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Parmelioid lichens (Parmeliaceae) in southernmost South America

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Abstract

The parmelioid lichens is a speciose group in the Parmeliaceae family, and the biodiversity of this group is still far from completely understood in many regions of the world. One such region is southernmost South America, viz. the parts of Chile and Argentina south of 49 and 46° S, respectively, and the Falkland Islands. Based on examination of 366 herbarium samples and a study of relevant literature, 51 species of parmelioid lichens are here accepted for southernmost South America, whereas 12 species reported from the area during the last decades have been rejected. *Xanthoparmelia austrosorediata* and *X. tehuelchorum* are described as new to science here. In addition, six species are reported as new to southernmost South America, three of which are new to Chile, whereas an additional five species are new to the Chilean region of Magallanes. The apothecia of *Flavoparmelia gerlachei* and *Xanthoparmelia subplittii* are described for the first time here. *Xanthoparmelia* is the largest genus in the area with 21 species, two still undescribed, followed by *Hypotrachyna* with 11 and *Parmelia* with five. The lichenologically least explored part of the area is the Patagonian steppe and adjacent areas. Half of the total number of species, including all *Xanthoparmelia* species, is concentrated to these arid areas, and the majority of these are species which are endemic to South America. *Hypotrachyna* species are characteristic of the humid evergreen forest zone along the coast, and most of these species have wide pantropical or subcosmopolitan distribution ranges and few records from the present study area. The strongest focus of the present study is the National Park Torres del Paine in Magallanes, and a total of 35 parmelioid species are reported from this area here. Several of these have had their only known localities in southernmost South America destroyed by the 2011/2012 forest fire. Exploration history, frequency, distribution and evolutionary patterns are also discussed for single species or groups of species.

Key words: Argentina, biodiversity, biogeography, Chile, Falkland Islands, new species, taxonomy, *Xanthoparmelia*

Introduction

Parmeliaceae is the largest family of lichen-forming fungi (Thell *et al.* 2012). Most members of the family are large and conspicuous, and representatives of the family are dominant in lichen communities throughout the world. Parmeliaceae taxonomy has been dominated by revisions particularly at generic level during the last four decades, in addition to a large number of new species descriptions. The introduction of molecular data in taxonomy together with international cooperating networks of lichenologists is now introducing a more stable situation regarding circumscriptions of both the family and its genera (Crespo *et al.* 2010). Traditionally named informal categories related to growth forms, such as alectorioid, cetrarioid, hypogymnioid, parmelioid and usneoid groups are now being studied phylogenetically and revised as clades (Crespo *et al.* 2007, Thell *et al.* 2012).

The family or parts of the family has also been reviewed critically for certain geographical areas, such as Europe (Hawksworth *et al.* 2008), the Alps (Thell *et al.* 2010), the Nordic countries (Thell *et al.* 2004, Thell & Moberg 2011), Taiwan (Kurokawa & Lai 2001) and New Caledonia (Louwhoff & Elix 2002). Southernmost South America has attracted lichenologists for a very long period. Northern Hemisphere scientists have found this area particularly interesting (see e.g. Tuhkanen *et al.*1990), being remote, isolated and botanically exotic, but still with climatic conditions related to those of their home countries and with a considerable number of species also well-known in the Northern Hemisphere. The best example is the cetrarioid group, where all accepted species present in the area have bipolar distributions, see discussion by Elvebakk & Moberg (2002), although there are two undocumented/critical taxa in *Tuckermanopsis* (Øvstedal & Smith 2001, Calvelo & Liberatore 2002) .

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explained as relatively recent immigration from the Northern Hemisphere, parallel to what has been proposed for the two *Flavocetraria* species (Bjerke & Elvebakk 2004, Geml *et al.* 2010). The strongly southern distribution and small number of species indicate that *Melanohalea* and *Melanelixia* are bipolar elements even at the generic level.

The panaustral element consists of eight species, viz. three *Xanthoparmelia* species, two *Hypotrachyna* species, and one species each from the genera *Melanohalea, Parmelia* and *Pannoparmelia*. Four of these are sorediate, and one could imagine that they could be rather easily dispersed with strong austral winds at high southern latitudes. *Pannoparmelia angustata* on the other hand, is a primarily fertile species of a small, strongly southern genus with a yet unresolved phylogeny, and it may have a longer history.

The species which are regionally concentrated to climatically intermediate biogeographic zones have a strongly mixed proportion of austral, endemic, bipolar, pantropical and cosmopolitan elements. Central parts of the National Park Torres del Paine could be characterized as a climatically favourable area, with relatively high temperatures throughout the year, in combination with moderate precipitation and little drought stress. Several species seem to have their optimum there, such as *Hypotrachyna chilensis, H. brevirhiza, Parmotrema reticulata, Xantoparmelia subplittii* and *X. wrightiana*. Tentatively, these can be suggested to belong to a thermophilous element in southernmost South America, at least if future studies will confirm that these species avoid the more summer-cool coastal areas and the winter-cold and dry continental areas.

Regarding the group of coastal species, most of them are pantropical or subcosmopolitan with extensions southwards into the wettest austral areas, like most *Hypotrachyna* species. The ecological similarities between wet, high-altitude forests in tropical and subtropical areas of South America and the wet coastal archipelago of southern Chile are not fundamentally different. However, the lichen mycobiotas of these two areas have very different phytogeographical affinities. Presence of minute soredia may be the most important factor explaining the wide distribution of these *Hypotrachyna* species, although most austral, fine-sorediate species from humid/moist areas never made the journey northwards across the desert and steppe-like landscapes. One could hypothesize that the dispersal capacities powered by cyclones in the subtropical belt are different from those powered by high latitude storms in the Southern Hemisphere. Phylogeographical studies are needed to study the origin of these biogeographic patterns.

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Literature cited

Acharius, E. (1803) *Methodus qua omnes detectos lichens secundum organa carpomorpha ad genera, species et variatates redigere atque onservationibus illustrare.* F.D.D. Ulrich, Stockholmiæ, 394 pp.
http://dx.doi.org/10.5962/bhl.title.79411

Adler, M. & Calvelo, S. (1993) New reports on Parmeliaceae s.str (lichenized Ascomycotina) from southwestern Argentina. *Mycotaxon* 46: 105−127.

Adler, M. & Calvelo, S. (2002) Parmeliaceae species (lichenized Ascomycetes) from Tierra del Fuego (southern South America) and their world distribution patterns. *Mitteilungen aus dem Institut für Allgemeine Botanik in Hamburg* 30–32: 9−24.

Adler, M. & Calvelo, S. (2007) Ampliación de las distribuciones de especies de Parmeliaceae (Ascomycota Liquenizados) en la República Argentina. *Boletín de la Sociedad Argentina de Botánica* 42: 1−11.

Adler, M. & Calvelo, S. (2010) *Flavoparmelia baltimorensis, Parmotrema yodae* y *Xanthoparmelia braziliensis*, primeras citas para Argentina y ampliación de distribuciones para otras *Parmeliaceae* (Ascomycota Liquenizados). *Boletín de la Sociedad Argentina de Botánica* 45: 5−16.

Amo de Paz, G., Lumbsch, H.T., Cubas, P., Elix, J.A. & Crespo, A. (2010) The morphologically deviating genera *Omphalodiella* and *Placoparmelia* belong to *Xanthoparmelia* (Parmeliaceae). *Bryologist* 113: 376−386.

http://dx.doi.org/10.1639/0007-2745-113.2.376
Amo de Paz, G., Cubas, P., Crespo, A., Elix, J.A. & Lumbsch, H.T. (2012) Transoceanic dispersal and subsequent diversification on separate continents shaped diversity of the *Xanthoparmelia pulla* group (Ascomycota). *Plos One* 7; 6 e39683. http://dx.doi.org/10.1371/journal.pone.0039683
Arnold, F. (1881) Lichenologische Ausflüge in Tirol. XXI. *Verhandlungen der Zoologish-Botanischen Gesellschaft in Wien* 30: 95−154.
Bjerke, J.W. (2005) Synopsis of the lichen genus *Menegazzia* (Parmeliaceae, Ascomycota) in South America. *Mycotaxon* 91: 423−454.
Bjerke, J. W. & Elvebakk, A. (1999) *Flavoparmelia soredians*, a common but previously overlooked lichen species in southernmost Chile. *Anales del Instituto de la Patagonia, Serie Ciencias Naturales* 27: 17−23.
Bjerke, J.W. & Elvebakk, A. (2004) Distribution of the lichen genus *Flavocetraria* (Parmeliaceae, Ascomycota) in the Southern Hemisphere. *New Zealand Journal of Botany* 42: 647−656. http://dx.doi.org/10.1080/0028825x.2004.9512916
Blanco, O., Crespo, A., Divakar, P.K., Esslinger, T.L., Hawksworth, D.L. & Lumbsch, H.T. (2004a) *Melanelixia* and *Melanohalea,* two new genera segregated from *Melanelia* (Parmeliaceae) based on molecular and morphological data. *Mycological Research* 108: 873−884. http://dx.doi.org/10.1017/s0953756204000723
Blanco, O., Crespo, A., Elix, J.A., Hawksworth, D.L. & Lumbsch, H.T. (2004b) A molecular phylogeny and a new classification of parmelioid lichens containing *Xanthoparmelia*-type lichenan (Ascomycota: Lecanorales). *Taxon* 53: 959−975. http://dx.doi.org/10.2307/4135563
Brusse, F.A. (1993) Eight new species in the lichen genus *Parmelia* (Ascomycotina, Parmeliaceae) from Southern Africa, with notes on Southern African lichens. *Mycotaxon* 49: 1−17.
Calvelo, S. (1998a) Keys to genera and species of *Parmeliaceae* s. lat. from Patagonia, Tierra del Fuego and South Atlantic Islands (Argentina). *In:* Marcelli, M.P. & Seaward, M.R.D. (eds.) *Lichenology in Latin America: history, current knowledge and applications.* CETESB, São Paulo, pp. 117−128.
Calvelo, S. (1998b) Lichenology in Argentina: past, present and future. *In* Marcelli, M.P. & Seaward, M.R.D. (eds.) *Lichenology in Latin America: history, current knowledge and applications.* CETESB, São Paulo, pp. 1−24.
Calvelo, S. & Adler, M. (1992) *Pannoparmelia anzioides*: a taxonomic synonym of *Pannoparmelia angustata* (Parmeliaceae, Lichenes). *Mycotaxon* 43: 487−498.
Calvelo, S. & Adler, M. (1999) *Parmelia araucana* sp. nov. and new reports in the Parmeliaceae sensu stricto (Lichenized Ascomycotina) from Patagonia and Tierra del Fuego (Argentina). *Sydowia* 51: 145−154.
Calvelo, S. & Adler, M. (2001) Novedades para la flora liquénica de Tierra del Fuego (Argentina): Parmeliaceae s. str. (Ascomycetes liquenizados). *Hickenia* 3: 105−110.
Calvelo, S. & Fryday, A.M. (2006) New reports of lichens from Argentine Tierra del Fuego and the Falkland Islands (Islas Malvinas). *Bryologist* 109: 372−380. http://dx.doi.org/10.1639/0007-2745(2006)109[372:nrolfa]2.0.co;2
Calvelo, S. & Liberatore, S. (2002) Catálogo de los líquenes de la Argentina. *Kurtziana* 29: 7−170.
Calvelo, S., Stocker-Wörgotter, E., Liberatore, S. & Elix, J.A. (2005) *Protousnea* (Parmeliaceae, Ascomycota), a genus endemic to southern South America. *Bryologist 108*: 1−15. http://dx.doi.org/10.1639/0007-2745(2005)108[1:ppaage]2.0.co;2
Choicy, M. (1952) Catalogue des lichens de la région lyonnaise. Fasc. 9. *Bolletin Mensuel de la Societé Linnéenne de Lyon* 21: 165−180.
Cotton, A.D. (1915) Cryptogams from the Falkland Islands, collected by Mrs. Vallentin, described by A.D.C. *Journal of the Linnaean Society* 43: 137−231. http://dx.doi.org/10.1111/j.1095-8339.1915.tb00606.x
Crespo, A., Lumbsch, H.T., Mattsson, J.-E., Blanco, O., Divakar, P.K., Articus, K., Wiklund, E., Bawingan, P.A. & Wedin, M. (2007) Testing morphology-based hypotheses of phylogenetic relationships in Parmeliaceae (Ascomycota) using three ribosomal markers and the nuclear RPB1 gene. *Molecular Phylogenetics and Evolution* 444: 812−824. http://dx.doi.org/10.1016/j.ympev.2006.11.029
Crespo, A., Kauff, F., Divakar, P.K., del Prado, R., Pérez-Ortega, S., Amo de Paz, G., Ferencova, Z., Blanco, O., Roca-Valiente, B., Núñez-Zapata, J., Cubas, P., Argüello, A., Elix, J.A., Esslinger, T.L. & Hawksworth, D.L. (2010) Phylogenetic generic classification of parmelioid lichens (Parmeliaceae, Ascomycota) based on molecular, morphological and chemical nevidence. *Taxon* 59: 1735−1753.
Culberson, C.F. (1972) Improved conditions and new data for the identification of lichen products by a standardized thin layer chromatography method. *Journal of Chromatography* 72: 113−125. http://dx.doi.org/10.1016/0021-9673(72)80013-x
Del-Prado, R., Blanco, O., Lumbsch, H.T., Divakar, P.K., Elix, J.A., Molina, M.C. & Crespo, A. (2013) Molecular phylogeny and historical

biogeography of the lichen-formingfungal genus *Flavoparmelia* (Ascomycota: Parmeliaceae). *Taxon* 62: 928–939. http://dx.doi.org/10.12705/625.22

Divakar, P.K., Crespo, A., Núñez-Zapata, J., Flakus, A., Sipman, H.J.M., Elix, J.A., & Lumbsch, H.T. (2013) A molecular perspective on generic concepts in the *Hypotrachyna* clade (Parmeliaceae, Ascomycota). *Phytotaxa* 132: 21−38. http://dx.doi.org/10.11646/phytotaxa.132.1.2

Dodge, C. W. (1966) New lichens from Chile. *Nova Hedwigia* 12: 307−352.

Elvebakk, A. (2011) A review of the genus *Hypogymnia* (Parmeliaceae) in Chile. *Bryologist* 114: 379−388. http://dx.doi.org/10.1639/0007-2745-114.2.379

Elvebakk, A., Robertsen, E.H., Park, C.H. &. Hong, S.G. (2010) *Psorophorus* and *Xanthopsoroma*, two new genera for yellow-green, corticolous and squamulose lichen species, previously in *Psoroma*. *Lichenologist* 42: 563−585. http://dx.doi.org/10.1017/s0024282910000083

Elvebakk, A. & Moberg, R. (2002) Foliose and placodioid species of the lichen family Physciaceae in southernmost Chile. *Lichenologist* 34: 311−320. http://dx.doi.org/10.1006/lich.2002.0389

Esslinger, T.L (1977) A chemosystematic revision of the brown Parmeliae. *Journal of the Hattori Botanical Laboratory* 42: 1−211.

Etayo, J. & Sancho, L.G. (2008) Hongos liquenícolas del sur de Sudamérica, especialmente de Isla Navarino (Chile). *Bibliotheca Lichenologica* 98: 1−302. http://dx.doi.org/10.1639/0007-2745-112.3.621

Ferencova, Z., Cubas, P., Divakar, P.K., Molina, M.C. & Crespo, A. (2014) *Notoparmelia*, a new genus of Parmeliaceae (Ascomycota) based on overlooked reproductive anatomical features, phylogeny and distribution pattern. *Lichenologist* 46: 51−67. http://dx.doi.org/10.1017/s0024282913000649

Fryday, A. (2005) *Nimisia deusta*, the correct name for *N. fuegiae*, with additional notes on morphology, chemical composition, and distribution. *Lichenologist* 37: 313−319. http://dx.doi.org/10.1017/s0024282905015239

Galloway, D.J. (1987) Austral lichen genera: some biogeographical problems. *Bibliotheca Lichenologica* 25: 385−399.

Galloway, D.J. (1992) Studies in *Pseudocyphellaria* (lichens) III. The South American species. *Bibliotheca Lichenologica* 46:1−275.

Galloway, D.J. (2010) Additions to the *Placopsis* mycobiota (Trapeliaceae, Ascomycota) of southern South America, with notes on new records (including *Aspiciliopsis macrophthalma*), and a revised regional key to the species. *Lichenologist* 42: 727−737. http://dx.doi.org/10.1017/s0024282910000460

Galloway, D.J. & Quilhot, W. (1998) Checklist of Chilean lichen-forming and lichenicolous fungi. *Gayana Botanica* 55: 111−185.

Galloway, D.J. & Jørgensen, P.M. (1990) *Bartlettiella*, a new lichen genus from New Zealand, with notes on a new species of *Melanelia* and a new chemodeme of *Bryoria indonesica* in New Zealand. *New Zealand Journal of Botany 28*: 5−12. http://dx.doi.org/10.1080/0028825x.1990.10412338

Geml, J., Kauff, F., Brochmann, C. & Taylor, D.J. (2010) Surviving climate change: high genetic diversity and transoceanic gene flow in two arctic-alpine lichens, *Flavocetraria cucullata* and *F. nivalis* (Parmeliaceae, Ascomycota). *Journal of Biogeography* 37: 1529−1542. http://dx.doi.org/10.1111/j.1365-2699.2010.02287.x

Grassi, M.M. (1950) Contribución al catálogo de líquenes argentinos, I. *Lilloa* 24: 5−296.

Hale Jr., M.E. (1974) *Bulbothrix, Parmelina, Relicina* and *Xanthoparmelia*, four new genera in the Parmeliaceae. *Phytologia* 28: 479−490.

Hale Jr., M.E. (1975) A revision of the lichen genus *Hypotrachyna* (Parmeliaceae) in tropical America. *Smithsonian Contributions to Botany* 25: 1−73. http://dx.doi.org/10.5479/si.0081024x.25

Hale Jr., M.E. (1986) *Flavoparmelia*, a new genus in the lichen family Parmeliaceae (Ascomycotina). *Mycotaxon* 25: 603−605.

Hale Jr., M.E. (1987a) A monograph of the lichen genus *Parmelia* Acharius sensu stricto (Asocmycotina: Parmeliaceae). *Smithsonian Contributions to Botany* 66: 1−55. http://dx.doi.org/10.5479/si.0081024x.66

Hale Jr., M.E. (1987b) New or interesting species of *Xanthoparmelia* (Vainio) Hale (Ascomycotina: Parmeliaceae). *Mycotaxon* 30: 319−334.

Hale Jr., M.E. (1989) New species in the lichen genus *Xanthoparmelia* (Ascomycotina: Parmeliaceae). *Mycotaxon* 34: 541−564.

Hale Jr., M.E. & Kurokawa, S. (1968) Studies on *Parmelia* subgenus *Parmelia*. *Contributions from the United States National Herbarium* 36: 121−191.

Hale, B.W. & DePriest, P. (1999) Mason E. Hale's list of epithets in the parmelioid genera. *Bryologist* 102: 462−544. http://dx.doi.org/10.2307/3244234

Henssen, A. (1991) *Omphalodiella patagonica*, a new peltate lichen genus and species from South America. *Lichenologist* 23: 333−342.
Henssen, A. (1992) *Placoparmelia patagonica*, a new lichen genus and species from Argentina (Parmeliaceae). *Lichenologist* 24: 133−142.
Hawksworth, D.L., Blanco, O., Divakar, P.K., Ahti, T, & Crespo, A. (2008) A first checklist of parmelioid and similar lichens in Europe and some adjacent territories, adopting revised generic circumscriptions and with indications of species distributions. *Lichenologist* 40: 1−21.
http://dx.doi.org/10.1017/s0024282908007329
Huneck, S. & Yoshimura, I. (1996) *Identification of lichen substances*. Berlin, Heidelberg, New York: Springer-Verlag.
Jørgensen, P. M. (2003) Conspectus familiae *Pannariaceae* (Ascomycetes lichenosae). *Ilicifolia* 4**:** 1–79.
Kantvilas, G & Jarman, S.J. (1999) Lichens of rainforest in Tasmania and south-eastern Australia. *Flora of Australia Supplementary Series* 9: 1−212.
Kärnefelt, I. & ,Thell, A. (1993) *Nimisia fuegiae* (Parmeliaceae), a new lichen genus and species from Argentina. *Lichenologist* 25: 369−377.
http://dx.doi.org/10.1017/s0024282993000465
Keogh, M.F. (1977) Malonprotocetraric acid from *Parmotrema conformatum*. *Phytochemistry* 16: 1102.
Krog, H. (1970) The Scandinavian members of the *Parmelia borreri* group. *Nytt Magasin for Botanikk* 17: 11−15.
Krog, H. (1982) *Punctelia*, a new lichen genus in the Parmeliaceae. *Nordic Journal of Botany* 2: 287−292.
http://dx.doi.org/10.1111/j.1756-1051.1982.tb01191.x
Krog, H. & Swinscow, T.D.V. (1987) New species and new combinations in some parmelioid lichen genera, with special emphasis on East African taxa. *Lichenologist 19*: 419−431.
http://dx.doi.org/10.1017/s0024282987000392
Kurokawa, S. (1999) A note on pustulate or sorediate species of *Cetrariastrum* (Parmeliaceae). *Journal of Japanese Botany* 74: 251−255.
Kurokawa, S. & Lai, M. (2001) Parmelioid genera and species in Taiwan. *Mycotaxon* 77: 225−284.
Louwhoff, S.H.J.J. & Elix, J.A. (2002) The Parmeliaceae (lichenized Ascomycota) of New Caledonia. *Lichenologist* 34: 373−394.
http://dx.doi.org/10.1006/lich.2002.0412
Mackay, J.T. (ed.) (1836) *Flora hibernica, comprising the flowering plants, Characeae, Musci, Hepaticae, Lichenes and Algae of Ireland arranged accordingly to the natural system with a synopsis of the genera according to the Linnaean system. Part second comprising the Musci, Hepaticae and Lichenes*, W.C. Jun et Comp., Dublin, London and Edinburgh, 275 pp.
http://dx.doi.org/10.5962/bhl.title.28754
Massalongo, A.B. (1860) Esame comparative di alcune genere di licheni. *Atti dell'Istituto Veneto di Scienze, Lettere ed arti.* Vol. 5, Ser. 3: 247−267; 313−337.
McGlone, M.S. (2005) Goodbye Gondwana. *Journal of Biogeography* 32: 739−740.
http://dx.doi.org/10.1111/j.1365-2699.2005.01278.x
Meyen, I. & de Flotow, I. (1843) Lichenes. F.J.F. Meyenii observationes botanicas, in itinere circum terram institutas. Opus posthumum, sociorum academiae curis suppletum. *Novorum actorum Academiae Caesarae Leopoldino-Carolinae naturae curiosorum,* 11, Suppl. 1: 209−232, XII Tab.
Meyer, S.L.F. (1985) The new lichen genus *Imshaugia* (Ascomycotina, Parmeliaceae). *Mycologia* 77: 336−338.
http://dx.doi.org/10.2307/3793090
Nash III, T.H., Elix, J.A. & Johnston, J. (1987) New species, new records and a key for *Xanthoparmelia* (Lichenized Ascomycotina) from South America. *Mycotaxon* 28: 285−296.
Nash III, T.H., Gries, C., Elix, J.A. (1995) A revision of the lichen genus *Xanthoparmelia* in South America. *Bibliotheca Lichenologica* 56:1−157.
Øvstedal, D.O., Elix, J.A. & Lewis Smith, R.I. (1996) A new species of *Parmelia* (lichenized Ascomycotina) from the Antarctic. *Nova Hedwigia* 55: 179−182.
Øvstedal, D. O. & Smith, R.I.L. (2001) *Lichens of Antartica and South Georgia. A guide to their identification and ecology*. Cambridge University Press, Cambridge, pp. 1−411.
Orange, A., James, P.W. & White, F.J. (2001). *Microchemical methods for the identification of lichens.* British Lichen Society, London, pp. 1−101.
Räsänen, V. (1932) Zur Kenntnis der Flechtenflora Feuerlands sowie der Prov. de Magallanes, Prov. de Chiloë und Prov. de Ñuble in Chile auf Grund des von H. Roivainen gesammelten Materiales. *Annales Botanici Societatis Zoologicae-Botanicae Fennicae 'Vanamo'* 2, I–VI: 1–65.
Redón, J. (1985) Catálogo de los líquenes. *In*: Boelcke, O., Moore, D.M & Roig, F.A. (eds.). *Transecta botanica de la Patagonia austral.* Consejo Nacional de Investigaciones Científicas y Técnicas, Instituto de la Patagonia, Royal Society; Buenos Aires, pp. 343−349.

Redón, J. & Quilhot, W. (1977) Los líquenes de isla Navarino. I: Estudio sistemático y ecológico preliminar. *Serie Cientifico del Instuto Antártico Chileno* 5: 65−79.

Santesson, R., Moberg, R., Nordin, A., Tønsberg, T, & Vitikainen, O. (2004) *Lichen-forming and lichenicolous fungi of Fennoscandia*. Museum of Evolution, Uppsala University, pp. 1−359.

Stenroos, S. (1991) The lichen genera *Parmelia* and *Punctelia* in Tierra del Fuego. *Annales Botanici Fennici* 28: 241−245.

Thell, A., Crespo, A., Divakar, P.K., Kärnefelt, I., Leavitt, S.D., Lumbsch, H.T. & Seaward, M.R.D. (2012) A review of the lichen family Parmeliaceae – history, phylogeny and current taxonomy. *Nordic Journal of Botany* 30: 641−664. http://dx.doi.org/10.1111/j.1756-1051.2012.00008.x

Thell, A. & Moberg, R. (eds.) (2011) *Nordic Lichen Flora*, Vol. 4. Uppsala University & The Nordic Lichen Society, Uppsala, pp 1−184.

Thell, A., Søchting, U., Kärnefelt, I., Elix, J. A., Sancho, L. G. (2007) Phylogeny of *Himantormia,* an Antarctic genus in the Parmeliaceae (lichenized ascomycetes). *In:* Kärnefelt, I. & Thell, A. (eds.): Lichenological Contributions in Honour of David Galloway. *Bibliotheca Lichenologica* 95: 531−541.

Thell, A., Westberg, M. & Kärnefelt, I. (2004) Biogeography of the lichen family Parmeliaceae in the Nordic countries with taxonomic remarks. *Symbolae Botanicae Upsalienses* 34: 429−452.

Thell, A., Westberg, M. & Kärnefelt, I. (2010) A key to the Parmeliaceae in the Alps with notes on their distribution and phylogeny. *Bibliotheca Lichenologica* 104: 275−298.

Tuhkanen, S. (1992) The climate of Tierra del Fuego from a vegetation geographical point of view and its eecoclimatic counterparts elsewhere. *Acta Botanica Fennica* 145: 1−64.

Tuhkanen, S.I., I. Kuokka, J. Hyvönen, S. Stenroos & J. Niemelä. (1990) [1992] Tierra del Fuego as a target for biogeographical research in the past and present. *Anales del Instituto de la Patagonia, Ciencias Naturales* 19: 5−107.

Wagstaff, S.J., Breitweiser, I. & Ito, M. (2011) Evolution and biogeography of *Pleurophyllum* (Astereae, Asteraceae), a small genus of megaherbs endemic to the subantarctic islands. *American Journal of Botany* 98: 62−75. http://dx.doi.org/10.3732/ajb.1000238

Wedin, M. (1993) A phylogenetic analysis of the lichen family Sphaerophoraceae (Caliciales); a new generic classification and notes on character evolution. *Plant Systematics and Evolution* 187: 213−241.

Wilson, F.R.M. (1900) Lichenes kerguelenses a Roberto Hall anno 1898 prope Royal Sound in Kerguelen Insula lecti, et in herbario nationali melbourniensi depositi. *Mémoires de l'Herbier Boissier* 18: 89−88.

Wirtz, N., C. Printzen & H.T. Lumbsch. (2008) The delimitation of Antarctic and bipolar species of neuropogonoid *Usnea* (Ascomycota, Lecanorales): a cohesion approach of species recognition for the *Usnea perpusilla* complex. *Mycological Research* 112: 472−484. http://dx.doi.org/10.1016/j.mycres.2007.05.006

Zahlbruckner, A. (1917) Botanische Ergebnisse der schwedischen Expedition nach Patagonien und dem Feuerlande 1907–1909. VI. Die Flechten. *Kongliga Svenska Vetenskaps-Akademiens Handlingar* 57: 1−62.

Zahlbruckner, A. (1930). Lichenes (Übersicht über sämtliche bisher aus China bekannten Flechten). *In*: Handel-Mazzetti, H. (Red.). *Symbolae sinicae. Botanische Ergebnisse der Expedition der Fig. and Akademie der Wissenschaften in Wien nach Südwest-China 1914−1918*. III. Teil, pp. 1−254.