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Third world list of cetrarioid lichens – in a new databased form, with amended phylogenetic and type information

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Abstract — The third, updated electronic version of the world list of cetrarioid lichens (<http://esamba.bo.bg.ut.ee/checklist/cetrarioid/home.php>) contains more than 570 names representing 149 accepted species. It is based on a FileMaker powered database, allowing users to view data in different sets and to perform searches. The list presents new information about the phylogenetic status of accepted taxa, and about the type materials for most of the names. A concise list of the cetrarioid lichens displayed below includes all the currently accepted 25 genera and 149 species which are now or have earlier been considered to be cetrarioid; taxa belonging to the monophyletic cetrarioid core group (17 genera and 101 species) are pointed out. A new combination *Nephromopsis sikkimensis* is proposed and some nomenclatural details discussed.

***Cetraria* / database / *Nephromopsis sikkimensis* / nomenclature / Parmeliaceae / phylogenetic status**

INTRODUCTION

‘Cetrarioid lichens’ is a colloquial term used for indicating a morphological group of taxa within Parmeliaceae (Lecanorales, Ascomycota), the largest family of lichen-forming fungi with circa 2700 species and 80 genera. The group is defined by an erect foliose or subfruticose growth form of the thallus being loosely attached to the substrate, presence of marginal apothecia and pycnidia, and production of the *Cetraria*-type lichenan (Elix, 1993; Kärnefelt *et al.*, 1992; Randlane & Saag, 1993, 1998a; Randlane *et al.*, 1997). The cetrarioid group as a whole has been proved to be polyphyletic while a core group of it represents a strongly supported clade comprising the majority of cetrarioid genera, and, in addition, a few representatives from another morphological group, parmelioid, within the family (Nelsen *et al.*, 2011; Thell *et al.*, 2009). Some genera which have been morphologically identified as cetrarioid, belong phylogenetically, however, to the parmelioid

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core group (Amo de Paz *et al.*, 2011; Blanco *et al.*, 2006; Crespo *et al.*, 2007, 2010). Thus, the common terminology can be easily misinterpreted, and it is essential to distinguish between the colloquial terms ‘cetrarioid (or parmelioid) lichens’ denoting polyphyletic groups of taxa delimited according to the “gross morphology”, and the phrases ‘cetrarioid (or parmelioid) core group (or clade)’ indicating certain phylogenetically delimited lineages.

The investigation of cetrarioid lichens started historically in 1803, with the description of the genus *Cetraria* by Erik Acharius, followed by the gradual increase of the genus from 8 species up to 76 (Rassadina, 1950), and then the continuous splitting of it into over 20 segregates – based mainly on phenotypic traits, including morphological and chemical characters – during three decades, in 1960-1990s (Kärnefelt, 1979; Randlane & Saag, 1998a). The process of recombining cetrarioid taxa in other genera or synonymizing the names is still in progress, now predominately derived from the phylogenetic DNA analyses (Mark *et al.*, 2012; Nelsen *et al.*, 2011; Thell *et al.*, 2005, 2007). In the group of cetrarioid lichens, nearly one hundred new names had been proposed during the past half-century, while numerous earlier names have turned into synonyms. Understandably this causes frequent misunderstandings and errors in use of the names of those lichens. To contribute to the better knowledge of cetrarioid group of lichens and being inspired by a manuscript “List of epithets in the parmelioid genera” prepared and distributed by Mason E. Hale in 1989, we compiled a similar list of epithets for the cetrarioid species. In its first, printed version (Randlane & Saag, 1993), over 200 species epithets were introduced in alphabetical order representing 120 cetrarioid species. For each epithet the accepted generic location and valid name was indicated. Altogether 36 species were pointed out as taxa with unacceptable generic location or insufficient information available. In the second printed version (Randlane *et al.*, 1997) and its electronic updates from 2000 and 2002 (<http://www.eseis.ut.ee/synonyms/cetraria.html>) nearly 500 epithets representing 138 accepted species in 23 genera were listed. As a novelty compared to the first version, bibliographical data were provided for each combination. Altogether 17 species were specified as poorly studied and/or inadequately located. During the last ten years no updates for this checklist have been provided.

The present, third version of the world list of cetrarioid lichens contains 572 names representing 149 accepted species. Its full edition is presented in electronic form, as it is based on a database, allowing users to view data in different sets and to perform searches. The list offers new information about the phylogenetic status of accepted taxa (e.g., whether they belong to the cetrarioid core group or not), and about the type materials for most of the names.

RESULTS

Functioning of the electronic checklist and the users’ interface. The third world list of cetrarioid lichens (Randlane *et al.*, 2013 – last update on 20 January 2013) is freely accessible at the web portal eSEIS, an Estonian information system of lichens (http://www.eseis.ut.ee/index_en.html); both the computer version (<http://esamba.bo.bg.ut.ee/checklist/cetrarioid>) and smartphone version (<http://esamba.bo.bg.ut.ee/checklist/cetrarioid-mob>) are available. The list is based on a FileMaker powered database and the web interface uses PHP programming language. It has been tested with all major web browsers, including Google Chrome, Internet Explorer, Mozilla Firefox, and Safari on various operating systems.

The current database model enables users to perform different operations: (a) view data in different sets; (b) perform simple search by different fields (e.g. names of accepted species, current status of the name, phylogenetic status of accepted taxa, type information, etc.); (c) perform complex search when indicating certain states in more than one field; (d) sorting according to certain fields – lists compiled by functions ‘Find’ or ‘Find All’ can be sorted by clicking the header of any column on the list. More detailed instructions (together with screenshots of the users’ interface) for using the electronic third world list of cetrarioid lichens are available in Saag *et al.* (2013).

List of accepted taxa, including bibliographic and type information. The checklist includes all currently accepted genera and species which have ever been considered cetrarioid, 25 genera and 149 species altogether. The names of genera which belong to the monophyletic cetrarioid core group (Nelsen *et al.*, 2011) are in **BOLD CAPITALS**; other included genera do not belong to this core group but have traditionally been treated as ‘cetrarioid’. The name of the type species of each genus is in **bold**. The names of species which have no phylogenetically satisfactory generic position according to the latest DNA analyses of the cetrarioid core group (Thell *et al.*, 2009; Nelsen *et al.*, 2011) are marked with an asterisk (*). The names of species which have not been examined or which are too insufficiently investigated (could be synonyms or belong to genera outside of the cetrarioid core group), are marked with a question mark (?) on the list.

The full list of epithets which have been applied to these species, containing 572 records, is available online.

AHTIANA Goward, Bryologist 88: 370. 1986 [1985]

- * *A. aurescens* (Tuck.) Randlane & A. Thell in Thell, Goward, Randlane, Kärnefelt & Saag, Bryologist 98: 599. 1995. Basionym: *Cetraria aurescens* Tuck., Proc. Amer. Acad. Arts 1: 208. 1846. Type: USA, New Hampshire, White Mts; Tuckerman, 1848 (FH-TUCK, lectotype)
- * *A. pallidula* (Tuck. ex Riddle) Goward & A. Thell in Thell, Goward, Randlane, Kärnefelt & Saag, Bryologist 98: 601. 1995. Basionym: *Cetraria pallidula* Tuck. ex Riddle, Bryologist 18: 27. 1915. Type: USA, Washington Territory, Mt. Adams; Pringle 218, 1881 (FH-TUCK, holotype)
- A. sphaerosporella* (Müll. Arg.) Goward, Bryologist 88: 370. 1986 [1985]. Basionym: *Parmelia sphaerosporella* Müll. Arg., Flora 74: 378. 1891. Type: Canada, British Columbia, Galton Mts; Lyall, 1861 (BM, holotype)

ALLOCETRARIA Kurok. & M.J. Lai, Bull. Natl. Sci. Mus. (Tokyo), B 17: 60. 1991

- A. ambigua* (C. Bab.) Kurok. & M.J. Lai, Bull. Natl. Sci. Mus. (Tokyo), B 17: 62. 1991. Basionym: *Cetraria ambigua* C. Bab., Hooker’s J. Bot. Kew Gard. Misc. 4: 244. 1852. Type: (India), Garhwal, Bompras; Strachey & Winterbottom 6 (BM, holotype)
- A. denticulata* (Hue) A. Thell & Randlane in Thell, Randlane, Kärnefelt, Gao & Saag, Flechten Follmann, Contributions to Lichenology in Honour of Gerhard Follmann (Cologne): 359. 1995. Basionym: *Cetraria denticulata* Hue, Nouv. Arch. Mus. Hist. Nat., Sér. 4, 1: 85. 1899. Type: China, Yunnan, Yen-tze-hay; Delavay; 1888 (PC)
- A. endochrysea* (Lynge) Kärnefelt & A. Thell, Nova Hedwigia 62: 507. 1996. Basionym: *Dactylina endochrysea* Lynge, Skr. Svalbard Ishavet (Oslo), 59, Suppl. 5: 62. 1933. Type: China, Yunnan; Delavay, 1886 (H-NYL, holotype; O, isotype)
- A. flavonigrescens* A. Thell & Randlane in Thell, Randlane, Kärnefelt, Gao & Saag, Flechten Follmann, Contributions to Lichenology in Honour of Gerhard Follmann (Cologne): 359. 1995. Type: Nepal, Langtang, Pemdang Karpo; Miehe & Miehe 13056, 1986 (GZU, holotype)

- A. globulans* (Nyl.) A. Thell & Randle in Thell, Randle, Kärnefelt, Gao & Saag, Flechten Follmann, Contributions to Lichenology in Honour of Gerhard Follmann (Cologne): 360. 1995. Basionym: *Platysma globulans* Nyl., Flora 70: 134. 1887. Type: China, Yunnan; Delavay 1570, 1885 (H-NYL 36135, holotype)
- A. isidiigera* Kurok. & M.J. Lai, Bull. Natl. Sci. Mus., Tokyo, B, 17: 62. 1991. Type: China, Xisang, Nylalam; Wei & Chen 1857 (HMAS, holotype; TNS, isotype)
- A. madreporiformis* (Ach.) Kärnefelt & A. Thell, Nova Hedwigia 62: 508. 1996. Basionym: *Dufourea madreporiformis* Ach., Lich. Univ.: 525. 1810. Type: Switzerland; Schleicher; Pl. Crypt. Helv. 2, no 67 (UPS, lectotype)
- A. sinensis* X.Q. Gao in Thell, Randle, Kärnefelt, Gao & Saag, Flechten Follmann, Contributions to Lichenology in Honour of Gerhard Follmann (Cologne): 365. 1995. Type: China, Shaanxi, Mt. Taibai; Gao 3052 (HMAS, holotype; LD, UPS, isotypes)
- A. stracheyi* (C. Bab.) Kurok. & M.J. Lai, Bull. Natl. Sci. Mus. Tokyo, Ser. B, 17: 62-63. 1991. Basionym: *Evernia stracheyi* C. Bab., Hooker's J. Bot. Kew Gard. Misc. 4: 244. 1852. Type: India, Kumaon, Gori River; Strachey & Winterbottom (H-NYL 36055, lectotype)
- ARCTOCETRARIA** Kärnefelt & A. Thell in Kärnefelt, Mattsson & Thell, Bryologist 96: 402. 1993
- A. andrejevii* (Oxner) Kärnefelt & A. Thell in Kärnefelt, Mattsson & Thell, Bryologist 96: 402. 1993. Basionym: *Cetraria andrejevii* Oxner, Bot. Zhurn. (Kiev) 1: 44. 1940. Type: (Russia, Sakha Republic), Yakutia, distr. Bulun, Montes Kharaulakh; Karavaev (KW, holotype)
- A. nigricascens* (Nyl.) Kärnefelt & A. Thell in Kärnefelt, Mattsson & Thell, Bryologist 96: 402. 1993. Basionym: *Platysma nigricascens* Nyl., Meddeland. Soc. Fauna Fl. Fenn. 18: 50. 1891. Type: (Russia), Lapponia ponjensis, Orlov; Kihlman 244, 1889 (H, lectotype)
- A. simmonsii* (Krog) E.S. Hansen 2007, Folia Cryptog. Estonica 43: 6. 2007. Basionym: *Cetraria simmonsii* Krog, Norsk Polarinst. Skr. 144: 124. 1968. Type: Greenland, Egedesminde; Simmons 116, 1898 (O, holotype)
- Asahinea** W.L. Culb. & C.F. Culb., Brittonia 17: 183. 1965
- A. chrysantha* (Tuck.) W.L. Culb. & C.F. Culb., Brittonia 17: 184. 1965. Basionym: *Cetraria chrysantha* Tuck., Amer. J. Sc. Arts 2, 25: 423. 1858. Type: (Russia), Asian side of Bering Strait; Wright (FH, lectotype)
- A. scholanderi* (Llano) W.L. Culb. & C.F. Culb., Brittonia 17: 187. 1965. Basionym: *Cetraria scholanderi* Llano, J. Wash. Acad. 41: 197. 1951. Type: USA, Alaska, Lake Schrader; Scholander & Flagg (US, holotype)
- Bryocaulon** Kärnefelt, Opera Bot. 86: 17. 1986
- B. divergens* (Ach.) Kärnefelt, Opera Bot. 86: 24. 1986. Basionym: *Cornicularia divergens* Ach., Meth. Lich.: 303. 1803. Type: Lapponia; Wahlenberg (H-ACH 1869A, lectotype)
- B. hyperboreum* Øvstedal in Øvstedal, Tønsberg & Elvebakk, Sommerfeltia 33: 99. 2009. Type: Svalbard, Kong Karls Land, Hårfagrehaugen; Dahl, 1936 (O, holotype)
- B. pseudosatoanum* (Asahina) Kärnefelt, Opera Bot. 86: 28. 1986. Basionym: *Cornicularia pseudosatoana* Asahina, J. Jap. Bot. 15: 356. 1939. Type: Japan, Mt. Fuji, Omiyaguchi; Asahina, 1930 (TNS, holotype)
- B. satoanum* (Gyeln.) Kärnefelt, Opera Bot. 86: 31. 1986. Basionym: *Alectoria satoana* Gyeln. in Satō, J. Jap. Bot. 10: 18. 1934. Type: Japan, Hondo, Nikko-Yumoto; Sato 101 (BP, holotype)
- CETRARIA** Ach., Meth. Lich.: 292. 1803
- C. aculeata* (Schreb.) Fr., Syst. Orb. Veg.: 239. 1825. Basionym: *Lichen aculeatus* Schreb., Spicil. Flor. Lipsiens.: 125. 1771. Type: Illustr. in Dillenius, Hist. Musc.: tab. 17, fig. 31B. 1742 (lectotype); corresponding specimen in Herb. Dillenius (without locality) (OXF, epitype)
- * *C. annae* Oxner, Zhurn. Bio-Bot. Tsyklu Vseukraïns'k. Akad. Nauk 7/8: 167. 1933. Type: (Russia), Czita; Oxner, 1927 (KW, holotype)
- C. arenaria* Kärnefelt, Bot. Not. 130: 125. 1977. Type: USA, Michigan; Imshaug 5449, 1949 (LD, holotype)
- C. australiensis* Kärnefelt, Bot. Not. 130: 127. 1977. Type: Australia, New South Wales, Snowy Mts; Weber & McVean, 1968; Lich. Exs. COLO, no 454 (COLO, holotype)

- C. crespoae* (Barreno & Vázquez) Kärnefelt, in Kärnefelt, Mattson & Thell, Bryologist 96: 399. 1993. Basionym: *Coelocaulon crespoae* Barreno & Vázquez, Lazaroa 3: 236. 1981 [1982]. Spain, Caceres, Garganta del rio Viejas; Barreno & Sancho, 1980 (MAF 3559, holotype)
- ? *C. dermatoidea* (Stirt.) Zahlbr., Catal. Lich. Univer. 6: 286. 1929 [1930]. Basionym: *Platysma dermatoideum* Stirt., Trans. Glasgow Field Naturalists' Soc. 1: 21. 1873. Type information missing.
- C. ericetorum* Opiz, Seznam rostlin kveteny: 173. 1852. Type: (Sweden), Svecia; Swartz (H-ACH 1523B, lectotype)
- C. ericetorum* Opiz ssp. *ericetorum*
- C. ericetorum* ssp. *patagonica* Kärnefelt, Opera Bot. 46: 82. 1979. Type: Argentina, Tierra del Fuego, Monte Marcial; Santesson 502, 1940 (S, holotype)
- C. ericetorum* ssp. *reticulata* (Räsänen) Kärnefelt, Opera Bot. 46: 82. 1979. Basionym: *Cetraria tenuifolia* var. *reticulata* Räsänen, Ann. Missouri Bot. Gard. 20: 20. 1933. Type: Canada, British Columbia, Kamloops; Kujala, 1931 (H, holotype)
- C. islandica* (L.) Ach., Meth. Lich.: 293. 1803. Basionym: *Lichen islandicus* L., Spec. Plant. 2: 1145. 1753. Type: LINN 1273.97 (lectotype)
- C. islandica* (L.) Ach. ssp. *islandica*
- C. islandica* ssp. *antarctica* Kärnefelt, Opera Bot. 46: 90. 1979. Type: Chile, Terra Magallanes, Rio Rubens; Santesson 5674, 1941 (S, holotype)
- C. islandica* ssp. *crispiformis* (Räsänen) Kärnefelt, Opera Bot. 46: 94. 1979. Basionym: *Cetraria islandica* var. *crispiformis* Räsänen, Ann. Soc. Bot. Soc. Zool.-Bot. Fenn. Vanamo 18(1): 19. 1943. Type: Russia, Murmansk Region, Lapponia petsamoënsis, Petsamo, Kervanto, Lupuniemi; Räsänen, 1938 (H, lectotype)
- C. islandica* ssp. *orientalis* (Asahina) Kärnefelt, Opera Bot. 46: 107. 1979. Basionym: *Cetraria islandica* var. *orientalis* Asahina in Satô, J. Jap. Bot. 14: 786. 1938. Type: (Japan), Hokkaido, prov. Ishikari, Mt. Ashibetsu; Asahina 1935 (TNS, lectotype)
- C. kamczatica* Savicz, Izv. Imp. Bot. Sada Petra Velikago 14, 1: 119. 1914. Type: (Russia), Kamtschatka, Mt. Schapoczka; Savicz, 1909 (LE, holotype)
- C. laevigata* Rass., Bot. Mater. Otd. Sporov. Rast. Bot. Inst. Komarova Akad. Nauk SSSR 5: 133. 1945. Type: (Russia), Ditio Angaro-Sajanensis, Tunka; Smirnov, 1926 (LE, holotype)
- C. muricata* (Ach.) Eckfeldt, Bull. Torrey Bot. Club 22: 240. 1895. Basionym: *Lichen muricatus* Ach., Lichenogr. Suec. Prodr.: 214. 1798. Type: (Sweden), Svecia (H-ACH 1865A, lectotype)
- C. nepalensis* D.D. Awasthi, Proc. Indian Acad. Sci. 45: 130. 1957. Type: Nepal, Topkegola; Awasthi 2373, 1953 (LWG-AWAS, holotype)
- C. nigricans* Nyl. in Nylander & Saelan, Herb. Musei Fenn.: 109. 1859. Type: (Russia), Kola; Nylander, 1843 (H-NYL 36333, lectotype)
- ? *C. nova-zealandiae* (C. Knight) Zahlbr., Catal. Lich. Univer. 6: 308, 1930. Basionym: *Platysma nova-zealandiae* C. Knight, Trans. & Proc. New Zealand Inst. 8: 328. 1876 [1875]. Type information missing.
- * *C. obtusata* (Schaer.) Van den Boom & Sipman, Lichenologist 26: 106. 1994. Basionym: *Cetraria aculeata* Fr. d. *obtusata* Schaer., Lich. Helvet. Spicil. 4-5: 225. 1833. Type: (Switzerland), (Alps), Mt. Grimsel; Schaerer (G, lectotype)
- C. odontella* (Ach.) Ach., Syn. Meth. Lich.: 230. 1814. Basionym: *Lichen odontellus* Ach., Lichenogr. Suec. Prodr.: 213. 1798. Type: (Sweden), Suecia (H-ACH 1524, lectotype)
- ? *C. peruviana* Kärnefelt & A. Thell, Graphis Scripta 5: 45. 1993. Type: Peru, dep. Cuzco; C. Bues; Herb. G.K. Merrill (FH, holotype)
- C. rassadinæ* Makryi, Bot. Zhurn. (Moscow & Leningrad) 69: 952. 1984. Type: (Russia), Irkutsk Reg., Baical Mts, Czerskii; Makryi, 1979 (NSK, holotype; LE, isotype)
- * *C. sepincola* (Ehrh.) Ach., Meth. Lich.: 297. 1803. Basionym: *Lichen sepincola* Ehrh., Hannover Mag. 21: 203. 1783. Type: (Sweden), Upsaliae; Ehrhart; Phytophylacium Ehrhartianum, no 90. (UPS, neotype)
- C. steppae* (Savicz) Kärnefelt, in Kärnefelt, Mattson & Thell, Bryologist 96: 400. 1993. Basionym: *Cornicularia steppae* Savicz, Bot. Mater. Inst. Sporov. Rast. Glavn. Bot. Sada RSFSR 3: 187. 1924. Type: Ukraine, Askania Nova, Gub. Jekaterinoslav; Oxner, 1924 (LE, lectotype)

- * *C. subalpina* Imshaug, *Mycologia* 42: 30. 1951. Type: Canada, British Columbia; Golden MO69142, 1931 (US, holotype)
- ? *C. subscutata* D.C. Linds., *Bull. Brit. Antarct. Surv.* 36: 107. 1973. Type: Antarctic Peninsula, Argentine Isls, Galindez Isl; Corner 514, 1964 (AAS, holotype; BM, O, isotypes)
- ? *C. xizangensis* J.C. Wei & Y.M. Jiang, *Acta Phytotax. Sin.* 18: 388. 1980. Type: (China), Xizang, Nyalam; Wei & Chen 1899, 1966 (HMAS, holotype)
- CETRARIELLA** Kärnefelt & A. Thell in Kärnefelt, Mattsson & Thell, *Bryologist* 96: 402. 1993
- C. commixta* (Nyl.) A. Thell & Kärnefelt in Thell, Feuerer, Kärnefelt, Myllys & Stenroos, *Mycol. Progr.* 3: 309. 2004. Basionym: *Platysma commixtum* Nyl., *Syn. Meth. Lich.* 1 (2): 310. 1860. Type: Finland, Helsingfors; Nylander, 1860 (H, lectotype)
- C. delisei* (Schaer.) Kärnefelt & A. Thell in Kärnefelt, Mattsson & Thell, *Bryologist* 96: 403. 1993. Basionym: *Cetraria islandica* d. *delisei* Bory ex Schaer., *Enum. Crit. Lich. Europ.*: 16. 1850. Type: (Canada), Terre-neuve (Newfoundland); Despreaux, 1829 (UPS, lectotype)
- C. fastigiata* (Nyl.) Kärnefelt & A. Thell in Kärnefelt, Mattsson & Thell, *Bryologist* 96: 403. 1993. Basionym: *Cetraria delisei* ssp. *fastigiata* Nyl. in Norrlin, *Not. Sällsk. Fauna Fl. Fenn. Förh.* 13: 325. 1873. Type: Finland, Enontekis, Hetta; Norrlin, 1867 (H, lectotype)
- C. sorediella* (Lettau) V.J. Rico & A. Thell in Nelsen *et al.*, *Lichenologist* 43: 548. 2011. Basionym: *Cetraria commixta* f. *sorediella* Lettau, *Hedwigia* 60: 119. 1918. Type: (Switzerland), Engadin; Lettau, 1912 (B 13052, lectotype)
- Cetrelia** W.L. Culb. & C.F. Culb., *Contr. U. S. Natl. Herb.* 34: 490. 1968
- C. alaskana* (W.L. Culb. & C.F. Culb.) W.L. Culb. & C.F. Culb., *Contr. U. S. Natl. Herb.* 34: 492. 1968. Basionym: *Cetraria alaskana* W.L. Culb. & C.F. Culb., *Bryologist* 69: 200. 1966. Type: USA, Alaska; Thomson, *Lich. Arct.* no 13 (DUKE, holotype)
- C. braunsiana* (Müll. Arg.) W.L. Culb. & C.F. Culb., *Contr. U. S. Natl. Herb.* 34: 493. 1968. Basionym: *Parmelia braunsiana* Müll. Arg., *Flora* 64: 506. 1881. Type: Japan, Tokyo; Brauns 2 (p.p.) (G, holotype)
- C. chicitae* (W.L. Culb.) W.L. Culb. & C.F. Culb., *Contr. U. S. Natl. Herb.* 34: 504. 1968. Basionym: *Cetraria chicitae* W.L. Culb. & C.F. Culb., *Bryologist* 68: 95. 1965. Type: USA, West Virginia; Hale; *Lich. Amer. Exs.*, no 56 (DUKE, holotype)
- C. cetrarioides* (Delise) W.L. Culb. & C.F. Culb., *Contr. U. S. Natl. Herb.* 34: 498. 1968. Basionym: *Parmelia perlata* f. *cetrarioides* Delise in Duby, *Bot. Gall.*, ed. 2: 601. 1830. Type: France, Mont d'Or; Delise, 1828 (STR, lectotype)
- C. collata* (Nyl.) W.L. Culb. & C.F. Culb., *Contr. U. S. Natl. Herb.* 34: 505. 1968. Basionym: *Platysma collatum* Nyl., *Flora* 70: 134. 1887. Type: China, Yunnan; Delavay 1590 (H-NYL, holotype)
- C. davidiana* W.L. Culb. & C.F. Culb., *Contr. U. S. Natl. Herb.* 34: 507. 1968. Type: China, Yunnan, Yülung-schan; Handel-Mazzetti 4254 (W, holotype)
- C. delavayana* W.L. Culb. & C.F. Culb., *Contr. U. S. Natl. Herb.* 34: 509. 1968. Type: China, Yunnan, Lopin-chan; Delavay, 1888 (DUKE, holotype)
- C. isidiata* (Asahina) W.L. Culb. & C.F. Culb., *Contr. U. S. Natl. Herb.* 34: 510. 1968. Basionym: *Cetraria sanguinea* f. *isidiata* Asahina in Nakai & Honda, *Nov. Fl. Jap.* 5: 73. 1939. Type: Japan, Honshu, Mt. Kobushi; Asahina, 1933 (TNS, holotype)
- C. japonica* (Zahlbr.) W.L. Culb. & C.F. Culb., *Contr. U. S. Natl. Herb.* 34: 511. 1968. Basionym: *Cetraria japonica* Zahlbr., *Ann. Mycol.* 14: 60. 1916. Type: Japan, Prov. Kotsuke, Mt. Akagi; Yasuda (W, lectotype)
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- N. leucostigma* (Lév.) A. Thell & Randlane in Thell, Randlane, Saag & Kärnefelt, Mycol. Progr. 4: 311. 2005. Basionym: *Cetraria leucostigma* Lév. in Jacquemont, Voyage dans l'Inde, Bot.: 180. 1841–1844. Type: India orientalis; Lévillé (H-NYL 36083, neotype)
- N. melaloma* (Nyl.) A. Thell & Randlane in Thell, Randlane, Saag & Kärnefelt, Mycol. Progr. 4: 311. 2005. Basionym: *Platysma melalomum* Nyl., Syn. Lich. 1: 303. 1860. Type: India, Sikkim, Jongri; Hooker 2065 (BM, lectotype)
- N. morrisonicola* M.J. Lai, Quart. J. Taiwan Mus. 33: 223. 1981 [1980]. Type: (China), Taiwan, Nanton, Mt. Morrison; Lai 10438 (TAIM, holotype)
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- * *N. ornata* (Müll. Arg.) Hue, Nouv. Arch. Mus. Hist. Nat., Sér. 4, 2: 90. 1900. Basionym: *Cetraria ornata* Müll. Arg., Nuovo Giorn. Bot. Ital. 23: 122. 1891. Type: Japan, Mt. Ontake; no 109 (herb unknown)

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- P. subthomsonii* (D.D. Awasthi) A. Crespo, Divakar & Elix in Crespo *et al.*, Taxon 59: 1746. 2010. Basionym: *Parmelaria subthomsonii* D.D. Awasthi, J. Hattori Bot. Lab. 63: 370. 1987. Type: India, Uttar Pradesh, Pithoragarh; Awasthi 3979, 1958 (LWG-AWAS, holotype)
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- P. erosa* W.L. Culb. & C.F. Culb., Contr. U. S. Natl. Herb. 34: 526. 1968. Type: Japan, Shinano Prov., Mt. Kitayoko-dake; Kurokawa 58349 (TNS, holotype)
- P. formosana* (Zahlbr.) W.L. Culb. & C.F. Culb., Contr. U. S. Natl. Herb. 34: 529. 1968. Basionym: *Cetraria formosana* Zahlbr., Feddes Repert. Spec. Nov. Reg. Veg. 33: 59. 1933. Type: (China), Formosa (Taiwan), Mt. Arisan; Asahina F.89 (W, holotype)
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- P. interrupta* W.L. Culb. & C.F. Culb., Contr. U. S. Natl. Herb. 34: 539. 1968. Type: Japan, Shinano Prov., Mt. Norikura; Asahina, 1952 (TNS, holotype)
- P. lacunosa* (Ach.) W.L. Culb. & C.F. Culb., Contr. U. S. Natl. Herb. 34: 541. 1968. Basionym: *Cetraria lacunosa* Ach., Meth. Lich.: 295. 1803. Type: North America; Herb. Swartzii (S, neotype)
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- P. regenerans* W.L. Culb. & C.F. Culb., Contr. U. S. Natl. Herb. 34: 547. 1968. Type: (Malaysia), Borneo, Kinabalu Nat. Park; Hale 28207 (US, holotype)
- P. stenophylla* (Tuck.) W.L. Culb. & C.F. Culb., Contr. U. S. Natl. Herb. 34: 548. 1968. Basionym: *Cetraria lacunosa* b. *stenophylla* Tuck., Synops. N. Am. Lich. 1: 35. 1882. Type: USA, California; Bolander (FH, holotype)
- P. tuckermanii* (Oakes) W.L. Culb. & C.F. Culb., Contr. U. S. Natl. Herb. 34: 549. 1968. Basionym: *Cetraria tuckermanii* Oakes in Tuckerman, Amer. J. Sc. Arts 45: 48. 1843. Type: USA, Massachusetts, Cambridge; Tuckerman, 1838 (FH, holotype)
- P. wheeleri* Goward, Altermann & Björk in Lumbsch *et al.*, Phytotaxa 18: 99. 2011. Type: USA, Montana, Missoula County, Mount Sentinel; Wheeler 2985, 2008 (UBC, holotype)

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- T. arizonica* Essl., Mycotaxon 85:137. 2003. Type: USA, Arizona, Greenlee Co, Apache National Forest; Esslinger 15724 (ASU, holotype; TLE, US, isotypes)
- T. coralligera* (W.A. Weber) Essl., Mycotaxon 85: 139. 2003. Basionym: *Cetraria fendleri* f. *coralligera* W.A. Weber, Univ. Colorado Stud., Ser. Biol. 10: 11. 1963. Type: USA, Colorado, Larimer Co.; Anderson 2975, 1963 (COLO, holotype; US, isotype)
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- T. pseudoweberi* Essl., Mycotaxon 85: 139. 2003. Type: Mexico, Chihuahua; Esslinger 13680 (ASU, holotype; Herb. Esslinger, isotype)
- T. subfendleri* (Essl.) Essl., Mycotaxon 85: 140. 2003. Basionym: *Cetraria subfendleri* Essl., Mycologia 65: 610. 1973. Type: Mexico, Oaxaca; Hale 20803 (US, holotype)
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- V. tilesii*** (Ach.) J.-E. Mattsson & M.J. Lai, Mycotaxon 49: 428. 1993. Basionym: *Cetraria tilesii* Ach., Syn. Meth. Lich.: 228. 1814. Type: (Russia), Kamtschatka; Tilesius (H-ACH 1519, lectotype; UPS, isotype)
- V. tubulosus*** (Schaer.) J.-E. Mattsson & M.J. Lai, Mycotaxon 49: 428. 1993. Basionym: *Cetraria juniperina* var. *tubulosa* Schaer. Lich. Helvet. Spicil.: 372. 1836. Type: (Switzerland), Mt. Gemmi; Guthmick, 1853 (G, lectotype)
- V. viridis*** (Schwein.) J.-E. Mattsson & M.J. Lai, Mycotaxon 49: 428. 1993. Basionym: *Cetraria viridis* Schwein. in Halsey, Ann. Lyceum Nat. Hist. New York 1: 16. 1824. Type: USA, New York, Long Island, Riverhead; Brodo 1094, 1960 (CANL 15631 neotype; COLO 179368, isotype)

DISCUSSION

Our experience with preparing this new revision, the third world list of cetrarioid lichens, clearly pointed out a number of shortcomings – listed below – in nomenclature and/or phylogenetic studies of this group of lichenized fungi. Knowledge about the shortage in information would help to improve the situation.

Nomenclatural issues

(1) The name *Tuckneraria sikkimensis* Divakar & Upreti turned out to be formally inadequate, therefore a new combination for this taxon is proposed below.

Nephromopsis sikkimensis (Divakar & Upreti) Randle & Saag, **comb. nov.**

Mycobank: MB 803356.

Basionym: *Tuckneraria sikkimensis* Divakar & Upreti in Bot. J. Linn. Soc. 150: 249. 2006.

Type: India, Sikkim, Yumthang; Upreti, Chatterjee & Divakar 04-004112; 2004 (LWG, holotype).

The genus *Tuckneraria* Randle & A. Thell was submitted in 1994 as a segregate from *Nephromopsis*, mainly based on anatomical characters in the reproductive structures, such as spherical shape of ascospores and traits of exciple and asci, but also on a character in gross morphology, the presence of cilia

(Randlane *et al.*, 1994; Randlane & Saag, 1998b). The species *T. sikkimensis* was described in 2006 within *Tuckneraria* (Divakar & Upreti, 2006), although a year earlier this entire genus had been synonymized with *Nephromopsis* based on a three-locus phylogenetic analysis (Thell *et al.*, 2005). The authors of the new species discussed its taxonomic position and accepted that the citriform shape of pycnoconidia caused doubts for its generic position, and referred to the necessity of molecular approach in solving the problem (Divakar & Upreti, 2006). Our attempts to obtain DNA sequences from the isotype material (LWG) have not been successful, but we still propose to transfer this species to *Nephromopsis*, for the time being, as the name *Tuckneraria sikkimensis* is not acceptable any longer. The species is very rare and has been collected only twice in North Sikkim, India, so far.

(2) Some minor changes in the author citation are introduced in cases when a name had been ascribed to another person by the publishing author. Lichenologists and botanists have not paid sufficient attention to the changes made in Article 46 in the Melbourne Code (McNeill *et al.*, 2012) in recent decades. Art. 46.4 clearly states: “When the epithet of a validly published name is taken up from and attributed to the author of a different binary designation that has not been validly published, only the author of the validly published name is to be cited”. When this rule is followed, the following changes of author citations may be accepted:

- *Cetraria australiensis* Kärnefelt, not *C. australiensis* W.A. Weber ex Kärnefelt;
- *Cetrariella delisei* (Schaer.) Kärnefelt & A.Thell, not *C. delisei* (Bory ex Schaer.) Kärnefelt & A. Thell;
- *Cetrariella fastigiata* (Nyl.) Kärnefelt & A. Thell, not *C. fastigiata* (Delise ex Nyl.) Kärnefelt & A. Thell.

In these cases the validating authors themselves ascribed the names (erroneously) to other persons because they had used the cited epithet – but in a different taxonomic position. For example, *Coelocaulon australiense* W.A. Weber. as “n. sp.” was already published, but not validly so, by Weber (1975) in his *exsiccata* list and on labels. Kärnefelt, describing *Cetraria australiensis*, pointed this out (Kärnefelt, 1979: 67) but considered the name *Coelocaulon australiense* unpublished. The situation is similar to that described in the Melbourne Code in Art. 46.4. Ex. 24 (McNeill *et al.*, 2012).

(3) The effective publication date of Ming-Jou Lai’s important articles on *Hypogymnia* and on cetrarioid lichens in Quarterly Journal of Taiwan Museum vol. 33(3,4), pp. 209–214 and 215–229 (Lai, 1981a, b), accordingly, is usually miscited as “December 1980”, as written on the paper copies of the journal. These articles were actually distributed in January 1981. Article 29.1 in the Melbourne Code (McNeill *et al.*, 2012) clearly states: “Publication is effected, under this Code, by distribution of printed matter (through sale, exchange, or gift) to the general public or at least to scientific institutions...”. The cited papers by Lai were parts of his Ph.D. thesis, and the opponent, Prof. Pekka Isoviiita, pointed out the correct dates during the defence on 25 September 1981 at the University of Helsinki, Finland. The publication date was investigated in detail because a new genus, *Ahtia* M.J. Lai was published in the latter article with *Sticta wallichiana* as type, and almost simultaneously (“December 1, 1980”) Syo Kurokawa published the new genus *Cetrariopsis* Kurok. with the same lichen as type. Then it turned out that *Cetrariopsis* was published more than 1 month earlier and *Ahtia* fell into synonymy, which is widely accepted. However, the erroneous publication date is usually cited in later papers by Lai and others.

Stage of phylogenetic studies

(1) Polyphyletic group of taxa, the so-called 'cetrarioid lichens', which has been delimited according to the gross morphology (Elix, 1993; Kärnefelt *et al.*, 1992; Randlane & Saag, 1993; Randlane *et al.*, 1997), currently includes 149 species from 25 genera. The monophyletic cetrarioid core group, defined by the phylogenetic analyses (Nelsen *et al.*, 2011; Thell *et al.*, 2009), includes 101 species from 17 genera, *Ahtiana*, *Alloctraria*, *Arctocetraria*, *Cetraria*, *Cetrariella*, *Cetrelia*, *Cetreliaopsis*, *Dactylina*, *Esslingeriana*, *Flavocetraria*, *Kaernefeltia*, *Masonhalea*, *Melanelia*, *Nephromopsis*, *Tuckermanella*, *Tuckermannopsis*, *Usnocetraria*, and *Vulpicida*. In the future, the confusion would be minimized if the phrase 'cetrarioid lichens' were to be used to refer to these genera only. The remaining eight genera (*Asahinea*, *Bryocaulon*, *Cetrelia*, *Coelopogon*, *Cornicularia*, *Himantormia*, *Parmotrema*, and *Platismatia*), which had earlier also been denoted as 'cetrarioids', belong phylogenetically either to the parmelioid core group (e.g. *Cetrelia* and *Parmotrema*) or to other, non-parmelioid groups with uncertain affinities within Parmeliaceae (Amo de Paz *et al.*, 2011; Crespo *et al.*, 2007).

(2) 6 species formally accepted in the cetrarioid core group are known only by the original description or have only been superficially examined, meaning that these names could be synonyms of other species or these taxa may belong to other genera, i.e. drop out of the cetrarioid core group. These taxa are: *Cetraria dermatioidea*, *C. nova-zealandiae*, *C. peruviana*, *C. subscutata*, *C. xizangensis*, and *Nephromopsis hengduanensis*.

(3) 9 species have currently a generic position which is not satisfactory according to molecular phylogenetic analyses (Nelsen *et al.*, 2011; Thell *et al.*, 2009), still, they have not been converted to any other genus because it is not convincingly clear where they belong. These taxa are: *Ahtiana aurescens*, *A. pallidula*, *Cetraria annae*, *C. obtusata*, *C. sepincola*, *C. subalpina*, *Flavocetraria minuscula*, *Nephromopsis ornata*, and *Tuckermannopsis platyphylla*.

(4) For 29 species from the cetrarioid core group, DNA has not yet been studied and phylogenetic analyses performed. This means that the generic position of these taxa has not been confirmed and may, theoretically, change in future. The list of such taxa can be obtained from the digital checklist (<http://esamba.bo.bg.ut.ee/checklist/cetrarioid>), by performing a search in the field 'Phylogenetic status of accepted taxa', when choosing the option 'cetrarioid core, DNA not studied'.

(5) Some cetrarioid genera, e.g. *Melanelia*, *Nephromopsis* and *Tuckermannopsis*, have gone through considerable changes concerning their delimitation. For example, genus *Melanelia* contained 37 species when described (Esslinger, 1978); after separating *Melanelixia* O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch, *Melanohalea* O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch (Blanco *et al.*, 2004), *Emodomelanelia* Divakar & A. Crespo (Crespo *et al.*, 2010) and *Montanelia* Divakar, A. Crespo, Wedin & Essl. (Divakar *et al.*, 2012), all of which appear as members of the parmelioid core group, *Melanelia* s.s. includes 4 species that belong to the cetrarioid core group. The genus *Cetraria*, formally containing 23 species altogether, still needs further studies – 5 included species are poorly known, 4 species require revision of the generic position and 3 (*Cetraria nepalensis*, *Cetraria rassadinae* and *C. steppae*) of the 14 accepted species lack DNA studies.

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