Kleopowiella thieleana	Canada, Ontario, KS27 [Lendemer 14480], Schneider *et al.* (2016) [sub *Trapelia placodioides*]	KU844704	KU844582	KU844517
Lambiella arenosa	USA: Oregon, McCune 29714	MF464548		MF464550
Lambiella caeca	Canada, T586	KR017138	KR017228	KR017391
Lambiella caeca	USA: California, T86	KR017106	KR017197	KR017360
Lambiella furvella	Sweden, R06	KR017118	KR017202	KR017366
Lambiella fuscosora	Russia, R19	KR017130	KR017211	KR017376
Lambiella insularis	Sweden, R17	KR017100	KR017209	KR017374
Lambiella insularis	USA, 1091	KJ462268	KJ462345	KJ462400
Lithographa tesserata	Japan, P134	KR017124	KR017186	KR017327
Lithographa tesserata	USA, P95	KJ462269	KJ462346	–
Lithographa tesserata	?	AF274079	–	–
Orceolina antarctica	Antarctica, A. Beck M-0019678	MH670331	–	AY212852
Orceolina antarctica	Antarctica, A. Beck M-0019676	MH670330	–	–
Orceolina antarctica	Antarctica, A. Beck M-0019673	MH670327	–	–
Orceolina kergulensis	Antarctica, US9398	AY212814	AF274116	AY212853

Table 1 (continued)

Species name	Vouchers / reference	ITS	nrLSU	mtSSU
Orceolina kergulensis	Antarctica, RP456	AY212813	AY212830	AF381561
Placopsis bicolor	RP166	AY212817	AY212833	AY212856
Placopsis bicolor	US9362	AY212816	AY212834	AY212857
Placopsis contortuplicata	China, NJ22-z	KT601492		
Placopsis contortuplicata	China, 124277	KC414624	EF489925	
Placopsis contortuplicata	Antarctica, Kim 05004	DQ219305	EF489914	
Placopsis contortuplicata	Antarctica, Hur ANT050784	DQ534479	EF489951	
Placopsis contortuplicata	Antarctica	AY212818	AY212835	AY212858
Placopsis cribellans	New Zealand [sub *Placopsis santessonii* nom. nudum]	AY212826	AY212845	AY212867
Placopsis cribellans	New Zealand, KS167	KU844712	KU844588	KU844523
Placopsis cribellans	New Zealand	KR017086	–	–
Placopsis erosa	New Zealand, KS134	KU844734	KU844611	KU844546
Placopsis fuscidula	New Zealand, KS155	KU844750	–	KU844562
Placopsis fusciduloides	New Zealand, KS161	KU844756	KU844590	KU844566
Placopsis gelida		AF274084	AY212836	AY212859
Placopsis gelida	Iceland, KS177	KU844771	–	–
Placopsis gelida	P118	KR017055	–	KR017321
Placopsis aff. *gelida*	Iceland, Resl 1156	KU844774	–	KU844579
Placopsis hertelii	KS145	KU844741	KU844616	KU844553
Placopsis illita	KS160	KU844755	KU844622	KU844565
Placopsis parellina		AY212822	AY212840	AY212863
Placopsis pruinosa	KS110	KU844717	KU844593	KU844529
Placopsis rhodophthalma	US9476	AY212825	AY212843	AY212865
Placopsis stellata		AY212827	–	AY212868
Placopsis subgelida	KS111	KU844718	KU844594	KU844530
Parainoa subconcolor	China, 14-44013	MN545159	–	MN545207
Parainoa subconcolor	China, 18-60631	MN545158	MN545225	MN545204
Parainoa subconcolor	China, 18-60622	MN545157	MN545226	MN545203
Placynthiella dasaea	Switzerland, LIFU058-16	KX132967	–	–
Placynthiella icmalea		AF274082	AY212846	AY212870
Placynthiella icmalea	UK	FR799276	EU940160	EU940300
Placynthiella icmalea	South Korea, KoLRI 34358	34358	–	–
Placynthiella oligospora	Norway, O-L-182032	MK811853	–	AY212870
Placynthiella hyporhoda	South Korea, KoLRI 23220	23220	–	–
Placynthiella hyporhoda	South Korea, KoLRI 23228	23228	–	–
Placynthiella sp.	Spribille 35911 (GZU)	MH636004	MH627045	MH627047 MH627039

Table 1 (continued)

Species name	Vouchers / reference	ITS	nrLSU	mtSSU
Placynthiella uliginosa	AFTOL-ID 1365	HQ650633	DQ986774	DQ986877
Placynthiella uliginosa	South Korea, KoLRI 34362	34362	–	–
Ptychographa xylographoides	UK, 1123	KJ462272	KJ462348	KJ462403
Ptychographa xylographoides	UK, 1122	KJ462271	KJ462347	KJ462402
Ptychographa xylographoides	USA, 2388	KJ462270	KJ462346	KJ462401
Rimularia badioatra	Sweden, R07	KR017116	KR017203	KR017367
Rimularia coreana	South Korea, 151666 KoLRI	151666	–	–
Rimularia coreana	South Korea, 151668 KoLRI	151668	–	–
Rimularia geumodoensis	South Korea, KoLRI	KY249623	–	–
Rimularia geumodoensis	South Korea, KoLRI	KY249625	–	–
Rimularia geumodoensis	South Korea, KoLRI	KY249627	–	–
Rimularia gibbosa	Austria, T1293	KR017129	KR017167	KR017387
Rimularia intercedens	Austria, R16	KR017119	KR017208	KR017373
Rimularia limborina	Austria, R08	KR017108	KR017215	KR017368
Rimularia limborina	1062	KJ462273	KJ462349	KJ462404
Trapegintarasia lilacea	Australia, Kantvilas 355/05HO	KU672612	KU672604	KU672618
Trapegintarasia tristis	UK, Orange 23171	KX961337	–	KX797806
Trapegintarasia tristis	UK, Orange 22708 sub *Trapelia sitiens*	KY800909	–	–
Trapejamesia corticola	Norway, TRH-L-14083	MK811911		
Trapejamesia corticola	USA, T1099	KR017135	–	KR017382
Trapejamesia corticola	UK, Orange 23618	KY797788	KR017199	KR017361
Trapejamesia hurii	South Korea, 161945 KoLRI	161945		
Trapejamesia hurii	South Korea, 161946 KoLRI	161946		
Trapejamesia hurii	South Korea, 161955 KoLRI	161955		
Trapejamesia hurii	South Korea, 161969 KoLRI	161969		
Trapejamesia hurii	South Korea, 161940 KoLRI	161940		
Trapelia coarctata	Austria, P141	KR017092	KR017249	KR017328
Trapelia coarctata	Austria, KS64	KU844706, KR017097	–	KR017311
Trapelia coarctata	Norway, O-L-200174	MK812584		
Trapelia coarctata	Wales, Orange 22875	KX961323	–	KY797800
Trapelia coarctata	Falkland Islands, Orange 22599	KX961314	–	KY797795
Trapelia coarctata	Germany, Orange 23555	KX961383	–	KY797821
Trapelia coarctata	Germany, Orange 23549	KX961380	–	KY797820
Trapelia coarctata	Germany. Orange 23556	KX961384	–	KY797822
Trapelia coarctata	Austria, KS61	KU844705	–	KR017309
Trapelia elacista	Sweden, P202 [sub *Trapelia coarctata*]	KR017074	KU844699, KR017194	KR017351

Table 1 (continued)

Species name	Vouchers / reference	ITS	nrLSU	mtSSU
Trapelia elacista	without locality, Schmitt *et al.* (2003) [sub *Trapelia coarctata*]	–	AF274117	AY121874
Trapelia elacista	without locality, Lumbsch *et al.* (2005) [sub *Trapelia placodioides*]	–	AF119500	AF431962
Trapelia elacista	USA: Ohio, KS20 [sub *Trapelia glebulosa*]	–	KR017157	KR017302
Trapelia elacista	Ukraine: Donetsk Upland, Nadyeina s.n., GZU, KS23 [sub *Trapelia coarctata*]	–	KR017160	KR017303
Trapelia elacista	UK, Orange 23455	KX961360	–	KY787813
Trapelia elacista	UK, Orange 23494	KX961372	–	KY787809
Trapelia elacista	South Korea, 151632 KoLRI	151632		
Trapelia involuta		AF274080	AF274098	AF381568
Trapelia involuta	Austria, KS18 sub *Trapelia coarctata*	KR017066	–	KR017301
Trapelia involuta	UK, Orange 23479	KX961370	–	–
Trapelia involuta	UK, Orange 23443	KX961354	–	–
Trapelia involuta	UK, Orange 22879	KX961326	–	–
Trapelia macrospora	P09	KR017102	–	KR017319
Trapelia sitiens	UK, Orange 23162	KX961336	–	KY797805
Trapeliopsis californica	USA, McCune 24126	AF353567	–	–
Trapeliopsis colensoi	Australia, CP1033	KR017052	–	KR017346
Trapeliopsis congregans	Australia, Kantvilas 729/03	MH636006	–	MH627041
Trapeliopsis congregans	Russia, Resl 1151 sub *Trapeliopsis* sp.	KR017117	KR017178	KR017318
Trapeliopsis congregans	Greenland, Hansen s.n. [sub *Trapeliopsis* sp.]	KT017083	KR017165	KR017363
Trapeliopsis flexuosa	USA, McCune 23901	AF353568	AF274118	AY212875
Trapeliopsis flexuosa	Norway, TRH-L-15151	MK811801	–	–
Trapeliopsis flexuosa	AFTOL-ID 1028	HQ650634	KR017232	DQ986862
Trapeliopsis flexuosa	Spribille 40723 (MSC) [sub *Trapeliopsis* sp.]	MN483161	–	MN508308
Trapeliopsis flexuosa	Spribille 40883 [sub *Trapeliopsis* sp.]	MN483162	MN460239	MN508309
Trapeliopsis* aff. *frexuosa	USA, P218	KR017091	KR017195	KR017352
Trapeliopsis glaucolepidea	Ecuador, H17	AY600080		KR017402
Trapeliopsis glaucolepidea	Ecuador, H18	AY600081		KR017401
Trapeliopsis granulosa	Germany, J. Schoen & C. Printzen (FR)	MN483158	MN460238	MN508306
Trapeliopsis granulosa	UK, CP949	KR017150	KR017168	KR017404
Trapeliopsis granulosa	Norway, O-L-177175	MK812798	–	MK812708
Trapeliopsis granulosa	Slovakia KS38 [sub *Trapeliopsis pseudogranulosa*]	KR017071	KR017169	KR017307
Trapeliopsis granulosa	[sub *Trapeliopsis pseudogranulosa*]	AF274088	AF274117	–
Trapeliopsis granulosa	without locality, Schmitt *et al.* (2003) [sub *Trapeliopsis flexuosa*]	–	–	AY212875

Table 1 (continued)

Species name	Vouchers / reference	ITS	nrLSU	mtSSU
Trapeliopsis granulosa	without locality, Wiklund and Wedin (2003) [sub *Trapeliopsis granulosa*]	–	–	AY340534
Trapeliopsis granulosa	Canada, Spribille *et al.* (2020) [sub *Trapeliopsis* sp.]	MN483163	MN460239	MN508309
Trapeliopsis gymnidiata	Spain: Canary Islands, Ertz 16241	MN483160	–	MN508261
Trapeliopsis haumanii	Equador, CP950	KR017151	–	KR017405
Trapeliopsis percrenata	Equador, CP952	KR017152	AF279302	KR017407
Trapeliopsis percrenata	Equador, CP951	KR017153	–	KR017406
Trapeliopsis pseudogranulosa		FR799296		
Trapeliopsis pseudogranulosa	Norway, O-L-208001	MK812568		
Trapeliopsis pseudogranulosa	Norway, O-L-183692	MK812270		
Trapeliopsis pseudogranulosa	USA: Alaska, S40723 sub *Trapeliopsis* sp.	MN483161	MN508039	MN508308
Trapeliopsis steppica	USA	AF353573	–	–
Trapeliopsis steppica	USA, CP954	KR017154	KR017234	KR017408
Trapeliopsis studerae	Brazil, ALV 14232	MK203064	MK203603	
Trapeliopsis studerae	Brazil, ALV 14232	NR_160645		
Trapeliopsis wallrothii	Portugal, CP956	KR017156	KR017235	KR017410
Trapeliopsis wallrothii	Austria, Hafellner 47381	AF353575		
Xyloelixia constricta	Chile, isolate 1147 , Buck 58580, holotype [sub *Xylographa constricta*]	KJ462278	KY068748, KJ068748	KJ462409
Xyloelixia constricta	Chile, isolate 1147, Buck 58580, holotype [sub *Xylographa constricta*]	NR_166370	NG_068748	
Xyloelixia disseminata	Isolate 822	KJ462283	KJ462355	–
Xyloelixia* aff. *disseminata	Chile, isolate 1146 sub *Xylographa* aff. *vitillago*	KJ462337	KJ462392, KJ462391	KJ462458
Xyloelixia isidiosa	J.A. Elix 31849 holotype	KF360391	KF360461	KF360430
Xylographa parallela	1049	KJ462312	KJ462378	KJ462435
Xylographa rubescens	Russia, P106	KJ462313	KJ462379	KJ462438
Xylographa stenospora	Canada, 2428	KJ462324	KJ462386	KJ462449
Xylographa vermicularis	Canada, 821	KJ462333	KJ462390	KJ462456, KJ462457
Xylographa vermicularis	Norway, Tønsberg 43918-C5	MN906296	–	–
Xylographa vermicularis	Norway, Tønsberg 43918-B5	MN906297	–	–
Xylographa vitiligo	USA, 1066	KJ462338	KJ462393	KJ462461
Xylographa vitiligo	Norway, O-L-200273	MK812010		
'Xylographa' bjoerkii	USA, 2401	KJ462276	–	KJ462407
'Xylographa' bjoerkii	USA, 1129	KJ462275	KJ462351	KJ462406
'Xylographa' lagoi	Spain, 162	KJ462291	KJ462363	KJ462419
'Xylographa' aff. opegraphella	China, 10-0197	MN103188	–	–

a 10,000,000 Markov chain Monte Carlo chain length with a 10,000-echo state screening and 1,000 log parameters. Then, a consensus tree was constructed in TreeAnnotator 2.6.4 (Bouckaert *et al.* 2019) with a burn-in of 5,000, no posterior probability limit, a maximum clade credibility tree for the target tree type, and median node heights. All trees were displayed in FigTree 1.4.2 (Rambaut 2014) and edited in Microsoft Paint. The bootstrapping and Bayesian analyses were repeated three times for the result consistency and no significant differences were shown for the tree shapes and branch values.

Combined concatenated matrix including nrITS, nrLSU and mtSSU data on 190 vouchers of 97 species and 25 genera was used for the final phylogenetic tree of the families mentioned (Fig. 1).

RESULTS

Confirmation of position of new monophyletic branches of the Trapeliaceae and Xylographaceae found within our study is provided by three gene phylogeny (Fig. 1). In general sequences of representatives of the Trapeliaceae and Xylographaceae, which were less than half of the estimated sequence length (i.e. for nrITS – of 510 bp, for the mtSSU – of 800 bp and for the nrLSU – of 860 bp), as well as those for which we were not able to provide alignment were excluded from our further analysis.

Combined phylogeny

Seven new monophyletic branches found during the combined molecular phylogeny of the Trapeliaceae and Xylographaeceae based on nrITS and 12S mtSSU sequences are proposed below as new genera, i.e. *Brianiopsis* for the former '*Lambiella*' *impavida* group, *Farkasiella* for the former '*Trapeliopsis*' *aeneofusca* group, *Gallowayiopsis* for the former '*Trapelia*' *collaris* group, *Kleopowiella* for the former '*Trapelia*' *placodioides* group, *Trapegintarasia* for the former '*Trapelia*' *lilacea* group, *Trapejamesia* for the former '*Trapelia*' *corticola* branch, as well as *Xyloelixia* for the former '*Xylographa*' *isidiosa* group. Of them two new genera (*Brianiopsis* and *Xyloelixia*) found to be present in the Xylographaceae and five new genera in the Trapeliaceae. Position of each of new branches in the combined phylogenetic tree is mentioned in 'Taxonomic notes' of each new genus below.

The Xylographaceae illustrated hitherto to include the genera *Brianiopsis*, *Lambiella*, *Xylographa*, *Xyloelixia*, *Ptychographa* and *Lithographa* after combined phylogenetic tree of the family mentioned based on nrITS and 12S mtSSU sequences. There are also separate the '*Xylograpa*' *bjoerkii* and the '*Xylographa*' *lagoi* branches having high level of support within the Xylographaceae subclade (Fig. 1).

The *Rimularia* branch found to be positioned in the outermost position in the Trapeliaceae subclade after combined phylogenetic tree of the family mentioned based on nrITS and 12S mtSSU sequences.

The *Trapejamesia* found to be positioned between the *Trapeliopsis* s. lat. subclade and the *Placynthiella* branch latter having the highest level of support in the Trapeliaceae subclade after combined phylogenetic tree of the family mentioned based on nrITS and 12S mtSSU sequences. It should be mentioned that molecular data on two vouchers of *Placynthiella uliginosa* (Schrad.) Coppins et P. James and one voucher of *P. hyporhoda* (Th. Fr.) Coppins et P. James are for the first time provided to the GenBank within this study.

The *Trapeliopsis* s. lat. subclade includes from five to seven robust monophyletic branches, status of which is waiting for special revision. As it is seen in the phylogenetic tree of the Trapeliaceae (Fig. 1) there are the following robust monophyletic branches: *Trapeliopsis congredians*, *T. percrenata* (with three taxa, i.e.: *T. percrenata*, *T. glaucolepidea*, and *T. haumannii*), *T. flexuosa*, *T. granulosa*, *T. studerae*, *T. viridescens* additionally to the *Trapeliopsis* s. str. branch. The latter (*Trapeliopsis* s. str. branch) includes from our data only four taxa, i.e.: *T. wallrothii* (type species), *T. californica*, *T. steppica* and *T. gymnidiata*. Unfortunately, data on nrLSU of some these branches are still missing and the conclusion about status of these branches will be done elsewhere when additional molecular data will be accumulated.

The newly proposed genera *Farkasiella* (for the former '*Trapeliopsis*' *aeneofusca* group (including two species, i.e. *Farkasiella aeneofusca* (Flörke ex Flot.) S. Y. Kondr. et L. Lőkös and *T. gelatinosa* (Flörke) S. Y. Kondr. et L. Lőkös), and *Trapejamesia* (for the former '*Trapelia*' *corticola* branch) including also two species *T. corticola* (Coppins et P. James) S. Y. Kondr. and *T. hurii* (S. Y. Kondr. et L. Lőkös) S. Y. Kondr., are positioned in the *Placynthiella* s. lat. subclade of the Trapeliaceae (Fig. 1, and see below). The status of the genus *Farkasiella* positioning in a separate branch in sister position to the genus *Placynthiella* after both the separate nrITS and mtSSU analyses is still waiting for confirmation by data on the nrLSU and combined concatenated matrix. It should be emphasised that the *Trapejamesia* is a robust monophyletic branch which is positioned in the outermost position after as combined and separate nrITS, mtSSU and nrLSU phylogenies as separate analyses. The status of the saxicolous South Korean *Trapejamesia hurii* is still open as far complete length mtSSU and nrLSU sequences for this taxon are still missing. After combined phylogeny based on the complete nrITS and partial nrLSU and mtSSU sequences as it was mentioned above *Trapejamesia hurii* is positioned in sister position to the *Trapejamesia corticola*. However, it is highly likely that *Trapejamesia hurii* will be a separate branch (genus) in the future as far level of support of this taxon within the *Trapejamesia* branch is somewhat low.

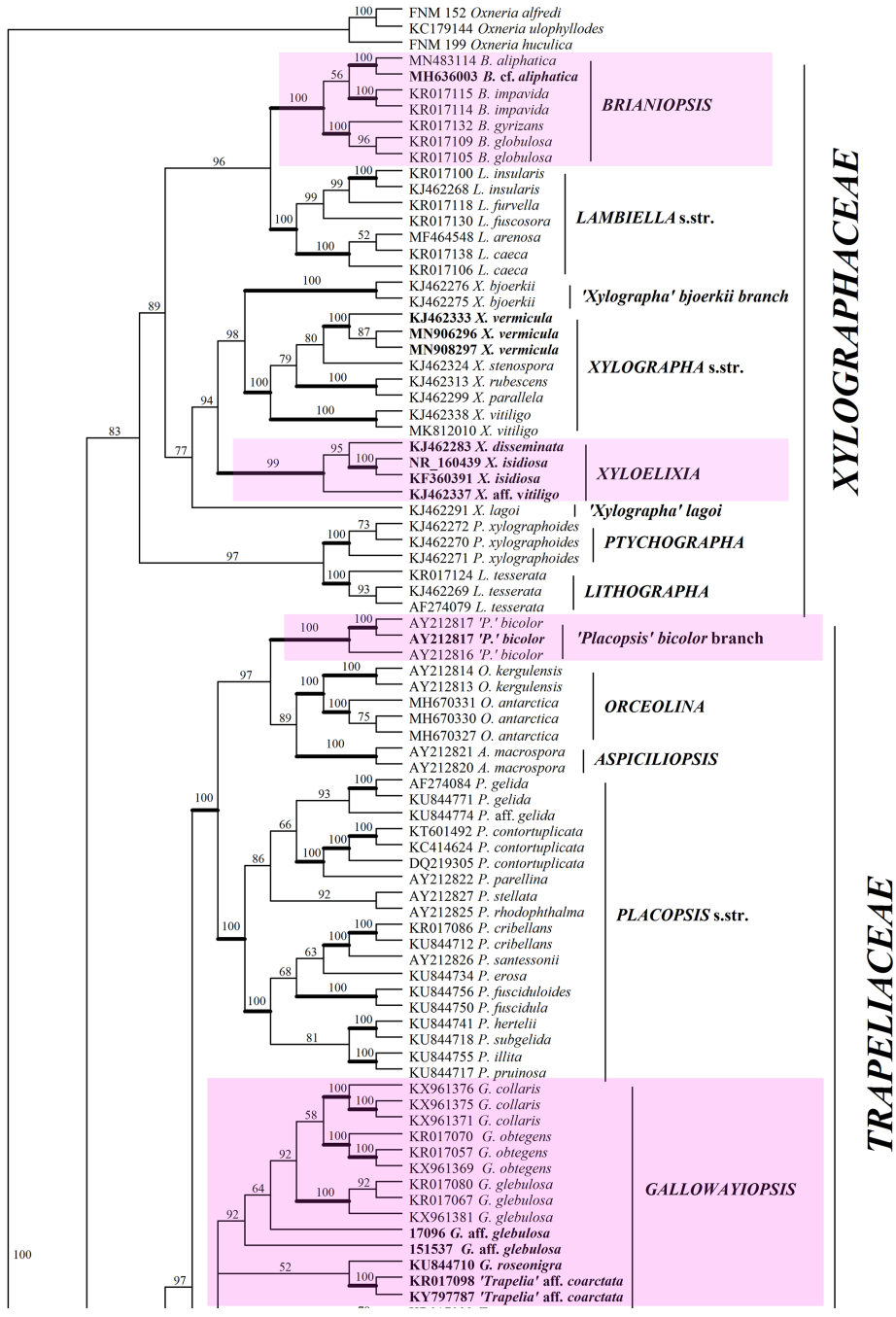

Fig. 1. Position of new monophyletic branches of the Trapeliaceae and Xylographaceae after combined phylogenetic analysis based on ntITS, nrLSU and mtSSU sequences

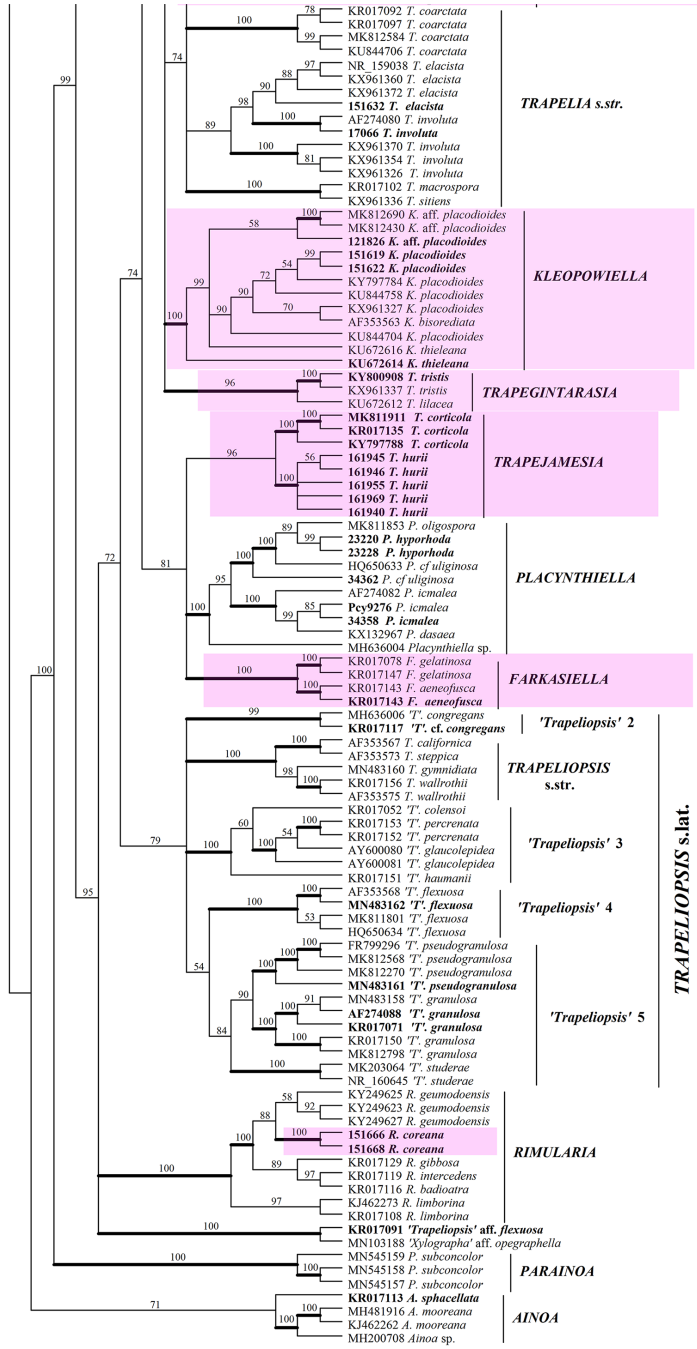

Fig. 1 (continued)

The genera *Gallowayiopsis*, *Kleopowiella* and *Trapegintarasia* found to be positioned in the *Trapelia* / *Placopsis* subclade of the Trapeliaceae after combined phylogenetic tree of the family mentioned based on nrITS and 12S mtSSU sequences, where the *Gallowayiopsis* is found in the closest, i.e. sister position to the *Trapelia* s. str. subclade. The *Trapelia* s. str. subclade here accepted to include the following four robust monophyletic branches: *T. coarctata*, *T. elacista*, *T. involuta* and *T. macrospora* (including two taxa, i.e.: *T macrospora* and *T. sitiens*) branches. The latter four branches may represent separate genera from molecular point of view. However, this hypothesis to be especially checked as with morphological and chemical points of view as on the basis of additional vouchers for molecular data.

The robust monophyletic branch '*Placopsis*' *bicolor* found to be positioned as a separate branch among the *Orceolina* –, the *Aspiciliopsis* – and the *Placopsis* s. str. branches of the Trapeliaceae.

Position of '*Lambiella*' *sphacelata* is still not settled out by combined phylogenetic tree of the family mentioned based on nrITS and 12S mtSSU sequences. As it is seen in Figure 1 it is positioned in close position to the *Ainoa* and *Dibeis* / *Thamnolia* branches, while it does not belong to the latter.

Monophyletic branches formed by the species of the *Trapeliopsis* s. lat. subclade were mentioned by Ertz *et al.* (2014). However, they were considered from wide species concept point of view and conclusion about polyphyly of the genus *Trapeliopsis* was not made.

In contrast to Ertz *et al.* (2017) we consider that only the *Trapeliopsis wallrothii* branch is in fact *Trapeliopsis* s. str. branch. The other branches, like '*Trapeliopsis*' *gelatinosa*, the '*Trapeliopsis*' *flexuosa*, '*Trapeliopsis*' *granulosa* or other robust monophyletic branches are real candidates for segregation from the genus *Trapeliopsis*. We do not share opinion that high level of their support is only an illustration that these branches include conspecific taxa. We have to emphasise that the level of support of the *Trapeliopsis* s. lat. subclade is very low, and for us it is an illustration that it is a polyphyletic group, which is waiting for the further revision.

nrITS phylogeny

All seven newly found monophyletic branches, i.e.: the *Brianiopsis*, *Farkasiella*, *Gallowayiopsis*, *Kleopowiella*, *Trapegintarasia*, *Trapejamesia*, *Xyloelixia* found to form separate branches after separate nrITS phylogeny.

The nrITS sequences of the *Placynthiella* Elenkin for the first time obtained within this study and submitted to GenBank, as well as *Placynthiella hyporhoda* and *P. uliginosa* for the first time confirmed from South Korea by molecular data.

The *Lambiella* s. lat. subclade includes three separate clades of which the '*Lambiella*' *impavida* branch often is positioned among the species groups of *Xylographa* s. lat. subclade. It depends on a number of taxa and vouchers of the Xylariaceae and Trapeliaceae included in the analysis. The further discussion on the *Lambiella impavida* group is provided below under generic name *Brianiopsis.* Two another branches, i.e. the *Lambiella caeca* branch and the *Lambiella insularis* branch are robust monophyletic branches which often positioned together in well supported subclade. The *Lambiella caeca* branch includes as *L. caeca* (J. Lowe) Resl et T. Sprib., as well as *L. arenosa* McCune et Lumbsch, while the *Lambiella insularis* branch includes additionally to *L. insularis* (Nyl.) T. Sprib. two more taxa, i.e. *L. furvella* (Nyl. ex Mudd) M. Westb. et Resl, and *L. fuscosora* (Muhr et Tønsberg) M. Westb. et Resl.

It should be mentioned that sometimes one more still undescribed Chinese taxon data for which are submitted with name as '*Trapelia* sp.' to the *Lambiella* branch (MN150524).

nrITS data on newly found monophyletic branches

There are some differences in the nrITS phylogeny and the combined phylogeny of the following groups (Fig. 1): The *Brianiopsis* including four taxa, i.e. *B. aliphatica*, *B. gyrizans*, *B. globulosa* and *B. impavida*, sometimes positioned in sister position to the *Xylographa* s. str. branch and in distant position from the other branches of the *Lambiella* s. str. branch. Voucher specimen of *Lambiella* sp. Spribille 39338 from USA: Alaska (Resl *et al.* 2018) is identified here as *Brianiopsis aliphatica*.

The *Rimularia* branch includes also one of three vouchers of '*Xylographa*' *opegraphella* Nyl. (voucher 10-0197, for which only nrITS data are hitherto available).

The *Gallowayiopsis* after nrITS phylogeny positioning in sister position to the genus *Placopsis* and in distant position from the *Trapelia* s. str. branch, includes five species, i.e. *G. collaris*, *G. glebulosa*, *G. obtegens* and *G. roseonigra*, as well as '*Trapelia*' *involuta*), while after combined data set the latter taxon, i.e.: '*Trapelia*' *involuta* is not positioned within this branch. The *Gallowayiopsis* branch includes also specimens identified as *Trapelia coarctata* (voucher SK24, Resl *et al.* 2015).

The *Trapejamesia* branch, including only the single taxon the former '*Trapelia*' *corticola* Coppins et James, usually forms a branch in sister position to the *Lambiella* s. lat. subclade or to the *Placynthiella* branch. Sometimes the *Trapejamesia* is positioned in separate branch together with South Korean epilithic lichen *Trapejamesia hurii* (see also above).

The two taxa, i.e.: *Trapegintarasia lilacea* Kantvilas et Elix and *Trapeliopsis studerae* Aptroot et M. Cáceres are positioned in separate branches within the

Trapeliopsis s. lat. subclade of the Trapeliaceae after the nrITS phylogeny, the position of latter taxa is discussed under combined data set.

The *Farkasiella aeneofusca* branch is positioned as a robust monophyletic branch after the nrITS phylogeny (as well as after mtSSU phylogeny, see below) and highly likely represent separate robust monophyletic branch of the Trapeliaceae. Unfortunately the nrLSU data are hitherto still missing for this branch.

The *Xyloelixia* branch additionally to *Xyloelixia disseminata* (Willey) S. Y. Kondr., *Xyloelixia isidiosa* (Elix) S. Y. Kondr., includes also '*Xylographa*' *lagoi* T. Sprib. et Pérez-Ort., recently described from continental Antarctica species *Trapegintarasia antarctica* (Ertz, Aptroot, G. Thor et Øvstedal) S. Y. Kondr., as well as one more voucher identified as '*Xylographa*' *vitiligo* (Ach.) J. R. Laundon isolate 1146 from Chile (KJ462337). From our data the latter may belong to Chilean lichen *Xyloelixia constricta* (T. Sprib.) S. Y. Kondr., while after nrITS phylogeny this taxon forms a separate branch within the *Xylographa* branch. The position of '*Xylographa*' *lagoi* T. Sprib. et Pérez-Ort. is still waiting for confirmation by an additional set of combined molecular data.

Data of the nrITS phylogeny on the further monophyletic branches

Isolated position of the former '*Lambiella*' *hepaticicola* and '*Lambiella*' *sphacelata* is confirmed by our nrITS phylogeny. To clarify position of these two taxa we have tried to include all available data on nrITS sequences of the Baeomycetaceae, as well as Ostropomycetidae. However, we have to emphasise that nrITS data are still missing for too many already described generic groups, so position of taxa mentioned is still very questionable.

Our nrITS phylogeny illustrates also polyphyly of voucher specimens of *Baeomyces rufus* and *B. placophyllus*, as well as *Trapecia coarctata*, *T. involuta* and others.

Correction to voucher identification from nrITS phylogeny

From our nrITS phylogeny '*Trapeliopsis* sp.' voucher Spribille 40883 from Canada, British Columbia (Spribille *et al.* 2020) (MN483162) identified as '*Trapeliopsis*' *flexuosa*; voucher '*Trapeliopsis*' sp. Spribille 40723 from USA, Alaska (Spribille *et al.* 2020) (MN483161) highly likely belong to '*Trapeliopsis*' *pseudogranulosa*, while the other two vouchers, i.e. '*Trapeliopsis pseudogranulosa*' (AF274088) (see Lumbsch *et al.* 2001) and '*Trapeliopsis pseudogranulosa* isolate KS38' (KR017071) (Resl *et al.* 2015) highly likely belong more to '*Trapeliopsis*' *granulosa* than to *T. pseudogranulosa*.

'*Trapeliopsis* sp. Resl 1151' from Kemerovo, Russia (KR017117) (Resl *et al.* 2015) from our data may belong to *Trapeliopsis congregans* Zahlbr. (which appeared to be a new record to Russia).

Position / status of voucher named as '*Placopsis tararuana*' (Zahlbr.) D. J. Galloway (isolate KS156 – Schneider *et al.* 2016) from New Zealand (Knight 064383, OTA) is still waiting for re-study as the current name for lichen with such name is *Pannaria leproloma* (Nyl.) P. M. Jørg. (Pannariaceae, Peltigerales). From our data it is highly likely belong to *Placopsis perrugosa* (Nyl.) Nyl.

From our data *Placopsis santessonii* D. J. Galloway, nom. nud. is also highly likely belonging to *Placopsis cribellans*.

From our nrITS phylogeny two species *Placopsis illita* (C. Knight) I. M. Lamb and *P. pruinosa* D. J. Galloway are positioned within the separate branch together with *Aspiciliopsis macrophthalma* (Hook. f. et Taylor) B. de Lesd., while their position within the *Aspiciliopsis* branch was not confirmed by combined phylogeny (Fig. 1).

As it was emphasised above from our nrITS phylogeny vouchers of '*Trapelia coarctata*' submitted to GenBank were found to be positioned at least in four different positions, i.e. in the *Trapelia* s. str. branch, totally about 18 vouchers, secondly, in the *Trapelia elacista* branch, thirdly in the *Gallowayiopsis glebulosa* branch and, fourthly, in the *Trapegintarasia lilacea* branch. The latter KU844772 and MN483156 based on the same Aptroot voucher, as well as voucher submitted as '*Trapelia* sp.' MN150524 are included in the phylogeny by us as '*Trapelia*' 'aff. *lilacea*'. Unfortunately, we were not able to investigate voucher specimens for making final conclusion about species status of three vouchers mentioned.

nrLSU phylogeny

Six of seven newly found monophyletic branches, i.e.: the *Brianiopsis*, *Gallowayiopsis*, *Kleopowiella*, *Trapegintarasia*, *Trapejamesia*, *Xyloelixia* found to form separate branches after separate nrLSU phylogeny while separate taxa found to be in different position after sequence of this gene.

It should be mentioned that *Xyloelixia constricta* (as *Xylographa constricta*) after nrLSU phylogeny is positioned in the outermost position to Trapeliaceae and Xylariaceae (as well as to Baeomycetaceae, i.e. *Ainoa* s. lat.), while it is positioned within the *Xyloelixia* branch after combined phylogeny based on nrITS, nrLSU and mtSSU sequences.

After nrLSU phylogeny *Kleopowiella* branch is positioned in the same branch with *Gallowayiopsis glebulosa* and *G. obtegens*, as well as with *Trapelia involuta* (not shown).

After nrLSU phylogeny '*Placopsis*' *bicolor* branch is positioned in the sister position to *Aspiciliopsis*.

It should be mentioned that after nrLSU phylogeny the *Rimularia* branch is positioned in the Baeomycetaceae (i.e. together with the following genera: *Anzina*, *Arctomia*, *Arthrorhaphis, Baeomyces*, *Cameronia*, *Dibaeis*, *Dictyocatenulata, Hymenelia*, *Parainoa*, *Phyllobeis*, *Protothelenella*, and *Sarea*) (not shown here).

After separate nrLSU phylogeny *Lithographa tesserata* found to be positioned in the *Rimularia* branch, which is positioned in the Baeomycetaceae, too.

After separate nrLSU phylogeny two taxa, i.e. *Xylographa bjoerkii* (KJ462351) and *X. lagoi* (KJ462263) found to be positioned within the monophyletic *Xyloelixia* branch, while position of two mentioned taxa in the separate nrITS and mtSSU phylogeny varying from analysis to analysis, were they are mostly are positioned in separate (from the *Xyloelixia* branch) branches. The latter may illustrate that position of the *Xylographa bjoerkii* and *X. lagoi* is in urgent need of clarifying with accumulation of the further molecular data on these taxa.

It should be emphasised that *Rimularia psephota* for which we hitherto have only data on nLSU and mtSSU sequences (data on nrITS sequence are still missing) is positioned in the *Lambiella* branch. In another words *Lambiella psephota* is correct name for this taxon from point of view of nrLSU phylogeny.

Brianiopsis aliphatica found to be correct name for '*Lambiella* sp. Spribille 39388' specimen from USA: Alaska after separate nrITS and nrLSU phylogeny, while data on mtSSU sequence are still missing for this voucher specimen.

mtSSU phylogeny

Confirmation of previously described genera by mtSSU phylogeny

The robust monophyletic *Ptychographa* and *Lithographa* branches after mtSSU phylogeny are positioned in separate subclade in sister position to the *Xyloelixia*, *Xylographa* s. lat. and the *Brianiopsis* branches.

It should be mentioned that the *Lambiella* s. str. branch positioning in sister position to the *Rimularia* branch, the latter two branches are positioned in the outermost position to the *Ptychographa-Lithographa* subclade and *Xyloelixia-Xylographa* s. lat. – *Brianiopsis* subclade.

mtSSU data on newly found monophyletic branches

All seven newly found monophyletic branches, i.e.: the *Brianiopsis*, *Farkasiella*, *Gallowayiopsis*, *Kleopowiella*, *Trapegintarasia*, *Trapejamesia*, *Xyloelixia* were found to form separate branches after separate mtSSU phylogeny.

The *Brianiopsis* was found to be positioned in sister position to the *Xylographa* s. str. branch within the *Xylographa* s. lat. subclade (i.e. between the *Xylographa* s. str., on one side) and the *Lambiella*, *Rimularia, Lithographa* and *Ptychographa* branches on another side after mtSSU phylogeny. It includes additionally four specimens of *Brianiopsis impavida*, two specimens of *B. globulosa*, a single specimen of *B. gyrizans*, as well as a single specimen (one of two) of '*Xylographa*' *bjoerkii* (KJ462406).

After mtSSU phylogeny the *Gallowayiopsis* branch (i.e. the '*Trapelia*' *collaris* branch) including also '*Placopsis*' *roseonigra* is positioned in sister position

to the *Placopsis* s. lat. subclade (or in another words being in sister position to both the *Placopsis* s. str. and the *Ducatina-Orceolina-Aspiciliopsis*-'*Placopsis*' *bicolor* branch of the *Placopsis* s. lat. subclade), i.e. in distant position from the other former *Trapelia* and *Trapeliopsis* branches. The *Gallowayiopsis* branch after mtSSU includes as *G. collaris* (2 sequences with correct identification and five more vouchers mentioned as '*Trapelia* sp.', but showing the closest similarities to *Gallowayiopsis collaris* after mtSSU phylogeny), *G. glebulosa* (4 sequences with correct identification and additional four, i.e. KR017353 and KR017310 submitted to GenBank as '*Trapelia coarctata*' and KY797816 and KY797819 submitted to GB as '*Trapeliopsis* sp.' are reidentified here from mtSSU analysis as *Gallowayiopsis glebulosa*)) and *Gallowayiopsis obtegens* (2 vouchers of *G. obtegens* itself and one more identified within our study MH627040 [it was submitted to GB as '*Trapeliopsis placodioides*']). *T. roseonigra* (single sequence), as well as a number of sequences of '*Trapelia* sp.' (i.e. KY797801, KY797811, KY797812, KY797815, KY797817) which may belong to *Gallowayiopsis collaris*, but nrITS data on these vouchers are still missing and this hypotheses requires additional study), as well as KY797816, and KY797819, which may belong to *Gallowayiopsis glebulosa* / *obtegens* complex too.

The *Kleopowiella* branch found to be positioned in separate branch in the outermost position to the *Placopsis* and the *Gallowayiopsis* branches, while close to the *Trapegintarasia antarctica* (KR017359 and KR017326) / *T. tristis* (KY797796, KY797806) branch. The *Kleopowiella* branch hitherto includes two taxa, i.e. *Kleopowiella placodioides* (three vouchers) and *Kleopowiella thieleana* (2 vouchers correctly identified and 4 vouchers, which earlier were identified as '*Trapelia placodioides*' KY797799, KY797810, KY797818, and KU672619, which may belong to *Kleopowiella thieleana* too from our mtSSU analysis.

The *Trapegintarasia lilacea* branch after mtSSU phylogeny includes three taxa, i.e. *Trapegintarasia lilacea* (Kantvilas et Elix) S. Y. Kondr., *Trapegintarasia antarctica* (Ertz *et al.*) S. Y. Kondr. and *Trapegintarasia tristis* (Orange) S. Y. Kondr. After mtSSU phylogeny one of vouchers of '*Trapelia*' *lilacea* (KU672617), as well as two vouchers of *Aspicilia gibbosa* (NM060702) are positioned in sister position to *Agyrium rufum* (Agyriaceae) (EF581824, EF582823) and were not included in the further analysis.

The *Trapejamesia* branch including two vouchers of single species *Trapejamesia corticola* is the most distant to the other former '*Trapelia*' and '*Trapeliopsis*' branches after mtSSU phylogeny. The *Trapejamesia* is positioned in the outermost position to the *Placopsis* s. lat. subclade including the *Ducatina-Orceolina-Aspiciliopsis* subclade and the *Placopsis* s. str. – *Gallowayiopsis* branches.

It should be mentioned that *Xyloelixia* branch together with *Xyloelixia isidiosa* (KJ462414, KJ462413, KJ462412 and *Xylographa trunciseda* (KJ462455 and KJ462453) includes also sequences of the following five taxa: *Xylographa erratica* (KJ462414), *X. opegraphella* (KJ462422), *X. difformis* (KJ642413 and KJ462412),

X. bjoerkii (KJ462407) and *X. carneopallida* (KJ462408), because mtSSU sequences of the latter five taxa are very short (403–404 bp). Data on these specimens were excluded from the further mtSSU analysis. In the mtSSU tree *Xyloelixia constricta* is positioned in separate branch in sister position to both the *Xylographa* s. str. and the *Brianiopsis* branches. In addition to this the separate single branch is formed by *Xyloelixia constricta* (T. Sprib.) S. Y. Kondr., being between the *Ptychographa* and *Brianiopsis* branches after mtSSU phylogeny.

mtSSU data on separate vouchers / species

In contrast to the nrITS phylogeny the genus *Ducatina* Ertz et Søchting recently described for the single species *D. umbilicata* Ertz et Søchting for which nrITS data are still missing found to be positioned in the same *Orceolina* s. lat. subclade, including the following robust monophyletic branches: the *Orceolina* branch (with two species *O. kergulensis* (Tuck.) Hertel and *O. antarctica* (Müll. Arg.) R. S. Poulsen et Søchting), the *Aspiciliopsis* branch (with single species *A. macrophthalma*) and the '*Placopsis*' *bicolor* branch including only one species, while there are mtSSU data on three different vouchers of the latter taxon (i.e. *Placopsis bicolor* (Tuck.) B. de Lesd.).

Among species of the genus *Placopsis* one species, i.e. *P. santessonii* Galloway, nom. nudum was mentioned in Schmitt *et al.* (2003) in the table of vouchers investigated, while description of this taxon was never published. Suggestion about status of this taxon see above (under nrITS phylogeny).

Data on mtSSU of *Placopsis tararuana* (Zahlbr.) Galloway [2001] (KU844563) is positioned in close position to *Placopsis perrugosa*, but may not belong to the latter taxon (after mtSSU).

After our mtSSU phylogeny *Lambiella psephota* (Fuck.) Hertel is the correct name after molecular phylogeny, while according to Index Fungorum *Rimularia psephota* (Fuck.) Hertel et Rambold is the current name for this species.

'*Lambiella*' *sphacelata* (Th. Fr.) M. Westb. et Resl found to be positioned in outermost position in the *Rimularia* branch after mtSSU phylogeny.

After mtSSU phylogeny *Trapeliopsis congregans* found to be present in the lichen flora of Greenland on the basis on a voucher specimen submitted to the GenBank as *Trapeliopsis* sp. Hansen s.n. (ITS KT017083, nrLSU KR017165 and mtSSU KR017363), while *Trapeliopsis flexuosa* identified on the basis of specimen *Trapeliopsis* sp. Spribille 40723 (MSC) (ITS MN483161 and mtSSU MN508308).

The *Trapeliopsis* s. str. branch after mtSSU phylogeny includes 7 vouchers of *Trapeliopsis flexuosa* (Fr.) Coppins et P. James (of which AY340534 and AF381567 submitted as '*Trapeliopsis*' *granulosa* (Hoffm.) Lumbsch reidentified here, as well as MN508309 submitted as '*Trapeliopsis* sp.' is identified, too),

T. glaucopholis (Nyl.) Printzen et McCune, *T. gymnidiata* Aptroot et Schumm, *T. steppica* McCune et F. J. Camacho, *T. granulosa* with 5 vouchers (of which KR017307 submitted as '*Trapeliopsis pseudogranulosa*' is identified here as *Trapeliopsis granulosa*, and AY212875 submitted as '*Trapeliopsis flexuosa*' is reidentified here as *Trapeliopsis granulosa*, too), and *T. pseudogranulosa* Coppins et P. James (on the basis of MN508308 submitted as '*Trapeliopsis* sp. Spribille 40783' and identified here as *Trapeliopsis pseudogranulosa*), as well as *T. wallrothii* (Flörke ex Spreng.) Hertel et Gotth. Schneid.

Trapeliopsis viridescens (J. F. Gmel.) Coppins et P. James and *T. congregans* (Zahlbr.) Brako (MH627041) found to be positioned in the outermost position within the *Trapeliopsis* s. str. branch.

The '*Trapeliopsis*' *glaucolepida* / *percrenata* branch is positioned in out position to the *Trapeliopsis* s. str. branch. It includes '*T.*' *percrenata* (Nyl.) Gotth. Schneid. – 2 vouchers, '*T.*' *glaucolepidea* (Nyl.) Gotth. Schneid. – two vouchers, '*T.*' *haumannii* (Zahlbr.) Gotth. Schneid. – 1 voucher and '*T.*' *colensoi* (C. Bab.) Gotth. Schneid. – 2 vouchers.

The *Farkasiella aeneofusca* branch including two vouchers of *F. gelatinosa* (Flörke) S. Y. Kondr. et L. Lőkös and two vouchers of *Farkasiella aeneofusca* (Flörke ex Flot.) S. Y. Kondr. et L. Lőkös is positioned in the outermost position to the *Trapeliopsis-Placynthiella* subclade being in sister position to the *Placynthiella* branch.

The *Trapelia* s. str. branch includes only *Trapelia coarctata* (Turner) M. Choisy presented by nine voucher specimens with mtSSU data, which is positioned in sister position to the *Trapelia elacista* branch including *T. elacista* (Ach.) Orange, *T. involuta* (Taylor) Hertel and *T. chiodectonoides* Brusse.

It should be stressed that total number of vouchers identified as *Trapelia coarctata* data on which are already submitted to GenBank is much higher. However, from our data they belong to other taxa and their reidentification is an urgent task. So, vouchers identified as '*Trapelia coarctata* AY212874, KR017303, KR017351, and MN708305 belong rather to *Trapelia elacista* [than to *T coarctata*], and voucher '*Trapelia glebulosa*' KR017302 belong to *T elacista*, while voucher '*Trapelia placodioides* AF431962' belong rather to *Trapelia involuta*.

Thus, the genus *Trapelia* s. str. may include both as the *T. coarctata* and the *T. elacista* branches, while the others branches are candidates for excluding from the genus *Trapelia*.

The next '*Trapelia*' *sitiens* and the *Trapegintarasia* (i.e. the former '*Trapelia*' *lilacea* group) branches being in sister position of each other are positioned in sister position to the *Trapelia* s. str. The '*Trapelia*' *sitiens* branch includes '*Trapelia*' *macrospora* Fryday (including from our data also several voucher specimens as '*Trapelia* sp.' – KY797794, KY797807, and KY797808), and *Trapelia calvariana* Kantvilas et Lumbsch.

NEW GENERA

Brianiopsis S. Y. Kondr., *gen. nova*

MycoBank No.: MB 843000

Similar to the genus Lambiella *but differs in having rounded, strongly convex and sometimes stipitate areoles, in having stictic acid complex and fatty acids as the major medullary substances, as well as mostly in the lack of gyrophoric acid as in forming distant from the latter separate monophyletic branch after combined phylogenetic tree.*

Type species: *Brianiopsis globulosa* (Coppins) S. Y. Kondr.

Thallus crustose, effuse and often wide-spreading on a thin black prothallus, to very thin and discontinuous; areoles globose, grey-brown to brown, or pale, to bicoloured, with a dark grey edge and light grey centre; matt, strongly convex, often constricted below and sometimes shortly stipitate, usually discrete, but occasionally confluent and obscuring the underlying prothallus; photobiont cells very sparse and limited to the base of apothecia, *Chlorella*-like, with individual cells globose to rhomboid, occurring singly or in pairs, surrounded by a gelatinous sheath, colonies of unidentified cyanobacteria also present; medulla I–. Apothecia at first urceolate with a deeply sunken disc, to immersed, mostly single, sessile, appearing lecideine or gyrose later, if tuberculate, immersed or a few sessile, or strongly convex to subglobose, broadly adnate at the base, with disc intensely gyrose-contorted and margin indistinct and mostly camouflaged by the gyrae of the disc, black to jet-black; exciple dark brown or greyish, K–; hypothecium brown below, sometimes paler above and green-tinged, K–; hymenium, colourless but green-tinged in the lower part; paraphyses 1.5–2 μm diam., richly branched in mid-hymenium, becoming bead-like above, with cells to 4.5 μm diam., apices neither capitate nor pigmented. Asci eight-spored, broadly clavate, of the typical *Rimularia*-type. Ascospores simple, near-globose or ellipsoidal to ovate, hyaline to occasionally slightly pale brownish, from small to medium size. Pycnidia partly immersed; wall brown; conidia bacilliform, aseptate.

Chemistry: Medulla C–, K± yellow, or K+ yellow-orange, to K+ yellow → red (with abundant crystals), KC– or KC + red, Pd+ red or Pd± yellow to Pd+ yellow → red; or all thallus spot tests negative. Stictic acid, or, stictic and ± norstictic acids, or norstictic acid, as well as aliphatic (fatty) acids are detected.

Ecology: On exposed siliceous rocks, on sandstone, on schists, primarily montane; on dry vertical or steeply sloping siliceous rock appears to be most frequent on iron-rich rock. On argillite rock on alpine ridgeline and in talus.

Etymology: Genus is named after the well-known British lichenologist Brian Coppins in recognition of his contribution to taxonomy of the Trapeliaceae, as well as in the lichenology in general.

Species diversity and distribution: Among four species of this genus confirmed by combined phylogeny *Brianiopsis gyrizans* is widespread in cool temperate areas of Europe and North America locally common in montane W and N Britain, but known from sea-level in S. Wales (Pembroke) is the commonest taxon. It is also one of the commonest crustose lichens on siliceous rocks in the eastern Scottish Highlands. The other three taxa are rather rare: *B. mullensis* – endemic of SW England (Dartmoor), N Wales, N Scotland, and *B. globulosa* – very rare Scottish endemic Scottish Highlands (Cairngorms, Glen Strathfarrar), as well as North American *B. aliphatica* is so far known only from type locality in the Gulf of Alaska. Position of three more rare taxa, i.e.: *B. cerebriformis* so far known from Northern Territory of Australia (and differing by content of gyrophoric and lecanoric acids), *B. gyromuscosa* hitherto recorded only from subalpine Taiwan (SE Asia) within this genus to be confirmed by molecular data.

Taxonomic notes: *Brianiopsis* is similar to the genus *Lambiella*, but differs in having rounded, strongly convex and sometimes stipitate areoles, in having stictic acid complex and fatty acids as the major medullary substances, as well as mostly in the lack of gyrophoric acid as in forming distant from the latter separate monophyletic branch after combined phylogenetic tree.

The genus *Lambiella* Hertel was recently treated in some detail, as a split from *Rimularia* Nyl., in a phylogenetic study by Spribille *et al*. (2014) and Resl *et al.* (2015). DNA sequences from *Brianiopsis aliphatica* (T. Sprib. et Resl) S. Y. Kondr. (first published by Resl *et al.* 2018) clearly place it in the *Brianiopsis* branch as sister to a clade that includes *Brianiopsis globulosa* (Coppins) S. Y. Kondr. and *B. gyrizans* (Nyl.) S. Y. Kondr.

Brianiopsis found to be positioned in sister position to the *Xylographa* branch of the *Litographa/Ptychographa/Xylographa* subclade of the Xylographaceae after mtSSU phylogeny, while *Brianiopsis constricta* found to be positioned in somewhat isolated position closely to the *Ptychographa* branch of the Xylographaceae.

Farkasiella S. Y. Kondr. et L. Lőkös, *gen. nova*

MycoBank No.: MB 843001

Similar to Trapeliopsis*, but differs in forming separate robust monophyletic branch in sister position to the* Placynthiella *branch of the Trapeliaceae tree.*

The type species of genus: *Farkasiella aeneofusca* (Flörke ex Flot.) S. Y. Kondr. et L. Lőkös.

Thallus thin and membranaceous, or minutely granular, dark green-brown to green-grey, without or with pale green soralia, at first 0.2–0.7 mm diam., but often becoming very conspicuous, irregular and confluent. Apothecia adpressed, exciple excluded or as a thin, pale rim not exceeding the level of disc, dark green-grey to grey-black; epithecium green, K+ brown. Ascospores simple, colourless.

Chemistry: Thallus K–, C–, RC–, Pd–.

Ecology: On shaded, peaty or clay soil, mainly in banks or cuttings with overhanging herbs or small shrubs, only locally abundant in upland districts.

Etymology: The genus is named after the well-known Hungarian lichenologist Edit Farkas (Vácrátót, Hungary) in recognition of her contribution to knowledge on the Hungarian lichen flora, as well as taxonomy of epiphyllous lichens of the world.

Species diversity and distribution: The genus includes so far two species of which *Farkasiella gelatinosa* is more or less widely distributed in Europe and North America, while *F. aeneofusca* is rather rare in Europe.

Taxonomic notes: After separate mtSSU phylogeny the *Farkasiella* found to be positioned in sister position to *Placynthiella* s. str. branch in the *Placynthiella* s. lat. subclade of the *Placynthiella/Trapeliopsis* subclade of the Trapeliaceae.

After combined phylogeny of the Trapeliaceae and Xylariaceae the *Farkasiella* is positioned in the *Placynthiella* s. lat. subclade of the Trapeliaceae.

The pale green colour of the soralia of the species of the genus *Farkasiella* is in marked contrast with the darker thallus, only occasionally no soralia are present.

Gallowayiopsis S. Y. Kondr., *gen. nova*

MycoBank No.: MB 843011

Similar to Trapelia, *but differs in having never exhibiting a visible prothallus, in having distinct primary areoles with abruptly thickened margins, in having varying amount of gyrophoric and 5-O-methylhiascic acids and in forming robust monophyletic branch in the Trapeliaceae tree.*

The type species of genus: *Gallowayiopsis obtegens* (Th. Fr.) S. Y. Kondr.

Prothallus inapparent. Thallus of areoles with abrupt margin, often scattered, strongly convex, sometimes more flattened later, with more or less round outline or becoming slightly lobed, or thallus of areoles, these arising singly, more or less plane or slightly convex, green-grey to normally pale brownish grey to dull grey-brown, pruinose; soralia either absent, or sparse, or abundant; when soralia are abundant, the areoles are dissolved into soralia

early on, and corticate areoles are inconspicuous. Cortex *ca* 10 μm thick, with brown pigment; thin epinecral layer (*ca* 4 μm) of cell remains. Apothecia relatively small, occasionally more; when emerging the margin has some whitish thalline tissue, but never conspicuous white flecks; frequent, even in sorediate morphs, in some species always present, appearing very early, sometimes on small areoles, erumpent, margin with stretched pale thalline material, or with few irregular teeth of material; young thalline margin often with pale stretched thalline remains; disc pinkish brown to brown-black, rough. Ascospores medium size, ovoid or ellipsoid. Conidiomata not detected.

Chemistry: Gyrophoric acid (major), 5-O-methylhiascic acid (minor or trace), or 5-O-methylhiascic acid (major) and gyrophoric acid (trace).

Ecology: On rock in a wide variety of habitats, often on siliceous stones beside tracks and on spoil heaps of coal, metal and slate mines, usually where moist from contact with soil; the non-sorediate morph frequent in upland situations on bedrock and boulders where there is recently exposed rock. Sometimes on stones apparently rich in heavy metals, at least iron. Both sorediate and non-sorediate morphs also on stones in scree and on spoil heaps; frequent.

Species diversity and distribution: Three species are hitherto confirmed to be member of this branch of the Trapeliaceae, while all these taxa are somewhat common in the Northern Hemisphere.

Etymology: Genus is named after the well-known New Zealand lichenologist David J. Galloway in recognition of his contribution to taxonomy of the *Placopsis*, as well as in the lichenology in general.

Taxonomic notes: *Gallowayiopsis* is similar to *Trapelia*, but differs in having never exhibiting a visible prothallus, in having distinct primary areoles with abruptly thickened margins, in having varying amount of gyrophoric and 5-O-methylhiascic acids and in forming robust monophyletic branch in the Trapeliaceae tree.

Separate position of the *Gallowayiopsis obtegens* branch was hitherto illustrated by Orange (2018), but author often included suggestions about conspecificity of taxa of this branch.

Kleopowiella S. Y. Kondr., *gen. nova*

MycoBank No.: MB 843012

Similar to Trapelia *s. str., but differs in having usually numerous soralia, sometimes with two types of soredia, in having very rare apothecia, in having yellow pigments, in having filiform, mostly strongly curved conidia as well as in positioning on separate monophyletic branch of the Trapeliaceae.*

Type species: *Kleopowiella placodioides* (Coppins et P. James) S. Y. Kondr.

Prothallus sometimes visible, whitish. Thallus thin or somewhat abruptly thickened at margin, margin entire or divided by cracks, no primary areoles visible, thallus forming a cracked crust, rimose-areolate to subsquamulose, well developed, rather thick, pale pinkish grey, dull pale grey, mostly with a smoky or faint lilac tinge, usually flushed here and there with diffuse patches of a vivid, egg-yolk yellow pigment, surface plane, matt, slightly pruinose. Cortex *ca* 20 μm thick, with thin epinecral layer or ecorticate, not effigurate, forming irregular patches up to ~10 cm across and 75–250 mm thick; upper surface generally even, but nevertheless reflecting the texture of the substratum beneath, smooth to faintly scabrid, in yellow-pigmented areas minutely farinose; prothallus usually absent, or forming a thin, black border, where a leading edge of the thallus abuts other lichens. Soralia present on upper surface of secondary areoles, usually originating at margin of areole, plane, pale green to pale greenish brown, irregular in shape, remaining limited in size and not obscuring the thallus. In one species (*bisorediata*) soredia of two types: 1) fine granules coloured like thallus in diffuse, weakly defined soralia and/or 2) fine dark brown to black granules in roundish well-defined soralia to 0.5 mm diam. that are often in the centre of areoles and superficially appearing like apothecia.

Apothecia biatorine, 0.3–0.6 mm wide, roundish, scattered, remaining discrete, soon emergent from the thallus, but mostly retaining adhering thalline fragments on the margin and disc; disc pale brown to grey-brown, plane to undulate to convex, often verruculose, or not seen in some species or reported as very rare, but some abortive apothecia-like structures are occasional; proper excipulum concolorous with the disc, inapparent to excluded in section hyaline, rather thick at the upper edge, becoming thinner and poorly differentiated at the sides and base, composed of loosely interwoven prosoplectenchymatous hyphae. Hypothecium colourless to pale reddish brown. Hymenium colourless. Asci 8-spored, of the *Trapelia*-type: cylindrical to elongate-clavate, with a non-amyloid or at most weakly amyloid tholus and a thin, external, amyloid sheath; ocular chamber lacking; ascoplasm with a truncate apex when young. Paraphyses 1.5–2 μm thick, sparsely branched and anastomosed, entangled, with apices unpigmented and not enlarged. Ascospores simple, hyaline, thin-walled, non-halonate, ellipsoid, medium size. Pycnidia immersed, scattered, visible as minute, pale pinkish brown pits in the thallus surface; conidia filiform, mostly strongly curved.

Chemistry: Cortical layer K–, KC+ pink, medullar K–; medulla C+ red, KC+ pink, P–, UV–. Gyrophoric acid only, or gyrophoric acid (major), 5-*O*-methylhiascic acid (minor), plus minor related unknowns.

Ecology: On stones and on flushed or poorly drained bedrock in the Northern Hemisphere, on granite and ironstone in open eucalypt forest and dense scrubby heathland of Australia, as well as on soil in shrub steppe (especially *Artemisia tridentata*) and grasslands of North America.

Species diversity and distribution: Among three species so far confirmed by molecular data being in this branch, *Kleopowiella placodioides* is rather widely distributed in the Northern Hemisphere (and from single collection in the Falkland Islands), while *Kleopowiella bisorediata* is so far known only from the semi-arid region between the Rocky Mountains and Cascade Range; Oregon, Washington, and Idaho, while *Kleopowiella thieleana* is known only from southwestern Western Australia.

Etymology: The genus is named after the Ukrainian botanist Yuri D. Kleopow (or Kleopov) (1902–1943), an author of the unique classification of historical and genetic elements of Eurasian flora of vascular plants, but which name was undeservedly silenced in Soviet period (Dubyna and Vynokurov 2019, Protopopova and Shevera 2002), because he was the director of Institute of Agricultural Botany during German period in Kiev in 1940s. Yu. D. Kleopov and A. M. Oxner are also co-authors of one species of vascular plants, i.e. *Lilium ucrainicum* Oxner et Kleopow included in the Flora of Ukraine in 1930s.

Taxonomic notes: After Orange (2018) in the ITS tree *Kleopowiella thieleana* is nested within sequences of *Kleopowiella placodioides*. This could indicate that *K. thieleana* represents a fertile morph of *K. placodioides*, but a wide geographical sampling and study of additional gene regions is needed to investigate this (Orange 2018). However, position of *Kleopowiella bisorediata* in the same branch found to be confirmation that this branch includes several taxa with rather different distribution (see above). Position of *Kleopowiella bisorediata* is hitherto based only on ITS sequences provided in the original paper (McCune *et al.* 2002). Combined molecular data provided in this paper were found to confirm position of the former '*Trapeliopsis*' *bisorediata* in the *Kleopowiella* branch.

The identity of the yellow pigment in *Kleopowiella thieleana* is still unknown. It does not show up on thin-layer chromatography plates; nor is it detected by high-performance liquid chromatography. In the section, it appears as angular-rhomboid crystals, 5–10 mm wide, that fluoresce yellow in polarised light, are greenish in transmitted light, and do not dissolve in KOH (Kantvilas *et al.* 2014).

Furthermore the excipulum of *Kleopowiella thieleana* is extremely reduced. At the upper edge, it is seen in vertical section as a slight bulge of intertwined hyphae, but with increasing depth into the apothecium, it tapers away to the point, where the hymenial and medullary tissues are adjacent. In this respect, it differs from *Trapelia coarctata*, where a thin, but nevertheless distinct excipulum is evident, completely enclosing the hymenium and hypothecium. As is rather common in Trapeliaceae, some ascospores within the ascus, especially the uppermost ones, may be grossly deformed and undeveloped.

According to mtSSU phylogeny, the *Kleopowiella* is positioned as a sister clade to *Gallowayiopsis* in the *Ducatina*, *Orceolina/Aspiciliopsis/Placopsis/Gallowayiopsis* and *Kleopowiella* subclade of the Trapeliaceae.

Trapegintarasia S. Y. Kondr., *gen. nova*

MycoBank No.: MB 843013

Similar to Trapelia *s. str. but differs in having the smaller apothecia, in having sometimes distinctly thickened at the apex paraphyses, in having the hiascic acid-related compounds additionally to gyrophoric, lecanoric and orsellinic acids, and by forming separate monophyletic branch in the Trapeliaceae after combined phylogeny.*

Type species: *Trapegintarasia lilacea* (Kantvilas et Elix) S. Y. Kondr.

Thallus pale grey, lilac-grey to lilac-brown or pale grey to dull greenish grey or greenish brown, generally rather dull, not glossy, forming an irregularly wide-spreading rather thick crust, frequently coalescing with or overgrowing adjacent thalli, deeply cracked and areolate, with individual areoles irregular; margins often thickened, more or less plicate and/or revolute, occasionally a little blackened; 'cortex' consisting of a poorly defined layer of more or less vertically orientated hyphae, with the outermost cell more or less rounded, brown-pigmented, appearing more or less paraplectenchymatous; medulla white, I–. Photobiont green, of the *Chlorella*-type, with cells irregularly roundish, oblong or rhomboid, typically single, paired, or in triads or tetrads and enclosed in a thick, gelatinous sheath, distributed rather unevenly in clumps beneath the 'cortex'. Prothallus whitish, sometimes visible.

Apothecia very rare, small to medium size, roundish or rather angular to somewhat elongate, especially when crowded together, at first immersed in the thallus, soon becoming emergent to sessile when mature but with adhering thalline tissue at the margin, at length sessile and broadly adnate; margin more or less inrolled, conspicuously elevated above the level of the disc, greyish black to pale greyish, sometimes radially cracked or eroded; disc rather sunken and concave, black to dark brown, mostly with a sparse, coarse whitish pruina. Excipulum in section cupular, dark brown to olive-brown, more or less unchanged or intensifying orange-brown in KOH, composed of poorly differentiated, conglutinated, prosoplectenchymatous hyphae *ca* 3 μm thick. Hypothecium pale brown to hyaline, unchanged in KOH, generally poorly differentiated from the hymenium. Hymenium IKI+ blue, mostly hyaline, but with an olive-brown epithecial layer, unchanged or intensifying orange-brown in KOH, inspersed with granules that fluoresce whitish yellow and dissolve in KOH. Paraphyses sparsely branched, mostly at the base and near the apices, slender, 1–2 μm thick, flexuose, entangled, separating readily in KOH, apices not markedly expanded. Asci 8-spored, clavate, of the *Trapelia*-type with a prominent tholus with amyloid flanks but no discernible internal amyloid structures. Ascospores simple, non-halonate, thin-walled, ovate to ellipsoid, but often squashed when within the ascus, medium size, frequently

with large vacuole. Pycnidia rare, visible as minute cracks on the upper surface of the thallus, conidia filiform.

Chemistry: Thallus K–, KC+ reddish, C+ reddish, P–, UV–. 5-O-methylhiascic acid (major), 5-methoxtlecanoric acid (major or minor), gyrophoric acid (minor), hiascic acid (minor or trace), lecanoric acid (minor) and orsellinic acid (minor). The above chemistry has been confirmed by HPLC. In TLC the hiascic acid-related compounds appear as distinctive, UV+ pale yellow spots.

Ecology and distribution: On rock (mostly on dolerite, while sometimes on metamorphosed Precambrian sediments), where it is widespread and common species at middle to high altitudes (750 to 1,350 m elevation) of Tasmania (the most extensive thalli usually occur on large boulders and exposed plates of bedrocks in gaps in open eucalypt woodland, beneath a sparse tree canopy or in subalpine heathland, while the species is generally less abundant in exposed, treeless, alpine areas.), or rocks beside streams, in the intermittently inundated zone of Falkland Islands.

Etymology: Genus is named after the well-known Australian lichenologist Gintaras Kantvilas in recognition of his contribution to taxonomy of the Trapeliaceae, as well as in the lichenology in general.

Species diversity and distribution: The genus includes rare species of the Southern Hemisphere, i.e. *Trapegintarasia lilacea* is endemic to Tasmania, while *Trapegintarasia tristis* is so far known only from three localities in Falkland Islands.

Taxonomic notes: *Trapegintarasia* is similar to *Trapelia* s. str. after notably the immersed, more or less angiocarpic ascomata when young, the very poorly developed prosoplectenchymatous excipulum, the rather delicate, entangled paraphyses, relatively large, vacuolate ascospores, and the filiform conidia, but differs in having the smaller apothecia, in having sometimes distinctly thickened at the apex paraphyses, in having the hiascic acid-related compounds additionally to gyrophoric, lecanoric and orsellinic acids, and by forming separate monophyletic branch in the Trapeliaceae after combined phylogeny.

The unusual chemistry of *Trapegintarasia* (the hiascic acid-related compounds appear as distinctive) makes it unique within Agyriaceae, although related substances, notably gyrophoric acid, are widespread in the family, and hiascic acid has been recorded in *Placopsis* by Lumbsch *et al.* (1993).

Trapegintarasia lilacea, the type species of this genus, is very distinctive species, readily recognised by the thick, lilac-tinted, crustose thallus that aggressively overgrows adjacent crustose lichens. Despite being very common and widespread, in some localities occurring as one of the dominant saxicolous species, it is almost invariably sterile. Furthermore it typically grows on the hardest, largest boulders from which it is extremely difficult to remove thallus fragments for study. As a result, it is rather rarely collected and poorly studied.

Trapejamesia S. Y. Kondr., *gen. nova*

MycoBank No.: MB 843014

Similar to Trapelia *s. str., but differs from the other species by the substratum of bark or wood, the smaller ascospores and the swollen paraphysis apices, as well as in positioning on separate monophyletic branch of the Trapeliaceae.*

Type species of the genus: *Trapejamesia corticola* (Coppins et P. James) S. Y. Kondr.

Prothallus occasionally visible as a very thin, pale film. Thallus with young areoles arising on the prothallus, with thin margins, early becoming uneven, coalescing into a thin, verrucose-uneven crust with very poorly-delimited subunits; thallus light brown in good light, brownish green in shade, occasionally lightly cracked. Soralia always present, mostly discrete, usually convex, rarely confluent, pale green with a brownish tinge; soredia very fine, *ca* 20 μm diam.

Apothecia rare (but easily overlooked in the field), sessile, rather small, margin pale brown, smooth, thin; disc pale brown to dull mid brown, more or less plane, without a pseudothalline margin. Exciple thin, brown; hymenium hyaline. Paraphyses with the apical cells brown, irregularly swollen, to 3.5 μm wide. Ascospores 9·0–15·5 × 5–9 μm [15/2].

Etymology: Genus is named after the well-known English lichenologist Peter James in recognition of his contribution to the taxonomy of the trapelioid lichens and lichenology in general.

Ecology and distribution: On acidic bark and wood of phorophytes including *Quercus petraea*, *Alnus glutinosa*, *Larix decidua* and *Picea sitchensis*, usually in humid woodland. Locally frequent in north and west Britain.

Taxonomic notes: *Trapejamesia corticola* differs from the other *Trapelia* species studied in his treatment by the substratum of bark or wood, the smaller ascospores and the swollen paraphysis apices.

Similarities of this taxon with the Eastern Asian endemic species *Trapejamesia hurii* after nrITS data are discussed above. Status of the latter species is waiting for confirmation after complete nrLSU and mtSSU sequences.

After mtSSU phylogeny the *Trapejamesia* found to be positioned in the outermost position in the *Ducatina*, *Orceolina*/*Aspiciliopsis*/*Placopsis*/*Gallowayiopsis* and *Kleopowiella* subclade of the Trapeliaceae. After combined phylogeny based on nrITS, nrLSU and mtSSU sequences the *Trapejamesia* is a member of the *Placynthiella* s. lat. subclade of the Trapeliaceae (Fig. 1).

Xyloelixia S. Y. Kondr., *gen. nova*

MycoBank No.: MB 843015

Similar to Xylographa, *but differs in having well-developed thallus being mostly isidiate, in having radiating outwards ascomata, in having confriesiic, friesiic and fatty acids as lichen substances, in having long, nearly fusiform ascospores, as well as positioning in separate monophyletic branch of the Xylariaceae.*

Type species: *Xyloelixia isidiosa* (Elix) S. Y. Kondr.

Thallus lignicolous, crustose to subsquamulose, scattered granules or squamules, adnate, separate, not proliferating, green-brown, margin somewhat crenulate and more or less upturned, squamules soon developing dense granular isidia, which dominate the thallus, sometimes thallus coarse isidioid, soredia absent. Granular isidia globulose to subglobulose, with conspicuously blackened apices, becoming coralloid and densely crowded, forming cerebriform, conglomerate clusters.

Ascomata appearing as narrow slits, apparently beginning as a single ascoma and then radiating outwards, ultimately forming a ring, in the centre of which wood grains become squeezed together into a shallow "hill"; form of ascomata narrowly angular, tips acuminate; or with lateral growth of *trunciseda*-type, regenerating in multiple directions off the edges of spent excipular shells, ascomatal complexes sometimes forming rings or stars; form angular, variably broadly or narrowly ellipsoid or irregularly lobed, strongly constricted basally, as well as unknown in some taxa; disc concave to deeply concave, dark brown to black, matte, with thin brown margin or when dry almost completely concealed by margins, these thick, black, flexuose, prominent; exciple paraplectenchymatous in vertical section, in lower part integral with and incorporating xylem cells; excipular hyphae pigmented brown to dark brown externally; hypothecium hyaline to pale reddish brown; hymenium hyaline to pale hazy brown throughout, euamyloid (I_{Lugols}+ blue, turning violet when flushed with KOH) or ±hemiamyloid (I_{Lugols}+ blue-green → rust red, with localised persistent blue patches), consisting of asci mingled with sparsely branched paraphyses *ca* 2.5 μm at midpoint, distally thickened to 3–4 μm in the apical cell, not or weakly pigmented to with brown wall pigments; ascospores 8/ascus, long-ellipsoid to almost fusiform. Conidiomata partially immersed, or to *ca* 3⁄4 immersed, globose, wall hyphae with internal brown and grey pigments; empty in the only specimen seen, conidia not seen.

Sterile hyphae not lichenised, intercalating with wood hyphae or lichenised, associated with algal plugs developing endosubstratally in the wood fibre, internally prosoplectenchymatous and mixed with algae, exter-

nally all areas of thallus covered in a thin to thick layer of goniocysts, these grouping into plates or areoles; goniocysts consisting of tightly packed algae surrounded by brown, angular, paraplectenchymatous fungal hyphae, easily dislodged and free in water squash preparations, macroscopically pigmented dark brown. Associated algae *Trebouxia*.

Chemistry: K–, C–, KC–, Pd–, UV+ faint white; containing confriesiic acid (major or trace), friesiic acid (minor or major) and 1–3 unidentified fatty acid(s) (major), or no substances detected.

Ecology: Lignicolous on dead, charred *Eucalyptus* logs of Australia, on wood, apparently mainly of Cupressaceae in North America, on wood of temperate forests and on drift-wood in salt marshes in the Atlantic coastal plain of eastern North America, to montane elevations in the Appalachians, as well as from glacial forelands in Cape Horn (Chile, South America).

Etymology: Genus is named after the well-known Australian lichenologist Jack Elix in recognition of his contribution to taxonomy of the Trapeliaceae and Xylariaceae, as well as in the lichenology in general.

Species diversity and distribution: The genus includes four very rare species from various continents, i.e. *Xyloelixia isidiosa* is only known from the type locality in Western Australia, *X. constricta* only from Cape Horn (Chile, South America), *X. disseminata* is one of only a few nemoral *Xylographa* species, and is known in eastern North America from Nova Scotia to North Carolina.

Taxonomic notes: *Xyloelixia* is similar to *Xylographa*, but differs in having well developed thallus being mostly isidiate, in having radiating outwards ascomata (vs. mostly parallel orientated ascomata), in having confriesiic, friesiic and fatty acids as lichen substances (vs. stictic and norstictic acids), in having long, nearly fusiform ascospores, as well as positioning in separate monophyletic branch of the Xylographaceae.

Xyloelixia isidiosa, the type species of this genus, a rare species is characterised by the dominant, black-tipped granular, globose to subglobose isidia, which coalesce to form cerebriform clusters largely obscuring the primary squamules and the presence of confriesiic and friesiic acids as lichen substances was described as '*Hypocenomyce*' *isidiosa* (Elix *et al.* 2004), friesiic and confreisiic acids very rare depsido-depsidones were at that time only known from the genus *Hypocenomyce* (Elix *et al.* 2004, Timdal 1984). Although common at type locality, no fertile material of *Xyloelixia isidiosa* was found.

However, on the basis of molecular results Bendiksby and Timdal (2013) show that '*Hypocenomyce*' *isidiosa* is not closely related to *Xylopsora*, but rather nests within *Xylographa* (Trapeliaceae, Baeomycetales, Ostropomycetidae). Morphologically, '*Hypocenomyce*' *isidiosa* resembles sorediate species of *Xylographa* in forming an endoxylic thallus with vegetative dispersal units bursting out through cracks in the wood. Furthermore confriesiic acid occurs in

two other genera of the Trapeliaceae, i.e., *Rimularia* Nyl. and *Trapeliopsis* Hertel et Gotth. Schneid. Hence, Bendiksby and Timdal (2013) proposed the new combination '*Xylographa*' *isidiosa* (Elix) Bendiksby et Timdal.

Xyloelixia isidiosa, the type species of this genus, described by Elix (2005), is only known without ascomata, and was recently transferred to *Xylographa* based on molecular data by Bendiksby and Timdal (2013). Its thallus form and goniocysts are similar to those of the Northern Hemisphere species *X. septentrionalis*, but are more continuous and thicker. It strongly resembles a *Placynthiella* (e.g., *P. icmalea*) in habit and could easily be overlooked as such.

Position of *Xyloelixia septentrionalis* in the *Xyloelixia* branch to be confirmed by molecular data in future.

NEW COMBINATIONS

The new combination '*Ainoa*' *sphacellata* is proposed with some hesitation, while its position is still waiting for confirmation with additional vouchers and molecular data on various branches of the Baeomycetales and Ostropomycetidae in general, which is very varying for different generic groups. So only nrITS sequences are available for *Bachmanniomyces*, only nrITS and nrLSU sequences are known for *Dictyocatenulata*, and only mtSSu and nrLSU data for genera *Aspilidea* and *Ducatina*, while no data hitherto provided for *Amphorothecium*, *Malvinia* and *Pleiopatella*.

'Ainoa' sphacellata (Th. Fr.) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843016 – Basionym: *Lecidea sphacelata* Th. Fr., Lich. Scand. (Upsaliae) (2): 445 (1874). – Syn.: *Biatora sphacelata* (Th. Fr.) Hellb., Öfvers. K. Svensk. Vetensk.-Akad. Förhandl., p. 69 (1875); *Rimularia sphacelata* (Th. Fr.) Hertel et Rambold in Jahns, Bibl. Lichenol. 38: 185 (1990); *Lambiella sphacelata* (Th. Fr.) M. Westb. et Resl in Resl *et al.*, Fungal Diversity 73: 255 (2015).

Brianiopsis aliphatica (T. Sprib. et Resl) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843017 – Basionym: *Lambiella aliphatica* T. Sprib. et Resl in Spribille *et al.*, Lichenologist 52(2): 101 (2020).

Brianiopsis cerebriformis (Kantvilas) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843018 – Basionym: *Rimularia cerebriformis* Kantvilas in Kantvilas *et al.*, Austrobaileya 7(4): 660 (2008).

Brianiopsis globulosa (Coppins) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843019 – Basionym: *Rimularia globulosa* Coppins, Bibl. Lichenol. 78: 45 (2001). – Syn.: *Lambiella globulosa* (Coppins) M. Westb. et Resl in Resl *et al.*, Fungal Diversity 73: 255 (2015).

Brianiopsis gyrizans (Nyl.) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843020 – Basionym: *Lecidea gyrizans* Nyl., Not. Sällsk. Fauna et Fl. Fenn.

Förh., Ny Ser. 3: 83 (1861). – Syn.: *Rimularia gyrizans* (Nyl.) Hertel in Jahns, Bibl. Lichenol. 38: 173 (1990); *Lambiella gyrizans* (Nyl.) M. Westb. et Resl, in Resl *et al.*, Fungal Diversity 73: 255 (2015).

Brianiopsis gyromuscosa (Aptroot) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843021 – Basionym: *Rimularia gyromuscosa* Aptroot in Aptroot and Sparrius, Fungal Diversity 14: 38 (2003).

Brianiopsis impavida (Th. Fr.) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843022 – Basionym: *Lecidea impavida* Th. Fr., K. svenska Vetensk-Akad. Handl., ny följd 7(no. 2): 42 (1867). – Syn.: *Rimularia impavida* (Th. Fr.) Hertel et Rambold, Mitt. bot. StSamml., München 23: 391 (1987); *Lambiella impavida* (Th. Fr.) M. Westb. et Resl in Resl *et al.*, Fungal Diversity 73: 255 (2015).

Brianiopsis mullensis (Stirt.) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843023 – Basionym: *Lecidea mullensis* Stirt., Scott. Natural. 4: 166 (1878) [1877–78]. – Syn.: *Rimularia mullensis* (Stirt.) Coppins, British Lichen Society Bulletin, Supplement 72: 75 (1993); *Lambiella mullensis* (Stirt.) Fryday et Coppins in Cannon *et al.*, Revisions of British and Irish Lichens 17: 9 (2021).

Farkasiella aeneofusca (Flörke ex Flot.) S. Y. Kondr. et L. Lőkös, *comb. nova* – MycoBank No.: MB 843024 – Basionym: *Lecidea aeneofusca* Flörke ex Flot., Flora, Regensburg 11(2): 635 (1828). – Syn.: *Trapeliopsis aeneofusca* (Flörke ex Flot.) Coppins et P. James, Lichenologist 16 (3): 258 (1984).

Farkasiella gelatinosa (Flörke) S. Y. Kondr. et L. Lőkös, *comb. nova* – MycoBank No.: MB 843025 – Basionym: *Lecidea gelatinosa* Flörke, Mag. Gessell. naturf. Freunde, Berlin 3(1–2): 201 (1809). – Syn.: *Trapeliopsis gelatinosa* (Flörke) Coppins et P. James, Lichenologist 16(3): 258 (1984).

Gallowayiopsis collaris (Orange) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843026 – Basionym: *Trapelia collaris* Orange, Lichenologist 50(1): 19 (2018). – Type: Great Britain, Wales, Caernarvonshire (V.C. 49), Capel Curig, east of Carnedd Moel Siabod, Clogwyn Llwyd, 23/7261.5432, on stones beside track in conifer plantation, with *Rhizocarpon reductum*, *Porpidia macrocarpa*, *Gallowayiopsis obtegens*, 12 June 2008, A. Orange 17512 (NMW C.2007.001.264).

Gallowayiopsis glebulosa (Sm.) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843027 – Basionym: *Lichen glebulosus* Sm. in Smith and Sowerby, Engl. Bot. 28: tab. 1955 (1809). – Syn.: *Trapelia glebulosa* (Sm.) J. R. Laundon, Bot. J. Linn. Soc. 147(4): 492 (2005).

Gallowayiopsis obtegens (Th. Fr.) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843028 – Basionym: *Biatora coarctata* subsp. *obtegens* Th. Fr., Bot. Notiser: 152 (1867). – Syn.: *Trapelia obtegens* (Th. Fr.) Hertel, Vortr. GesGeb. Bot. 4: 181 (1970).

Gallowayiopsis roseonigra (Brodo) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843029 – Basionym: *Placopsis roseonigra* Brodo, Bibl. Lichenol. 57: 61 (1995).

Kleopowiella bisorediata (McCune et F. J. Camacho) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843030 – Basionym: *Trapeliopsis bisorediata* McCune et F. J. Camacho in McCune *et al.*, Bryologist 105(1): 80 (2002). – Type: USA, Washington, Benton Co., Horse Heaven Hills, open *Agropyron spicatum* grassland, 320 m, Mc Cune 23928 (holotype: OSC).

Kleopowiella placodioides (Coppins et P. James) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843031 – Basionym: *Trapelia placodioides* Coppins et P. James, Lichenologist 16(3): 257 (1984). – Type: England, Yorkshire, Hebden Bridge, 1978, P. M. Earland-Bennett (holotype: E, not seen).

Kleopowiella thieleana (Kantvilas, Lumbsch et Elix) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843032 – Basionym: *Trapelia thieleana* Kantvilas, Lumbsch et Elix in Kantvilas *et al.*, Aust. Syst. Bot. 27: 400 (2014). – Type*:* Australia, Western Australia: Tutunup Road, 33° 40′ S, 115° 34′ E, 35 m altitude, on ironstone boulders in dense heathland, 13 Nov. 2011, G. Kantvilas 439/11 (holotype: HO; isotype: PERTH).

Rimularia coreana (S. Y. Kondr., Lőkös et Hur) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843033 – Basionym: *Trapelia coreana* S. Y. Kondr., L. Lőkös et J.-S. Hur, Acta Bot. Hung. 58(1–2): 101 (2016). – Type: Republic of Korea, Gyeongsangbuk-do, Gumi-si, Jangcheon-myeon, nearby mountain of Baenomu Valley, on rock, growing together with *Polysporina golubkovae*. Lat.: 36° 09′ 08.21″ N; Long.: 128° 30′ 40.41″ E; Alt.: *ca* 158 m a.s.l. Coll.: Park, J. S., Woo, J. J. (141418), 29.07.2014 (holotype: KoLRI 023872).

Trapegintarasia antarctica (Ertz, Aptroot, G. Thor et Øvstedal) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843034 – Basionym: *Trapelia antarctica* Ertz, Aptroot, G. Thor et Øvstedal in Ertz *et al.*, Phytotaxa 191: 108 (2014).

Trapegintarasia lilacea (Kantvilas et Elix) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843035 – Basionym: *Trapelia lilacea* Kantvilas et Elix, Bibl. Lichenol. 95: 327 (2007). – Type: Tasmania: South Sister, near summit, 4.3 km NNW of St Mary's, 41° 32′ S, 148° 10′ E, on exposed dolerite boulders, 750 m altitude, 10 Nov. 2004, J. A. Elix 28615 & G. Kantvilas (holotypus: HO, not seen).

Trapegintarasia tristis (Orange) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843036 – Basionym: *Trapelia tristis* Orange, Lichenologist 50(1): 33 (2018). – Type: Falkland Islands, West Falkland, North of Fox Bay, Chartres Farm, 'Patricia Luxton Nature Reserve', 51.72459° S, 59.98522° W, alt. 10 m, on rocks in stream, shortly above water, 30 January 2015, Orange 22626 (holotype: NMW.C.2015.005.178).

Trapejamesia corticola (Coppins et P. James) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843037 – Basionym: *Trapelia corticola* Coppins et P. James, Lichenologist 16: 254 (1984). – Type: Wales, Breconshire, Cwm Dyfnant, B. J. Coppins 4078 & R. G. Woods (holotype: E, not seen).

Trapejamesia hurii (S. Y. Kondr. et L. Lőkös) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843038 – Basionym: *Placynthiella hurii* S. Y. Kondr. et L. Lőkös in Kondratyuk *et al.*, Acta Bot. Hung. 59(1–2): 179 (2017). – Type: Republic of Korea. Gyeongsangbuk-do: Ulleung-do Island, Ulleung-gun, Seomyeon, Namyang-ri, in front of Tonggumi mongdol Beach, on siliceous rock, growing together with *Flavoplaca laszloana*, *Verrucaria* and *Buellia* spp. Lat.: 37° 27′ 33.1″ N; Long.: 130° 52′ 05.5″ E; Alt.: *ca* 4 m a.s.l. Coll.: Kondratyuk, S. Y. and Lőkös, L. (161970), 10.07.2016 (holotype: KoLRI 040207 sub *Placynthiella*).

Xyloelixia constricta (T. Sprib.) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843039 – Basionym: *Xylographa constricta* T. Sprib. in Spribille *et al.*, Symb. bot. upsal. 37(no. 1): 31 (2014). – Type: Chile: Prov. Antártica Chilena, Comuna Cabo de Hornos, Parque Nacional Alberto de Agostini, N shore of Isla Hoste, SE end of Península Cloué, S end of Estero Fouque, S shore of stream that drains Lago Covadonga, 55° 10′ 59″ S, 69° 34′ 50″ W; boulder field just ESE of glacier, on lignum, 21 Jan 2012, W. R. Buck 58580 (holotype: NY).

Xyloelixia disseminata (Willey) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843040 – Basionym: *Xylographa disseminata* Willey, in Tuckerman, Syn. N. Amer. Lich. (Boston) 2: 112 (1888). – Type: [USA: *Massachusetts*,] New Bedford, H. Willey (lectotype: FH-00060438; isolectotypes: BM, F, G, H-NYL p.m. 6772!, NY, US).

Xyloelixia isidiosa (Elix) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843041 – Basionym: *Hypocenomyce isidiosa* Elix, Mycotaxon 94: 219 (2006) [2005]. – Syn.: *Xylographa isidiosa* (Elix) Bendiksby et Timdal, Taxon 62(5): 952 (2013). – Type: Australia, Western Australia, Avon district, Charles Gardner Flora Reserve, central track, 20 km SW of Tammin along old York Road, 31° 47′ 24″ S, 117° 28′ 07″ E, alt. 305 m, on dead, charred wood in *Eucalyptus* woodland with *Casuarina* and *Acacia* in shallow gully, 22 April 2004, J. A. Elix 31849 (holotype: PERTH n.v.; isotype: CANB No. 737037!).

Xyloelixia septentrionalis (T. Sprib.) S. Y. Kondr., *comb. nova* – MycoBank No.: MB 843042 – Basionym: *Xylographa septentrionalis* T. Sprib. in Spribille *et al.*, Symb. bot. upsal. 37(no. 1): 64 (2014).

CONCLUSIONS

Seven new monophyletic branches, i.e. two in Xylariaceae and five in the Trapeliaceae were found to be present in combined phylogenetic tree of the families mentioned. New genera *Brianiopsis*, *Farkasiella*, *Gallowayiopsis*, *Placidiopsis*, *Trapejamesia*, *Trapegintarasia*, and *Xyloelixia* are proposed. It is emphasised that the status of the *Farkasiella* including two taxa i.e. *F. aeneofusca* and *F. gelatinosa*, positioning in separate branch after both the separate nrITS and mtSSU analyses is still waiting for confirmation by data on the nrLSU

and combined concatenated matrix. Position of all branches discussed in this paper will be pending of accumulation of data on members of the genera of Trapeliaceae (*Amylora*, *Coppinsia*, *Amphorothecium*, *Malvinia*, etc.) molecular data on which still are missing.

Additionally to the branches discussed in details in this paper (i.e.: *Brianiopsis*, *Farkasiella*, *Gallowayiopsis*, *Placidiopsis*, *Trapejamesia*, *Trapegintarasia*, and *Xyloelixia*), our results confirm previous data (Ertz *et al.* 2017) that the former '*Trapeliopsis geochroa*' is positioned within the *Ainoa* branch of the Baeomycetaceae. Position of vouchers of some taxa, i.e. '*Xylographa*' *opegraphella* positioning in close relations with *Lambiella* species, '*Xylographa*' *vitiligo* – in close relations with *Rimularia*, etc. to be checked as with morphological and anatomical characters as with nrLSU and mtSSU data.

*

Acknowledgements – We are thankful to Prof. Vira V. Protopopova and Dr Myroslav V. Shevera (KW, Kyiv, Ukraine) for productive discussion on correct spelling in English of Yu. D. Kleopow surname, as well as two unknown reviewers for valuable comments on this manuscript.

REFERENCES

Bendiksby, M. and Timdal, E. (2013): Molecular phylogenetics and taxonomy of Hypocenomyce sensu lato (Ascomycota: Lecanoromycetes): extreme polyphyly and morphological/ecological convergence. – *Taxon* **62**(5): 940–956. https://doi.org/10.12705/625.18

Bouckaert, R. R., Drummond, A. J. (2017): bModelTest: Bayesian phylogenetic site model averaging and model comparison. – *BMC Evol. Biol.* **17**(1): 42. https://doi.org/10.1186/s12862-017-0890-6

Bouckaert, R., Vaughan, T. G., Barido-Sottani, J., Duchêne, S., Fourment, M., Gavryushkina, A., Heled, J., Jones, G., Kühnert, D., De Maio, N., Matschiner, M., Mendes, F. K., Müller, N. F., Ogilvie, H. A., du Plessis, L., Popinga, A., Rambaut, A., Rasmussen, D., Siveroni, I., Suchard, M. A., Wu, C.-H., Xie, D., Zhang, C., Stadler, T. and Drummond, A. J. (2019): BEAST 2.5: An advanced software platform for Bayesian evolutionary analysis. – *PLoS Comp. Biol.* **15**(4): e1006650. https://doi.org/10.1371/journal.pcbi.1006650

Dubyna, D. and Vynokurov, D. (2019): Yurii Kleopov (1902–1943) Ukrainian botanist and unsurpassed scholar of the origin and genesis of floristic complexes. – *Bull. Int. Assoc. Veg. Sci.* **3**: 3–13. https://doi.org/10.21570/BUL-201903

Edler, D., Klein, J., Antonelli, A., and Silvestro, D. (2021): raxmlGUI 2.0: a graphical interface and toolkit for phylogenetic analyses using RAxML. – *Methods Ecol. Evol.* **12**(2): 373–377. https://doi.org/10.1111/2041-210X.13512

Ekman, S. (2001): Molecular phylogeny of the Bacidiaceae (Lecanorales, lichenized Ascomycota). – *Mycol. Res.* **105**: 783–797. https://doi.org/10.1017/S0953756201004269

Elix, J. A. (2005): New species of sterile crustose lichens from Australia. – *Mycotaxon* **94**: 219–224.

Elix, J.A., Tønsberg, T. and Wardlaw, J. H. (2004): The structure of friesiic acid, a novel lichen substance from Hypocenomyce friesii. – *Bibl. Lichenol.* **88**: 103–109.

Ertz, D., Aptroot, A., Van de Vijver, B., Sliwa, L., Moermans, C. and Øvstedal, D. (2014): Lichens from the Utsteinen Nunatak (Sør Rondane Mountains, Antarctica), with the description of one new species and the establishment of permanent plots. – *Phytotaxa* **191**: 99–114. https://doi.org/10.11646/phytotaxa.191.1.6

Ertz, D., Søchting, U., Gadea, A., Charrier, M. and Poulsen, R. S. (2017): Ducatina umbilicata gen. et sp. nov., a remarkable Trapeliaceae from the subantarctic islands in the Indian Ocean. – *Lichenologist* **49**: 127–140. https://doi.org/10.1017/S0024282916000700

Hall, T. A. (1999): BioEdit: A user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT. – *Nucl. Acids Symp. Ser.* **41**: 95–98.

Kantvilas, G., Leavitt, S. D., Elix, J. A. and Lumbsch, H. T. (2014): Additions to the genus Trapelia (Trapeliaceae: lichenised Ascomycetes). – *Austral. Syst. Bot.* **27**: 395–402.

Kumar, K., Siva, B., Sarma, V. U. M., Mohabe, S., Reddy, A. M., Boustie, J., Tiwari, A. K., Rao, N. R. and Babu, K. S. (2018): UPLC-MS/MS quantitative analysis and structural fragmentation study of five Parmotrema lichens from the Eastern Ghats. – *J. Pharmaceut. Biomed. Analysis* **156**: 45–57. https://doi.org/10.1016/j.jpba.2018.04.017

Lumbsch, H. T., Schmitt, I., Döring, H. and Wedin, M. (2001): ITS sequence data suggest variability of ascus types and support ontogenetic characters as phylogenetic discriminators in the Agyriales (Ascomycota). – *Mycol. Res.* **105**(1): 265–274. https://doi.org/10.1017/S0953756201003483

Lumbsch, H. T., Kashiwadani, H. K. and Streimann, H. (1993): A remarkable new species in the lichen genus Placopsis from Papua New Guinea (lichenized Ascomycetes, Agyriaceae). – *Pl. Syst. Evol.* **185**: 285–292.

Lumbsch, H. T., Schmitt, I., Lindemuth, R., Miller, A., Mangold, A., Fernandez, F. and Huhndorf, S. (2005): Performance of four ribosomal DNA regions to infer higher-level phylogenetic relationships of inoperculate euascomycetes (Leotiomycota). – *Mol. Phyl. Evol.* **34**: 512–524. https://doi.org/10.1016/j.ympev.2004.11.007

McCune, B., Camacho, F. and Ponzetti, J. (2002): Three new species of Trapeliopsis on soil in Western North America. – *Bryologist* **105**: 78–85. https://doi.org/10.1639/0007-2745(2002)105[0078:tnsoto]2.0.co;2

Orange, A. (2018): A new species-level taxonomy for Trapelia (Trapeliaceae, Ostropomycetidae) with special reference to Great Britain and the Falkland Islands. – *Lichenologist* **50**(1): 3–42. https://doi.org/10.1017/s0024282917000639

Orange, A., James, P. W. and White, F. J. (2010): *Microchemical methods for the identification of lichens*. – British Lichen Society, London, 101 pp.

Protopopova, V. V. and Shevera, M. V. (2002): *Yu. D. Kleopow (1902–1943) to 100-year anniversary from the birth.* (Yu. D. Kleopow (1902–1943) do 100-richchya vid dnya narodzhennya). – Phytosociocentre, Kyiv, 112 pp. [In Ukrainian]

Rambaut, A. (2014): *FigTree v1.4.2.* – University of Edinburgh, Edinburgh, https://tree.bio.ed.ac.uk/software/figtree

Rehner, S. A. and Samuels, G. J. (1994): Taxonomy and phylogeny of Gliocladium analysed from nuclear large subunit ribosomal DNA sequences. – *Mycol. Res.* **98**: 625–634. https://doi.org/10.1016/S0953-7562(09)80409-7

Resl, P., Schneider, K., Westberg, M., Printzen, C., Palice, Z., Thor, G., Fryday, A., Mayrhofer, H. and Spribille, T. (2015): Diagnostics for a troubled backbone: testing topological hypotheses of trapelioid lichenized fungi in a large-scale phylogeny of Ostropomycetidae (Lecanoromycetes). – *Fungal Divers.* **73**(1): 239–258. https://doi.org/10.1007/s13225-015-0332-y

Resl, P., Fernández-Mendoza, F., Mayrhofer, H. and Spribille, T. (2018): The evolution of fungal substrate specificity in a widespread group of crustose lichens. – *Proc. Royal Soc.*, **B 285**: 20180640.

Schmitt, I., Lumbsch, H. T. and Søchting, U. (2003): Phylogeny of the lichen genus Placopsis and its allies based on Bayesian analyses of nuclear and mitochondrial sequences. – *Mycologia* **95**(5): 827–835. https://doi.org/10.2307/3762011

Schneider, K., Resl, P. and Spribille, T. (2016): Escape from the cryptic species trap: lichen evolution on both sides of a cyanobacterial acquisition event. – *Mol. Ecol.* **25**: 3453–3468. https://doi.org/10.1111/mec.13636

Schwarz, G. (1978): Estimating the dimension of a model. – *Ann. Statist.* **6**: 461–464. https://doi.org/10.1214/aos/1176344136

Spribille, T., Resl, P., Ahti, T., Pérez-Ortega, S., Tønsberg, T., Mayrhofer, H. and Lumbsch, H. T. (2014): Molecular systematics of the wood-inhabiting, lichen-forming genus Xylographa (Baeomycetales, Ostropomycetidae) with eight new species. – *Symb. Bot. Upsal.* **37**(1): 1–87.

Spribille, T., Fryday, A. M., Pérez-Ortega, S., Svensson, M., Tønsberg, T., Ekman, S., Holien, H., Resl, P., Schneider, K., Stabentheiner, E., Thüs, H., Vondrák, J. and Sharman, L. (2020): Lichens and associated fungi from Glacier Bay National Park, Alaska. – *Lichenologist* **52**(2): 61–181. https://doi.org/10.1017/s0024282920000079

Stecher, G., Tamura, K. and Kumar, S. (2020): Molecular Evolutionary Genetics Analysis (MEGA) for macOS. – *Mol. Biol. Evol.* **37**(4): 1237–1239. https://doi.org/10.1093/molbev/msz312

Timdal, E. (1984): The genus Hypocenomyce (Lecanorales, Lecideaceae), with special emphasis on Norwegian and Swedish species. – *Nordic J. Bot.* **4**: 83–108. https://doi.org/10.1111/j.1756-1051.1984.tb01979.x

Timdal, E. (2002): Three squamulose species of Rimularia (Lecanorales). – *Bryologist* **105**: 219–224. https://doi.org/10.1639/0007-2745(2002)105[0219:tssorl]2.0.co;2

White, T. J., Bruns, T., Lee, S. and Taylor, J. W. (1990): Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. – *PCR protocols* **18**(1): 315–322. https://doi.org/10.1016/B978-0-12-372180-8.50042-1

Wijayawardene, N. N., Hyde, K. D., Al-Ani, L. K. T., Tedersoo, L., Haelewaters, D., Rajeshkumar, K. C. *et al.* (2020): Outline of Fungi and fungus-like taxa. – *Mycosphere* **11**(1): 1060–1456. https://doi.org/10.5943/mycosphere/11/1/8

Wiklund, E. and Wedin, M. (2003): The phylogenetic relationships of the cyanobacterial lichens in the Lecanorales suborder Peltigerineae. – *Cladistics* **19**: 419–431. https://doi.org/10.1111/j.1096-0031.2003.tb00312.x

Zoller, S., Scheidegger, C. and Sperisen, C. (1999): PCR primers for the amplification of mitochondrial small subunit ribosomal DNA of lichen-forming ascomycetes. – *Lichenologist* **31**(5): 511–516. https://doi.org/10.1006/lich.1999.0220