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# CONTRIBUTIONS TO MOLECULAR PHYLOGENY OF LICHENS 4. New names in the Teloschistaceae

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The new genus *Kudratoviella* for the former *Caloplaca zeorina* group having the highest level of bootstrap support in the phylogenetic tree of the Teloschistaceae, based on combined dataset of nrITS, 28S nrLSU DNA and 12S SSU mtDNA sequences, which does not belong to any other earlier proposed genera of the subfamily Xanthorioideae, is described. The genus *Oceanoplaca* Arup, Søchting et Bungartz found to be a new synonym of the genus *Loekoeslaszloa* S. Y. Kondr., Kärnefelt, A. Thell et Hur, and *Villophora onas* Søchting, Søgaard et Arup appeared to be new synonym of *Raesaeneniana maulensis* (S. Y. Kondr. et Hur) S. Y. Kondr., Elix, Kärnefelt et A. Thell. Sixteen new combinations are proposed, i.e. *Honeggeria leoncita* (for *Xanthomendoza leoncita* Bungartz et Søchting), *Honeggeria wetmorei* (for *Xanthoria wetmorei* S. Y. Kondr. et Kärnefelt), *Kudratoviella anularis* (for *Caloplaca anularis* Clauzade et Poelt), *Kudratoviella bohlinii* (for *Caloplaca bohlinii* H. Magn.), *Kudratoviella rajasthanica* (for *Caloplaca rajasthanica* S. Y. Kondr., Upreti et G. P. Sinha), *Kudratoviella scrobiculata* (for Caloplaca *scrobiculata* H. Magn.), and *Kudratoviella zeorina* (for *Caloplaca zeorina* B. G. Lee et Hur), *Loekoeslaszloa caesioisidiata* (for *Caloplaca caesioisidiata* Arup et van den Boom), *Loekoeslaszloa caesiosorediata* (for *Caloplaca caesiosorediata* Arup et van den Boom), *Loekoeslaszloa chemoisidiosa* (for *Oceanoplaca chemoisidiosa* Søchting et Bungartz), *Loekoeslaszloa isidiosa* (for *Placodium isidiosum* Vain.), *Loekoeslaszloa sideritoides* (for *Oceanoplaca sideritoides* Søchting et Bungartz), *Raesaeneniana darwiniana* (for *Villophora darwiniana* Søchting, Søgaard et Arup), *Raesaeneniana patagonica* (for *Villophora patagonica* Søchting et Søgaard), *Raesaeneniana rimicola* (for *Villophora rimicola* Søchting), and *Raesaeneniana wallaceana* (for *Villophora wallaceana* Søchting et Søgaard). *Iqbalia kashmirensis* is for the first time confirmed from South Korea and India on the basis of 'extraneous mycobiont DNA' (sensu Kondratyuk *et al.* 2019*b*).

Key words: *Honeggeria, Iqbalia,* lichenised fungi, *Loekoeslaszloa, Oceanoplaca, Raesaeneniana,* Teloschistaceae, *Villophora*

## INTRODUCTION

The lichen family Teloschistaceae is characterised by the presence of parietin as a major secondary product, which imparts yellowish orange colour to the thallus and apothecia, polarilocular ascospores and *Teloschistes*-type of asci as defined by Kärnefelt (1989). The family is a widespread and well-delimited, currently comprises *ca* 110 genera of which seven were proposed in 2020–2022 and estimated at over 1,500 species (Arup *et al.* 2013, Bungartz *et al.* 2020, Fayyaz *et al.* 2022, Gaya et al. 2011, Kantvilas 2016, Kärnefelt 1989, Kondratyuk and Kudratov 2003, Kondratyuk and Poelt 1997, Kondratyuk *et al.* 2013*b*, 2014*a*, *c*, 2015*a*, *c*, *d*, 2016, 2017, 2018*a*, *b*, *c*, 2020, Mishra *et al.* 2020, Søchting *et al.* 2014*a*, *b*, Wilk *et al.* 2021). Taxonomy of the Teloschistaceae has been revised since 2012, based on molecular phylogeny (Arup *et al.* 2013, Fayyaz *et al.* 2022, Fedorenko *et al.* 2012, Gaya *et al.* 2012, 2015, Kondratyuk *et al.* 2013*a*, *b*, 2014*a*, *b*, 2015*b*, *c*, *d*, 2016, 2017, 2018*a*, *b*, *c*, 2020). Within regional study of South American representatives of the Teloschistaceae seven new genera were recently described (Bungartz *et al.* 2020, Wilk *et al.* 2021), additionally to 104 previously known genera of this family (Mishra *et al.* 2020). Furthermore data on new representatives of the Caloplacoideae and Xanthorioideae of the Teloschistaceae were also provided (Bungartz *et al.* 2020, Søchting *et al.* 2021, Wilk *et al.* 2021).

The aim of this paper was to identify and study monophyletic clades of the subfamily Xanthorioideae, using a dataset of nrITS, nrLSU, and mtSSU sequences. One of the clades, the Eurasian *Caloplaca zeorina* group, was identified as a new genus. The positions of some species of *Honeggeria*, *Loekoeslaszloa*, and *Raesaeneniana* are discussed in the light of new molecular data, resulting in new combinations.

## MATERIAL AND METHODS

*Collection and preservation* – Lichen specimens were collected from different sites of South Korea and Japan during 2016–2018 and of Azad Jammu and Kashmir, Pakistan, during the years 2019–2020, focused on increasing knowledge of the lichen biota of the countries mentioned. The collected specimens are deposited in the lichen herbarium of Sunchon National University, South Korea (KoLRI), and in the herbarium of Institute of Botany, University of the Punjab, Lahore, Pakistan (LAH).

*Morphological characterisation* – The specimens were examined macro and micro-morphologically under a stereomicroscope (Meiji Techno, EMZ–5TR, Japan) and compound microscope (SWIFT M4000–D) with a 9MP camera system, respectively. For anatomical investigation, free hand sections of apothecia were made by hand and mounted in water, KOH (10%). A minimum of

twenty measurements in water were made for each diagnostic feature from six samples.

*Chemical characterisation* – The secondary chemistry was analysed using spot tests which were performed using KOH (10%; K) and Potassium hypochlorite solution (C). Thin-layer chromatography was carried out using Solvent System G, following standard methods (Orange *et al.* 2010). *Cladonia subcervicornis* (Vain.) Kernst., *Punctelia borreri* (Sm.) Krog, *Lepraria lobificans* Nyl., *Pertusaria lactea* (L.) Arnold and *Parmelia sulcata* Taylor were used as control.

*DNA extraction, PCR amplification and sequencing* – Genomic DNA was extracted directly from a portion of thallus with apothecia from each specimen using a modified 2% CTAB method (Gardes and Bruns 1993). The ITS–nrDNA region (Internal Transcribed Spacer of the nrDNA) was amplified using the primer pair ITS1F (forward primer) (Gardes and Bruns 1993) and ITS4 (reverse primer) (White *et al.* 1990). The nrLSU region was amplified by using the LROR as forward and LR5 as reverse primer for nrLSU region (Vilgalys and Hester 1990) following the amplification protocol of Khan *et al.* (2018) and the 12S mtSSU using the primers. PCR products were visualised on 1% agarose gel with ethidium bromide through Gel documentation system (Sambrook and Russel 2001). PCR products were sent for sequencing to Tsingke, China. Molecular data on *Raesaeneniana maulensis* are obtained in the KoLRI, Sunchon National University (Sunchon, South Korea).

*Phylogenetic analysis* – The newly generated sequences were compared to GenBank database sequences using BLAST search (http://www.ncbi.nlm.nih.gov/BLAST/). All sequences were aligned with sequences of selected representatives of Teloschistoideae obtained from GenBank (see Appendix for voucher details). Bidirectional sequences (nrITS, nrLSU and mtSSU) were assembled by using BioEdit software (Hall 1999). Multiple sequences (including sequences retrieved from GenBank) were aligned using webPRANK multiple alignment software with default parameters (Löytynoja and Goldman 2010). Maximum likelihood (RAxML) analyses were performed for the representatives of the Teloschistoideae at first using RAxMLHPC v.8 on XSEDE (Stamatakis 2014) under the GTRGAMMA model on CIPRES Science Gateway (Miller *et al.* 2010). Rapid bootstrap analyses were performed with 1000 bootstrap replicates. Matrix of the whole Teloschistaceae including 229 voucher specimens of the 123 species belonging to the 103 genera of the Teloschistaceae and *Brigantiaea ferruginea* as out group was analysed with Maximum Parsimony (MP), Minimum Evolution (ME) and Maximum Likelihood (ML) methods. The MP tree was obtained using the Tree-Bisection-Regrafting (TBR) algorithm, within the ME method the evolutionary distances were computed using the Maximum Composite Likelihood method (Tamura *et al.* (2004), and the ML analysis was conducted with the lowest BIC scores (Bayesian Information Criterion) model. The bootstrap consensus trees inferred from 1000

replicates each. The analyses involved 229 nucleotide sequences, there were a total 2258 positions in the final dataset. All three analyses were conducted in MEGA11 (Tamura *et al.* 2021).

## RESULTS

The final data matrix of the phylogeny of the whole Teloschistaceae including 229 voucher specimens of the 123 species belonging to the 103 genera of this family and it was rooted with species of the genus *Brigantiaea* (see Fig. 1). The following genera *Catenarina*, *Follmannia*, *Haloplaca*, and *Wilketalia* (syn. *Andina*, see Kondratyuk and Mosyakin 2022) of the Teloschistoideae, *Hanstrassia*, *Ioplaca* and *Upretia* of Caloplacoideae, as well as *Calogaya*, *Orientophila*, *Pachypeltis*, *Zeroviella* of Xanthorioideae are hitherto excluded from our combined analysis as far data on nrLSU or data on nrLSU and mtSSU are still missing for the type species or for all members of the genera mentioned.

Our combined phylogenetic analysis of nrITS, nrLSU and mtSSU regions show that the new genus *Kudratoviella* is forming a robust monophyletic branch within the Xanthorioideae from all other earlier proposed genera of the Teloschistaceae with the highest level of bootstrap support.

Furthermore, within the Teloschistoideae new data on the *Raesaeneniana* branch are included too. So newly generated data on *Raesaeneniana maulensis* within this study show that after molecular data the type species of the genus *Raesaeneniana maulensis* and recently described species for South America '*Villophora*' *onas* are identical (Fig. 1A). From these data conclusion that '*Villophora*' *onas* is a new synonym of the *Raesaeneniana maulensis* is done. Furthermore, it is also for the first time illustrated that '*Villophora*' *darwiniana* Søchting, Søgaard et Arup, '*Villophora*' *patagonica* Søchting et Søgaard, '*Villophora*' *rimicola* Søchting, and '*Villophora*' *wallaceana* Søchting et Søgaard are positioned within the same *Raesaeneniana* monophyletic branch of the Teloschistoideae (Fig. 1A). Consequent new combinations for the genus *Raesaeneniana* are proposed.

### ***Kudratoviella*** S. Y. Kondr., L. Lőkös, I. Kärnefelt et A. Thell, *gen. nova*

MycoBank No.: MB 845734

*Similar to* Coppinsiella *of the Xanthorioideae but differs in well-developed placodioid thallus, in having much thicker thalline lobes, as well as in having additionally to parietin teloschistin and zeorine.*

Type species: *Kudratoviella zeorina* (B. G. Lee et Hur) S. Y. Kondr., L. Lőkös, I. Kärnefelt et A. Thell.

Thallus crustose, well developed, mostly placodioid or rather thick crustose. Lobes in the peripheral zone or areoles in the centre very convex, surface

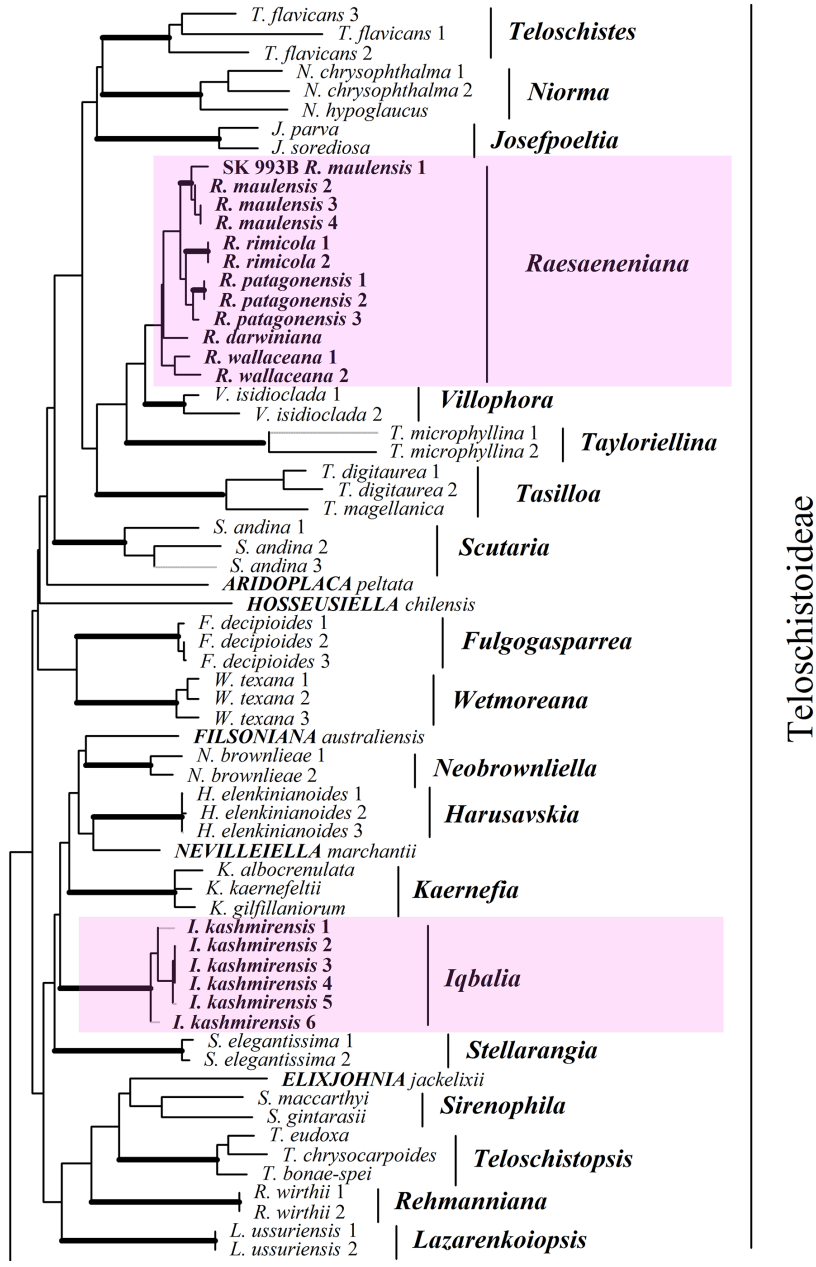


*Fig. 1A*. Most likely phylogenetic relationship of *Kudratoviella* with their associated taxa inferred from nrITS, nrLSU and mtSSU data on rooting with *Brigantiaea ferruginea* as outgroup. Nodes with the highest level of bootstrap support from MP (100), ME (≤ 97) and ML (≤ 95) analyses are shown in bold

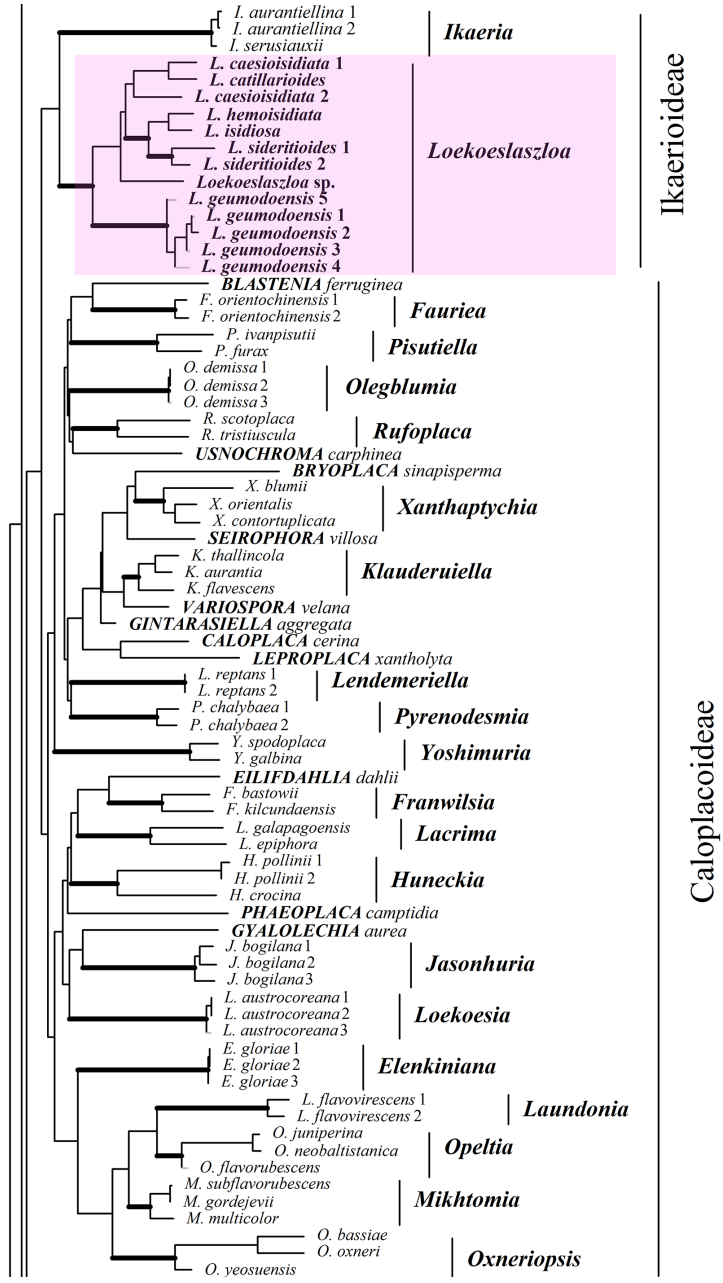


*Fig. 1B*. Most likely phylogenetic relationship of *Kudratoviella* with their associated taxa inferred from nrITS, nrLSU and mtSSU data on rooting with *Brigantiaea ferruginea* as outgroup. Nodes with the highest level of bootstrap support from MP (100), ME (≤ 97) and ML (≤ 95) analyses are shown in bold

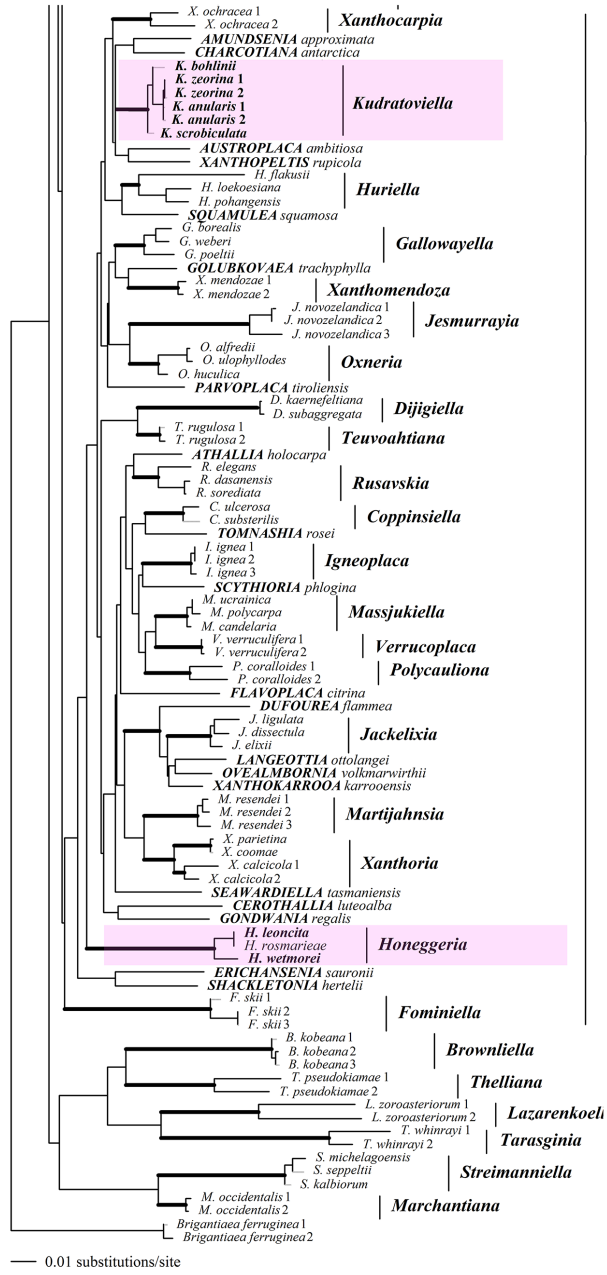


*Fig. 1C*. Most likely phylogenetic relationship of *Kudratoviella* with their associated taxa inferred from nrITS, nrLSU and mtSSU data on rooting with *Brigantiaea ferruginea* as outgroup. Nodes with the highest level of bootstrap support from MP (100), ME (≤ 97) and ML (≤ 95) analyses are shown in bold

smooth or with characteristic cracks exfoliations; cortical layer rather thick (to 50–100 μm thick), and the medulla often with prosoplectenchymatous dense portions.

Apothecia lecanorine or zeorine, disc red to orange. Asci 8-spored, ascospores hyaline, mostly with rather narrow septum.

Chemistry: Thallus and epihymenium K+ red-purple, C–, KC–, P– by spot test, UV– or UV+ red to dark orange; parietin, teloschistin and zeorine.

Etymology: It is named after the Tajik lichenologist Imomnazar Kudratov (*1946 in Dushanbe, Tajikistan) in the recognition of his contribution to the knowledge on lichen species diversity of Central Asia.

Distribution and species diversity: The genus currently includes the Eurasian mountainous taxon *Kudratoviella anularis*, the Asian taxa *K. bohlinii*, and *K. scrobiculata**, as well as recently described species *K. zeorina* from China and *K. rajasthanica* from India.

Taxonomic notes: The genus *Kudratoviella* is positions in intermediate / sister position between the genera *Amundsenia* Søchting, Garrido-Ben., Arup et Frödén, including *A. approximata* (Lynge) Søchting, Arup et Frödén and *A. austrocontinentalis* Garrido-Ben., Søchting, Pérez-Ort. et Seppelt and monotypic genus *Charcotiana* Søchting, Garrido-Ben. et Arup with type species *Charcotiana antarctica* Søchting, Garrido-Ben., Pérez-Ort., Seppelt et Castello on one side (Fig. 1C) and the genus *Coppinsiella* S. Y. Kondr. et L. Lőkös (with species *C. ulcerosa* S. Y. Kondr. et L. Lőkös and *C. substerilis* S. Y. Kondr. et L. Lőkös on another side as after the nrITS phylogeny, as well as on three gene phylogeny (Fig. 1C). These genera are members of the *Teuvoahtiana–Coppinsiella* subclade of the Xanthorioideae.

The genus *Kudratoviella* differs from three other genera of the Xanthorioideae, in having a rather thick thallus with thick areoles in the centre and more or less lobate margin and by its secondary chemistry characterised by the parietin and zeorine chemosyndromes.

In contrast to genus *Kudratoviella*, the genus *Amundsenia* Søchting, Garrido-Ben., Arup et Frödén (type species *A. approximata* (Lynge) Søchting, Arup et Frödén including one more Antarctic species, i.e. *A. austrocontinentalis* Garrido-Ben., Søchting, Pérez-Ort. et Seppelt is distributed as in both hemispheres. The species included are characterised by a thin crustose, often indistinct, thallus and lack of well-developed thalline lobes.

The monotypic genus *Charcotiana* Søchting, Garrido-Ben. et Arup (type species (*C. antarctica* Søchting, Garrido-Ben., Pérez-Ort., Seppelt et Castello) is distributed only in Southern Hemisphere and is characterised by crustose thallus with unique chemistry.

* One more species, unfortunately so far illegally described as *Caloplaca zeravshanica* Kudratov et S. Y. Kondr. in Handbook of Lichens of Russia (Kondratyuk *et al.* 2004) is also member of the *Kudratoviella* branch. However, new combination for this taxon will be proposed after its validation.

## DISCUSSION

'Extraneous mycobiont DNA' in lichen association as term for one case of conflict of morphological and molecular data was proposed by us earlier (Kondratyuk *et al.* 2019*b*). At that time extraneous mycobiont DNA, i.e. nrITS and mtSSU seqeunces of lichens of the Ramalinaceae were discovered in the thalli of the genera *Agonimia, Biatora, Kashiwadia, Oxneriopsis, Pyxine, Rinodina* and *Verrucaria*. Additional examples in the Physciaceae, known from other publications were also discussed (Kondratyuk *et al.* 2019*b*). Extraneous mycobiont DNA had been previously neglected as contaminants or sample mix-ups. However, when the same extraneous DNA was detected in other species collected in different parts of the world, its existince became apparent.

Few examples of extraneous mycobiont DNA are hiterto known in the Teloschistaceae, too. One more case was resolved in connection with this study when nrITS sequence of *Iqbalia kashmirensis* (Fayyaz, Asfan, Niazi et Khalid (subfamily Teloschistoideae) published by Fayyaz *et al.* (2022), was revealed as present in thalli of *Orientophila dodongensis* S. Y. Kondr., Lokos et Hur and *Huriella* sp. (both of the subfamily Xanthorioideae) from South Korea and India, respectively. The later two taxa were investigated by the senior author in 2017 at the Korean Lichen Research Institute (KoLRI), Sunchon National University, South Korea and in 2018 at the Department of Molecular Cell Biology, Lund University, Sweden. However, the sequences did not match the morphology and were conseqeuntly dismissed as contaminations at that time. Thus *Iqbalia kashmirensis* is here for the first time confirmed from South Korea and India on the basis of 'extraneous mycobiont DNA'.

Some nomenclatural problems have been solved within this study. Within the subfamily Teloschistoideae new data on the *Raesaeneniana* monophyletic branch were obtained. *Villophora onas* appeared to be positioned in the *Raesaeneniana maulensis* branch. Secondly, four species of the monophyletic *Raesaeneniana* monophyletic branch, previously described in *Villophora,* i.e.: *V. darwiniana* Søchting, Søgaard et Arup, *V. patagonica* Søchting et Søgaard, *V. rimicola* Søchting, and *V. wallaceana* Søchting et Søgaard are confirmed as member of the monophyletic *Raesaeneniana* branch by our phylogenetic analysis (Fig. 1A).

'*Caloplaca*' *caesioisidiata* Arup et van den Boom, '*Caloplaca*' *caesiosorediata* Arup et van den Boom, '*Oceanoplaca*' *chemoisidiosa* Søchting et Bungartz, '*Placodium*' *isidiosum* Vain. (type species of the genus *Oceanoplaca*), and '*Oceanoplaca*' *sideritoides* Søchting et Bungartz were revealed as members of the *Loekoeslaszloa* monophyletic branch of the subfamily Ikaerioideae (Fig. 1B).

'*Xanthomendoza*' *leoncita* Bungartz et Søchting, and '*Xanthoria*' *wetmorei* S. Y. Kondr. et Kärnefelt are accepted as members of *Honeggeria* in the subfamily Xanthorioideae (Fig. 1C), originally a monotypic genus (Fedorenko *et al.* 2012).

## New combinations

***Honeggeria leoncita*** (Bungartz et Søchting) S. Y. Kondr., *comb. nova* – MycoBank No.: 842813 – Basionym: *Xanthomendoza leoncita* Bungartz et Søchting in Bungartz et al., Plant and Fungal Systematics 65(2): 569 (2020).

***Honeggeria wetmorei*** (Bungartz et Søchting) S. Y. Kondr., *comb. nova* – MycoBank No.: 842814 – Basionym: *Xanthoria wetmorei* S. Y. Kondr. et Kärnefelt [as '*wetmori*'], Ukr. Bot. Zh. 60(2): 128 (2003). – Syn.: *Oxneria wetmorei* (S. Y. Kondr. et Kärnefelt) S. Y. Kondr. et Kärnefelt [as '*wetmori*'], Ukr. Bot. Zh. 60(4): 432 (2003); *Gallowayella wetmorei* (S. Y. Kondr. et Kärnefelt) S. Y. Kondr., Fedorenko, S. Stenroos, Kärnefelt, Elix, Hur et A. Thell in Fedorenko et al., Bibl. Lichenol. 108: 60 (2012).

***Kudratoviella anularis*** (Clauzade et Poelt) S. Y. Kondr., L. Lőkös, I. Kärnefelt et A. Thell, *comb. nova* – MycoBank No.: MB 845735 – Basionym: *Caloplaca anularis* Clauzade et Poelt, Herzogia 2(1): 305 (1972).

***Kudratoviella bohlinii*** (H. Magn.) S. Y. Kondr., L. Lőkös, I. Kärnefelt et A. Thell, *comb. nova* – MycoBank No.: MB 845736 – Basionym: *Caloplaca bohlinii* H. Magn., Lichens Central Asia 1: 137 (1940). – Syn.: *Gasparrinia bohlinii* (H. Magn.) N. S. Golubk., Ukr. Bot. Zh. 35(2): 186 (1978).

***Kudratoviella rajasthanica*** (S. Y. Kondr., Upreti et G. P. Sinha) S. Y. Kondr., L. Lőkös, I. Kärnefelt et A. Thell, *comb. nova* – MycoBank No.: MB 845737 – Basionym: *Caloplaca rajasthanica* S. Y. Kondr., Upreti et G. P. Sinha in Mishra et al., Acta Bot. Hung. 62(3–4): 340 (2020).

***Kudratoviella scrobiculata*** (H. Magn.) S. Y. Kondr., L. Lőkös, I. Kärnefelt et A. Thell, *comb. nova* – MycoBank No.: MB 845738 – Basionym: *Caloplaca scrobiculata* H. Magn., Lichens Central Asia 1: 143 (1940). – Syn.: *Gasparrinia scrobiculata* (H. Magn.) Kudratov, Ukr. Bot. Zh. 35(2): 187 (1978).

***Kudratoviella zeorina*** (B. G. Lee et Hur) S. Y. Kondr., L. Lőkös, I. Kärnefelt et A. Thell, *comb. nova* – MycoBank No.: MB 845739 – Basionym: *Caloplaca zeorina* B. G. Lee et Hur in Lee et al., Mycotaxon 133(1): 119 (2018).

***Loekoeslaszloa*** S. Y. Kondr., Kärnefelt, A. Thell et Hur in Kondratyuk et al., Acta Bot. Hung. 61(3–4): 338 (2019). – New synonym: *Oceanoplaca* Arup, Søchting et Bungartz in Bungartz et al., Plant and Fungal Systematics 65(2): 540 (2020). – Type species: *Oceanoplaca isidiosa* (Vain.) Bungartz, Søchting et Arup in Bungartz et al., Plant and Fungal Systematics **65**(2): 541 (2020).

***Loekoeslaszloa caesioisidiata*** (Arup et van den Boom) S. Y. Kondr., *comb. nova* – MycoBank No.: 842815 – Basionym: *Caloplaca caesioisidiata* Arup et van den Boom, Bibl. Lichenol. 106: 2 (2011). – Syn.: *Oceanoplaca caesioisidiata* (Arup et van den Boom) Arup in Bungartz et al., Plant and Fungal Systematics 65(2): 546 (2020).

***Loekoeslaszloa caesiosorediata*** (Arup et van den Boom) S. Y. Kondr., *comb. nova* – MycoBank No.: 842816 – Basionym: *Caloplaca caesiosorediata* Arup et van den Boom, Bibl. Lichenol. 106: 3 (2011). – Syn.: *Oceanoplaca caesiosorediata* (Arup et van den Boom) Arup in Bungartz et al., Plant and Fungal Systematics 65(2): 546 (2020).

***Loekoeslaszloa chemoisidiosa*** (Søchting et Bungartz) S. Y. Kondr., *comb. nova* – MycoBank No.: 842817 – Basionym: *Oceanoplaca chemoisidiosa* Søchting et Bungartz in Bungartz et al., Plant and Fungal Systematics 65(2): 546 (2020).

***Loekoeslaszloa isidiosa*** (Vain.) S. Y. Kondr., *comb. nova* – MycoBank No.: 842818 – Basionym: *Placodium isidiosum* Vain., Acta Soc. Fauna Flora Fenn. 7(1): 118 (1890). – Syn.:

*Oceanoplaca isidiosa* (Vain.) Bungartz, Søchting et Arup in Bungartz et al., Plant and Fungal Systematics 65(2): 541 (2020).

***Loekoeslaszloa sideritoides*** (Søchting et Bungartz) S. Y. Kondr., *comb. nova* – MycoBank No.: 842819 – Basionym: *Oceanoplaca sideritoides* Søchting et Bungartz in Bungartz et al., Plant and Fungal Systematics 65(2): 544 (2020).

***Raesaeneniana darwiniana*** (Søchting, Søgaard et Arup) S. Y. Kondr., *comb. nova* – MycoBank No.: 842820 – Basionym: *Villophora darwiniana* Søchting, Søgaard et Arup in Søchting et al., Lichenologist 53(3): 250 (2021).

***Raesaeneniana maulensis*** (S. Y. Kondr. et Hur) S. Y. Kondr., Elix, Kärnefelt et A. Thell in Kondratyuk et al., Acta Bot. Hung. 57(3–4): 340 (2015). – Basionym: *Marchantiana maulensis* S. Y. Kondr. et Hur in Kondratyuk et al., Acta Bot. Hung. 56(1–2): 108 (2014). – Syn.: *Villophora maulensis* (S. Y. Kondr. et Hur) Søchting in Søchting et al., Lichenologist 53(3): 248 (2021). – New synonym: *Villophora onas* Søchting, Søgaard et Arup in Søchting et al., Lichenologist 53(3): 252 (2021).

***Raesaeneniana patagonica*** (Søchting et Søgaard) S. Y. Kondr., *comb. nova* – MycoBank No.: 842821 – Basionym: *Villophora patagonica* Søchting et Søgaard in Søchting et al., Lichenologist 53(3): 253 (2021).

***Raesaeneniana rimicola*** (Søchting) S. Y. Kondr., *comb. nova* – MycoBank No.: 842822 – Basionym: *Villophora rimicola* Søchting in Søchting et al., Lichenologist 53(3): 253 (2021).

***Raesaeneniana wallaceana*** (Søchting et Søgaard) S. Y. Kondr., *comb. nova* – MycoBank No.: 842823 – Basionym: *Villophora wallaceana* Søchting et Søgaard in Søchting et al., Lichenologist 53(3): 254 (2021).

## CONCLUSIONS

Multigene phylogenetic analysis has resulted in erection of the new genus *Kudratoviella* for the former *Caloplaca zeorina* group, as well as illustration of position of new eleven species within the *Honeggeria*, *Loekoeslaszloa* and *Raesaeneniana* monophyletic branches of the family Teloschistaceae. *Iqbalia kashmirensis* is for the first time confirmed from South Korea and India on the basis of 'extraneous mycobiont DNA'. Further molecular data on the Asian members of genera *Huriella* and *Orientophila* of the Xanthorioideae, as well as data on several new monophyletic branches including Asian representatives of the Caloplacoideae will be presented elsewhere in the nearest future.

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*Appendix*. Sequences used in the phylogenetic analyses (sequences generated for this study as well as new names are **in bold**). Abbreviations: Ref = References

| Species, voucher number in the phylogenetic tree | Isolate | Country | nrITS | nrLSU | mtSSU | Ref |
|---|---|---|---|---|---|---|
| *Amundsenia approximata* | U934 / U1135 / U1136 | Norway | KJ789965 | KJ789972 | KJ789974 | 9 |
| *Aridoplaca peltata* | KW21 | Bolivia | MT754232 | MT741635 | MT754201 | 24 |
| *Athallia holocarpa* | U484 / U604 / U614 | Sweden | FJ346539 | KC179148 | KC179478 | 1 |
| *Austroplaca ambitiosa* | USE405 / USE4398 | UK | KC179081 | KC179151 | KC179481 | 1 |
| *Blastenia ferruginea* | USE493 | Sweden | KC179416 | KC179163 | KC179493 | 1 |
| *Brigantiaea ferruginea* 1 | SK 779 | South Korea | KF264622 | JQ301545 | KC179494 | 1, 7, 8 |
| *Brigantiaea ferruginea* 2 | SK 780 | South Korea | KF264623 | JQ301546 | KJ766362 | 1, 7, 8 |
| *Brownliella kobeana* 1 | 130231 KoLRI | South Korea | KT456213 | KT456228 | KT456243 | 8, 13 |
| *Brownliella kobeana* 2 | 120032 KoLRI | South Korea | KT456213 | KT456228 | KT456243 | 8, 13 |
| *Brownliella kobeana* 3 | 130318 KoLRI | South Korea | KT456213 | KT456228 | KT456243 | 8, 13 |
| *Bryoplaca sinapisperma* | U1162 / U1557 / U1189 | Norway | KC179421 | MT952896 | KC179495 | 1 |
| *Caloplaca cerina* | USE548 | Norway: Svalbard | KC179425 | KC179168 | KC179499 | 1 |
| *Cerothallia luteoalba* | PF229 | Sweden | KC179099 | KC179177 | KC179511 | 1 |
| *Charcotiana antarctica* | USE1464 / USE4808 / USE1542 | Antarctica | KJ789967 | KJ789973 | KJ789976 | 20 |
| *Coppinsiella substerilis* | Palice 13441 / ZP13441 | Slovakia | KC416110 | KU554438 | KU554433 | 18 |
| *Coppinsiella ulcerosa* | CBFS JV6913 / TUN83 | Czech Republic | GU080297 | KU554439 | KU554434 | 18 |
| *Dijigiella kaernefeltiana* | SK 969 | Australia | KY614396 | KY614444 | KY614475 | 15 |
| *Dijigiella kaernefeltiana* | SK 971 | Australia | KY614397 | KY614445 | KY614476 | 15 |
| *Dijigiella subaggregata* | SK 955 | Australia | KY614398 | KY614446 | KY614477 | 15 |
| *Dufourea flammea* | PF158 | South Africa | KC179357 | KC179183 | KC179518 | 1 |
| *Eilifdahlia dahlii* | SK 959 | Australia | KJ021318 | KJ021253 | KJ021279 | 9 |
| *Elenkiniana gloriae* 1 | Gaya 59 | Spain | EU639589 | JQ301555 | JQ301491 | 7 |
| *Elenkiniana gloriae* 2 | SK 611 | Spain | KJ021321 | KJ021256 | KJ021282 | 9 |
| *Elenkiniana gloriae* 3 | SK 613 / SK 611 | Spain | KJ021322 | KJ021256 | KJ021282 | 9 |
| *Elixjohnia jackelixii* | U868 /U1402 / U1403 | New Zealand | KC179303 | KC179248 | KC179587 | 1 |
| *Erichansenia sauronii* | USE288 | Antarctica | KC179120 | KC179241 | KC179580 | 1 |
| *Fauriea orientochinensis* 1 | SK 709 | China | KX793096 | KX793099 | KX793102 | 14 |
| *Fauriea orientochinensis* 2 | SK 710 | China | KX793097 | KX793100 | KX793103 | 14 |
| *Filsoniana australiensis* | SK 851 | Australia | KF264631 | KF264665 | KF264691 | 8 |

| Species, voucher number in the phylogenetic tree | Isolate | Country | nrITS | nrLSU | mtSSU | Ref |
|---|---|---|---|---|---|---|
| *Filsoniana australiensis* | SK 850 | Australia | KF264632 | KF264666 | KF264692 | 8 |
| *Flavoplaca citrina* | U481 / U603 / U613 | Sweden | DQ173224 | KC179186 | KC179521 | 1 |
| *Follmannia orthoclada* | PF288 | Chile | KC179291 | KC179191 | – | 1 |
| *Fominiella ski* 1 | JS107 / SK D19 | Bulgaria | HM582188 | KY614447 | KY614478 | 15 |
| *Fominiella ski* 2 | JS145 / SK D19 | Turkey | HM582193 | KY614447 | KY614478 | 15 |
| *Fominiella ski* 3 | JS32 / SK D19 | Ukraine | HM582194 | KY614447 | KY614478 | 15 |
| *Franwilsia bastowii* | SK 810 | Australia | KJ021324 | KJ021257 | KJ021284 | 9 |
| *Franwilsia kilcundensis* | SK 931 | Australia | KJ021328 | KJ021261 | KJ021288 | 9 |
| *Fulgogasparrea decipioides* 1 | SK 691 / Cadec188 | South Korea | KF264644 | KT291540 | KF264695 | 8 |
| *Fulgogasparrea decipioides* 2 | Cadec188 | South Korea | KT291453 | KT291540 | KT291487 | 7 |
| *Gallowayella borealis* | USE590 / USE118 | Greenland | KC179133 | KC179278 | KC179617 | 1 |
| *Gallowayella poeltii* | Gaya 7 | Sweden | JQ301689 | JQ301583 | JQ301525 | 7 |
| *Gallowayella weberi* | FNM-031 / Gaya 98 /FNM-031 | USA | KC179141 | KT291568 | KT291527 | 1 |
| *Gintarasiella aggregata* | SK 267 | Australia | KY614392 | KY614450 | KY614481 | 15 |
| *Gintarasiella aggregata* | SK A84 | Australia | KY614390 | KY614448 | KY614479 | 15 |
| *Golubkovaea trachyphylla* | PF227 | USA | KC179143 | KC179283 | KC179623 | 1 |
| *Gondwania regalis* | USE4363 / USE4394 / USE3308 | Antarctica | KC179103 | KC179193 | KC179527 | 1 |
| *Gyalolechia aurea* | U415 / USE249 / U607 | Austria | KC179434 | KC179196 | KC179530 | 1 |
| *Haloplaca britannica* | U569 / U982 / U983 | UK: Wales | KC179292 | KC179203 | KC179537 | 1 |
| *Haloplaca* sp. 6 | U981 / U982 / U983 | Spain | KC179295 | KC179203 | KC179537 | 1 |
| *Haloplaca suaedae* | U772 | UK | HM582197 | KC179203 | KC179538 | 1, 22 |
| *Harusavskia elenkinianoides* 1 | SK 996 | Chile | KY614403 | KY614451 | KY614484 | 15 |
| *Harusavskia elenkinianoides* 2 | SK 997 | Chile | KY614404 | KY614452 | KY614485 | 15 |
| *Harusavskia elenkinianoides* 3 | SK 269 | Chile | KY614405 | KY614453 | KY614486 | 15 |
| ***Honeggeria leoncita*** | **USE2395** | **Ecuador** | MT967477 | KC179285 | KC179625 | 1, 2 |
| ***Honeggeria rosmarieae*** | **M57t5ad – holotype / USE61** | **USA** | AM292814 | KC179285 | KC179625 | 1 |
| ***Honeggeria wetmorei*** | **U1098** | **USA** | MT967481 | KC179285 | KC179625 | 1, 2 |
| *Hosseusiella chilensis* | Gaya 68 | Chile | JQ301660 | JQ301551 | JQ301485 | 7 |
| *Huneckia crocina* | USE4849 / USE4912 / USE4850 | | MT967384 | MT952902 | MT952928 | 2 |
| *Huneckia pollinii* 1 | SK 3206 | USA | KJ021336 | KJ021265 | KJ021296 | 9 |
| *Huneckia pollinii* 2 | SK 869 | USA | KJ021337 | KJ021266 | KJ021297 | 9 |
| *Huriella flakusii* | KRAM-L 70242 | Peru | MN108089 | MN108090 | MN108238 | 19 |
| *Huriella loekoesiana* | SK 694 | South Korea | KJ133481 | MN108090 | MN108238 | 10 |

| Species, voucher number in the phylogenetic tree | Isolate | Country | nrITS | nrLSU | mtSSU | Ref |
|---|---|---|---|---|---|---|
| *Huriella pohangensis* | KoLRI 19017 | South Korea | KY614407 | | KY614488 | 15 |
| *Huriella pohangensis* | KoLRI 15423 | South Korea | KY614406 | | KY614487 | 15 |
| *Igneoplaca ignea* 1 | U328 / USE2017 / USE1938 | Mexico | KC179382 | KC179219 | KC179555 | 1 |
| *Igneoplaca ignea* 2 | Cign104 | USA | KT291458 | KT291545 | KT291492 | 7 |
| *Igneoplaca ignea* 3 | Cign360 / Cign104 / Cign104 | USA | EU639648 | KT291545 | KT291492 | 7 |
| *Ikaeria aurantiellina* 1 | ALV8578 | Portugal | MN586956 | MN586911 | MN586905 | 19 |
| *Ikaeria aurantiellina* 2 | ALV8672 | Portugal | MN586957 | MN586912 | MN586906 | 19 |
| *Ikaeria serusiauxii* | ALV8575 | Portugal | MN586958 | MN586915 | MN586909 | 19 |
| *Iqbalia kashmirensis* 1 | LAH22920 | Pakistan | OM453624 | OM453630 | OM453635 | 4 |
| *Iqbalia kashmirensis* 2 | LAH25919 | Pakistan | OM453627 | OM453633 | – | 4 |
| *Iqbalia kashmirensis* 3 | LAH23920A | Pakistan | OM453625 | OM453631 | OM453636 | 4 |
| *Iqbalia kashmirensis* 4 | LAH23920B | Pakistan | OM453626 | OM453632 | – | 4 |
| ***Iqbalia kashmirensis* 5** | **SK L16, Dokdo Islands, 7ix2017 B.G. Lee 170891 KoLRI 045172 from thallus of *Orientophila dodongensis*** | **South Korea** | **SK L16** | **–** | **–** | **TP** |
| ***Iqbalia kashmirensis* 6** | **SK F69, LWG from thallus of *Huriella* sp. 2** | **India** | **SK F69** | **–** | **–** | **TP** |
| *Jackelixia dissectula* | U493 / U1312 / U1313 holotype | South Africa | KC179355 | KC179182 | KC179517 | 1 |
| *Jackelixia elixii* | FNM 061 | Australia | EU681308 | KC179182 | EU680877 | 1 |
| *Jackelixia ligulata* | PF134 | Australia | KC179359 | KC179185 | KC179520 | 1 |
| *Jasonhuria bogilana* 1 | KoLRI 120469 | South Korea | KT220197 | KT220206 | KT220215 | 12 |
| *Jasonhuria bogilana* 2 | KoLRI 120641 | South Korea | KT220198 | KT220207 | KT220216 | 12 |
| *Jasonhuria bogilana* 3 | KoLRI 120647 | South Korea | KT220199 | KT220208 | KT220217 | 12 |
| *Jesmurrayia novozelandica* 1 | FNM 114 / SK C82 | New Zealand | EU681347 | KY614454 | EU680935 | 15 |
| *Jesmurrayia novozelandica* 2 | 66 / SK C82 | New Zealand | AJ320153 | KY614454 | KY614489 | 15 |
| *Jesmurrayia novozelandica* 3 | SK C82 | New Zealand | | KY614454 | KY614489 | 15 |
| *Josefpoeltia parva* | PF46 | Argentina | KC179296 | KC179204 | KC179539 | 1 |
| *Josefpoeltia sorediosa* | SK 991 | Chile | KF264645 | KC179205 | KF264696 | 8 |
| *Kaernefia albocrenulata* | SK 245 | South Africa | KF264647 | KF264675 | KF264698 | 8 |
| *Kaernefia albocrenulata* | SK 246 | South Africa | KF264648 | KF264676 | KF264699 | 8 |
| *Kaernefia gilfillaniorun* | SK 999 | Australia | KF264650 | KF264678 | KF264701 | 8 |
| *Kaernefia gilfillaniorun* | SK 253 | Australia | KF264649 | KF264677 | KF264700 | 8 |
| *Kaernefia kaernefeltii* | SK 919 | Australia | KF264651 | KF264679 | KF264702 | 8 |
| *Kaernefia kaernefeltii* | SK 921 | S Australia | KF264652 | KF264680 | KF264703 | 8 |

| Species, voucher number in the phylogenetic tree | Isolate | Country | nrITS | nrLSU | mtSSU | Ref |
|---|---|---|---|---|---|---|
| *Klauderuiella thallincola* | Gaya 22 | Sweden | JQ301667 | JQ301563 | JQ301498 | 7 |
| ***Kudratoviella anularis* 1** | Cscr407, under *Caloplaca scrobiculata* | | EU639649 | | | 7 |
| ***Kudratoviella anularis* 2** | Vondrák 9927 | | MG954136 | | | 19 |
| ***Kudratoviella bohlinii* 1** | Vondrák 18215 | | MG954139 | | | 19 |
| ***Kudratoviella bohlinii* 2** | Vondrák 18216 | | MG954138 | | | 19 |
| ***Kudratoviella scrobiculata* 1** | voucher 20081198 | | HQ917072 | | | 18 |
| ***Kudratoviella scrobiculata* 2** | voucher 500117 | | HQ917073 | | | 18 |
| ***Kudratoviella scrobiculata* 3** | Vondrák 9933 | | MG954135 | | | 19 |
| ***Kudratoviella zeorina* 1** | CH 140080A | | KU199677 | | | 18 |
| ***Kudratoviella zeorina* 2** | CH 140080B | | KU199678 | | | 18 |
| ***Kudratoviella zeorina* 3** | Vondrák 9928 | | MG954137 | | | 19 |
| *Lacrima epiphora* | U2265 / U2702 / U2703 | Panama | MT967392 | MT952904 | MT952930 | 2 |
| *Lacrima galapagoensis* | USE2945 / U3016 / U3017 | Ecuador: Galapagos | MT967397 | MT952905 | MT952931 | 2 |
| *Langeottia ottolangei* | SK 265 | Namibia | KJ133471 | KJ133500 | KJ133536 | 10 |
| *Laundonia flavovirescens* 1 | U352 / USE 101 | Russia | AF353966 | KC179198 | KC179532 | 1 |
| *Laundonia flavovirescens* 2 | SK 657 / USE 101 | Russia | KY614417 | KC179198 | KY614496 | 1, 15 |
| *Lazarenkoella zoroasteriorum* 1 | SK A51 | Iran | KT456216 | KT456231 | KT456246 | 13 |
| *Lazarenkoella zoroasteriorum* 2 | SK A55 | Iran | KT456217 | KT456232 | KT456247 | 13 |
| *Lazarenkoiopsis ussuriensis* 1 | SK A37 | Russia | KY614418 | KY614455 | KY614498 | 15 |
| *Lazarenkoiopsis ussuriensis* 2 | SK D22 | Russia | KY614419 | KY614456 | KY614499 | 15 |
| *Lendemeriella reptans* 1 | NY177 | USA | JQ686192 | MH100766 | JQ686191 | 19 |
| *Lendemeriella reptans* 2 | F330 | USA | MH104934 | MH100766 | MH100796 | 19 |
| *Leproplaca xantholyta* | Gaya 32 | Greece | JQ301670 | JQ301565 | JQ301501 | 7 |
| *Loekoesia austrocoreana* 1 | KoLRI 120511 | South Korea | KT220200 | KT220209 | KT220218 | 12 |
| *Loekoesia austrocoreana* 2 | KoLRI 120523 | South Korea | KT220201 | KT220210 | KT220219 | 12 |
| *Loekoesia austrocoreana* 3 | SK 261 | South Korea | KT220202 | KT220211 | KT220220 | 12 |
| ***Loekoeslaszloa caesioisidiata* 1** | **U813 / U1785 / U1668** | **Cape Verde** | MT967411 | MT952910 | MT952936 | 2 |
| ***Loekoeslaszloa caesiosorediata* 2** | **U811 / U1784 / U1668** | **Cape Verde** | MT967412 | MT952911 | MT952936 | 2 |
| ***Loekoeslaszloa catillarioides*** | **U814 / U1670 / U1669** | **Cape Verde** | MT967410 | MT952909 | MT952935 | 2 |
| *Loekoeslaszloa geumodoensis* 1 | SK 235/ U1784 / SK 235 | South Korea | OK335271 | MT952911 | OK335265 | 18 |

| Species, voucher number in the phylogenetic tree | Isolate | Country | nrITS | nrLSU | mtSSU | Ref |
|---|---|---|---|---|---|---|
| *Loekoeslaszloa geumodoensis* 2 | SK 236 / U1784 / SK 236 | South Korea | OK335272 | MT952911 | OK335266 | 18 |
| *Loekoeslaszloa geumodoensis* 3 | SK 234 / U1784 / SK 234 | South Korea | OK335273 | MT952911 | OK335267 | 18 |
| *Loekoeslaszloa geumodoensis* 4 | SK 233 / U1784 / SK 233 | South Korea | OK335274 | MT952911 | OK335268 | 18 |
| *Loekoeslaszloa geumodoensis* 5 | 161450 KoLRI / U1784 / SK 235 | South Korea | OK335278 | MT952911 | OK335265 | 18 |
| ***Loekoeslaszloa hemoisidiosa*** | **USE2509 / U2757 / U3009** | **Ecuador** | MT967413 | MT952912 | MT952937 | 2 |
| ***Loekoeslaszloa isidiosa*** | **USE1476 / U2755 / U2756** | **Ecuador** | MT967416 | MT952913 | MT952938 | 2 |
| ***Loekoeslaszloa sideritoides* 1** | **U3018 / U3019 / U3132** | **Ecuador** | MT967423 | MT952914 | MT952939 | 2 |
| ***Loekoeslaszloa sideritoides* 2** | **U3008 / U3131 / U3007** | **Ecuador** | MT967424 | MT952915 | MT952939 | 2 |
| *Marchantiana occidentalis* 1 | SK 981 | Australia | KJ021227 | KJ021268 | KJ021303 | 9 |
| *Marchantiana occidentalis* 2 | SK 982 | Australia | KJ021228 | KJ021269 | KJ021304 | 9 |
| *Martinjahnsia resendei* 1 | SK 3185 / USE442 | Spain | JN984131 | KC179290 | KC179630 | 1, 6 |
| *Martinjahnsia resendei* 2 | SK 3192 / USE442 | Spain | JN984130 | KC179290 | KC179630 | 1, 6 |
| *Martinjahnsia resendei* 3 | Xres2336 | Spain | EU639641 | | | 7 |
| *Massjukiella polycarpa* | EDNA09-01482 / AFTOL ID 200 / FNM 105 | UK | FR799310 | DQ912351 | JN984147 | 10 |
| *Massjukiella polycarpa* | USE599 | Denmark | KC179389 | KC179222 | KC179558 | 1 |
| *Massjukiella ucrainica* | FNM 038 / USE599 / FNM 038 | Ukraine | EU681329 | KC179222 | EU680915 | 5 |
| *Mikhtomia gordejevii* | KoLRI 16914 | South Korea | KY614421 | KY614457 | KJ021308 | 15 |
| *Mikhtomia multicolor* | SK A19 / SK 90117 | South Korea | KJ021238 | KJ021273 | KJ021311 | 15 |
| *Mikhtomia subflavorubescens* | SK 80646 / KoLRI 16914 / SK 80646 | South Korea | KJ021232 | KY614458 | KJ021308 | 9 |
| *Neobrownliella brownlieae* 1 | SK 831 | Australia | KF264626 | KF264661 | KF264687 | 8 |
| *Neobrownliella brownlieae* 2 | SK 838 | Australia | KF264627 | KF264662 | KF264688 | 8 |
| *Nevilleiella marchantii* | SK D18 | Australia | KY614425 | KY614462 | KY614500 | 15 |
| *Niorma chrysophthalma* 1 | Tchr13687 / Gaya 06 | Spain | EU639652 | JQ301576 | JQ301518 | 7 |
| *Niorma chrysophthalma* 2 | SK 818 | Australia | KF264654 | KF264682 | KF264705 | 8 |
| *Niorma hypoglaucus* | PF68 | Kenya | KC179319 | KC179256 | KC179595 | 1 |
| *Olegblumia demissa* 1 | U264 / U628 | Austria | AF353960 | KC179172 | KC179505 | 1 |
| *Olegblumia demissa* 2 | SK C65 | Ukraine | KT220203 | KT220212 | KT220221 | 12 |
| *Olegblumia demissa* 3 | V878 | Spain | MH104937 | MH100752 | MH100784 | 12 |
| *Opeltia flavorubescens* | USE556 | Sweden | AY143394 | AY300831 | AY143403 | 19 |
| *Opeltia juniperina* | SK D10 / USE556 / SK D10 | China | KY614429 | KC179197 | KY614504 | 15 |

| Species, voucher number in the phylogenetic tree | Isolate | Country | nrITS | nrLSU | mtSSU | Ref |
|---|---|---|---|---|---|---|
| *Opeltia neobaltistanica* | SK D09 / USE556 / SK D09 | China | KY614428 | KC179197 | KY614503 | 15 |
| *Ovealmbornia volkmar-wirthii* | SK 241 | South Africa | KJ133477 | KJ133501 | KJ133541 | 10 |
| *Oxneria alfredii* | FNM 151 / T11 / FNM 151 | Russia | EU681344 | MK439836 | EU680932 | 5 |
| *Oxneria huculica* | Gaya 33 | USA | JQ301687 | JQ301580 | JQ301522 | 7 |
| *Oxneria ulophyllodes* | T11 | China | MK414784 | MK439836 | MK439832 | 23 |
| *Oxneriopsis oxneri* | SK 771 | Russia | KY614431 | KY614465 | KY614506 | 15 |
| *Oxneriopsis yeosuensis* | KoLRI 007067 | South Korea | KY614432 | KY614465 | KY614507 | 15 |
| *Oxneriopsis yeosuensis* | KoLRI 15346 | South Korea | KY614433 | KY614466 | KY614508 | 15 |
| *Parvoplaca tiroliensis* | U1292 / U1324 / U1323 | Sweden | KC179116 | KC179216 | KC179552 | 1 |
| *Phaeoplaca camptidia* | U1037 / U1692 / U1691 | USA | MT967431 | MT952918 | MT952942 | 2 |
| *Pisutiella conversa* | Gaya 152 | USA | KT291450 | KT291554 | KT291504 | 7 |
| *Pisutiella conversa* | V780 | – | MH104924 | MH100750 | MH100782 | 19 |
| *Pisutiella furax* | Gaya 46 | – | JQ301662 | JQ301554 | JQ301490 | 7 |
| *Pisutiella ivanpisutii* | D49 | | JQ301662 | JQ301554 | JQ301490 | 7 |
| *Polycauliona coralloides* 1 | USE529 | Mexico | KC179380 | KC179218 | KC179554 | 1 |
| *Polycauliona coralloides* 2 | Caco79 | USA | KT291451 | KT291539 | KT291485 | 7 |
| *Pyrenodesmia chalybaea* 1 | Gaya 38 | Sweden | JQ301659 | JQ301550 | JQ301484 | 7 |
| *Pyrenodesmia chalybaea* 2 | USE243 / U241 / U243 | Austria | KC179454 | MT952921 | KC179571 | 1 |
| *Pyrenodesmia rugosa* | BDNA-L-0001099 | South Korea | MW832828 | MW832804 | MW832825 | 19 |
| ***Raesaeneniana darwiniana*** | | | KC179326 sub *Villophora* sp. | MW397533 sub *Villophora darwiniana* | MW397529 sub *Villophora darwiniana* | 1, 21 |
| ***Raesaeneniana maulensis* 1** | **SK993B** | **Chile** | SK993B | SK993B | SK993B | **C** |
| ***Raesaeneniana maulensis* 2** | **PF279/ USE1387 sub *Villophora* sp. 50** | **Chile** | KC179330 | KC179268 | MW397529 | 1, 21 |
| ***Raesaeneniana maulensis* 3** | **USE5125 /U1340 / USE1387 sub *Villophora onas*** | **Chile** | MW397556 | MW397533 | MW397529 | 21 |
| ***Raesaeneniana maulensis* 4** | **USE2580 /U1340 / USE1387 sub *Villophora onas*** | **Chile** | MW397557 | MW397533 | MW397529 | 21 |
| ***Raesaeneniana patagonensis* 3** | **USE2462 /U1340 / USE1387 sub *Villophora patagonensis*** | **Chile** | KC179327 | MW397533 | MW397529 | 1, 21 |

| Species, voucher number in the phylogenetic tree | Isolate | Country | nrITS | nrLSU | mtSSU | Ref |
|---|---|---|---|---|---|---|
| ***Raesaeneniana patagonensis* 2** | **USE5083 /U1340 / USE1387 sub *Villophora patagonensis*** | **Chile** | MW397561 | MW397533 | MW397529 | 21 |
| ***Raesaeneniana rimicola* 1** | **USE4301 /U1340 / USE1387 sub *Villophora rimicola*** | **Antarctica** | MW397562 | MW397533 | MW397529 | 21 |
| ***Raesaeneniana rimicola* 2** | **USE4815 /U1340 / USE1387 sub *Villophora rimicola*** | **Antarctica** | MW397563 | MW397533 | MW397529 | 21 |
| ***Raesaeneniana wallaceana* 1** | **USE574 / USE574 / USE598 sub *Villophora wallaceana*** | **Chile** | KC179328 | KC179267 | KC179607 | 1 |
| ***Raesaeneniana wallaceana* 2** | **USE571 / USE574 / USE598 sub *Villophora wallaceana*** | **Chile** | MW397565 | KC179267 | KC179607 | 1, 21 |
| *Rehmanniella wirthii* 1 | SK 243 | Namibia | MG811851 | MG811852 | MG811853 | 17 |
| *Rehmanniella wirthii* 2 | SK 244 / SK243 / SK 244 | Namibia | MG811851 | MG811852 | MG811854 | 17 |
| *Rufoplaca scotoplaca* | U1532 / U1531 / U1530 | Sweden | KC179457 | KC179235 | KC179573 | 1 |
| *Rufoplaca tristiuscula* | U913 / U1529 / U1528 | Norway | KC179460 | KC179237 | KC179575 | 1 |
| *Rusavskia dasanensis* | SK702 | South Korea | KU056846 | | KU043472 | 15 |
| *Rusavskia elegans* | USE202 / USE459 | Russia | KC179406 | KC179238 | KC179576 | 1 |
| *Rusavskia elegans* | MP78 | Sweden | KX512947 | KX512896 | KX512948 | |
| *Rusavskia sorediata* | R. Honegger 396t1 / USE204 | Switzerland | AM408405 | KC179239 | KC179577 | 1 |
| *Scutaria andina* 1 | PF209 | Argentina | KC179298 | KC179242 | KC179581 | 1 |
| *Scutaria andina* 2 | KW1 | Peru | MT754221 | MT741623 | MT754190 | 24 |
| *Scutaria andina* 3 | KW25 | Peru | MT754236 | MT741639 | MT754205 | 24 |
| *Scythioria phlogina* | U535 / U469 | Sweden | DQ173233 | KC179221 | KC179557 | 1 |
| *Seawardiella tasmaniensis* | SK 803 | Australia | KJ133448 | KJ133487 | KJ133506 | 10 |
| *Seirophora villosa* | SK D27 voucher KW-L | Italy | KY614435 | KY614468 | KY614510 | 15 |
| *Shackletonia hertelii* | USE346 / USE570 / USE346 | Chile | KC179118 | KC179240 | KC179579 | 1 |
| *Sirenophila gintarasii* | SK D17 | Australia | KY614437 | KY614470 | KY614512 | 15 |
| *Sirenophila maccarthyi* | U867 / PF345 / U1404 | Australia | KC179304 | KC179249 | KC179588 | 1 |
| *Solitaria chrysophthalma* | Cchr157 | | KT291446 | KT291537 | KT291484 | 7 |
| *Solitaria chrysophthalma* | U626 / U627 | | KC179408 | KC179251 | KC179590 | 1 |
| *Squamulea squamosa* | U241 / U611 | USA | KC179125 | KC179252 | KC179591 | 1 |

| Species, voucher number in the phylogenetic tree | Isolate | Country | nrITS | nrLSU | mtSSU | Ref |
|---|---|---|---|---|---|---|
| *Stellarangia namibiensis* | - | Namibia | MZ367688 | MZ391147 | MZ367689 | 3 |
| *Streimanniella kalbiorum* | SK 939 | Australia | KJ021225 | KJ023183 | KJ021300 | 9 |
| *Streimanniella michelagoensis* | SK 971 | Australia | KJ021226 | KJ023185 | KJ021302 | 9 |
| *Tarasginia whinrayi* 1 | SK A95 | Australia | KT456220 | KT456235 | KT456250 | 13 |
| *Tarasginia whinrayi* 2 | SK B02 | Australia | KT456221 | KT456236 | KT456251 | 13 |
| *Tassiloa digitaurea* 1 | SK A34 / USE5156 / SK A34 | Chile | KP096222 | MW397530 | KP096224 | 11 |
| *Tassiloa digitaurea* 2 | SK A35 / USE5156 / SK A35 | Chile | KP096223 | MW397530 | KP096225 | 11 |
| *Tassiloa magellanica* | USE5155 / USE5156 / USE5001 | Chile | MW397534 | MW397530 | MW397526 | 21 |
| *Tayloriellina erythrosticta* | U1026 / U1522 / U1523 | | MW397535 | MW397531 | MW397527 | 21 |
| *Tayloriellina microphyllina* 1 | Cmicp115 / U1338 / Cmicp115 | USA | KT291462 | MW397532 | KT291501 | 7, 21 |
| *Tayloriellina microphyllina* 2 | U1886 / U1338 / U1887 | USA | MW397536 | MW397532 | MW397528 | 21 |
| *Teloschistes flavicans* 1 | Gaya 1b / AFTOL ID 315 | USA | JQ301727 | JQ301578 | JQ301520 | 7 |
| *Teloschistes flavicans* 2 | PF43 | | KC179317 | KC179255 | KC179594 | 1 |
| *Teloschistopsis bonae-spei* | PF82 | South Africa | KC179322 | KC179257 | KC179596 | 1 |
| *Teloschistopsis chrysocarpoides* | PF116 / PF82 | Namibia | KC179323 | KC179257 | KC179596 | 1 |
| *Teloschistopsis eudoxa* | PF72 | Namibia | KC179324 | KC179258 | KC179597 | 1 |
| *Teuvoahtiana rugulosa* 1 | SK A25 | Chile | KY614441 | KY614472 | KY614516 | 15 |
| *Teuvoahtiana rugulosa* 2 | SK A26 | Chile | KY614442 | KY614473 | KY614517 | 15 |
| *Teuvoahtiana rugulosa* 3 | SK A27 | Chile | KY6144432 | KY614474 | KY614518 | 15 |
| *Thelliana pseudokiamae* 1 | SK 925 | Australia | KT456225 | KT456240 | KT456255 | 13 |
| *Tomnashia rosei* | U712 / USE2638 / USE2636 | USA | KC179390 | KC179223 | KC179559 | 1 |
| *Upretia amarkantakana* | SK J20 / 15-47423 / SK J20 | India | MG652764 | MH497049 | MG652767 | 16 |
| *Upretia squamulosa* | 15-47423 / SK J20 | China | MH497055 | MH497049 | MG652767 | 25 |
| *Upretia squamulosa* | 16-50175 / SK J20 | China | MH497057 | MH497051 | MG652767 | 25 |
| *Usnochroma carphinea* | Ccar201 / Gaya 51 | Spain | EU639595 | JQ301548 | JQ301482 | 7 |
| *Variospora velana* | U769 / U834 | Italy | KC179476 | KC179265 | KC179605 | 1 |
| *Verrucoplaca verruculifera* 1 | Gaya 23 | Iceland | JQ301669 | JQ301564 | JQ301500 | 7 |
| *Verrucoplaca verruculifera* 2 | U815 / USE198 | Sweden | KC179404 | KC179233 | KC179570 | 1 |
| *Villophora isidioclada* 1 | USE563 | Chile | KC179325 | KC179266 | KC179606 | 1 |
| *Villophora isidioclada* 2 | USE2462 / USE1340 sub *Villophora* sp. 51 | Chile | KC179327 | MW397533 | MW397529 | 1, 21 |

| Species, voucher number in the phylogenetic tree | Isolate | Country | nrITS | nrLSU | mtSSU | Ref |
|---|---|---|---|---|---|---|
| *Wetmoreana tenax* | Xten96 | | KT291610 | KT291571 | KT291531 | 7 |
| *Wetmoreana texana* | SK 536 / SK 533 | Mexico | KF264658 | KC179273 | KF264711 | 8 |
| *Xanthaptychia blumii* | SK A65 | Iran | KT456219 | KT456232 | KT456249 | 13 |
| *Xanthaptychia contortuplicata* | Secon197 | Tajikistan | KT291471 | No data | KT291522 | 7 |
| *Xanthaptychia orientalis* | SK 755 | China | KJ021240 | No data | KJ023189 | 9 |
| *Xanthocarpia ochracea* 1 | USE270 / U837 / U835 | France | KC179132 | KC179277 | KC179616 | 1 |
| *Xanthocarpia ochracea* 2 | Gaya 21 | Spain | JQ301663 | JQ301558 | JQ301494 | 7 |
| *Xanthokarrooa karrooensis* | PF154 /U1317 / U1316 | South Africa | KC179358 | KC179184 | KC179519 | 1 |
| *Xanthokarrooa karrooensis* | FNM-066 | South Africa | EU681320 | | EU680903 | 5 |
| *Xanthomendoza mendozae* 1 | Gaya 20 | Bolivia | JQ301688 | JQ301581 | JQ301523 | 7 |
| *Xanthomendoza mendozae* 2 | USE 562 | Argentina | KC179138 | KC179281 | KC179620 | 1 |
| *Xanthopeltis rupicola* | PF49 | Chile | KC179146 | KC179286 | KC179626 | 1 |
| *Xanthoria calcicola* 1 | U257 / USE371 | Spain | AF353944 | KC179287 | KC179627 | 1 |
| *Xanthoria calcicola* 2 | Gaya 3 | Spain | KT291475 | JQ301586 | JQ301527 | 7 |
| *Xanthoria parietina* | Gaya 8 | Sweden | JQ301691 | JQ301589 | JQ301530 | 7 |
| *Xanthoria coomae* | FNM-007 | Australia | EU681292 | | EU680883 | 5 |
| *Xanthoria coomae* | FNM-025 | Australia | EU681291 | | EU680884 | 5 |
| *Yoshimuria galbina* | U2445 / U2344 / U2345 | South Korea | MT967482 | MT952923 | MT952946 | 2 |
| *Yoshimuria spodoplaca* | SK 725 / U2237 / SK 725 | South Korea | KJ021249 | MT952924 | KJ023194 | 9 |

*Notes for References: TP = present paper; 1 = Arup *et al.* (2013); 2 = Bungartz *et al.* (2020); 3 = de Los Rios *et al.* (2022); 4 = Fayyaz *et al.* (2022); 5 = Fedorenko *et al.* (2009); 6 = Fedorenko *et al.* (2012); 7 = Gaya *et al.* (2012, 2015); 8 = Kondratyuk *et al.* (2013*c*); 9 = Kondratyuk *et al.* (2014*a*); 10 = Kondratyuk *et al.* (2014*c*); 11 = Kondratyuk *et al.* (2015*a*); 12 = Kondratyuk *et al.* (2015*c*); 13 = Kondratyuk *et al.* (2015*d*); 14 = Kondratyuk *et al.* (2016); 15 = Kondratyuk *et al.* (2017); 16 = Kondratyuk *et al.* (2018*a*); 17 = Kondratyuk *et al.* (2018*b*); 18 = Kondratyuk *et al.* (2019*a*); 19 = Kondratyuk *et al.* (2020); 20 = Søchting *et al.* (2014*b*); 21 = Søchting *et al.* (2021); 22 = Vondrák *et al.* (2012); 23 = Wen *et al.* (2020); 24 = Wilk *et al.* (2021); 25 = Zhang *et al.* (2019)