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Research Article

Three New Monotypic Genera of the Caloplacoid Lichens (Teloschistaceae, Lichen-Forming Ascomycetes)

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Abstract Three monophyletic branches are strongly supported in a phylogenetic analysis of the Teloschistaceae based on combined data sets of internal transcribed spacer and large subunit nrDNA and 12S small subunit mtDNA sequences. These are described as new monotypic genera: *Jasonhuria* S. Y. Kondr., L. Lőkös et S. -O. Oh, *Loekoesia* S. Y. Kondr., S. -O. Oh et J. -S. Hur and *Olegblumia* S. Y. Kondr., L. Lőkös et J. -S. Hur. Three new combinations for the type species of these genera are proposed.

Keywords Caloplacoideae, *Gyalolechia*, *Jasonhuria*, *Loekoesia*, *Olegblumia*, *Pyrenodesmia*

The taxonomy of the Teloschistaceae has developed rapidly since 2012. A large number of new genera, based on molecular phylogeny investigations, have been proposed [1-7]. The number of genera in the Teloschistaceae increased from 10 in Kärnefelt [8] to 29 [1] and to presently 67 [5-7, 9, 10]. The family is divided in three, Caloplacoideae Teloschistoideae, and Xanthorioideae [3, 11] or four subfamilies [12].

Three new, monotypic genera were discovered within this study and are described below: *Jasonhuria* for the Eastern Asian *Caloplaca bogilana*; *Loekoesia* for the South Korean *Caloplaca austrocoreana;* and *Olegblumia* for the European and North American *Caloplaca demissa*.

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MATERIALS AND METHODS

Specimens were examined using standard microscopical techniques, i.e., hand-sectioned under a Nikon SMZ-645 dissecting microscope (Nikon Corp., Tokyo, Japan), sections were observed under a Nikon E-200 and Olympus BX-51 microscope (Olympus, Tokyo, Japan). Spot test reactions were performed on thalli. Chemicals were extracted in analytical grade acetone in a 1-mL Eppendorf tube. Thin layer chromatography (TLC) was performed using a glass plate coated with TLC Silica gel 60, in solvent system A (toluene : dioxin : acetic acid = 180 : 45 : 5) [13].

Total DNA was extracted directly from the thalli according to Ekman [14] and was purified with DNeasy Plant Mini Kit (Qiagen, Hilden, Germany). The nuclear ribosomal RNA gene region including the internal transcribed spacers 1 and 2 and the 5.8S subunit (ITS) was amplified using the primers ITS1F [15] and ITS4 [16], the 28S large subunit (LSU) using the primer LR5 [17], and the 12S mtSSU using the primers mtSSU1-mtSSU3R and mtSSU2R [2, 18].

The amplification was done using a Takara JP/TP600 PCR machine (Takara Bio Inc., Tokyo, Japan). One initial cycle of 5 min at 94°C was followed by 30 cycles of the following steps: 30 sec at 94°C, 39 sec at 57°C, and 1 min at 72C. Amplifications were ended with a final cycle at 72°C for 10 min. PCR products were then sent to the sequencing facilities of the Genotech Co. (Seoul, Korea) for cleaning and sequencing. The sequencing was carried out using the

Table 1. Specimen vouchers used in the phylogenetic analysis with GenBank numbers

Species name	Voucher details/References	ITS	LSU	mt DNA
Brigantiaea ferruginea	SK779, Kondratyuk *et al.* (2013) [5]	KF264622	-	KF264684
Brigantiaea ferruginea	SK780, Kondratyuk *et al.* (2013) [5]	KF264623	-	KF264685
Blastenia crenularia	Gaya *et al.* (2012) [3]	JQ301711	-	JQ301489
Blastenia ferruginea	-	KC179416	KC179163	KC179493
Blastenia subochracea	Arup *et al.* (2013) [1]	KC179418	-	-
Bryoplaca jungermanniae	Arup *et al.* (2013) [1]	KC179420	-	-
Bryoplaca sinapisperma	Arup *et al.* (2013) [1]	KC179421	-	KC179495
Bryoplaca tetraspora	Arup *et al.* (2013) [1]	KC179422	-	-
Caloplaca cerina	FNM185, Fedorenko *et al.* (2009, 2012) [2, 18]	EU681284	-	EU680863
Caloplaca cerina	Gaya *et al.* (2012) [3]	-	JQ301549	-
Caloplaca pelodella	SK714, Kondratyuk *et al.* (2013) [5]	KF264629	-	KF264689
'*Caloplaca*' *furax*	-	HQ644341	-	-
'*Caloplaca*' *furax*	Gaya *et al.* (2012) [3]	JQ301622	-	-
'*Caloplaca*' *phaeothamnos*		JN813419	-	-
Caloplaca stillicidiorum	Gaya *et al.* (2008) [19]	EU639607	-	-
Caloplaca thracopontica	-	HM538525	-	-
Eilifdahlia dahlii	SK956, Kondratyuk *et al.* (2014) [6]	KJ021221	KJ021252	KJ021277
Eilifdahlia dahlii	SK959, Kondratyuk *et al.* (2014) [6]	KJ021318	KJ021253	KJ021279
Eilifdahlia wirthii	SK262, Kondratyuk *et al.* (2014) [6]	KJ021319	KJ021254	KJ021280
Elenkiniana ehrenbergii	Søchting and Figueras (2007) [20]	DQ888715	-	-
Elenkiniana gloriae	SK750, Kondratyuk *et al.* (2014) [6]	KJ021323	-	-
Elenkiniana gloriae	SK611, Kondratyuk *et al.* (2014) [6]	KJ021321	KJ021256	KJ021282
Elenkiniana gloriae	SK613, Kondratyuk *et al.* (2014) [6]	KJ021322	-	KJ021283
Franwilsia bastowii	SK810, Kondratyuk *et al.* (2014) [6]	KJ021324	KJ021257	KJ021284
Franwilsia kilcundaensis	SK920, Kondratyuk *et al.* (2014) [6]	KJ021326	KJ021259	KJ021286
Franwilsia renatae	SK235, Kondratyuk *et al.* (2014) [6]	KJ021329	-	KJ021289
Fulgensia cranfieldii	SK983, Kondratyuk *et al.* (2014) [6]	KJ021333	KJ021262	KJ021292
Fulgensia fulgens	SK735, Kondratyuk *et al.* (2014) [6]	KJ021335	-	KJ021295
Fulgensia poeltii	Gaya *et al.* (2008) [19]	EU639586	-	-
Fulgogasparrea decipioides	SK689, Kondratyuk *et al.* (2013) [5]	KF264644	-	KF264695
Gyalolechia aurea	Arup *et al.* (2013) [1]	KC179434	KC179196	KC179530
Gyalolechia canariensis	Gaya *et al.* (2008) [19]	EU639587	-	-
Gyalolechia canariensis	SK583, Kondratyuk *et al.* (2014) [6]	KJ021332	-	-
Huneckia pollinii	SK3206, Kondratyuk *et al.* (2014) [6]	KJ021336	KJ021265	KJ021296
Huneckia pollinii	SK870, Kondratyuk *et al.* (2014) [6]	KJ021337	KJ021266	KJ021297
Huneckia rheinigera	SK3204, Kondratyuk *et al.* (2014) [6]	KJ021222	-	-
Ioplaca pindarensis	Gaya *et al.* (2012) [3]	JQ301672	-	-
Jasonhuria bogilana	KoLRI 120454, South Korea: Jeollanam-do, Yeosu-si, Nam-myeon, Geumohdo, Usil coast side road, 34°30′40.01″ N, 127°46′38.07″ E, 1 m alt., on rock U Jayalal, JS Park, JA Ryu (120454), 26 Apr 2012, KoLRI 015444	KT220196	KT220205	KT220214
Jasonhuria bogilana	KoLRI 120469, South Korea: Jeollanam-do, Goheung-gun, Geum-san-myeon, Eojeon-ri, Geumohdo, Simpo coast, 34°26′16.09″ N, 127°07′15.04″ E, 20 m alt., on rock, U Jayalal, JS Park, and JA Ryu (120469), 27 Apr 2012, KoLRI 015459	KT220197	KT220206	KT220215
Jasonhuria bogilana	KoLRI 120641, South Korea: Jeollanam-do, Yeosu-si, Hwayang-myeon, Imok-ri, Baelga coast, 34°39′00.04″ N, 127°34′04.07″ E, 12 m alt., on rock, U Jayalal, JS Park, and JA Ryu (120641), 28 Apr 2012, KoLRI 015635	KT220198	KT220207	KT220216
Jasonhuria bogilana	KoLRI 120647, the same locality, U Jayalal, JS Park, and JA Ryu (120647), 28 Apr 2012, KoLRI 015642	KT220199	KT220208	KT220217
Josefpoeltia sorediosa	SK991, Kondratyuk *et al.* (2013) [5]	KF264645	KF264673	KF264696
Kaernefia kaernefeltii	SK921, Kondratyuk *et al.* (2013) [5]	KF264652	KF264680	KF264703
Leproplaca obliterans	Arup *et al.* (2013) [1]	KC179449	KC179207	-
Leproplaca xantholyta	Arup *et al.* (2013) [1]	KC179451	KC179208	KC179542
Leproplaca xantholyta	Gaya *et al.* (2012) [3]	JQ301670	JQ301565	-

Table 1. Continued

Species name	Voucher details/References	ITS	LSU	mt DNA
Loekoesia austrocoreana	KoLRI 120511, South Korea: Jeollanam-do, Yeosu-si, Nam-myeon, Yusong-ri, Geu-mohdo, on rock, 34°31′55.03″ N, 127°45′55.05″ E, alt. 11 m a.s.l. Coll., U Jayalal, JS Park, and JA Ryu (120511), 27 Apr 2012, KoLRI 015502–isotype	KT220200	KT220209	KT220218
Loekoesia austrocoreana	KoLRI 120523, the same locality (120523), KoLRI 015515-isotype	KT220201	KT220210	KT220219
Loekoesia austrocoreana	SK261, KoLRI 120525-1, the same locality (120525-1), KoLRI 015507-isotype	KT220202	KT220211	KT220220
Marchantiana maulensis	SK994, Kondratyuk *et al.* (2014) [6]	KJ023182	KJ023184	-
Marchantiana occidentalis	SK981, Kondratyuk *et al.* (2014) [6]	KJ021227	KJ021268	KJ021303
Marchantiana occidentalis	SK982, Kondratyuk *et al.* (2014) [6]	KJ021228	KJ021269	KJ021304
Mikhtomia gordejevii	SK80515, Kondratyuk *et al.* (2014) [6]	KJ021231	-	KJ021307
Mikhtomia gordejevii	SK80646, Kondratyuk *et al.* (2014) [6]	KJ021232	-	KJ021308
Mikhtomia oxnerii	SK90117, Kondratyuk *et al.* (2014) [6]	KJ021233	-	KJ021311
Mikhtomia oxnerii	SK90755, Kondratyuk *et al.* (2014) [6]	KJ021234	-	KJ021312
Olegblumia demissa	SK C65, Ukraine: Mykolaiv oblast, Arbuzynka district, right bank of Pivdenny Buh River, lower of Konstantinovka village, about 3~5 km lower along the river from Yuzhnoukrainsk town, near stone rapids on river, SE vertical surfaces of granite outcrops, at the plots 22, 23 and 24, 47°48′23″ N, 31°10′10.6″ E, alt. ca 18 m a.s.l., Coll., SY Kondratyuk (20311), NM Fedorenko, 17 May 2003 (KW-L 70478)	KT220203	KT220212	KT220221
Olegblumia demissa	Arup and Grube (1999) [21]	AF353960	-	-
Olegblumia demissa	Arup *et al.* (2013) [1]	-	KC179172	KC179505
Olegblumia demissa	Arup and Grube (1999) [21]	AF353962	-	-
Olegblumia demissa	Arup and Grube (1999) [21]	AF353961	-	-
Oxneria alfredii	FNM 152, Fedorenko *et al.* (2009) [18]	FNM 152	-	-
Pyrenodesmia alociza	SK747, Kondratyuk *et al.* (2014) [6]	KJ021239	-	KJ021313
Pyrenodesmia teicholyta	Vondrák *et al.* (2012) [22]	JN641791	-	-
Pyrenodesmia teicholyta	Arup *et al.* (2013) [1]	-	KC179176	-
Pyrenodesmia variabilis	Gaya *et al.* (2003) [23]	AY233224	-	-
Rufoplaca scotoplaca	Arup *et al.* (2013) [1]	KC179457	KC179235	KC179573
Rufoplaca tristiuscula	Arup *et al.* (2013) [1]	KC179460	KC179237	KC179575
Seirophora californica	Arup *et al.* (2013) [1]	KC179643	-	-
Seirophora lacunosa	SK B07, Ukraine: AR Crimea, Arabatskaya strelka, on soil at the fortress, 200 m to NW, 10 Jun 2003, OY Khodosovsev (KW-L 70478 sub *Lichenoconium xanthoriae*)	KT220204	KT220213	KT220222
Seirophora villosa	Martin and Winka (2000) [24]	AF098407	-	-
Teloschistes flavicans	FNM-139, Fedorenko *et al.* (2009, 2012) [2, 18]	EU681363	-	EU680955
Teloschistes flavicans	Arup *et al.* (2013) [1]	KC179317	KC179255	KC179594
Usnochroma carphinea	Arup *et al.* (2013) [1]	KC179468	KC179259	KC179598
Usnochroma carphinea	-	EU639595	-	-
Usnochroma carphinea	Gaya *et al.* (2012) [3]	-	JQ301548	
Usnochroma scoriophila	Gaya *et al.* (2012) [3]	JQ301664	JQ301560	-
Variospora alpigena	Arup and Grube (1999) [21]	AF353956	-	-
Variospora latzelii	Vondrák *et al.* unpublished	JN813418	-	-
Variospora velana	Arup *et al.* (2013) [1]	KC179476	KC179265	KC179605
Xanthocarpia ochracea	SK637, Kondratyuk *et al.* (2014) [7]	KJ133483	-	-
Xanthoria parietina	FNM-177, Fedorenko *et al.* (2009, 2012) [2, 18]	EU681289	-	EU680868
Xanthoria parietina	Gaya *et al.* (2012) [3]	-	JQ301589	-
Yoshimuria galbina	SK704, Kondratyuk *et al.* (2014) [6]	-	-	KJ023197
Yoshimuria cerussata	SK768, Kondratyuk *et al.* (2014) [6]	KJ021248	-	-
Yoshimuria spodoplaca	SK725, Kondratyuk *et al.* (2014) [6]	KJ021249	-	KJ023194

fluorescent marker BigDye and an ABI 3730xl sequencing machine (Applied Biosystems, Carlsbad, CA, USA).

The consensus sequence was aligned with all related species sequences retrieved from the GenBank database. The consensus sequences were then deposited into GenBank under the accession numbers KT220196~KT220222 (Table

1). Phylogenetic analysis was performed using the ITS region and LSU gene of nrDNA and 12S SSU mtDNA sequences of the treated fungi retrieved from the GenBank database and the 5 lichen-forming fungi investigated in this study. Sequence alignment was conducted in BioEdit and a phylogenetic tree was generated by the maximum parsimony, minimum evolution, and maximum likelihood analysis methods performed in MEGA 5.0 [25] with the number of bootstrap trials set to 1,000.

Altogether 27 sequences on nrDNA and mtDNA are submitted to GenBank.

RESULTS AND DISCUSSION

Description of taxa.

Jasonhuria S. Y. Kondr., L. Lőkös et S. -O. Oh, **gen. nov.**
MycoBank No. MB 812929.
Thallus saxicolous, crustose, grey to greyish white; cortex paraplectenchymatous. Apothecia biatorine to lecanorine; disc orange-brown to brownish red or rust-red; thalline margin concolorous with the thallus; proper margin black, true exciple paraplectenchymatous, outer region aeruginose pigmented. Conidia ellipsoid. Constituents: atranorin, gyrophoric and lecanoric acids (major compounds), parietin (traces).
Type species: *Jasonhuria bogilana* (Y. Joshi et Hur) S. Y. Kondr., L. Lőkös, J. Kim, A. S. Kondratiuk et S. -O. Oh.

Thallus saxicolous, crustose, areolate to cracked areolate, grey to greyish white. Cortex paraplectenchymatous, necral layer absent. Apothecia biatorine to lecanorine, adnate to sessile; disc orange-brown to brownish red to rust-red, plane to convex, epruinose; thalline margin concolorous with the thallus; proper margin black. Hymenium hyaline, hypothecium hyaline, without oil-droplets; true exciple paraplectenchymatous, outer region ± aeruginose pigmented. Paraphyses thin, with a few swollen cells at the top. Asci 8-spored, ascospores polarilocular, ellipsoid, ascospore septum of medium width. Pycnidia present, ostiole black. Conidia ellipsoid.
Chemistry: Thallus and medulla K+ yellow, C–, Pd–, UV–. Apothecial discs K+ red, C–, Pd–. Ostiolar tissue of pycnidia and aeruginose region of proper exciple K–. Constituents: atranorin, gyrophoric and lecanoric acids (major compounds), parietin (traces).
Ecology: Known from the coastal regions, where it grows abundantly on large siliceous boulders (rocks) both on subvertical and horizontal faces exposed to the sun along with *Caloplaca kobeana* (Nyl.) Zahlbr., *Buellia* spp., *Lecanora* spp., *Heterodermia diademata* (Taylor) D. D. Awasthi, *Physcia* spp., *Endocarpon petrolepideum* Ach., *Phylliscum* spp., *Aspicilia* spp., *Xanthoparmelia saxeti* (Stizenb.) Amo de Paz, A. Crespo, Elix et Lumbsch, *Xanthoparmelia* spp., *Ramalina* spp., *Verrucaria* spp.
Species diversity: *Jasonhuria* is presently a monophyletic genus; however, it is likely that additional species, occurring in Eastern Asia, will be described in the genus.
Distribution: The type species was originally found in Bogil Island, southern South Korea, but is now, in addition, known from numerous coastal, inland and island localities.
Etymology: The genus honours the South Korean lichenologist Prof. Jae-Seoun Hur (Suncheon, Korean Lichen Research Institute [KoLRI], South Korea), the founder of the KoLRI of Sunchon National University, to acknowledge his great contributions to the Korean lichen flora, his investigations of complete genomes of lichen-forming fungi including their practical application, Prof. Hur furthermore described the type species of the genus.
Taxonomic notes: The genus *Jasonhuria* is characterized by a crustose, cracked areolate to areolate, greyish thallus, reacting K+ yellow, a rust-red apothecial disc, a black proper margin, a grey thalline margin and maritime distribution, as well as atranorin, gyrophoric and lecanoric acids as major compounds.

Molecular data of *Caloplaca agrata* (Vain.) Zahlbr., *C. leptozona* (Nyl.) Zahlbr., *C. subleptozona* Y. Joshi et Upreti, *C. poliotera* (Nyl.) J. Steiner, and *C. subpoliotera* Y. Joshi et Upreti, supposed to be related with the type species are missing. Possibly some of them will become members of the new genus after future analyses.

Jasonhuria is similar to *Usnochroma* Søchting, Arup et Frödén in having gyrophoric acid, but differs in having a white or whitish grey colour of thallus (vs. pale yellow), in having anthraquinones in the thallus (vs. thallus without anthraquinones), and in the lack of usnic acid in the thallus.

Jasonhuria forms a weakly supported clade together with the genus *Loekoesia*, why we prefer to describe two monotypic genera (Fig. 1). Furthermore, preliminary analyses reveal several undescribed species in both genera, forming two strongly supported clades.

Loekoesia S. Y. Kondr., S. -O. Oh et J. -S. Hur, **gen. nov.**
MycoBank No. MB 812930.
Thallus crustose, entire to areolate; grey; soralia rounded, stipitate, aggregated in irregular groups, bright white; soredious mass bluish to whitish; soredia powdery. Hypothallus bluish black. Apothecia black, biatorine, true exciple paraplectenchymatous with well-developed matrix. Thallus K+ yellow, then greenish yellow, Pd+ slowly becoming pale yellow; probably contains atranorin and other compounds.
Type species: *Loekoesia austrocoreana* (S. Y. Kondr., L. Lőkös et J. -S. Hur) S. Y. Kondr., J. Kim, A. S. Kondratiuk, S. -O. Oh et J. -S. Hur.

Thallus crustose, entire to areolate; plumbeus or lead grey to greyish white with brighter white soralia, sometimes coalescing in places; soralia rounded, stipitate, often aggregated in irregular groups; soredious mass bluish or becoming whitish. Soredia powdery, bluish. Hypothallus bluish black. Apothecia black, biatorine; true exciple paraplectenchymatous with well-developed matrix; ascospores bipolar hyaline, elongated ellipsoid with rounded ends, ascospore septum

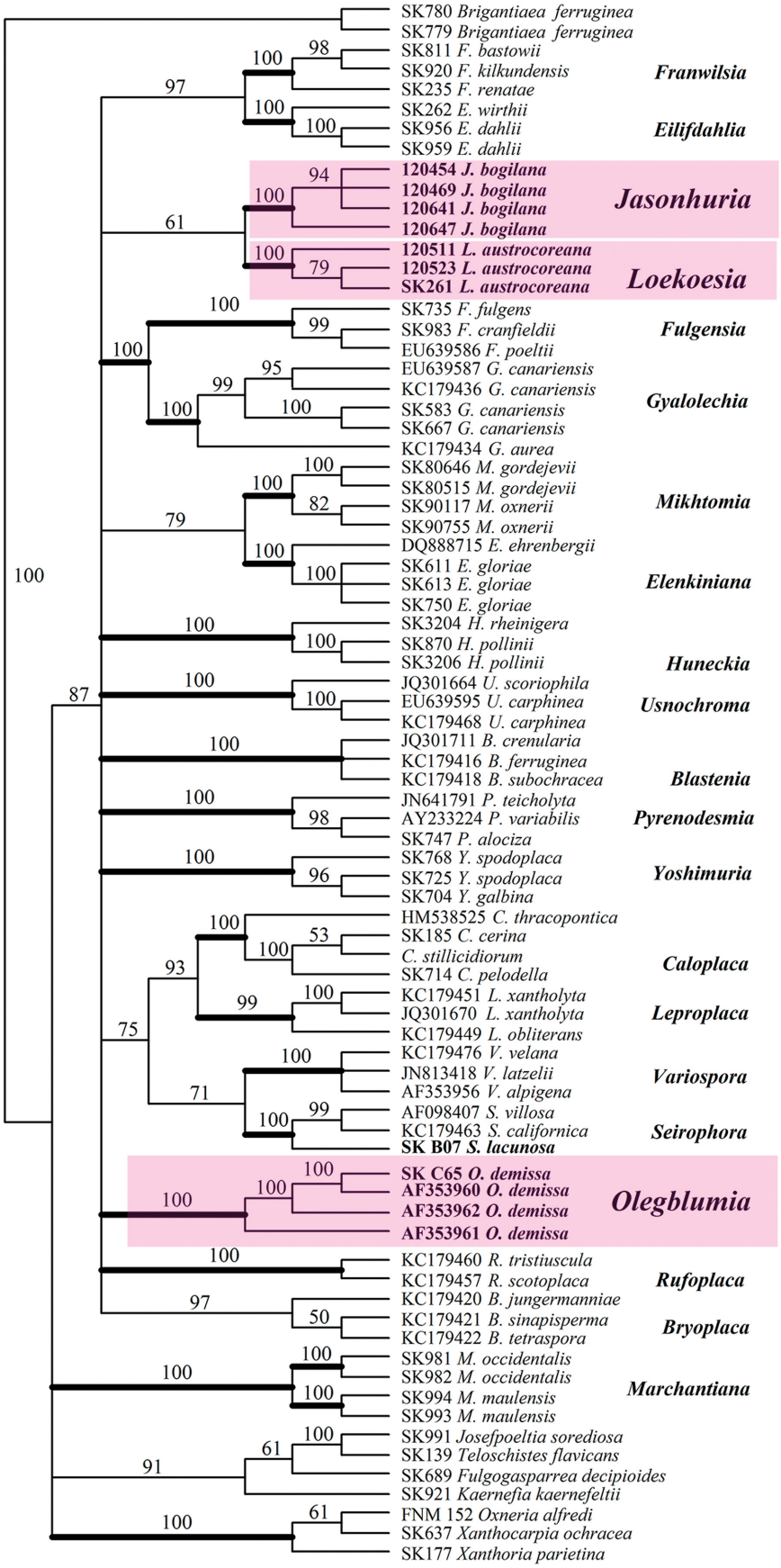

Fig. 1. Phylogenetic tree of the caloplacoid lichens based on combined data set.

of medium width.

Chemistry: Thallus K+ yellow, then greenish yellow; Pd+ slowly becoming pale yellow; epihymenium K+ purple and becoming lighter to/or hyaline or dull crimson; probably contains atranorin and other compounds.

Ecology: In coastal zone on rock surface growing together with *Pyxine endochrysina* Nyl., *Physcia adscendens* (Fr.) H. Olivier, *Caloplaca squamosa* (B. de Lesd.) Zahlbr. and species of the genera *Aspicilia, Myelochroa, Buellia, Dimelaena, Verrucaria*, and *Lecanora*.

Etymology: This new genus is named after the Hungarian lichenologist Dr László Lőkös (1959~) (Budapest, BP, Hungary), who contributed much to the knowledge of North and South Korean lichens.

Distribution: The new genus occurs in South Korea.

Taxonomic notes: *Loekoesia austrocoreana* is similar to *Caloplaca albovariegata* (B. de Lesd.) Wetmore, a western North American species growing on calcareous and non-calcareous rocks, having a blue-grey thallus, stipitate areoles, a thick irregular cortex with an epinecral layer, and clumps of algae forming a variegated surface. Thus, *Loekoesia austrocoreana* differs from *C. albovariegata* by a regular cortex, presence of a lower hymenium, shorter and narrower ascospores and wider ascospore septa, a distinctly bluish epihymenium and a bluish lateral true exciple and a K– reaction in the thalline cortex and the lateral outermost part of the true exciple, as well as in the lack of an epinecral layer and clumps of algae [4, 26-28].

A number of other members of the genus *Pyrenodesmia* A. Massal., i.e., *P. variabilis* (Pers.) A. Massal., '*Caloplaca*' *conversa* (Kremp.) Jatta, '*Caloplaca*' *atroalba* (Tuck.) Zahlbr., '*Caloplaca*' *peliophylla* (Tuck.) Zahlbr., differ from *Loekoesia austrocoreana* in having much wider ascospores and in the lack of soredia.

'*Caloplaca*' *oblongula* (H. Magn.) Wetmore differs from *Loekoesia austrocoreana* in having light purplish brown epihymenium, in having non-septate or one-septate, larger longer and wider ascospores (15.5~21 × 5.5~8.5 µm vs. 13~14 × 5~6 µm), with narrower septa (0~1.5 µm vs. 4~6 µm wide), as well as in having a K+ purple apothecial margin [28].

The genus *Loekoesia* is similar to some representatives of the Australian genus *Marchantiana* S. Y. Kondr., Kärnefelt, Elix, A. Thell et J. -S. Hur of the Teloschistoideae, i.e., *M. kalbiorum* (S. Y. Kondr. et Kärnefelt) S. Y. Kondr., Kärnefelt, A. Thell, Elix, J. Kim, A. S. Kondratiuk et J. -S. Hur, but differs in its distribution and in its position in the subfamily Caloplacoideae after phylogenetic analysis based on combined set of ITS and LSU nrDNA and 12S small subunit (SSU) mtDNA sequences.

As mentioned earlier, *Loekoesia* forms a weakly supported clade together with the genus *Jasonhuria.* However, preliminary analyses show that hirtherto undescribed species are to be described in both genera proposed here, forming two strongly supported clades, explaining why two new genera are described already.

Olegblumia S. Y. Kondr., L. Lőkös et J. -S. Hur, **gen. nov.** MycoBank No. MB 812931.

Thallus lobate, distinctly rosette-like, upper surface brown to brownish grey; lobes flat to subconvex, very narrow; soralia laminal with convex, highly uplifted brownish soredious mass; soredia irregularly rounded, brown to brownish green; constituents: vicanicin and caloploicin.

Type species: *Olegblumia demissa* (Flot.) S. Y. Kondr., L. Lőkös, J. Kim, A. S. Kondratiuk, S. -O. Oh et J. -S. Hur.

Thallus lobate, distinctly rosette-like, 5~8 mm diam., often in large aggregations; upper surface brown, dark brown to greenish brown in peripheral portions and greyish brown or whitish greyish in the centre, thallus whitish pruinose, whitish grey to whitish brown or brownish grey, grey in shaded conditions. Lobes to 1~1.5 (~2) mm long, flat to subconvex, very narrow to 0.1~0.2 (~0.3) mm wide, towards the tips branched or divided into 2~3 (~4) secondary lobules almost the same width; total width of terminal portion of single lobe with all secondary lobules to (0.3~) 0.4~1 mm wide. Soralia mainly in the centre of thallus, laminal (in the middle of lobe), at first punctiform or regularly rounded to (0.1~) 0.2~0.3 mm diam., soon becoming elongated along the lobe, fissure-like, to 0.3~0.4 mm long/across, eroded portions with somewhat uplifted margins of cortical layer with convex, highly uplifted brownish soredious or soredious/isidious mass to confluent often whitish eroded-soredious mass in the centre. Soredia irregularly rounded, ca. (20~) 30~50 µm across, becoming isidious, brown to dark brown or brownish green well contrasting to light (white) medulla. Apothecia, conidiomata and conidia unknown.

Chemistry: Vicanicin and caloploicin.

Ecology: The single species of this genus grows on hard siliceous rocks, usually on vertical and inclined surfaces. It is often associated with *Aspicilia contorta* (Hoffm.) Körb., sometimes significantly damaged by parasites of the genus *Lichenostigma* Hafellner, *Lichenothelia scopularia* (Nyl.) D. Hawksw. [29], *Caloplaca aractina* (Fr.) Häyrén, *Lecanora* aff. *frustulosa* Stizenb., *Lecanora lithophila* Oxner, *Aspicilia* sp., *Physcia* sp., and *Candelariella vitellina* (Hoffm.) Müll. Arg.

Species diversity and distribution: The genus is monotypic, known from Europe and North America.

Etymology: The genus is named after the Ukrainian lichenologist Oleg Blum (1937~) (Kyiv, Ukraine), who made important contributions to lichen ecology of Eurasian lichens, as well as in the usage of lichens as bioindicators for anthropogenic pollution of the environment.

Taxonomic notes: This genus *Olegblumia* is easily distinguished from the other caloplacoid lichens by the brownish, soredious, lobate thallus, and the negative reaction with K.

According to morphological and chemical characters it is similar to the genera *Elenkiniana* S. Y. Kondr., Kärnefelt, Elix, A. Thell et J. -S. Hur, and *Leproplaca* (Nyl.) Hue of the subfamily Caloplacoideae, however, comparing with molecular

characters it is closely related only to *Usnochroma* or *Pyrenodesmia*.

The brownish lobate thallus, containing the depsidones vicanicin and caloploicin, shows similarity with some species of the genus *Elenkiniana*.

The lobate soredious thallus reminds of some species of the genus *Leproplaca*, particularly *L. cirrochroa* (Ach.) Th, Fr., but differs by its brownish thallus, compared with bright yellow to bright orange or reddish orange in *Leproplaca*. Further differences are the brownish soredious mass, not bright yellow, and the depsidones instead of anthraquinones of the parietin chemosyndrome in *Leproplaca*.

This new monotypic genus is known only as sterile and was earlier positioned in the Lecanoraceae, in the genera *Lecanora* and *Placolecanora* Räsänen, because of its general appearance. Molecular analyses finally confirmed its position in the Teloschistaceae [21] where *Olegblumia* appears as a sister group to the genus *Usnochroma*.

New combinations.

Jasonhuria bogilana (Y. Joshi et Hur) S. Y. Kondr., L. Lőkös, J. Kim, A. S. Kondratiuk et S. -O. Oh, **comb. nov.**
MycoBank No. MB 812932.
Basionym: *Caloplaca bogilana* Y. Joshi et Hur, The Lichenologist 42: 716 (2010).
Type: South Korea, Jeonnam Prov., Wando Co., Bogil Island, 34°09′14.7″ N, 126°37′33.2″ E, alt. 5 m, on rock, 31 Dec 2004, JS Hur, 041679 (KoLRI 002475, holotype).

Loekoesia austrocoreana (S. Y. Kondr., L. Lőkös et J. -S. Hur) S. Y. Kondr., J. Kim, A. S. Kondratiuk, S. -O. Oh et J. -S. Hur, **comb. nov.**
MycoBank No. 812934.
Basionym: *Caloplaca austrocoreana* S. Y. Kondr., L. Lőkös et J.-S. Hur, in Kondratyuk *et al.*, Acta Bot. Hung. 55: 42 (2013).
Type: South Korea, Jeollanam-do, Yeosu-si, Nam-myeon, Yusong-ri, Geumohdo, on rock, 34°31′55.03″ N, 127°45′55.05″ E, alt. 11 m a.s.l. Coll., U Jayalal, JS Park, and JA Ryu (120513), 27 Apr 2012, KoLRI 015504-holotype.

Olegblumia demissa (Flot.) S. Y. Kondr., L. Lőkös, J. Kim, A. S. Kondratiuk, S. -O. Oh et J. -S. Hur, **comb. nov.**
MycoBank No. MB 812935.
Basionym: *Imbricaria demissa* Flot., Jber. Schles. Ges. Vaterl. Kultur 28: 133 (1850).
Synonym: *Caloplaca demissa* (Flot.) Arup et Grube, Lichenologist 31: 428 (1999).

Conclusions. Future analyses of molecular characters reveal additional species to be described in all the three monotypic genera proposed here, which very likely will confirm their necessity analyses in which additional genera of the Caloplacoideae, firstly *Mikhtomia* s. lat., *Variospora* s. lat. and *Seirophora* s. lat., will be included and discussed.

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REFERENCES

1. Arup U, Søchting U, Frödén P. A new taxonomy of the family Teloschistaceae. Nord J Bot 2013;31:16-83.
2. Fedorenko NM, Stenroos S, Thell A, Kärnefelt I, Elix JA, Hur JS, Kondratuyk SY. Molecular phylogeny of xanthorioid lichens (Teloschistaceae, Ascomycota), with notes on their morphology. Bibl Lichenol 2012;108:45-64.
3. Gaya E, Högnabba F, Holguin Á, Molnár K, Fernández-Brime S, Stenroos S, Arup U, Søchting U, van den Boom P, Lücking R, et al. Implementing a cumulative supermatrix approach for a comprehensive phylogentic study of the Teloschistales (Pezizomycotina, Ascomycota). Mol Phylogenet Evol 2012;63: 374-87.
4. Kondratyuk SY, Lőkös L, Zarei-Darki B, Haji Moniri M, Tchabanenko SI, Galanina I, Yakovchenko L, Hooshmand F, Ezhkin AK, Hur JS. Five new *Caloplaca* species (Teloschistaceae, Ascomycota) from Asia. Acta Bot Hung 2013;55:41-60.
5. Kondratyuk S, Jeong MH, Yu NH, Kärnefelt I, Thell A, Elix JA, Kim J, Kondratyuk AS, Hur JS. Four new genera of Teloschistoid lichens (Teloschistaceae, Ascomycota) based on molecular phylogeny. Acta Bot Hung 2013;55:251-74.
6. Kondratyuk SY, Jeong MH, Yu NN, Kärnefelt I, Thell A, Elix JA, Kim J, Kondratiuk AS, Hur JS. A revised taxonomy for the subfamily Caloplacoideae (Teloschistaceae, Ascomycota) based on molecular phylogeny. Acta Bot Hung 2014;56:93-123.
7. Kondratyuk SY, Kärnefelt I, Thell A, Elix JA, Kim JA, Jeong MH, Yu NH, Hur JS. A revised taxonomy of the subfamily Xanthorioideae (Teloschistaceae, Ascomycota) based on molecular phylogeny. Acta Bot Hung 2014;56:141-78.
8. Kärnefelt I. Morphology and phylogeny in the Teloschistales. Cryptogam Bot 1989;1:147-203.
9. Søchting U, Søgaard MZ, Elix JA, Arup U, Elvebakk A, Sancho LG. *Catenarina* (Teloschistaceae, Ascomycota), a new Southern Hemisphere genus with 7-chlorocatenarin. Lichenologist 2014;46:175-87.
10. Søchting U, Garrido-Benavent I, Seppelt R, Castello M, Pérez-Ortega S, De Los Ríos Murillo A, Sancho LG, Frödén P, Arup U. *Charcotiana* and *Amundsenia*, two new genera in Teloschistaceae (lichenized Ascomycota, subfamily Xanthorioideae) hosting two new species from continental Antarctica, and *Austroplaca frigida*, a new name for a continental Antarctic species. Lichenologist 2014;46:763-82.
11. Arup U, Søchting U, Frödén P. Addendum to 'A new taxonomy of the family Teloschistaceae'. Nord J Bot 2013; 31:256.
12. Kondratyuk SY, Kärnefelt I, Thell A, Elix JA, Kim J, Kondratiuk AS, Hur JS. A new subfamily in the Teloschistaceae

(Lecanoromycetes, Ascomycota). Acta Bot Hung. Forthcoming.
13. Orange A, James PW, White FJ. Microchemical methods for the identification of lichens. 2nd ed. London: British Lichen Society; 2010.
14. Ekman S. PCR optimization and troubleshooting, with special reference to the amplification of ribosomal DNA in lichenized fungi. Lichenologist 1999;31:517-31.
15. Gardes M, Bruns TD. ITS primers with enhanced specificity for basidiomycetes: application to the identification of mycorrhizae and rusts. Mol Ecol 1993;2:113-8.
16. White TJ, Bruns T, Lee S, Taylor J. Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. In: Innis MA, Gelfand DH, Sninsky JJ, White TJ, editors. PCR protocols: a guide to methods and applications. San Diego (CA): Academic Press; 1990. p. 315-22.
17. Vilgalys R, Hester M. Rapid genetic identification and mapping of enzymatically amplified ribosomal DNA from several *Cryptococcus* species. J Bacteriol 1990;172:4238-46.
18. Fedorenko N, Stenroos S, Thell A, Kärnefelt I, Kondratyuk S. A phylogenetic analysis of xanthorioid lichens (Teloschistaceae, Ascomycota) based on ITS and mtSSU sequences. Bibl Lichenol 2009;100:49-84.
19. Gaya E, Navarro-Rosinés P, Llimona X, Hladun N, Lutzoni F. Phylogenetic reassessment of the Teloschistaceae (lichen-forming Ascomycota, Lecanoromycetes). Mycol Res 2008;112: 528-46.
20. Søchting U, Figueras G. *Caloplaca lenae* sp. nov., and other *Caloplaca* species with caloploicin and vicanicin. Lichenologist 2007;39:7-14.
21. Arup U, Grube M. Where does *Lecanora demissa* (Ascomycota, Lecanorales) belong? Lichenologist 1999;31:419-30.
22. Vondrák J, Khodosovtsev A, Šoun J, Vondráková O. Two new European species from the heterogeneous *Caloplaca holocarpa* group (Teloschistaceae). Lichenologist 2012;44:73-89.
23. Gaya E, Lutzoni F, Zoller S, Navarro-Rosinés P. Phylogenetic study of *Fulgensia* and allied *Caloplaca* and *Xanthoria* species (Teloschistaceae, lichen-forming Ascomycota). Am J Bot 2003;90:1095-103.
24. Martin MP, Winka K. Alternative methods of extracting and amplifying DNA from lichens. Lichenologist 2000;32:189-96.
25. Tamura K, Peterson D, Peterson N, Stecher G, Nei M, Kumar S. MEGA5: molecular evolutionary genetics analysis using maximum likelihood, evolutionary distance, and maximum parsimony methods. Mol Biol Evol 2011;28:2731-9.
26. Kondratyuk SY, Lőkös L, Farkas E, Oh SO, Hur JS. New and noteworthy lichen-forming and lichenicolous fungi 2. Acta Bot Hung 2015;57:77-141.
27. Joshi Y, Wang XY, Yamamoto Y, Koh YJ, Hur JS. A first modern contribution to *Caloplaca* biodiversity in South Korea: two new species and some new country records. Lichenologist 2010;42:715-22.
28. Wetmore CM. The lichen genus *Caloplaca* in North and Central America with brown or black apothecia. Mycologia 1994;86:813-38.
29. Mikhailyuk TI, Kondratyuk SY, Nyporko SO, Darienko TM, Demchenko EM, Voytsekhovicj AO. Lichen-forming fungi, bryophytes and terrestrial algae of granitic cayons of Ukraine. Kyiv: Alterpress; 2011.